Impacts of Feed Additives on Surface Mucosal Health and Columnaris Susceptibility in Channel Catfish, *Ictalurus punctatus*

by

Honggang Zhao

A thesis submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Master of Science

Auburn, Alabama
August 1, 2015

Keywords: Channel catfish; *Flavobacterium columnare*; RNA-seq; mannan oligosaccharides; prebiotic; nutri-genomics

Approved by

Eric Peatman, Chair, Associate Professor, School of Fisheries, Aquaculture, and Aquatic Sciences
Jeffery Terhune, Associate Professor, School of Fisheries, Aquaculture and Aquatic Sciences
Allen Davis, Alumni Professor, Fisheries, School of Fisheries, Aquaculture, and Aquatic Sciences

Abstract

One of the highest priority areas for improvement in aquaculture is the development of dietary additives and formulations which provide for complete mucosal health and protection of fish raised in intensive systems. Far greater attention has been paid to dietary impact on gut health than to protective effects at other mucosal surfaces such as skin and gill. These exterior surfaces, however, are important primary targets for pathogen attachment and invasion. *Flavobacterium columnare,* the causative agent of columnaris disease, is among the most prevalent of all freshwater disease-causing bacteria, impacting global aquaculture of catfish, salmonids, baitfish and aquaria-trade species among others. We were interested in examining here whether the feeding of a standard catfish diet supplemented with Alltech dietary additives Actigen®, a concentrated source of yeast cell wall-derived material and/or Allzyme® SSF, a fermented strain of Aspergillus niger, could offer protection against F. columnare mortality.

A nine-week feeding trial of channel catfish fingerlings with basal diet (B), B+Allzyme® SSF, B+Actigen® and B+Actigen®+Allzyme® SSF revealed good growth in all conditions (FCR < 1.0), but no statistical differences in growth between the treatments was found. At nine weeks, based on pre-challenge trial results, basal, B+Actigen®, and B+Allzyme® SSF groups of fish were selected for further challenges with *F. columnare*. Replicated challenge with a virulent *F. columnare* strain, revealed significantly longer median days to death in B+Allzyme® SSF and B+Actigen® when compared with the basal diet ($P < 0.05$) and significantly higher survival following the eight day challenge period in B+Actigen® when compared with the other two diets

($P < 0.05$). Given the superior protection provided by the B+Actigen® diet, we carried out transcriptomic comparison of gene expression of fish fed that diet and the basal diet before and after columnaris challenge using high-throughput RNA-seq. Pathway and enrichment analyses revealed changes in mannose receptor DEC205 and IL4 signaling at 0 h (prior to challenge) which likely explain a dramatic divergence in expression profiles between the two diets soon after pathogen challenge (8 h). Dietary mannose priming resulted in reduced expression of inflammatory cytokines, shifting response patterns instead to favor resolution and repair. Our results indicate that prebiotic dietary additives may provide protection extending beyond the gut to surface mucosa.

Acknowledgments

First and foremost, I would like to sincerely thank Dr. Eric Peatman for his patience and mentoring throughout. I have learned a lot from him and wish to be a scientist like him in the near future. I would like to thank my other committee members, Dr. Allen Davis and Dr. Jeffery Terhune for their advice and support. I would like to thank my family and friends for supporting me through this challenging but meaningful journey. I would like to thank the financial supporter of this project: Alltech Inc. and my living expense supporters: China Scholarship Council and Shanghai Ocean University. I would like to thank Dr. Chao Li for his guidance and help with my research. I would also like to thank Dr. Huseyin Kucuktas and Milla Kaltenboeck for their help during my research. Sincere thanks will be also go to Spencer Gowan, Wilawan Thongda, Dongdong Zhang, Ammu Anil, Qifan Zeng and Wenlu Wang.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

MOS	Mannan Oligosaccharides
ESC	Enteric Septicemia of Catfish
MALT	Mucosa-Associated Lymphoid Tissue
CFU	Colony Forming Unit
PE	Paired-end
RPKM	Reads Per Kilobase of exon model per Million mapped reads
FDR	False Discovery Rate
QPCR	Quantitative PCR
GO	Gene Ontology
PRR	Pathogen Recognition Receptor
Ig	Immunoglobulin
Th2	Type 2 helper T cells
ECM	Extracellular matrix
Ct	Crossing Point
FCR	Feed Conversion Ratio
CLR	C-type Lectin Receptor
DC	Dendritic Cell
MR	Mannose Receptors
CMIS	Common-mucosal Immune System

I. **Introduction**

Background

Global aquaculture production of fish, crustaceans, molluscs and other aquatic animals has continually increased over the last three decades and currently accounts for 16.7 percent of the global population's intake of animal protein (FAO, 2014). Concomitantly, wild fisheries harvests have declined by 32% per capita since 1970, with continued declines predicted. However, with growing middle class populations, particularly in Asia and South America, an expansion of aquaculture worldwide is needed to meet overall rising demands for fish consumption. However, sustainable, profitable growth of the aquaculture industry continues to be hindered by uncontrolled disease, from virus outbreaks in Chile's salmon industry to Early Mortality Syndrome in Southeast Asian shrimp farms. Against this backdrop, domestic aquaculture in the US continues to play only a minor role in the global market. American domestic aquaculture only provided 5 percent of U.S. seafood supplies in 2012, and represented only 1.2 percent of global fish and shellfish production. Farm-raised catfish (*Ictalurus spp*.) is the top fish species produced in the United States with a 334 million pounds processed in 2013 (Hanson and Sites, 2014). However, the industry has declined from a peak of ~600 million pounds of processed fish just a decade before, due to rising competition from imports and elevated feed prices. In order to remain competitive domestically, increase profitability, and contribute in the global marketplace, catfish producers need to optimize and intensify production practices. However, as with terrestrial agriculture, increasing biomass in the culture system has contributed to rising incidence of disease and rising risks associated with

production. Optimization of fish diets, alongside selection of genetically resistant fish lines and strains, is needed to operate profitably in this new landscape. Diets which increase overall gut health while providing protection against a variety of opportunistic aquatic pathogens are particularly needed.

Fish Disease and Columnaris

Flavobacterium columnare, the causative agent of columnaris disease, is a Gram negative pathogen and among the most destructive freshwater disease-causing bacteria among cultured fish (Sundberg et al., 2014). It was first described by Davis in 1922 from warmwater fish in Mississippi River (Davis, 1922). This slender, motile bacteria was named *Bacillus columnaris* at that time due to the appearance of bacteria found in associated lesions. Tissues in epidermal surfaces such as gill and skin will show erosion or necrosis following visible pale discoloration on these area when fish is infected with columnaris disease (Arias et al., 2012; Davis, 1922). Common clinical presentation of columnaris in fish is a pale white band encircling the body, which is also known as "saddleback" erosion. The bacteria can also attach themselves to the gill tissue, enabling them to proliferate and finally erode the gill (Aboagye, 2008). Cell death in the gill can result in impaired gill vascular blood circulation and cardiac changes, finally leading death of infected fish (Foscarini, 1989). Because of pigment flexirubin in this bacteria, the colonies of *F. columnare* present as yellow with flat and rhizoid plaques on culture media (Bernardet et al., 1996). The *F. columnare* cells are long, slender gliding rods of approximately 3 to 10 μm in length and 0.3 to 0.5 μm of width (Declercq et al., 2013).

Genetic Diversity

Genetic variability of *F. columnare* have been demonstrated among isolates. Based on 16S rRNA sequence, restriction fragment length polymorphism (RFLP) and DNA-DNA hybridization, *F. columnare* was subdivided into three main genomovars: genomovars I, II, and III (Darwish and Ismaiel, 2005; Arias et al., 2004). Using the same method, subgroups within genomovars I and II were identified and named as genomovar I-B and genomovar II-B (Olivares-Fuster et al., 2007). Recently, LaFrentz et al. (LaFrentz et al., 2014) identified a new genomovar I/II of *F. columnare* based on intragenomic heterogeneity within 16S rRNA restriction sites. The establishment of genetic typing systems have allowed for gains in knowledge of different *F. columnare* genomovars, promoting research examining associations between genomovars and virulence in fish. Shoemaker et al. demonstrated that genomovar II appears to be more virulent for channel catfish (Shoemaker et al., 2008). Similar associations between genomovar and virulence were also observed in rainbow trout (*Oncorhynchus mykiss*) and zebrafish (*Danio rerio*, Lafrentz et al., 2012; Olivares-Fuster et al., 2011).

Epidemiology

Columnaris disease has a worldwide distribution, infecting many different wild, cultured and ornamental freshwater fish species including catfish, carp, eel, perch, salmonids and tilapia (Bernardet and Bowman, 2006; Figueiredo et al., 2005; Soto et al., 2008; Suomalainen et al., 2009). This pathogen is considered as the second most severe disease impacting the U.S. domestic channel catfish (*Ictalurus punctatus*) industry after *Edwardsiella ictaluri*, with yearly economic

losses equaling to 30 million dollars (Shoemaker et al., 2011). Previous studies have isolated *F. columnare* from fish, eggs, biofilm and the rearing waters (Barker et al., 1990, Cai et al., 2013). Transmission of this bacteria is believed to be through fish contact and contaminated water (Arias et al., 2012; Kunttu et al., 2009). Channel catfish, the predominant aquaculture species in the United States, are exceedingly susceptible to columnaris disease (Arias et al., 2004). Mortality of channel catfish infected with this pathogen can reach 50 percent to 60 percent but can be more severe in the case of catfish fingerlings. Farmed salmon infected with columnaris have suffered from some outbreaks which led to 100% mortality (Plumb, 1994). When outside the host, *F. columnare* can survive in sterile river mud, fish feed, and lake water (Bullock et al., 1986; Kunttu et al., 2012). Also research on this bacteria has demonstrated that *F. columnare* can form altered colony morphologies, such as biofilm, to survive in aquaculture systems (Cai et al., 2013).

Colonization to Host Fish

The colonization of the fish tissue is to be regarded as a complex multistep process and there are several factors that have been shown to mediate colonization of *F. columnare* to host surfaces. These factors include mucus, sugars, biofilms, and water parameters.

First, the mucus, a slimy fluid secreted by sub-mucosal glands or specialized cells (goblet, club, and mucocytes) lining epithelia (Beck and Peatman, 2015), is critical for adherence of *F. columnare*. From a practical standpoint, fish handling and hauling can result in stress that leads to mucus sloughing, which is often related to subsequent *F. columnare* infection (Klesius and Shormaker, 2015). Tripathi et al. (Tripathi et al., 2005) previously demonstrated that lesions were

frequently seen on locations where mucus had been removed. In an experimental study using scanning electron microscope (SEM), a *F. columnare* isolate with high virulence (AJS 1) was observed adhering in large groups to the mucus secreted by goblet cells (Decostere et al., 1999a). In addition to this, mucus from fish gill and skin has been demonstrated to promote chemotactic response by *F. columnare* (Klesius et al., 2008). A recent study examined the different abilities of *F. columnare* isolates to grow and survive in formulated water (FW) containing tilapia mucus, found that genomovar I and II isolates can replicate in FW containing tilapia mucus or porcine mucin but not in FW only. Based on the results of this study, it seems that *F. columnare* can use fish mucus as a nutrient source for growth and survival (Shoemaker and LaFrentz, 2015). Collectively, the surface mucus layer is an important physical and immunological barrier, and its role in host–pathogen interaction needs further investigation.

Second, lectin-mediated interactions is another one of the proposed mechanisms of bacterial colonization. Lectins are a group of carbohydrate-binding proteins that can recognize specific carbohydrate moieties expressed on cell surfaces. Lectins can be expressed by bacteria like *F. columnare* or the host epithelial cells (Beck et al., 2012; Watanabe et al., 2009). Binding to specific monosaccharides and oligosaccharides can prevent lectin attachment to carbohydrates within the cell membrane. To gain an insight into this interaction, Decostere et al. previously exposed *F. columnare* to four sugars (D-glucose, D-galactose, D-sucrose, and N-acteyl-D-glucosamine) and sodium metaperiodates (cleaves the C-C bond between vicinal hydroxyl groups of sugar) and found a significant reduction of bacterial adhesion (Decostere et al., 1999a). They hypothesized that the interaction between bacterial lectins and their host's carbohydrate receptors

may explain the reduction (Beck et al., 2012; Decostere et al., 1999a). Work by our group has recently utilized channel catfish (*Ictalurus punctatus*) and *F. columnare* as a host-pathogen model to understand teleost mucosal dynamics (Beck and Peatman, 2015). Global transcriptome profiling of the channel catfish gill revealed a rhamnose-binding lectin (RBL) whose expression was induced greater than 100-fold soon after *F. columnare* experimental infection (Sun et al., 2012). Previously we have shown that lectin expression in catfish is linked to greater susceptibility to acute columnaris outbreaks (Beck et al., 2012). Moreover, addition of RBL ligands such as L-rhamnose and D-galactose significantly reduced catfish mortality upon *F. columnare* infection (Beck et al., 2012). Saturation of the RBL with its ligands, L-rhamnose or D-galactose, lowered its expression and decreased *F. columnare* adhesion and catfish mortality in a dosage-dependent manner in a subsequent challenge infection (Beck et al., 2012). Additionally, RBL expression was found to be inversely correlated with host resistance to *F. columnare* infection (Peatman et al., 2013). Taken together, these results suggested that the host lectin is mediating *F. columnare* binding to the surface mucosa. Work by our lab have subsequently characterized the broader RBL family in channel catfish, identifying six RBL genes, all of which showed some degree of homeostatic expression in mucosal tissues (Thongda et al., 2014). Further research is needed to better delineate the function and signaling of these diverse lectins.

Biofilm is generally defined as a community of microbes attached to a surface and embedded in an organic matrix, which is mainly composed of extracellular polysaccharides, proteins, DNA and lipids. Many aquatic bacteria can form biofilms that act as reservoirs to protect themselves from desiccation and predators (Cai et al., 2013). Staroscik and Nelson have previously

described the ability of *F.* columnare to grow as biofilm in Atlantic salmon (*Salmo salar*) surface mucus (Staroscik and Nelson, 2008). Another study showed that *F. columnare* can attach to inert surfaces and colonize them by producing biofilm. The virulence potential of biofilm was also confirmed by cutaneous inoculation of channel catfish fingerlings with mature biofilm. It is important to note here, that biofilm formation was greatly enhanced at a higher calcium carbonate hardness level (360 ppm). Calcium has been shown to increase surface attachment and the growth of *F. columnare* (Shieh, 1980). A recent study of *F. columnare* biofilm formation highlighted the importance of factors such as salinity, water hardness, and the presence of sugars such as mannose, all directly relevant to mucus production (Cai et al., 2013). Further work is needed to explore the relationship between biofilm formation and bacterial attachment.

Last but not least, the adhesion of *F. columnare* to the surface tissues was shown to be impacted by various water parameters. Among them are dissolved metal ions, clay minerals, nitrite, and water temperatures (Declercq et al., 2013). By immersing the gill into bivalent, ion-rich water, Decostere et al. noted that addition of divalent ions such as Ca^{2+} and Mg^{2+} was positively related to bacterial adhesion (Decostere et al., 1999b). In fact, it has been reported that highest infection rates occur in hard water (Decostere et al., 1999b). In a recent study, Beck et al. evaluated the potential use of kaolin ($Al_2Si_20_5(OH)_4$) for the prevention of columnaris disease. The results indicated that addition of kaolin as a clay mineral can improve survival, reduce gill pathologies and reduce bacterial attachment associated with columnaris disease (Beck et al., 2015). According to Decostere et al., high nitrite levels and organic loads can stimulate the adhesive capacity of *F. columnare*, and therefore it is important to control these parameters as well

(Decostere et al., 1999b). Besides, it has been noted that transmission of columnaris disease is more efficient in higher temperatures (Declercq et al., 2013). Normal rearing densities with high temperatures (23 ℃) proved to increase both transmission rate and mortality in fish (Suomalainen et al., 2005b).

Control

Fish culture conditions including high rearing density (Shoemaker et al., 2003), high organic loads (Chowdhury, 1988), excessive handling (Wakabayashi, 1991), and high ammonia (Farmer et al., 2011) and other water quality issues, may make fish more susceptible to columnaris disease. To combat this disease, chemical control such as the utilization of kaolinitic clay (Beck et al., 2015), saline or acidic conditions (Suomalainen et al., 2005a), ozone treatment (Conrad et al., 1975), Diquat (Darwish and Mitchell, 2009) have been used for the practical control of columnaris disease. Meanwhile, management practices such as lowering rearing density (Suomalainen et al., 2005b) and maintaining a frequent course of feeding could also lessen the likelihood of columnaris epizootics. However, while these methods may be cost-effective in small-scale farms, in larger commercial ponds, farmers may have to consider the high cost of such chemicals.

Another way to protect fish from columnaris disease is through vaccination. Vaccines have been used in a number of farmed fish such as salmonids, cyprinids, and Altantic salmon (*Salmo salar*) in Norway (Lazado et al., 2015). Formalin inactivated *F. colmunare* from the preceding year's epizootic were used to immunize channel catfish (*Ictalurus punctatus*) and a significant reduction in mortality was observed (Moore et al., 1990). Beyond that, bacteria treated with sialic

acid were shown to serve as potential vaccine strains capable of protecting catfish from columnaris (Ourth and Bachinski, 1987). Recently, a vaccine made from an attenuated *F. columnare* isolate (genomovar I) has been registered in the USA (Shoemaker et al., 2011; AQUAVAC-Col). However, as genomovar II strains have been found to responsible for the majority of virulent columnaris outbreaks (Shoemaker et al. 2008), a genomovar II isolate is a more appropriate starting point for a protective vaccine. Accordingly, a new attenuated vaccine (genomovar II mutant 17-23) has been recently developed and demonstrated to provide superior protection against genomovar II columnaris relative to the commercial vaccine (Mohammed et al., 2013). However, this vaccine is not currently available on the commercial market.

Another current strategy to combat columnaris is the administration of antibiotics through feed. Antibiotics including oxytetracycline (OTC), chloramphenicol, trimethoprim-sulphamethoxazole, florfenicol, nalidixic acid, ampicillin, etc. have been used in catfish aquaculture. Sulfadimethoxine/ormetoprim (Romet) 5:1 mixed with floating feed has been traditionally applied in catfish culture (O' Hara et al., 1997; Sarter et al., 2007). Currently in the US only a few antibiotics have been approved for use in aquaculture (Doyle et al., 2006). For example, Aquaflor®, an antibiotic product fully approved by U. S. Food and Drug Administration (FDA), is typically used in the treatments of columnaris disease and enteric septicemia of catfish (ESC). Oxytetracycline (Terramycin) is permitted for the treatment of several aquatic animal disease such as ulcerm, furuncolosis, columnaris and *Pseudomonas* disease (Serrano, 2005). However, the indiscriminant use of antibiotics in aquaculture may lead to problems including the spread of antibiotic-resistant pathogens, environmental hazards and food safety issues (Ran et al.,

2012). For example, Hawke and Thune, over two decades ago, found that 3.5% of strains of isolated *F. columnare* from diseased fish were resistant to Sulfadimethoxine/ormetoprim 5:1 (Romet), indicating that the extensive use of antibiotics can cause antibiotic resistance in bacteria (Hawke and Thune, 1992). Additionally, medicated feed can increase costs per ton of feed by 30-100%. The high prices associated with medicated feed often mean that farmers do not keep the feed on hand, delaying the onset of treatment. Furthermore, the high price often prompts farmers to withdraw medicated feed before the standard treatment regimen has been completed, allowing the faster buildup of antibiotic-resistant strains. Given the deficiencies identified in the current control strategies (management, chemicals, vaccine, antibiotics), alternatives for ameliorating the impact of *F. columnare* are clearly still needed (Terova et al., 2009).

Prebiotics and Probiotics

Our understanding of the importance of beneficial microflora for growth and disease resistance has expanded dramatically in the last decade. Interactions between commensal bacteria and host tissues set the stage for digestion, absorption of nutrients, release of hormones, and exclusion of pathogenic invaders. Therefore, addition of substances or cultures which foster or supplement native flora in fish is emerging as an area of focus in fish nutrition.

Prebiotics and probiotics, commonly known as non-digestible dietary ingredients and live microbial feed supplements, respectively, provide natural and cost-effective alternatives for promoting growth and disease control in host fish (Gatesoupe, 2005; Gibson and Roberfroid, 1995). Prebiotics were first defined as “a non-digestible dietary ingredient that beneficially affects

the host by selectively stimulating the growth of and/or activating the metabolism of health-promoting bacteria in the colon and thus improve host health" (Gibson and Roberfroid, 1995; Manning and Gibson, 2004). Following the criteria used to classify food ingredients as prebiotics, non-digestible carbohydrates such as oligosaccharides, some peptides and proteins, and certain lipids are potential prebiotic candidates (Gibson and Roberfroid, 1995). According to Roberfroid (2007), who refined the definition of prebiotics to "the increase in the absolute number of bifidobacteria expressed divided by the daily dose of prebiotic ingested", trans-galactooligosaccharide (TOS) and inulin were classified as prebiotics and other fermented ingredient such as mannan oligosaccharides (MOS), fructooligosaccharide (FOS) and lactulose were also classified as prebiotics (Roberfroid, 2007; Saraiva et al., 2011). Over the past two decades the prebiotic concept of promoting colon health has stimulated extensive research in the areas of nutrition, medical science and feed science of aquaculture as well. The effects of prebiotics range from the enhancement of feeding efficiency (Staykov et al., 2007), increased growth (Buentello et al., 2010; Grisdale-Helland et al., 2008), body composition (Genc et al., 2007), quick stimulation of immune responses and disease resistance (Buentello et al., 2010; Staykov et al., 2007). Previously, Welker et al. (Welker et al., 2012) used whole-cell yeast and yeast subcomponents (β-glucan and MOS) (YYS) to evaluate impacts of prebiotic on catfish growth performance and immune function. They confirmed that inclusion of YYS-supplements prior to challenge can benefit ESC resistance in catfish. The use of konjac mannanoligosaccharide (KMOS) in yellow catfish (*Pelteobagrus fulvidraco*) has been investigated in another study (Wu et al., 2014). Catfish feed with dietary supplementations MOS and konjac mannanoligosaccharide

(KMOS) showed higher relative gain rate (RGR), specific growth rate (SGR) and lower feed conversion ratio (FCR). In addition, the study concluded that the optimum level of KMOS inclusion in diets (2 g per kg) could also modulate intestinal microflora and induce digestive enzyme activity. Subsequent studies have used the dietary prebiotic such as arabinoxylooligosaccharides (AXOS) and Grobiotic®-A (a commercial prebiotic product mixed with autolyzed brewer's yeast, dairy ingredient components, and fermentation products) to investigate effects of prebiotics on the catfish (Rurangwa et al., 2008; Thompson et al., 2015).

Probiotics are defined as live microorganisms such as bacteria in yogurt and fermented milk that could benefit the intestinal flora, which plays an important role in regulating host health and immune status (Pandey et al., 2015). To introduce such positive effects, the probiotics must be alive and active in both supplements and gastrointestinal (GI) tract (Austin, 2015). Previously probiotics have been mostly applied in humans with demonstration of several beneficial effects, including providing a protective commensal barrier in mucus, alternating milieu pH, enhancing host immunological response and competing with pathogens for host receptors (Clauson and Crawford, 2015). In aquaculture, probiotics are regarded as an important prophylactic agent and sustainable antibiotic alternatives. There are a number of studies indicating that probiotics used in aquatic animals not only modulate host microbiota but also impact fish growth, improve digestion and, most interestingly, boost host immunity (Hai, 2015; Verschuere et al., 2000). Reneshwary et al., (Reneshwary et al., 2011) has conducted an experiment to evaluate the effects of *Bacillus thuringiensis* (Bt) incorporated diets on innate immunity of African catfish (*Clarias gariepinus*). By evaluating granulocyte counts and survival rates before and after *A. hydrophila* infection, they

demonstrated that Bt as a probiotic can enhance innate immune responses in African catfish. A recent study was conducted to investigate the effect of dietary yeast polysaccharides on some hematologic parameters and intestinal morphology of channel catfish. The results revealed that polysaccharides supplementation has positive impacts on blood monocytes, leukocytes phagocytic activity, and the development of the intestine in channel catfish (Zhu et al., 2012). Apart from the laboratory research of probiotics, few commercial probiotics products are available for the catfish industry. Among them is Lymnozyme®, a blend of naturally occurring microbes, which could enhance catfish resistance to ESC and reduce mortality under subsequent challenge (Aboagye, 2008). Another previous study indicated that Biostart®, a commercial probiotic product containing a few species of *Bacillus spp.*, could increase survival rate and net production of catfish (Queiroz and Boyd, 1998). Recently, by utilizing 454 pyrosequencing of 16S rRNA, Larsen et al. examined gastrointestinal microbiota of channel catfish inhabiting a lake and consuming natural food items. While several differences were documented from replicate samples; broadly, the gut microbial communities were dominated by the phylum Fusobacteria, particularly the species *Cetobacterium somerae*. Surprisingly, the human pathogens *Plesiomonas shigelloides*, *Fusobacterium mortiferum*, and members of the genus *Aeromonas*, were well-represented, suggesting these species are normal inhabitants of catfish gut. Understanding the microbiome in catfish consuming natural prey items could be useful in developing probiotics for improving catfish growth on artificial diets.

Though the impact of prebiotics/probiotics on the systemic and mucosal immunity of fish have become an emerging topic, the mechanisms governing their beneficial attributes are still

poorly understood. To explore the real-time impacts of prebiotics/probiotics on host immunity, RNA-seq, a method with an ability to compare the transcriptional regulation after dietary supplementation, has been applied. RNA-seq, also called whole transcriptome shotgun sequencing, is an essential technology that uses next-generation sequencing platforms to sequence the transcriptome in a given tissue under specific experimental conditions (Martin and Wang, 2011). Transcriptome and differential expression analysis by RNA-seq may be a powerful approach to discover mechanisms underlying measurable dietary impacts on catfish (nutrigenomics). Previous work by our lab has utilized RNA-seq to examine global gene expression profiles after short term fasting, a nutritional state previously associated with higher *F. columnare* mortality (Li et al., 2014; Liu et al., 2013b; Shoemaker et al., 2003). In those studies, we have observed a consistent correlation between basic immune status and feed restriction regimen on catfish mucosal surfaces.

Mucosal Immunity of Catfish

Channel catfish is one of the better-studied immune models among teleost fish (Bengten et al., 2006). Given its role as a cultured food fish, immune responses in catfish have been studied in the context of important pathogens known to cause widespread disease. While the etiology of these pathogens have been studied for 30-40 years, we have only recently focused intensively on the invasive strategies and associated host defense responses at the sites of initial entry such as skin, gill, nares, and gut. Much of the recent knowledge of mucosal barriers in catfish have been gained

through transcriptome studies of impacted mucosal tissues, accompanied by infection challenge models which help to dissect the early stages of pathogenesis.

Structure of Gill

The gills of catfish play important roles in respiration, osmoregulation, and nitrogenous waste secretion, in addition to their immune roles as a mucosal tissue. In teleost, each of the two gills have four gill arches and five slits. Each arch contains a septum and two rows of filaments termed the primary lamellae. Arches and filaments are a complex tissue of cartilage, connective tissue, blood vessels, nerves, and immune cells (Beck and Peatman, 2015). Although relatively unexplored, recent research has described a gill associated lymphoid tissue (GiALT) or inter-branchial lymphoid tissue with intraepithelial aggregations of T cells (Koppang et al., 2010; Salinas et al., 2011).

Structure of Skin

The skin is a large and multifunctional outermost organ in catfish, acting as a first line of defense against external aggressions and hazards (Xu et al., 2013). The skin of the catfish, also referred to as the integumentary system, covers the outer surface of the fish with three layers, the epidermis, dermis, and the hypodermis (Beck and Peatman, 2015). The epidermal surface is covered by an aqueous mucus layer, accompanied with complex immune factors in it including secretory IgM, lysozyme, and lymphocytes (Ourth, 1980). The dermis is composed of a collagenous matrix while the hypodermis contains loosely organized collagen and vasculature.

The majority of catfish species, including those in the genus *Ictalurus* do not have scales (Ángeles Esteban, 2012; Beck and Peatman, 2015; Chang and Hwang, 2011; Hawkes, 1974; Konráðsdóttir et al., 2009). While relatively little is known about immunity in fish skin, recent studies have established intriguing similarities between the skin-associated lymphoid tissue (SALT) and that of the gut (Xu et al., 2013).

Structure of Gut

The gut barriers of fish are responsible for nutrition absorption, sodium and water balance, neuroendocrine actions, and immune barrier functions. The gastrointestinal tracts of teleost fish share many common characteristics with corresponding mucosal surfaces in mammals. The intestine of the channel catfish can be divided into a thick ascending segment, a descending segment, a thin convoluted segment and a thicker terminal segment, the rectum (Beck and Peatman, 2015). The mucosal epithelium is generally composed of a simple lamina propria, blood vessels, nerves, collagenous matrices and gut-associated lymphoid tissue (GALT) which including lymphocytes populations, macrophages, dendritic cells, as well as other intraepithelial immune cells (Gomez et al., 2013; Hawkes, 1974; Krementz and Chapman, 1975; Wardle, 1971). As with other mucosal tissues, catfish intestinal mucosal surfaces are covered by a mucosal gel layer secreted by mucus-secreting goblet cells, forming the outermost barrier of innate defense and providing a matrix for immunoglobulins secreted by GALT-analog plasma cells (Di Conza and Halliday, 1971; Wu et al., 2014).

The Role of Mucus

In catfish, mucus is continuously secreted by goblet cells in the gill, skin, and gut epidermis, playing indispensable roles in shedding pathogen and dead cells away to maintain host health. Mucus is predominantly made up of mucins, high-molecular weight glycoproteins saturated with O-linked sugars. Mucus cell numbers have been shown to be sensitive to dietary changes, stress and handling in other *Ictalurus* species (Zuchelkowski et al., 1985) and to water temperature in channel catfish (Quiniou et al., 1998). Through transcriptome detection, work by our lab has identified expression patterns of mucins and related isoforms in catfish mucosal sites.

Examination of fish susceptible to the common freshwater pathogen, *Flavobacterium columnare*, revealed basally higher levels of gill goblet cells and mucin expression, a pattern maintained after infection (Peatman et al., 2013). Interestingly, *F. columnare* shows a strong chemotactic attraction to catfish mucus, where it appears to associate with goblet cells (Klesius et al., 2008; Klesius et al., 2010; Olivares-Fuster et al., 2011). Goblet cell proliferation has been reported to be under the control of anterior gradient 2 protein (AGR2) in zebrafish (Chen et al., 2012). Similarly, we have observed changes in AGR2 due to diet and immune status (Peatman et al., 2013; Liu et al., 2013). Mucin levels in both skin and gill are altered by short-term fasting (Li et al., 2014; Liu et al., 2013).

In recent years a virulent strain of *Aeromonas hydrophila* capable of producing a motile aeromonad septicemia (MAS) infection, has caused widespread mortality in the US catfish industry. Our previous work utilized high-density Affymetrix microarrays to examine gene expression profiles in both channel and blue catfish skin upon *A. hydrophila* infection.

Intriguingly, in experimental challenge, only disruption (scraping) of skin mucus prior to immersion challenge could reliably produce *A. hydrophila* mortality. Microarray analyses revealed differential expression patterns of MUC5AC, MUC5B at early timepoints following challenge in the more susceptible channel catfish but not in blue catfish (Li et al., 2013a; Li et al., 2013b). Quantity and composition (e.g. sialomucin vs. sulfomucin) of mucus is likely critical for dynamics of pathogen invasion, successful attachment to host receptors, and persistence, and, therefore, is a target of immuno-sculpting by fish pathogens (Hertzog et al., 2011). A recent study of *F. columnare* biofilm formation highlighted the importance of factors such as salinity, water hardness, and the presence of sugars such as mannose, all directly relevant to mucus production (Cai et al., 2013; Paz et al., 2003; Roberts and Powell, 2003).

In catfish gut, a histological and flow cytometric study of cell types revealed distribution of goblet cells throughout all gut segments, with highest numbers and copious amounts of mucin found in the distal rectal segment (Hébert et al., 2002). Our RNA-seq analysis of intestinal immune responses following *Edwardsiella ictaluri* infection identified perturbed expression of mucins in the gut (MUC2, MUC5B), but further work is needed to clarify the roles of these mucins (Li et al., 2012).

Mucosal Secretions

Fish mucosal secretions are known to contain a variety of antimicrobial peptides, complement proteins, proteases, and lysozyme (Gomez et al., 2013). A series of RNA-seq expression studies in catfish gill exposed to *F. columnare* or following feed deprivation have

catalogued a diverse innate repertoire likely secreted into the mucus (Liu et al., 2013; Peatman et al., 2013; Sun et al., 2012). These include complement factor D, C1, C7, C1q, NK-lysin, bacterial permeability-increasing protein (BPI) and several fish toxin proteins including natterin and toxin-1 precursor, lysozyme C, and lysozyme G. In the intestine, we have additionally detected H2 antimicrobial peptides, serine proteases, granzyme and abundant metalloproteinases (Li et al., 2012). Of these, lysozyme C appears to be a particularly good marker of immune readiness, particularly in the skin and gill of catfish. Lysozyme C also displayed consistently higher expression in resistant catfish gill than that observed in susceptible fish (Peatman et al., 2013). Plasma lysozyme levels have been studied for several decades in the context of fish immunity, but relatively little attention has been given to the level and roles of lysozyme in mucosal surfaces (Bergsson et al., 2005; Nigam et al., 2012). In mammals, lysozymes are supposed to kill bacterial pathogens through enzymatic and antimicrobial activity (Davis and Weiser, 2011). In previous studies in catfish challenged with *Edwardsiella ictaluri*, plasma lysozyme dynamics differed between resistant and susceptible fish, with a faster response and elevated lysozyme levels characterizing resistant catfish strains (Bilodeau et al., 2005; Bilodeau-Bourgeois et al., 2008).

Lectins

Lectins are carbohydrate-binding proteins that can recognize specific carbohydrate moieties expressed on cell surfaces. In vertebrates and invertebrates, lectin repertoires not only participate in recognition of pathogens, but also play distinct biological roles in both innate and adaptive immunity (Vasta et al., 2011). Expression studies by our group have found that lectins

are rapidly and strongly regulated in response to a variety of infections in the gill, skin, and gut, pointing to a critical role for these molecules in early pathogen detection and binding. Many of these lectins may be secreted directly into the mucus where they are held by binding to mucin glycoproteins and where they can provide protection and surveillance against foreign pathogens (Al-Banaw et al., 2010; Tsutsui et al., 2009). A rise in mucin secretion, therefore, may lead to a rise in the presence of certain mucus-bound lectins.

Mannose binding lectin is an important member of the collectin family and one of the better studied lectins in catfish (Peterson et al., 2015; Ourth et al., 2007; Zhang et al., 2012), albeit with few studies examining its roles in mucosal barriers. MBLs are important for induction of the complement system via mannose-binding lectin-associated serine proteases (MASPs). In catfish, we have observed induction of MASP2 in catfish gill following *F. columnare* infection (Sun et al., 2012), higher levels of MBL1 in channel and blue catfish skin following *A. hydrophila* infection, and 86-fold higher expression of MBL2b in resistant channel catfish gill tissue compared to susceptible gill at 1 h following *F. columnare* challenge (Li et al., 2013a; Li et al., 2013b; Peatman et al., 2013).

Galectins constitute a lectin family defined by their binding specificity for β-galactoside sugars. Since their first description in the mid-1970s, galectins have been assigned to several roles including embryogenesis, host early development and response to infection through the IFN-induced antiviral pathway (Vasta et al., 2004; Verrier et al., 2011). Currently no comprehensive assessment of galectins has been carried out in catfish. However, our recent expression analyses again indicate the presence and regulation of these receptors before and soon after bacterial

infection in mucosal tissues. Galectin-4 was observed to be down-regulated by short-term feed deprivation in channel catfish (Liu et al., 2013). Particularly strong galectin responses to *A. hydrophila* infection were also detected, including a 13-fold up-regulation of galectin-3 in channel catfish skin at 2 h post-infection, and a 63-fold down-regulation of galectin-9 at 24 h post-infection in blue catfish.

A Common Mucosal Immune System

A common mucosal immune system (CMIS) refers to the immunological concept that antigens encountered at one introductive mucosal site can stimulate immune responses and provide protection across all mucosal sites (Iijima and Kiyono, 2001). While this phenomenon is well documented in mammals, the status of a CMIS is unclear in fish (Rombout et al., 2014). In most fish studies, antigens can stimulate immune responses covering MALT and serum when one mucosal site secretes specific IgM (Salinas et al., 2011). But only a few studies have measured the stimulated antibody production in gill, skin, gut, and serum simultaneously. Perhaps most relevant for aquaculture is whether fed- probiotics, prebiotics, and immunostimulants, well-documented for protective effects against enteric pathogens, can stimulate protective immune responses in distal mucosal sites such as the skin and gill. As an array of fish bacteria, viruses, and parasites invade through mucosal surfaces other than the gut, a healthy gut should not be the only concern of nutritionists working to craft diets offering superior disease protection to fish. If dietary additives can broadly prime mucosal immune responses across the organism, concrete gains in fish health in aquaculture systems may be possible. In this vein, recently, Chen et al., investigated the

effects of dietary riboflavin on the growth, gill immunity, tight junction proteins, and antioxidant system of young grass carp (*Ctenopharyngodon idella*). Fish fed with riboflavin, an essential water-soluble vitamin mainly absorbed by fish small intestine, showed positive effects on gill immunity with increased expression of inflammatory cytokines (Chen et al., 2015). Similarly, in the next chapter, the body of my thesis, I examined the impact of fed prebiotic additives on the gill mucosal responses of channel catfish to *F. columnare*.

References

Aboagye D. L., 2008. Evaluation of the commercially-available probiotic Lymnozyme® as an effective control of bacterial infections in Channel Catfish. M. S. thesis. Auburn University, Auburn, Alabama, USA.

Al-Banaw A., Kenngott R., Al-Hassan J. M., Mehana N., Sinowatz F., 2010. Histochemical analysis of glycoconjugates in the skin of a catfish (*Arius tenuispinis*, *day*). Anat Histol Embryol 39, 42-50.

Ángeles Esteban M., 2012. An overview of the immunological defenses in fish skin. ISRN Immunol 2012.

Arias C., Welker T., Shoemaker C., Abernathy J. and Klesius P., 2004. Genetic fingerprinting of *Flavobacterium columnare* isolates from cultured fish. J Appl Microbiol 97, 421-428.

Arias C. R., Lafrentz S., Cai W. and Olivares-Fuster O., 2012. Adaptive response to starvation in the fish pathogen *Flavobacterium columnare*: cell viability and ultrastructural changes. BMC Microbiol 12, 266.

Austin B., 2015. Editorial: probiotics. Fish Shellfish Immunol 45, 1.

Barker G., Smith S. and Bromage N., 1990. Effect of oxolinic acid on bacterial flora and hatching success rate of rainbow trout, *Oncorhynchus mykiss*, eggs. Aquaculture 91, 205-222.

Beck B. H., Barnett L. M., Farmer B. D., Peatman E. and Carter D., 2015. Kaolinitic clay protects against *Flavobacterium columnare* infection in channel catfish *Ictalurus punctatus* (Rafinesque). J Fish Dis 38, 241-8.

Beck B. H., Farmer B. D., Straus D. L., Li C. and Peatman E., 2012. Putative roles for a rhamnose binding lectin in *Flavobacterium columnare* pathogenesis in channel catfish *Ictalurus punctatus*. Fish shellfish immunol 33, 1008-1015.

Beck B. H. and Peatman E. eds. 2015. Mucosal Health in Aquaculture. Academic Press 2015; 395 pp.

Bengten E., Clem L. W., Miller N. W., Warr G. W. and Wilson. M., 2006. Channel catfish immunoglobulins: repertoire and expression. Dev Comp Immunol 30:77-92.

Bergsson G., Agerberth B., Jörnvall H. and Gudmundsson G. H., 2005. Isolation and identification of antimicrobial components from the epidermal mucus of Atlantic cod (*Gadus morhua*). FEBS J 272, 4960-9.

Bernardet J. F. and Bowman J., 2006. The Genus *Flavobacterium*. In Dworkin M., Falkow S., Rosenberg E., Schleifer K. H. and Stackebrandt E. (Eds.), Springer New York, pp. 481-531.

Bernardet J. F., Segers P., Vancanneyt M., Berthe F., Kersters K. and Vandamme P., 1996. Cutting a Gordian knot: emended classification and description of the genus *Flavobacterium*, emended description of the family Flavobacteriaceae, and proposal of *Flavobacterium*

hydatis nom. nov. (basonym, *Cytophaga aquatilis* Strohl and Tait 1978). Int J Syst Bacteriol 46, 128-148.

Bilodeau A. L. and Waldbieser G. C., 2005. Activation of TLR3 and TLR5 in channel catfish exposed to virulent *Edwardsiella ictaluri*. Dev Comp Immunol 29, 713-21.

Bilodeau-Bourgeois L., Bosworth B. G., Peterson B. C. 2008. Differences in mortality, growth, lysozyme, and toll-like receptor gene expression among genetic groups of catfish exposed to virulent *Edwardsiella ictaluri*. Fish Shellfish Immunol 24, 82-9.

Buentello J. A., Neill W. H. and Gatlin I. I. I. D. M., 2010. Effects of dietary prebiotics on the growth, feed efficiency and non-specific immunity of juvenile red drum *Sciaenops ocellatus* fed soybean-based diets. Aquaculture Research 41, 411-418.

Bullock G., Hsu T. C. and Shotts Jr E., 1986. Columnaris disease of fishes.

Cai W., De La Fuente L. and Arias C. R., 2013. Biofilm formation by the fish pathogen *Flavobacterium columnare*: development and parameters affecting surface attachment. Appl Environ Microbiol 79, 5633-42.

Chang W. J. and Hwang P. P., 2011. Development of zebrafish epidermis. Birth defects research. Part C, Embryo today : reviews 93, 205-14.

Chen L., Feng L., Jiang W. D., Jiang J., Wu P., Zhao J., Kuang S. Y., Tang. L., Tang W. N., Zhang Y. A., Zhou X. Q. and Liu Y., 2015. Dietary riboflavin deficiency decreases immunity and antioxidant capacity, and changes tight junction proteins and related signaling molecules

mRNA expression in the gills of young grass carp (*Ctenopharyngodon idella*). Fish Shellfish Immunol. 45, 307-320.

Chen Y. C., Lu Y. F., Li I. C. and Hwang S. P., 2012 Zebrafish *Agr2* is required for terminal differentiation of intestinal goblet cells. PLoS One 7:e34408.

Chowdhury M. B. R. and Wakabayashi H., 1988. Effects of sodium, potassium, calcium and magnesiumions on *Flexibacter columnaris* infection in fish. Fish Pathol 23, 237–41.

Clauson E. R. and Crawford P., 2015. What you must know before you recommend a probiotic. J Fam Pract 64, 151-5.

Conrad J., Holt R. and Kreps T., 1975. Ozone disinfection of flowing water. The Progressive Fish-Culturist 37, 134-136.

Darwish, A. M., and Ismaiel, A. A. (2005) Genetic diversity of *Flavobacterium columnare* examined by restriction fragment length polymorphism and sequencing of the 16S ribosomal RNA gene and the 16S–23S rDNA spacer. Molecular and Cellular Probes 19, 267-274.

Darwish, A. M., and Mitchell A. J., 2009. Evaluation of diquat against an acute experimental infection of *Flavobacterium columnare* in channel catfish, *Ictalurus punctatus* (Rafinesque). J Fish Dis 32, 401-8.

Davis H. S., 1922. A new bacterial disease of fresh-water fishes: Bulletin of the United States Bureau of Fisheries. Washington: GPO. p. 261–280

Darwish A. M. and Ismaiel A. A., 2005. Genetic diversity of *Flavobacterium columnare* examined by restriction fragment length polymorphism and sequencing of the 16S ribosomal RNA gene and the 16S-23S rDNA spacer. Mol Cell Probes. 19:267-74.

Davis K. M. and Weiser J. N. 2011 Modifications to the peptidoglycan backbone help bacteria to establish infection. Infect Immun 79, 562-70.

Declercq A. M., Haesebrouck F., Van den Broeck W., Bossier P. and Decostere A., 2013. Columnaris disease in fish: a review with emphasis on bacterium-host interactions. Vet Res 44, 27.

Decostere A., Haesebrouck F., Van Driessche E., Charlier G. and Ducatelle R., 1999a. Characterization of the adhesion of *Flavobacterium columnare* (*Flexibacter columnaris*) to gill tissue. J Fish Dis 22, 465–474

Decostere A., Haesebrouck F., Turnbull J. F., and Charlier G., 1999b. Influence of water quality and temperature on adhesion of high and low virulence *Flavobacterium columnare* strains to isolated gill arches. J Fish Dis 22, 1-11.

Di Conza J. J. and Halliday W. J., 1971. Relationship of catfish serum antibodies to immunoglobulin in mucus secretions. Aust J Exp Biol Med Sci 49, 517-9.

Doyle M. P., Busta F. F., Cords B., and Davidson P., 2006. Antimicrobial resistance: implications for the food system. Compr Rev Food Sci Food Saf 5, 71-137.

FAO, 2014. FAO yearbook. Fishery and Aquaculture Statistics. 2012.

Farmer B. D., Mitchell A. J. and Straus D. L., 2011. The effect of high total ammonia concentration on the survival of channel catfish experimentally infected with *Flavobacterium columnare*. J Aquat Anim Health 23, 162-8.

Figueiredo H. C., Klesius P. H., Arias C. R., Evans J., Shoemaker C. A., Pereira D. J. Jr. and Peixoto M. T., 2005. Isolation and characterization of strains of *Flavobacterium columnare* from Brazil. J Fish Dis 28, 199-204.

Findly R. C., Zhao X., Noe J., Camus A. C. and Dickerson H. W., 2013. B cell memory following infection and challenge of channel catfish with *Ichthyophthirius multifiliis*. Dev Comp Immunol 39, 302-11.

Foscarini R., 1989. Induction and development of bacterial gill disease in the eel (*Anguilla japonica*) experimentally infected with *Flexibacter columnaris*: pathological changes in the gill vascular structure and in cardiac performance. Aquaculture 78, 1-20.

Gatesoupe J., 2005. Probiotics and prebiotics for fish culture, at the parting of the ways. Aqua Feeds: Formulation & Beyond 2, 3-5.

Genc M., Aktas M., Genc E. and Yilmaz E., 2007. Effects of dietary mannan oligosaccharide on growth, body composition and hepatopancreas histology of *Penaeus semisulcatus* (de Haan 1844). Aquacult Nutr 13, 156-161.

Gomez D., Sunyer J. O. and Salinas I., 2013. The mucosal immune system of fish: the evolution of tolerating commensals while fighting pathogens. Fish Shellfish Immunol 35, 1729-39.

Grisdale-Helland B., Helland S. J. and Gatlin III D. M., 2008. The effects of dietary supplementation with mannanoligosaccharide, fructooligosaccharide or galactooligosaccharide on the growth and feed utilization of Atlantic salmon (*Salmo salar*). Aquaculture 283, 163-167.

Hanson T. and Sites M. D., 2014. 2013 U. S. Catfish Database. http://www.agecon.msstate.edu/whatwedo/budgets/docs/catfish/toc_2013_1.pdf.

Hawkes J., 1974. The structure of fish skin. Cell Tissue Res. 149, 159-172.

Hébert P., Ainsworth A. J. and Boyd B., 2002. Histological enzyme and flow cytometric analysis of channel catfish intestinal tract immune cells. Dev Comp Immunol 26, 53-62.

Hertzog P. J., Mansell A., van Driel I. R. and Hartland E. L., 2011. Sculpting the immune response to infection. Nat Immunol 12, 579-82.

Iijima H, Takahashi I. and Kiyono H., 2001. Mucosal immune network in the gut for the control of infectious diseases. Rev Med Virol 11, 117-33.

Klesius P. H., Shoemaker C A. and Evans J. J., 2008. *Flavobacterium columnare* chemotaxis to channel catfish mucus. FEMS Microbiol Lett. 288, 216-20.

Konráðsdóttir F., Loftsson T. and Sigfússon S. D., 2009. Fish skin as a model membrane: structure and characteristics. J Pharm Pharmacol 61, 121-124.

Koppang E. O., Fischer U., Moore L., Tranulis M. A., Dijkstra J. M., Kollner B., Aune L., Jirillo E. and Hordvik I., 2010. Salmonid T cells assemble in the thymus, spleen and in novel interbranchial lymphoid tissue. J Anat 217, 728-39.

Krementz A. B. and Chapman G. B., 1975. Ultrastructure of the posterior half of the intestine of the channel catfish, *Ictalurus punctatus*. J Morphol 145, 441-481.

Kunttu H. M., Sundberg L. R., Pulkkinen K. and Valtonen E. T., 2012. Environment may be the source of *Flavobacterium columnare* outbreaks at fish farms. Environ Microbiol Rep 4, 398-402.

Kunttu H. M., Valtonen E. T., Jokinen E. I. and Suomalainen L. R., 2009. Saprophytism of a fish pathogen as a transmission strategy. Epidemics 1, 96-100.

LaFrentz B. R., LaPatra S. E., Shoemaker C. A. and Klesius P. H., 2012. Reproducible challenge model to investigate the virulence of *Flavobacterium columnare* genomovars in rainbow trout *Oncorhynchus mykiss*. Diseases of Aquatic Organisms 101, 115–122.

LaFrentz B. R., Waldbieser G. C., Welch T. J. and Shoemaker C. A., 2014. Intragenomic heterogeneity in the 16S rRNA genes of *Flavobacterium columnare* and standard protocol for genomovar assignment. J Fish Dis 37,657-69.

Larsen A. M., Mohammed H. H. and Arias C. R., 2014 Characterization of the gut microbiota of three commercially valuable warmwater fish species. J Appl Microbiol. 116:1396-404.

Lazado C. C., Caipang C. M. and Estante E. G., 2015. Prospects of host-associated microorganisms in fish and penaeids as probiotics with immunomodulatory functions. Fish Shellfish Immunol 45, 2-12.

Li C., Beck B. H., Su B., Terhune J. and Peatman E., 2013a. Early mucosal responses in blue catfish (*Ictalurus furcatus*) skin to *Aeromonas hydrophila* infection. Fish Shellfish Immunol 34, 920-8.

Li C., Beck B. H. and Peatman E., 2014. Nutritional impacts on gene expression in the surface mucosa of blue catfish (*Ictalurus furcatus*). Dev Comp Immunol 44, 226-234.

Li C., Wang R., Su B., Luo Y., Terhune J., Beck B. H. and Peatman E., 2013b. Evasion of mucosal defenses during *Aeromonas hydrophila* infection of channel catfish (*Ictalurus punctatus*) skin. Dev Comp Immunol 39, 447-55.

Li C., Zhang Y., Wang R., Lu J., Nandi S., Mohanty S., Terhune J., Liu Z. and Peatman E., 2012. RNA-seq analysis of mucosal immune responses reveals signatures of intestinal barrier disruption and pathogen entry following *Edwardsiella ictaluri* infection in channel catfish, *Ictalurus punctatus*. Fish Shellfish Immunol 32, 816-27.

Liu L., Li C., Su B., Beck B. H. and Peatman E., 2013b. Short-term feed deprivation alters immune status of surface mucosa in channel catfish (*Ictalurus punctatus*). PloS one 8, e74581.

Manning T. S. and Gibson G. R., 2004. Microbial-gut interactions in health and disease. Prebiotics. Best Pract Res Clin Gastroenterol 18, 287-98.

Martin J. A. and Wang Z., 2011. Next-generation transcriptome assembly. Nature Rev Genet 12, 671-682.

Mohammed H., Olivares-Fuster O., LaFrentz S. and Arias C. R., 2013. New attenuated vaccine against columnaris disease in fish: choosing the right parental strain is critical for vaccine efficacy. Vaccine 31, 5276-80.

Moore A. A., Eimers M. E., and Cardella M. A., 1990. Attempts to control *Flexibacter columnaris* epizootics in pond-reared channel catfish by vaccination. J Aquat Anim Health 2, 109-111.

Nigam A. K., Kumari U., Mittal S. and Mittal A. K., 2012. Comparative analysis of innate immune parameters of the skin mucous secretions from certain freshwater teleosts, inhabiting different ecological niches. Fish Physiol Biochem 38, 1245-56.

O' Hara T. M., Azadpour A., Scheemaker J. and Gerard P. D., 1997. Oxytetracycline residues in channel catfish: a feeding trail. Vet Hum Toxicol. 39, 65-70.

Olivares-Fuster O., Bullard S. A., McElwain A., Llosa M. J. and Arias C. R., 2011. Adhesion dynamics of *Flavobacterium columnare* to channel catfish *Ictalurus punctatus* and zebrafish *Danio rerio* after immersion challenge. Dis Aquat Organ 96:221.

Olivares-Fuster O., Shoemaker C. A., Klesius P. H. and Arias C. R., 2007. Molecular typing of isolates of the fish pathogen, *Flavobacterium columnare*, by single-strand conformation polymorphism analysis. FEMS Microbiol Lett 269, 63-9.

Ourth D. D., 1980. Secretory IgM, lysozyme and lymphocytes in the skin mucus of the channel catfish, *Ictalurus punctatus*. Dev Comp Immunol 4, 65-74.

Ourth D. D. and Bachinski L. M., 1987. Bacterial sialic acid modulates activation of the alternative complement pathway of channel catfish (*Ictalurus punctatus*). Dev Comp Immunol 11, 551-564.

Ourth D. D., Narra M. B. and Simco B. A., 2007. Comparative study of mannose-binding C-type lectin isolated from channel catfish (*Ictalurus punctatus*) and blue catfish (*Ictalurus furcatus*). Fish Shellfish Immunol; 23:1152-60.

Pandey V., Berwal V., Solanki N. and Malik N. S., 2015. Probiotics: Healthy bugs and nourishing elements of diet. J Int Soc Prev Community Dent 5, 81-7.

Paz H. B., Tisdale A. S., Danjo Y., Spurr-Michaud S. J., Argüeso P., and Gipson I. K., 2003. The role of calcium in mucin packaging within goblet cells. Exp Geront 77, 69-75.

Peatman E., Li C., Peterson B. C., Straus D. L., Farmer B. D. and Beck B. H., 2013. Basal polarization of the mucosal compartment in *Flavobacterium columnare* susceptible and resistant channel catfish (*Ictalurus punctatus*). Mol Immunol 56, 317-327.

Roberts S. D. and Powell M. D., 2003. Comparative ionic flux and gill mucous cell histochemistry: effects of salinity and disease status in Atlantic salmon (*Salmo salar* L.). Comp Biochem Physiol, Part A: Mol Integr Physiol 134, 525-37.

Peterson B. C., Peatman E., Ourth D. D. and Waldbieser G. C., 2015. Effects of a phytogenic feed additive on growth performance, susceptibility of channel catfish to *Edwardsiella ictaluri* and levels of mannose binding lectin. Fish Shellfish Immunol 44, 21-5.

Plumb J. A., 1994. Health maintenance of cultured fishes: principal microbial diseases. CRC Press Inc.

Queiroz J. and Boyd C. E., 1998. Effects of a bacterial inoculum in channel catfish ponds. J World Aquacult Soc 29: 67–73.

Quiniou S. A., Bigler S., Clem L. and Bly J., 1998. Effects of water temperature on mucous cell distribution in channel catfish epidermis: a factor in winter saprolegniasis. Fish Shellfish Immunol 8, 1-11.

Roberfroid M., 2007. Prebiotics: the concept revisited. J Nutri 137, 830s-7s.

Rombout J. H., Yang G. and Kiron V., 2014. Adaptive immune responses at mucosal surfaces of teleost fish. Fish Shellfish Immunol 40, 634-43.

Rurangwa E., Delaedt Y., Geraylou Z., Van De Wiele T., Courtin C. M., Delcour J. A., and Ollevier F., 2008. Dietary effect of arabinoxylan oligosaccharides on zootechnical performance and hindgut microbial fermentation in *Siberian sturgeon* and African catfish. Aquaculture Europe, Krakow, September 15-18.

Salinas I., Zhang Y. A. and Sunyer J. O., 2011. Mucosal immunoglobulins and B cells of teleost fish. Dev Comp Immunol 35, 1346-65.

Saraiva T. C., Grund L. Z., Komegae E. N., Ramos A. D., Conceicao K., Orii N. M., Lopes-Ferreira M. and Lima C., 2011. Nattectin a fish C-type lectin drives Th1 responses in vivo: licenses macrophages to differentiate into cells exhibiting typical DC function. Int Immunopharmacol 11, 1546-56.

Sarter S., Nguyen H. N. K., Hung L. T., Lazard J. and Montet D., 2007. Antibiotic resistance in Gram-negative bacteria isolated from farmed catfish. Food control 18, 1391-1396.

Serrano P. H., Responsible use of antibiotics in aquaculture. 2005 FAO Fish Tech Pap 469:1–97.

Shieh H. S., 1980. Studies on the nutrition of a fish pathogen, *Flexibacter columnaris*. Microbios Letters 13, 129-133.

Shoemaker C. A. and LaFrentz B. R., 2015. Growth and survival of the fish pathogenic bacterium, *Flavobacterium columnare*, in tilapia mucus and porcine gastric mucin. FEMS Microbiol Lett. 362(4)

Shoemaker C., Klesius P., Lim C. and Yildirim M., 2003. Feed deprivation of channel catfish, *Ictalurus punctatus* (Rafinesque), influences organosomatic indices, chemical composition and susceptibility to *Flavobacterium columnare*. J Fish Diseases 26, 553-561.

Shoemaker C. A., Klesius P. H., Drennan J. D. and Evans J. J., 2011. Efficacy of a modified live *Flavobacterium columnare* vaccine in fish. Fish Shellfish Immunol 30, 304-8.

Shoemaker C. A., Olivares-Fuster O., Arias C. R. and Klesius P. H., 2008. *Flavobacterium columnare* genomovar influences mortality in channel catfish (*Ictalurus punctatus*). Vet Microbiol 127, 353-9.

Soto E., Mauel M. J., Karsi A. and Lawrence M. L., 2008. Genetic and virulence characterization of *Flavobacterium columnare* from channel catfish (*Ictalurus punctatus*). J Appl Microbiol 104, 1302-10.

Staroscik A. M. and Nelson D. R. 2008. The influence of salmon surface mucus on the growth of *Flavobacterium columnare*. J Fish Dis 31,59-69.

Staykov Y., Spring P., Denev S. and Sweetman J., 2007. Effect of a mannan oligosaccharide on the growth performance and immune status of rainbow trout (*Oncorhynchus mykiss*). Aquacult Int 15, 153-161.

Sun F., Peatman E., Li C., Liu S., Jiang Y., Zhou Z. and Liu Z., 2012. Transcriptomic signatures of attachment, NF-κB suppression and IFN stimulation in the catfish gill following columnaris bacterial infection. Dev Comp Immunol 38, 169-180.

Sundberg L. R., Kunttu H. M. and Valtonen E. T., 2014. Starvation can diversify the population structure and virulence strategies of an environmentally transmitting fish pathogen. BMC Microbiol 14, 67.

Suomalainen L. R., Bandilla M. and Valtonen E. T., 2009. Immunostimulants in prevention of columnaris disease of rainbow trout, *Oncorhynchus mykiss* (Walbaum). J Fish Dis 32, 723-6.

Suomalainen L. R., Tiirola M. and Valtonen E. T., 2005a. Treatment of columnaris disease of rainbow trout: low pH and salt as possible tools? Dis Aquat Organ 65, 115-20.

Suomalainen L. R., Tiirola M. A. and Valtonen E. T., 2005b. Influence of rearing conditions on *Flavobacterium columnare* infection of rainbow trout, *Oncorhynchus mykiss* (Walbaum). J Fish Dis 28, 271-7.

Terova G., Forchino A., Rimoldi S., Brambilla F., Antonini M. and Saroglia M., 2009. Bio-Mos: an effective inducer of dicentracin gene expression in European sea bass (*Dicentrarchus labrax*). Comp Biochem Physiol B Biochem Mol Biol 153, 372-7.

Thongda W., Li C., Luo Y., Beck B. H. and Peatman E., 2014. L-rhamnose-binding lectins (RBLs) in channel catfish, *Ictalurus punctatus*: Characterization and expression profiling in mucosal tissues. Dev Comp Immunol 44, 320-331.

Thompson M., Lochmann R., Phillips H. and Sink T. D., 2015 A dietary dairy/yeast prebiotic and flaxseed oil enhance growth, hematological and immunological parameters in channel catfish at a suboptimal temperature (15 ℃). Animal. 6, 1-7.

Tripathi N. K., Latimer K. S., Gregory C. R., Ritchie B. W., Wooley R. E. and Walker R. L., 2005. Development and evaluation of an experimental model of cutaneous columnaris disease in koi *Cyprinus carpio*. J Vet Diagn Invest, 17:45–54.

Tsutsui S., Yamaguchi M., Hirasawa A., Nakamura O. and Watanabe T. 2009 Common skate (*Raja kenojei*) secretes pentraxin into the cutaneous secretion: The first skin mucus lectin in cartilaginous fish. J Biochem 146, 295-306.

Vasta G. R., Ahmed H. and Odom E. W., 2004. Structural and functional diversity of lectin repertoires in invertebrates, protochordates and ectothermic vertebrates. Curr Opin Struct Biol 14, 617-30.

Vasta G. R., Nita-Lazar M., Giomarelli B., Ahmed H., Du S., Cammarata M., Parrinello N., Bianchet M. A. and Amzel L. M., 2011. Structural and functional diversity of the lectin repertoire in teleost fish: relevance to innate and adaptive immunity. Dev Comp Immunol 35, 1388-99.

Verrier E. R., Langevin C., Benmansour A. and Boudinot P., 2011. Early antiviral response and virus-induced genes in fish. Dev Comp Immunol 35, 1204-14.

Verschuere L., Rombaut G., Sorgeloos P. and Verstraete W., 2000. Probiotic bacteria as biological control agents in aquaculture. Microbiol Mol Biol Rev reviews : MMBR 64, 655-71.

Wakabayashi H., 1991. Effect of environmental conditions on the infectivity of *Flexibacter columnaris* to fish. J Fish Dis 14, 279-290.

Wardle C. S., 1971. New Observations on the Lymph System of the Plaice Pleuronectes Platessa and other Teleosts. J Mar Biol Assoc U. K. 51, 977-990.

Watanabe Y., Tateno H., Nakamura-Tsuruta S., Kominami J., Hirabayashi J., Nakamura O., Watanabe T., Kamiya H., Naganuma T. and Ogawa T., 2009. The function of rhamnose-binding lectin in innate immunity by restricted binding to Gb3. Dev Comp Immunol 33, 187-97.

Welker T. L., Lim C., Yildirim-Aksoy M. and Klesius P. H., 2012. Effect of short-term feeding duration of diets containing commercial whole-cell yeast or yeast subcomponents on immune function and disease resistance in channel catfish, *Ictalurus punctatus*. J Anim Physiol Anim Nutr (Berl) 96, 159-71.

Wu Z., Yu Y., Chen X., Liu H., Yuan J., Shi Y. and Chen X., 2014. Effect of prebiotic konjac mannanoligosaccharide on growth performances, intestinal microflora, and digestive enzyme activities in yellow catfish, *Pelteobagrus fulvidraco*. Fish Physiol Biochem 40, 763-771.

Xu Z., Parra D., Gomez D., Salinas I., Zhang Y. A., von Gersdorff Jorgensen L., Heinecke R. D., Buchmann K., LaPatra S. and Sunyer J. O., 2013. Teleost skin, an ancient mucosal surface that elicits gut-like immune responses. Proc Natl Acad Sci U S A 110, 13097-102.

Zhang N. N., Yao L., Zhuang M. Q., Wang G. C., Chen T. T., Yang Y. J., Zhang J., Lv M. and Jin L., 2012. [Association between mannose-binding lectin 2 gene and protein kinase C-beta 1 gene polymorphisms and type 2 diabetic macrovascular complications in northern Chinese Han population]. Zhonghua Yi Xue Yi Chuan Xue Za Zhi. 29, 709-14.

Zhu H., Liu H., Yan J., Wang R. and Liu L., 2012. Effect of yeast polysaccharide on some hematologic parameter and gut morphology in channel catfish (*Ictalurus punctatus*). Fish Physiol Biochem 38, 1441-7.

Zuchelkowski E. M., Pinkstaff C. A. and Hinton D. E., 1985. Mucosubstance histochemistry in control and acid-stressed epidermis of brown bullhead catfish, *Ictalurus nebulosus* (LeSueur). Anat Rec 212, 327-35.

II. Impact of feed additives on surface mucosal health and columnaris susceptibility in channel catfish fingerlings, *Ictalurus punctatus*

Introduction

Fish currently provides three billion people with 20% of their animal protein requirements. However, environmental pollution and overexploitation threaten natural fish stock regeneration (FAO, 2014; Gutierrez et al., 2011). To meet the increased demand from the global market, aquaculture will play an increasingly important role in contributing to the volume and stability of global fish supplies. Commercial fish farming, in tanks or enclosures under monitored conditions, can increase production by controlling variables ranging from exclusion of predators and improved water quality to enhancement of diet and nutrition (Naylor et al., 2000). However, intensive aquaculture has been traditionally accompanied by increasing incidence and severity of disease outbreaks as environmental, genetic, or nutritional deficiencies are exploited by primary and opportunistic pathogens. Developing dietary supplements and additives to provide complete mucosal health and protection of fish raised in intensive systems has emerged, therefore, as a high priority area with a great potential for significant improvements in aquaculture.

Teleost fish exhibit well-developed physical and immunological barriers at mucosal surfaces where a complex interplay of secreted mucus, commensal bacteria, and underlying mucosa-associated lymphoid tissue (MALT) elements serve to co-regulate immunity and maintain homeostasis in healthy fish (Peatman et al., 2013; Salinas et al., 2011). While our understanding of host-pathogen-commensal-environment interactions are growing, our knowledge has been, until

recently, focused in the gut mucosa, with relatively little study on skin and gill barriers. These exterior surfaces, however, are important primary targets for pathogen attachment and invasion. A key question is whether dietary additives, known to enhance gut immune health (Abid et al., 2013; Hoseinifar et al., 2014), may also stimulate beneficial, protective immunity at distal mucosal surfaces, either through transfer through the blood or by direct stimulation of immune receptors through the presence of whole or digested feed components in the water (Lazado and Caipang, 2014).

Flavobacterium columnare, the causative agent of columnaris disease, is among the most prevalent of all freshwater disease-causing bacteria. Often characterized as unpredictable and difficult to treat, columnaris impacts global aquaculture of catfish, salmonids, baitfish and aquaria-trade species among others (Declercq et al., 2013; Sun et al., 2012). Channel catfish, the predominant aquaculture species in the United States, are exceedingly susceptible to columnaris disease (Arias et al., 2004b). Catfish experiencing stress due to high rearing density (Shoemaker et al., 2003), high organic loads (Chowdhury and Wakabayashi, 1988), excessive handling (Wakabayashi, 1991), or high ammonia etc. (Farmer et al., 2011) are more susceptible to *F. columnare* infection. Catfish gill and skin tissues constitute the primary route of entry for the pathogen, with infection often grossly evident soon after colonization in the form of pale discoloration, erosion or necrosis of these tissues (Arias et al., 2012a). Strategies to combat columnaris infections have long included lowering rearing density, salt baths, acid baths, and chemical therapeutants (Davis, 1922). However, these approaches have failed to reduce columnaris disease incidence, as they are largely reactive measures after the onset of disease. Cost-effective,

improved dietary formulations which improve immune readiness or decrease pathogen adhesion offer the potential of continuous, proactive mucosal protection (Peterson et al., 2012; Peterson et al., 2010).

High-throughput transcriptome sequencing (RNA-seq) offers several advantages over traditional microarray approaches for nutri-genomics (Shahzad and Loor, 2012). It allows for capture of novel transcripts and splicing variants which may not be present on static arrays, it has a larger dynamic range, and it avoids the potential of cross-hybridization of similar probes resulting in inaccurate gene expression values (Wang et al., 2009). Using RNA-seq approaches, previous work by our group has demonstrated that differing cytokine and lectin profiles in surface mucosa differentiate fish from families identified as resistant or susceptible to columnaris disease (Peatman et al., 2013). We have particularly focused on the role of a rhamnose-binding lectin (RBL1a) in facilitating pathogen attachment and invasion in the gill (Beck et al., 2012; Li et al., 2014; Peatman et al., 2013; Thongda et al., 2014). Our group found that pathogen attachment could be reduced in a dose-dependent manner through addition of a sugar ligand (rhamnose or D-galactose) and that levels of RBL1a were dramatically impacted by feeding status (Beck et al., 2012). Given our improved understanding of mechanisms potentially governing host mucosal immunity in the context of columnaris, we were interested in examining whether commercially-available enhanced diets could increase catfish survival by modulating these same pathways. It was investigated whether the feeding of a standard catfish diet supplemented with Alltech dietary additives Actigen®, a concentrated source of yeast cell wall-derived material including mannan oligosaccharides (Saraiva et al., 2011) and/or Allzyme® SSF, a fermented strain of *Aspergillus*

niger producing a complex of enzymes (Hooge et al., 2010), could offer protection against *F. columnare* mortality.

Material and Methods

Fish and Diet Composition

All procedures involving the handling and treatment of fish used during this study were approved by the Auburn University Institutional Animal Care and Use Committee (AU-IACUC) prior to initiation.

In order to evaluate the biological response of two dietary supplements (Actigen® and Allzyme® SSF meals, Alltech, Inc., Nicholasville, KY, USA), four practical diets (Basal diet (B), B+Allzyme® SSF, B+Actigen® and B+Actigen®+Allzyme® SSF) were formulated to contain 36% protein and 8% lipids and offered to juvenile (average size 4.1±0.11 g) channel catfish over a nine week growth trial (Table 2.1). Fish were stocked in 36 aquaria (75L) at a density of 20 fish per aquaria with nine replicate tanks per dietary treatment. The fish in the replicate aquaria were randomly assigned to each dietary treatment and offered feed twice daily (8:00 am, 4:00 pm) based on a set percentage of body weight. Water temperature (27.82±1.16 ℃) and dissolved oxygen (5.63±0.73 mg/L) were measured twice daily by YSI Model 58 Oxygen Meter (Yellow Springs Instrument Model 58, Yellow Springs, OH, USA) and pH (7.23±0.40) weekly with a pH meter. A diel light: dark cycle was set at 14:10 h. Fish were weighed upon initiation of the trial and every two weeks thereafter. Feed inputs were adjusted based on observed feed consumption and

biweekly feed conversion ratio. At the conclusion of the growth trial, final weight, weight gain and feed utilization were determined. All data was analyzed using one-way analysis of variance to determine significant differences ($P < 0.05$) among treatments. The statistical analyses were performed using the SAS® software package (SAS Institute Inc., Cary, NC, USA).

The basal diet was formulated to meet the known nutrient requirements of the fish and represents a typical fingerling diet. Diets were manufactured at Auburn Fisheries North Station, Auburn, AL under laboratory conditions. Each diet was prepared by mixing pre-ground dry and wet ingredients in a food mixer (Hobart, Troy, OH) for 15 min. Boiling water was then blended into the mixture to attain a consistency appropriate for pelleting. The moist mash from each diet was passed through a die (2.4 or 3.17 mm) in a meat grinder, and the pellets were dried in a forced air drying oven (< 50 ^{o}C) to a moisture content of less than 10%. Diets were stored at -20 ^{o}C and prior to use each diet was ground and sieved to an appropriate size.

Ingredient	Basal (B)	B+Allzyme® SSF	B+Actigen®	B+Allzyme® SSF+Actigen®
Fishmeal [a]	6.00	6.00	6.00	6.00
Soybean meal [b]	60.00	60.00	60.00	60.00
Corn gluten meal [c]	5.00	5.00	5.00	5.00
Corn, yellow [d]	18.00	18.00	18.00	18.00
Corn starch [e]	0.84	0.79	0.74	0.69
Menhaden Fish Oil [a]	5.56	5.56	5.56	5.56
Vitamin premix [f]	1.80	1.80	1.80	1.80
Choline chloride	0.20	0.20	0.20	0.20
Stay C 25% [h]	0.10	0.10	0.10	0.10
Trace mineral premix [i]	0.50	0.50	0.50	0.50
CaP-dibasic [e]	2.00	2.00	2.00	2.00
Allzyme® SSF [g]	0.00	0.05	0.00	0.05
Actigen® [g]	0.00	0.00	0.10	0.10

[a] Omega Protein Inc., Reedville, VA, USA.
[b] De-hulled solvent extract soybean meal, Bunge Limited, Decatur, AL, USA.
[c] Empyreal® 75, Cargill Corn Milling, Cargill, Inc., Blair, NE, USA.
[d] Faithway Feed Co., Guntersville, AL, USA.
[e] MP Biochemicals Inc., Solon, OH, USA.
[f] Vitamin (g/kg Premix): Thiamin HCl 0.44, Riboflavin 0.63, Pyridoxine HCl 0.91, D pantothenic acid 1.72, Nicotinic acid 4.58, Biotin 0.21, Folic acid 0.55, Inositol 21.05, Menadione sodium bisulfite 0.89, Vitamin A acetate (500,000 IU g^{-1}) 0.68, Vitamin D_3 (400,000 IU g^{-1}) 0.12, DL-alpha-tocoperol acetate (250 IU g^{-1}) 12.63, cellulose 955.59.
[h] Stay-C® (L-ascorbyl-2-polyphosphate), Roche Vitamins Inc., Parsippany, NJ, USA.
[i] Trace mineral (g/100g Premix): Cobalt chloride 0.004, Cupric sulfate pentahydrate 0.25, Ferrous sulfate 4.0, Magnesium sulfate anhydrous 13.862, Manganous sulfate monohydrate 0.65, Potassium iodide 0.067, Sodium selenite 0.01, Zinc sulfate hepahydrate 13.193, cellulose 67.964.
[g] Alltech Inc., Nicholasville, KY, USA

Table 2.1 Composition (g/100g as is) of test diets formulated to contain 36% protein and 8% lipids for the evaluation of two dietary supplements.

Bacterial Challenge and Tissue collection

Fish were maintained in four 50 gallon tanks and acclimatized for two weeks at a temperature of 28 ^{o}C after transfer to the challenge lab in the CASIC building, Auburn University. Before challenge, the *F. columnare* bacteria (BGFS-27; genomovar II) were cultured from a single colony and re-isolated from a symptomatic fish (Olivares-Fuster et al., 2011). The bacteria were inoculated in modified Shieh broth and grown in the shaker incubator (100 rpm) for 24 h at 28 ^{o}C. Challenge experiments were conducted by immersion exposure for 2 h at a final concentration 1×10^{5} CFU/mL. After eight weeks of the above feeding regimen, fish from 3 replicate per treatment were challenged with *F. columnare* through standard bath challenge (Beck et al., 2012;

Sun et al., 2012). Daily and accumulative mortality was tracked to preliminarily estimate the effect of four diets.

At nine weeks, based on pre-challenge trial results, basal, B+Actigen®, and B+Allzyme® SSF groups were selected for further challenges with *F. columnare*. Four tanks were used for each group, three of which were challenged with *F. columnare* and one tank served as the control group. Control fish were treated with identical procedures except that they were not exposed to the bacteria, but exposed to sterile modified Shieh broth. Gill, skin, and intestine tissues were collected before (0 h) and soon after challenge (1 h, 2 h, 8 h). Equal amounts of tissue (approximately 50 mg) were collected from each fish within the three pools (3 pools of 5 fish each). The fish were euthanized with tricaine methanesulfonate (MS 222) at 300 mg/L (buffered with sodium bicarbonate) before tissues were collected. Pooled tissues were put into 5 ml RNALater™ at -80°C until RNA extraction. The remaining challenged catfish were utilized to monitor challenge mortality in 9- 60 L (45 L water) aquaria (3 aquaria/diet, 25 fish/aquaria) every 8 hours with flow through water as previously described (Li et al., 2013b). Median days to death and survival rate at the end of process were recorded. Survival data was analyzed with SigmaPlot 11 (San Jose, CA, USA) using Kaplan-Meier Log Rank Survival Analysis and all pair-wise multiple comparisons used the Holm-Sidak method with adjusted *P* values. Treatment effects were considered significant at $P < 0.05$ (Beck et al., 2012).

RNA Extraction, Library Construction and Sequencing

Based on the results of median days to death, survival rate and overall response against columnaris, we carried out transcriptomic comparison of gene expression of fish fed with the B+Actigen® diet and the basal diet before (0 h) and after (8 h) columnaris challenge using high-throughput RNA-seq (2 diets × 2 timepoints × 3 replicates=12 samples). Total RNA extraction was carried out following the manufacturer's directions using the RNeasy Plus Universal Mini Kit (Qiagen). RNA quality of each sample was measured on an Agilent 2100 Bioanalyzer using the RNA Nano Bioanalysis chip. RNA-seq library preparation was carried out by HudsonAlpha Genomic Services Lab (Huntsville, AL, USA). Briefly, cDNA libraries were prepared with 2.14-3.25 µg of starting total RNA and using the Illumina TruSeq RNA Sample Preparation Kit (Illumina), as dictated by the TruSeq protocol. The libraries were amplified with 15 cycles of PCR and contained TruSeq indexes within the adaptors, specifically indexes 1-12. Finally, amplified library yields were 30 µg of 19.8-21.4 ng/ µl with an average length of ~270 bp, indicating a concentration of 110-140 nM.12 samples were clustered per lane and sequenced by an Illumina HiSeq 2000 instrument with 100 bp paired end (PE) reads.

De novo Assembly and Annotation

De novo assembly of sequencing reads by Trinity package was applied after raw reads trimming (Grabherr et al., 2011). Before assembly, raw reads were trimmed by removing adaptor sequences and ambiguous nucleotides. Reads with quality scores less than 20 and length below 30 bp were all trimmed. High quality sequences were then assembled based on three independent software modules. Inchworm assembled raw reads into unique transcripts by kmers (k-mer 25)

and computed their abundance values. Chrysalis merged identified contigs from Inchworm into deBruijn graphs. Butterfly traced the paths that reads and pairs of reads taken within the graph and reported full-length transcripts as well as paralogous genes (Haas et al., 2013). The assembled contigs were used as queries against the NCBI zebrafish protein database, the UniProtKB/SwissProt database and the non-redundant (NR) protein database using the BLASTX program. The cutoff E-value was set at 1e-5 and only the top gene id and name were initially assigned to each contig.

Identification of Differentially Expressed contigs

The high quality reads from each sample were mapped onto the Trinity reference assembly using CLC Genomics Workbench software. At least (95%) of the read length was required to align to the reference and a maximum of two mismatches were allowed during mapping. The total mapped reads number for each transcript was determined, and then normalized to detect RPKM (Reads Per Kilobase of transcript per Million mapped reads) (Baggerly et al., 2003). The proportions-based Baggerly's test was used to identify the differentially expressed genes between Actigen®-fed and basal-fed fish at two timepoints with FDR corrected $P < 0.05$. The fold changes were calculated after scaling normalization of the RPKM values (Robinson and Oshlack, 2010). Analysis was performed using the RNA-seq module and the expression analysis module in CLC Genomics Workbench. Transcripts with absolute fold change values larger than 2 were included in analysis as the differentially expressed genes.

Contigs with previously identified gene matches were carried forward for further analysis. Functional groups and pathways encompassing the differently expressed genes were identified based on GO analysis, pathway analysis based on the Kyoto Encyclopedia of Genes and Genomes (KEGG) database, and manual literature review.

Gene Ontology and Enrichment Analysis

In order to identify overrepresented GO annotations in the differentially expressed gene set compared to the broader reference assembly, GO analysis and enrichment analysis of significantly expressed GO terms was performed using Ontologizer 2.1 using the Parent-Child-Intersection method with a Benjammini-Hochberg multiple testing correction (Bauer et al., 2008; Grossmann et al., 2007). GO terms for each gene were obtained by utilizing zebrafish annotations for the unigene set. The difference of the frequency of assignment of gene ontology terms in the differentially expressed genes sets were compared to the overall catfish reference assembly. The threshold was set as FDR corrected $P < 0.05$.

Experimental Validation: QPCR

A total of 10 differentially expressed genes were selected for validation using real time QPCR with gene specific primers designed using Primer3 software based on RNA-seq contig sequences. Table 2.2 showed the sequence information of these primers. Total RNA was extracted using the RNeasy Plus Universal Mini Kit (Qiagen) following manufacturer's instructions. First strand cDNA was synthesized by qScript™ cDNA Synthesis Kit (Quanta BioSciences) according

to manufacturer's protocol. The qScript chemistry used a blend of oligo-dT and random primers. All the cDNA products were diluted to 250 ng/µl and utilized for the quantitative realtime PCR reaction using the PerfeCTa® SYBR® Green FastMix® (Quanta BioSciences, Gaithersburg, MD, USA) on a CFX96 real-time PCR Detection System (Bio-Rad Laboratories, Hercules, CA, USA). The thermal cycling profile consisted of an initial denaturation at 95 ºC (for 30 s), followed by 40 cycles of denaturation at 94 ºC (5 s), an appropriate annealing/extension temperature (58 ºC, 5 s). An additional temperature ramping step was utilized to produce melting curves of the reaction from 65 ºC to 95 ºC. Results were expressed relative to the expression levels of 18S rRNA in each sample using the Relative Expression Software Tool (REST) version 2009 (Pfaffl et al., 2002). The biological replicate fluorescence intensities of the control and treatment products for each gene, as measured by crossing-point values, were compared and converted to fold change by the relative quantification method (Chee et al., 2010). The mathematical model was based on the correction for PCR efficiencies (assumed as 2) and the mean crossing point (Ct) deviation between sample groups and control groups. Expression differences between groups were assessed for statistical significance using a randomization test (≥ 2000 randomizations) and plotted using standard error (SE) estimation. Test amplifications were conducted to ensure that 18S and target genes were within an acceptable range. A no-template control was run on all plates. QPCR analysis was repeated in triplicate runs (technical replicates) to confirm expression patterns.

Gene		Sequence
Anterior gradient protein 2 homolog	Forward	TCCTTCTTGACCGCAGTCTTGT
	Reverse	AACCTGAGAGCAGCCTGTGAA

Argininosuccinate synthase	Forward	GTCTATAACAGGTGATGGACAG
	Reverse	GACACGTAGGAGCATTATATCC
Caspase-1-like, partial	Forward	ATTTTGTGTCTGACGGGCTA
	Reverse	GGCCCACAAAGTGATAGAAG
CC chemokine 106 SCYA106	Forward	CATTGGACTGCTGTTTGAAG
	Reverse	TTTTCATCAGCTCTCTGACC
CC chemokine 109 SCYA109	Forward	CTGAACTTTCTACAGTGTGTGG
	Reverse	GAACTGAAGAACTGGAGAGGA
IgGFc-binding protein-like isoform X1	Forward	AGTCACCAACTTGGAAAGAG
	Reverse	CCTCGCTTCAAATGTATCCT
Interleukin 17a/f1 precursor	Forward	TGGTTGCTCAGGCTGCTCCTT
	Reverse	ACGCCAGCTTGATGTCATGTTCC
Interleukin-1 beta	Forward	AGGCTTAGAGGAGGTAAAAGAC
	Reverse	CTTATAGTCCTCCTTTGAGGTG
Matrix metalloproteinase-9 precursor	Forward	GTGCGCTACTACAGCCAAT
	Reverse	TCGTGCAGGAAGTATAGGTT
Rhamnose binding lectin type Ia	Forward	GTGATGTCCAAAGACTCACGTG
	Reverse	GGTCGGGGTTGCCAAGTAAATC
Toxin-1 precursor	Forward	CTGCCTAGAAACTTCTGGTGT
	Reverse	CCAGGTCTCTTACAGAACTCC
18S rRNA	Forward	GAGAAACGGCTACCACATCC
	Reverse	GATACGCTCATTCCGATTACAG

Table 2.2 Primers used for QPCR validation (5' to 3').

Results

Catfish feed trial and challenge

Diets were formulated according to a standard catfish diet with the addition of Actigen®, Allzyme® SSF, or both products. Channel catfish fingerlings were fed from a 4.1 g average starting weight for nine weeks. All groups showed good weight gain, feed conversion ratios (FCRs) below

1.0, and excellent survival (> 95%). No significant differences in growth, FCR, or survival were observed among the different diet treatments. Results were presented in table 2.3.

Following a pre-challenge of a subset of the fed fingerlings (data not shown), the basal, Actigen®, and Allzyme® SSF groups were chosen for a full challenge to examine potential differences in *F. columnare* susceptibility. We challenged with a virulent *F. columnare* isolate known to cause heavy mortalities by two days in aquaculture settings. While mortality levels exceeded expectations based on pre-challenge dosage, there were statistically significant differences in survival curves of all three groups (Figure 2.1; $P < 0.001$). Mean survival times were 2.0, 2.5, and 5.0 days with the basal, Allzyme® SSF, and Actigen® diets respectively. Inclusion of Actigen® significantly enhanced survival, with 32% of challenged fish from that dietary treatment surviving at the completion of the challenge period compared with 100% mortality in the other two treatments.

Treatments	Final Mean Weight	Mean Weight Gain	FCR	Survival
Basal	35.01	754.60	0.79	96.67
B+Allzyme® SSF	32.03	692.90	0.83	97.78
B+Actigen®	34.27	745.30	0.82	98.89
B+Allzyme® SSF+Actigen®	34.02	747.80	0.82	95.00
PSE[a]	0.80	19.21	0.02	1.61
P-Value	0.08	0.11	0.40	0.38

[a] Pooled Standard Error

Table 2.3 Aquaria-based growth and survival response of juvenile channel catfish (average size 4.1 ± 0.11 g) to the test diets over an eight week growth trial.

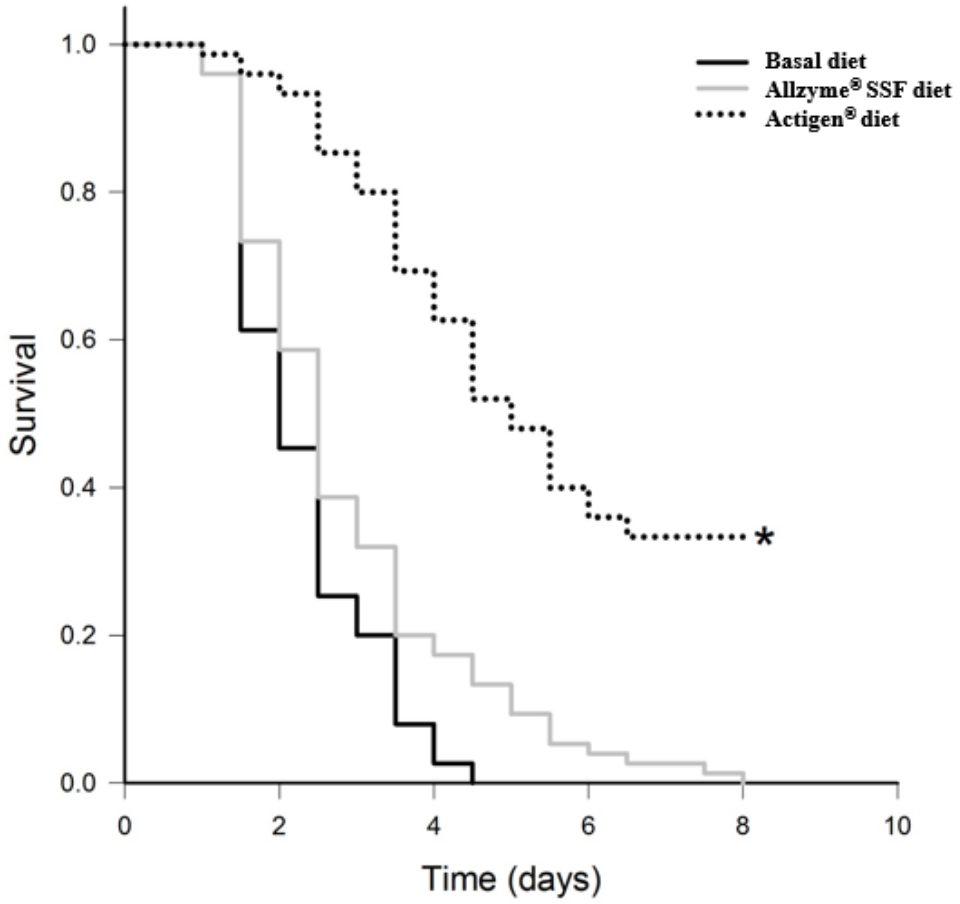

Figure 2.1 Summary of cumulative survival rate of channel catfish fingerlings after challenge with virulent *F. columnare* ($P < 0.001$)

Sequencing and Assembly

Given the clear protective effect of the Actigen®-supplemented diet, we chose to compare the whole transcriptome expression between the basal and Actigen® diet at 0 h and 8 h post infection. The 8 h post infection time point has been previously shown to be a key time point for

pathogen adherence as well as a point where we have observed diverging immune responses between resistant and susceptible catfish (Beck et al., 2012; Sun et al., 2012). Three replicate samples were used for each treatment/timepoint for a total of 12 samples. Approximately 40 million reads were obtained for each of the twelve libraries. After removing ambiguous nucleotides, low-quality sequences (quality scores < 20) and short reads (length < 30 bp), the remaining high-quality reads were carried forward for assembly and analysis. The Trinity assembly generated 396,019 contigs with average length of 798 bp, N50 size of 1,411 bp in its initial assembly, and 88,311 contigs longer than 1,000 bp (Table 2.4). Raw read data are archived at the NCBI Sequence Read Archive (SRA) under Accession SRP052919.

Contigs	396,019
Large contigs (1000 bp)	88,311
N50 (bp)	1411
Median contig length	413
Average contig length	798
Reads mapped in pairs (%)	67.84%

Table 2.4 Summary of *de novo* assembly results of Illumina RNA sequence data from channel catfish gill using Trinity assembler.

Gene Identification and Annotation

BLAST-based gene identification was performed to annotate the transcriptome and inform downstream differential expression analysis. After gene annotation, 112,104 Trinity contigs had a significant BLAST hit against 36,631 unique non-redundant genes. 23,689 unigenes were

identified based on hits to the NR database with the more stringent criteria of a BLAST score ≥ 100 and E-value ≤ 1e-20. The same BLAST criteria were used in comparison of the Trinity reference contigs with the Uni-Prot and zebrafish database (Table 2.5). Direct comparison of expression levels between basal and Actigen®-enhanced diets at 0 h (pre-challenge) revealed a relatively small (148) number of differentially expressed genes. In contrast, direct comparison of 8 h (post-challenge) expression differences, revealed 3,042 differentially expressed genes with over 96% of those showing higher expression in the Actigen® diet treatment relative to the basal diet treatment (Table 2.6; Appendix 1).

	Channel catfish		
	Zebrafish	UniProt	NR
Contigs with gene matches	103,692	95,179	112,104
Annotated contigs ≥ 500 bp	56,819	79,036	88,634
Annotated contigs ≥ 1000 bp	22,281	61,745	66,636
Unigene matches	24,636	28,833	36,631
Hypothetical gene matches	2024	0	3320
Quality Unigene matches	15,096	17,049	23,689

Table 2.5 Summary of gene identification and annotation of assembled catfish contigs based on BLAST homology searches against various protein databases (Zebrafish, UniProt, NR). Putative gene matches were at E-value ≤ 1e-5. Hypothetical gene matches denote those BLAST hits with uninformative annotation. Quality unigene hits denote more stringent parameters, including score ≥ 100, E-value ≤ 1e-20.

Group	Up-regulated	Down-regulated	Total
Basal diet 8 h vs 0 h	178	213	391

Actigen® diet 8 h vs 0 h	990	22	1012
Actigen® vs Basal 0 h	120	28	148
Actigen® vs Basal 8 h	2932	110	3042

Table 2.6 Statistics of differentially expressed genes following *F. columnare* challenge between Actigen® and basal diet treated fish at 0 h and 8 h. Values indicate contigs/genes passing cutoff values of fold change ≥ 2 (FDR-corrected $P < 0.05$).

Enrichment and Pathway Analysis

Differentially expressed unique genes were used as inputs to perform enrichment analysis using Ontologizer 2.1. Terms with $P < 0.05$ (FDR-corrected) were considered significantly overrepresented. Ten higher level GO terms for each comparison (within group and between group) were shown in table 2.7 and retained as informative for further pathway analysis. Enriched GO terms highlighted processes and pathways evident from the differentially expressed gene sets including broadly differing immune responses between dietary treatments, profound dysregulation of extracellular matrix components, and changes in mucosal constituents likely governing the rate of pathogen adhesion and colonization. Differentially expressed genes representing these signatures were gathered (Table 2.8) from the larger dataset (Appendix 1) and the putative functional significance of their differential expression is discussed below.

A

GO ID	GO Name	p-Value(FDR)	Population count	Study count
GO:0050896	Response To Stimulus	4.91E-07	2673	89

GO:0005581	Collagen Trimer	2.48E-06	44	8
GO:0009607	Response To Biotic Stimulus	5.33E-05	111	13
GO:0002376	Immune System Process	6.58E-05	419	22
GO:0042611	MHC Protein Complex	0.000197	14	4
GO:0005201	Extracellular Matrix Structural Constituent	0.000336	29	6
GO:0005102	Receptor Binding	0.001571	345	17
GO:0034097	Response To Cytokine	0.002278	56	6
GO:0050839	Cell Adhesion Molecule Binding	0.002298	24	4
GO:0005539	Gycosaminoglycan Binding	0.004857	44	5

B

GO ID	GO Name	p-Value(FDR)	Population count	Study count
GO:0032502	Developmental Process	8.97E-13	2406	204
GO:0032501	Multicellular Organismal Process	4.07E-10	2351	191
GO:0022610	Biological Adhesion	7.19E-10	261	41
GO:0065007	Biological Regulation	2.38E-06	1225	101
GO:0005856	Cytoskeleton	2.54E-06	3897	265
GO:0005201	Extracellular Matrix Structural Constituent	3.07E-06	526	47
GO:0006793	Phosphorus Metabolic Process	2.03E-05	29	9
GO:0043412	Macromolecule Modification	2.20E-05	1303	105
GO:0050896	Response To Stimulus	7.06E-05	2673	186
GO:0097367	Carbohydrate Derivative Binding	0.000555	1450	124

C

GO ID	GO Name	p-Vaule(FDR)	Population count	Study count
GO:0043062	Extracellular Structure Organization	0.002692	35	3
GO:1901699	Cellular Response To Nitrogen Compound	0.003096	51	4
GO:0006955	Immune Response	0.003401	182	6
GO:1901698	Response To Nitrogen Compound	0.008329	82	4
GO:0018193	Peptidyl-Amino Acid Modification	0.010728	171	6
GO:0007167	Enzyme Linked Receptor Protein signaling pathway	0.012131	288	7
GO:0008283	Cell Proliferation	0.020587	190	5
GO:0006952	Defense Response	0.028256	133	5
GO:0018212	Peptidyl-Tyrosine Modification	0.029928	41	4
GO:0004055	Argininosuccinate Synthase Activity	0.036036	1	1

D

GO ID	GO Name	p-Value(FDR)	Population count	Study count
GO:0065007	Biological Regulation	3.03E-11	3897	743
GO:0022610	Biological Adhesion	6.97E-10	261	81
GO:0006793	Phosphorus Metabolic Process	2.14E-09	1225	282
GO:0097367	Carbohydrate Derivative Binding	1.71E-08	1450	335
GO:0050896	Response To Stimulus	1.02E-06	2673	507
GO:0044271	Cellular Nitrogen Compound Biosynthetic Process	2.53E-06	1408	275
GO:0005201	Extracellular Matrix Structural Constituent	8.07E-06	29	14
GO:0005581	Collagen Trimer	0.000139	44	17
GO:0043412	Macromolecule Modification	0.000158	1303	269
GO:0009611	Response To Wounding	0.000737	175	46

Table 2.7 Summary of GO term enrichment results of significantly expressed genes in channel catfish between dietary treatments. The differentially expressed genes were analyzed as the study set in analyzing terms in within-group comparison of Basal (A) and Actigen® (B) treatments, and between-group comparison of 0 h (pre-challenge, C) and 8 h (post-challenge, D). FDR correct $P \leq 0.05$ was considered significant. Population count is the number of genes associated with the term in the population set. Study count is the number of genes associated with the term in the study set. GO names were retained only from GO terms of levels > 2.

Description	**Feature ID**	**Actigen® vs Basal**		**Basal**	**Actigen®**
		Between Group		**Within Group**	
		0 h	**8 h**	**8 h vs 0 h**	
IL4R pathway					
E3 ubiquitin-protein ligase CBL	c78522_g4_i2	2.59	**6.88**	1.16	**3.09**
Growth factor receptor-bound protein 10 isoform X3	c76466_g4_i3	1.03	**9.50**	-1.86	4.82
Insulin receptor substrate 1-B-like isoform X2	c80575_g6_i2	1.54	**3.80**	-1.03	2.40
Insulin receptor substrate 2	c82722_g12_i1	1.12	**3.44**	-1.30	**2.34**
Interleukin-4 receptor subunit alpha isoform X3	c81765_g4_i1	**2.15**	1.85	1.81	1.55
Janus kinase 3	c77974_g4_i5	**2.11**	**2.03**	1.51	1.44

Mitogen-activated protein kinase 3	c78210_g10_i3	1.51	**2.96**	1.00	1.98
Protein tyrosine phosphatase, non-receptor type 11	c75032_g3_i4	1.38	**3.78**	-1.41	1.98
Proto-oncogene c-Fos-like	c70011_g1_i2	1.43	**6.48**	**-5.28**	-1.15
Signal transducer and activator of transcription 3 isoform	c78505_g14_i6	1.25	**2.76**	-1.10	**2.00**
Signal transducer and activator of transcription 5	c82916_g2_i3	1.84	**3.36**	1.19	**2.20**
Signal transducer and activator of transcription 5b	c82916_g2_i6	1.42	**3.67**	-1.32	1.94
Signal transducer and activator of transcription 6	c79892_g8_i11	2.40	**5.13**	1.49	**3.10**
Son of sevenless homolog 1-like isoform X1	c82956_g11_i6	1.37	**7.83**	-1.12	5.01
Immune/inflammatory response					
Argininosuccinate synthase	c82175_g7_i2	**2.05**	1.09	**2.55**	1.36
Caspase-1-A-like	c71179_g1_i1	4.47	-2.52	**9.34**	-1.20
Caspase-1-like, partial	c197216_g1_i1	**-7.46**	**-3.66**	**-2.71**	-1.32
C-C chemokine receptor type 7-like	c71752_g1_i2	**2.25**	1.25	**2.33**	1.29
CC chemokine SCYA106	c78989_g3_i3	2.42	-1.50	**4.70**	1.30
CC chemokine SCYA109	c77257_g5_i3	2.99	**-2.94**	**8.84**	1.02
CC chemokine SCYA113	c74352_g3_i4	6.04	-2.33	**14.10**	-1.00
CC chemokine SCYA116	c70509_g1_i1	**3.71**	-1.45	**6.58**	1.22
CD209 antigen-like protein 2-like isoform X1(DC-SIGN)	c75853_g2_i11	**-5.56**	-2.00	**-2.86**	-1.03
CD4-like protein 1	c77482_g1_i2	2.66	-1.12	**3.38**	1.11
CD4-like protein 2 precursor	c76656_g2_i4	2.23	1.11	**3.10**	1.57
Chemokine (C-X-C motif) ligand 12b (stromal cell-derived factor 1)	c79153_g4_i4	-1.32	**3.88**	**-2.11**	**2.44**
Complement C1q tumor necrosis factor-related protein	c76437_g11_i2	1.04	**5.08**	-1.83	**2.72**
Complement C4-1	c83218_g2_i10	1.70	**2.81**	1.34	2.13
Connector enhancer of kinase suppressor of ras 3-like	c79400_g2_i1	1.81	**3.25**	1.19	**2.22**
C-type lysozyme	c64942_g1_i2	**2.71**	-1.03	2.75	-1.01
C-type mannose receptor 2	c79310_g5_i3	1.22	**6.91**	-1.74	**3.31**
C-X-C motif chemokine 10-like	c78829_g1_i5	2.77	-1.39	**4.80**	1.27
Galectin-4	c78285_g4_i1	11.26	**121.89**	-1.99	**5.59**
Galectin-4-like, partial	c78285_g2_i4	1.44	**11.67**	-2.30	3.23
Ig kappa chain V-III region CLL precursor	c83593_g1_i1	3.70	-1.34	**4.20**	-1.22
Ig mu chain C region membrane-bound form	c81635_g1_i5	1.93	-1.36	**2.98**	1.12
IgGFc-binding protein-like	c76549_g1_i1	4.11	**22.12**	-1.24	**5.25**
Immunoglobulin light chain	c83492_g3_i4	2.07	-1.30	**2.59**	-1.04
Integrin alpha 6b precursor	c83435_g3_i6	1.44	**4.69**	-1.37	**2.38**
Integrin alpha-1	c83443_g8_i4	1.92	**6.90**	-1.39	**2.58**
Integrin alpha-10 isoform X1	c82839_g3_i3	1.50	**7.11**	-1.79	2.40
Integrin alpha-2-like	c82135_g3_i11	1.55	**5.96**	-1.47	**2.63**

Integrin alpha-3 isoform X2	c78267_g4_i1	1.91	**6.71**	-1.13	**3.12**
Integrin alpha-3-like	c78267_g4_i2	2.48	**3.58**	1.95	2.85
Integrin alpha-5 precursor	c79286_g3_i8	1.51	**5.25**	-1.40	**2.49**
Integrin alpha-8	c80757_g25_i1	1.02	**2.16**	-1.33	1.57
Integrin alpha-E-like (CD103)	c80604_g3_i2	**2.67**	1.80	2.34	1.55
Integrin alpha-X-like	c84227_g2_i5	1.60	**3.10**	1.30	2.48
Integrin beta-3-like	c79865_g3_i1	1.12	**3.04**	-1.21	2.20
Integrin beta-4 isoform X1	c81949_g1_i7	2.08	**9.13**	-1.81	**2.45**
Integrin beta-4 isoform X2	c81949_g1_i6	1.41	**5.31**	-1.72	**2.18**
Integrin beta-7-like	c76232_g7_i4	2.31	**2.68**	1.72	**2.03**
Integrin, beta 1	c80193_g4_i4	1.11	**5.10**	**-2.34**	1.99
Interleukin 1, beta	c78925_g2_i12	1.37	6.94	**-7.01**	-1.38
Interleukin 17a/f1 precursor	c77837_g8_i2	23.42	-2.33	**67.92**	1.21
Interleukin 17a/f2 precursor	c62007_g1_i1	8.30	-1.51	**37.83**	2.92
Interleukin 22	c70125_g2_i1	7.81	-1.11	**11.16**	1.32
Interleukin 7 receptor precursor	c78110_g5_i1	1.63	**3.24**	1.41	**2.81**
Interleukin-1 receptor type 1-like	c82485_g5_i9	1.73	**10.10**	-2.54	2.36
Interleukin-11 receptor subunit alpha isoform X1	c80717_g11_i10	1.30	**12.32**	-1.88	**4.94**
Interleukin-13 receptor subunit alpha-2 precursor	c77237_g2_i3	1.56	-1.36	**2.43**	1.14
Interleukin-6 receptor subunit beta	c81756_g1_i6	1.58	**4.64**	-1.27	**2.31**
Interleukin-6 receptor subunit beta-like isoform X1	c78102_g6_i2	1.46	**3.70**	-1.11	**2.38**
Kinase suppressor of Ras 1-like isoform X2	c78509_g6_i3	4.71	**7.52**	1.44	2.26
Lymphocyte antigen 75 (DEC205)	c83066_g2_i1	**2.60**	**8.31**	-1.08	**2.95**
Macrophage mannose receptor 1	c80828_g1_i2	1.19	**2.61**	1.08	**2.35**
MHC class II beta chain, partial	c77410_g5_i3	1.86	-1.63	**3.76**	1.24
MHC class IIA antigen	c79083_g6_i3	2.17	-1.11	**4.14**	1.70
Microfibril-associated glycoprotein 4-like isoform X1	c80625_g2_i2	1.51	**-2.58**	**4.11**	1.05
N-acetylglutamate synthase, mitochondrial-like	c84176_g5_i2	1.33	**2.11**	-1.18	1.35
Natterin-like protein	c83837_g6_i3	1.42	**4.48**	**-3.70**	-1.20
Olfactomedin-like 3	c76681_g3_i3	**-3.92**	1.04	**-3.39**	1.24
Ornithine aminotransferase, mitochondrial	c82495_g10_i1	1.66	**3.93**	-1.18	**2.01**
Protein jagged-2-like isoform X2	c82047_g5_i2	-1.02	**3.71**	-1.31	2.79
Protein NLRC3-like isoform X1	c78545_g4_i3	2.35	**16.72**	-2.15	**3.49**
Protein NLRC5	c78312_g1_i1	2.90	**4.33**	1.82	**2.66**
Protein NLRC5-like	c82299_g2_i1	**2.20**	**2.88**	1.28	1.68
Retinoic acid receptor gamma-A	c78386_g8_i14	1.44	**2.24**	1.02	1.58
Retinoic acid receptor gamma-A-like isoform X2	c70458_g2_i1	8.21	**60.23**	-4.02	2.39
Secretory phospholipase A2 receptor	c79169_g6_i2	1.31	**8.82**	-1.63	**4.04**

T cell receptor alpha, partial	c83360_g3_i2	2.77	-1.77	**3.22**	-1.54
T cell receptor gamma 2	c77668_g3_i1	2.39	-1.79	**3.14**	-1.32
T-cell antigen receptor alpha, partial	c83360_g3_i3	2.37	-1.47	**3.62**	1.04
T-cell antigen receptor beta	c80911_g1_i7	1.92	-1.65	**3.26**	1.03
Tight junction protein ZO-1-like isoform X10	c76166_g6_i2	1.89	**4.38**	1.02	**2.35**
Tight junction protein ZO-1-like isoform X2	c81503_g3_i5	1.65	**10.08**	-1.26	**4.70**
Tight junction protein ZO-3-like isoform X2	c83258_g4_i4	**2.04**	**4.68**	-1.08	**2.12**
Toxin-1 precursor	c82831_g4_i1	-1.19	2.08	**-3.04**	-1.23
Transforming growth factor, beta 1a precursor	c81254_g6_i2	1.11	**3.32**	-1.41	**2.12**
Tumor necrosis factor receptor superfamily member 14	c81448_g3_i2	**10.29**	2.40	5.55	1.31
ECM/Tissue repair/Resolution					
A disintegrin and metalloproteinase with thrombospondin motifs 10	c78926_g3_i3	2.25	**6.05**	1.37	3.77
Chitinase-like protein PB1E7.04c-like	c77776_g5_i2	2.79	**15.71**	-1.63	**3.49**
Collagen alpha-1(II) chain-like isoform X2	c82454_g8_i2	-1.19	**5.96**	**-3.13**	2.26
Collagen alpha-1(IX) chain-like	c81123_g1_i2	-1.38	**2.86**	-2.37	1.66
Collagen alpha-1(VI) chain	c79446_g1_i2	-1.17	**3.08**	**-2.08**	1.73
Collagen alpha-1(X) chain-like	c78022_g2_i1	-1.72	**2.75**	**-3.07**	1.54
Collagen alpha-1(XI) chain isoform X1	c84151_g2_i1	1.02	**7.24**	**-2.73**	**2.55**
Collagen alpha-1(XI) chain isoform X5	c84151_g2_i7	-1.38	**2.60**	**-2.44**	1.47
Collagen alpha-1(XI) chain-like	c83057_g1_i7	1.03	**3.60**	-1.76	1.98
Collagen alpha-1(XI) chain-like isoform X6	c80532_g3_i16	1.21	**7.82**	-2.57	**2.56**
Collagen alpha-1(XII) chain isoform X1	c77224_g7_i6	1.04	**13.08**	**-3.32**	**3.72**
Collagen alpha-1(XII) chain-like isoform X2	c82683_g7_i11	-1.06	**3.46**	-1.96	1.87
Collagen alpha-1(XII) chain-like isoform X3	c77224_g5_i3	1.97	**50.72**	-2.65	**8.46**
Collagen alpha-1(XII) chain-like isoform X4	c77224_g7_i3	1.86	**45.89**	-2.08	**11.65**
Collagen alpha-1(XII) chain-like isoform X5	c77224_g5_i1	1.52	**27.77**	-2.48	**7.56**
Collagen alpha-1(XIV) chain	c77222_g1_i3	1.03	**4.23**	-1.79	2.18
Collagen alpha-1(XVI) chain-like	c82903_g6_i8	-1.22	**4.59**	-2.17	**2.60**
Collagen alpha-1(XVIII) chain-like isoform X2	c81631_g7_i9	1.10	**8.06**	-2.55	**2.97**
Collagen alpha-1(XVIII) chain-like isoform X3	c81631_g7_i4	1.38	**2.92**	1.15	**2.39**
Collagen alpha-1(XXII) chain precursor	c77456_g2_i6	1.50	**16.19**	-5.68	1.96
Collagen alpha-1(XXIII) chain-like	c78447_g11_i5	-1.07	**2.71**	-1.93	1.55
Collagen alpha-1(XXVII) chain B precursor	c80585_g3_i8	1.37	**8.89**	-1.24	**5.13**
Collagen alpha-2(IV) chain isoform X2	c82843_g3_i2	1.15	**2.05**	-1.18	1.51
Collagen alpha-2(V) chain-like	c75359_g3_i4	-1.07	**3.62**	-2.12	1.83
Collagen alpha-2(VI) chain isoform X2	c79746_g5_i5	-1.20	**2.12**	-1.63	1.56
Collagen alpha-2(VI) chain-like	c79746_g5_i1	-1.40	**3.69**	**-3.30**	1.59

Collagen alpha-2(XI) chain isoform X9	c80532_g3_i7	1.17	**11.25**	-2.85	3.39
Collagen alpha-3(VI) chain-like	c84294_g1_i2	1.38	**5.10**	-1.35	**2.77**
Collagen alpha-4(IV) chain-like	c81110_g2_i5	1.04	**5.03**	-1.17	**4.14**
Collagen alpha-5(IV) chain	c84125_g1_i14	-1.31	**2.82**	**-2.20**	1.68
Collagen alpha-6(IV) chain	c77834_g7_i1	-1.12	**2.01**	-1.66	1.37
Collagen type I alpha 2	c83429_g1_i12	-1.62	**5.34**	**-4.13**	2.10
Collagen type IV alpha1 precursor	c77834_g9_i4	-1.05	**5.94**	-1.80	**3.50**
Collagen type IV alpha-3-binding protein-like isoform X1	c77391_g9_i3	-1.02	**2.10**	-1.46	1.48
Collagen, type I, alpha 1	c76517_g9_i4	-1.26	**9.15**	**-4.45**	**2.58**
Decorin	c81816_g5_i2	1.09	**5.83**	-2.16	**2.50**
Disintegrin and metalloproteinase domain-containing protein 12	c75507_g3_i1	1.19	**5.20**	-1.89	2.19
Fibronectin	c84233_g5_i9	1.38	**4.00**	-1.43	**2.05**
Fibronectin 1b	c84233_g5_i3	1.10	**2.16**	-1.12	1.74
Fibronectin type III domain-containing protein 1 isoform	c80599_g1_i7	-1.12	**5.60**	-1.63	3.84
Fibronectin type III domain-containing protein 3B	c76568_g3_i6	1.00	**2.60**	-1.53	1.70
Fibronectin type III domain-containing protein 3B-like	c76568_g3_i3	1.14	**13.11**	-2.98	**3.92**
Fibronectin type-III domain-containing protein 3A isoform	c79826_g17_i6	2.02	**7.05**	1.06	**3.55**
Gelsolin-like	c81531_g3_i2	-1.02	**2.00**	-1.31	1.55
Glucocorticoid receptor isoform X1	c80677_g3_i2	1.74	**6.25**	-1.22	2.69
Lumican isoform X1	c78518_g2_i1	**-4.66**	**4.20**	**-5.17**	3.78
Lysyl oxidase homolog 1-like	c78063_g1_i1	1.31	**8.65**	-2.08	**3.22**
Lysyl oxidase homolog 2A-like	c81461_g3_i3	-1.42	**2.90**	-1.95	2.15
Lysyl oxidase homolog 3-like isoform X1	c78790_g3_i5	-1.49	**4.11**	-2.53	2.32
Lysyl oxidase homolog 4	c81080_g10_i3	-1.52	**2.43**	**-2.58**	1.42
Lysyl oxidase homolog 4-like	c81080_g10_i1	-1.65	**5.34**	-3.98	2.13
Matrix metalloproteinase 13	c84067_g2_i5	1.15	**2.68**	**-2.15**	1.09
Matrix metalloproteinase 13 precursor	c84067_g6_i2	2.25	**7.07**	-2.26	1.39
Matrix metalloproteinase-15	c77990_g1_i3	-1.32	**2.12**	-1.75	1.61
Matrix metalloproteinase-15-like	c77990_g1_i2	1.95	**5.16**	-1.05	2.65
Matrix metalloproteinase-16-like isoform X2	c80383_g12_i1	1.58	**7.65**	-1.59	**2.92**
Matrix metalloproteinase-19-like	c78392_g1_i4	1.13	**2.05**	-1.18	1.57
Matrix metalloproteinase-9 precursor	c79228_g1_i1	-1.58	**11.26**	**-7.34**	2.45
Von Willebrand factor precursor	c83313_g6_i2	-1.12	**2.32**	-1.47	1.77
Mucin secretion and modification					
Anterior gradient protein 2 homolog precursor	c74607_g1_i2	3.33	-1.63	**5.40**	-1.01
Anterior gradient protein 2-like protein	c74607_g1_i1	3.63	-2.66	**6.74**	-1.40
Mucin 17-like protein, partial	c81110_g2_i2	1.51	**3.88**	-1.61	1.65

Mucin-17 isoform X2	c78080_g3_i5	6.13	**40.15**	4.00	**23.06**
Mucin-2-like isoform X2	c75765_g1_i9	**3.26**	**21.90**	-1.72	**3.87**
Mucin-5AC-like	c77449_g2_i4	2.86	**24.77**	1.09	**9.99**
Mucin-5AC-like isoform X1	c83581_g8_i2	1.70	**3.13**	1.14	**2.08**
Normal mucosa of esophagus-specific gene 1 protein-like	c71085_g1_i3	**3.09**	-1.59	**3.68**	-1.34
Glycan-Binding					
Aggrecan core protein isoform X2	c18174_g1_i1	1.58	**14.51**	-1.88	**4.70**
Aggrecan core protein-like	c76196_g1_i3	1.03	**13.10**	-2.67	**4.64**
Amyloid beta A4 precursor protein-binding family B member	c80591_g3_i5	1.75	**3.46**	1.06	**2.10**
Amyloid beta A4 protein isoform X2	c82991_g3_i8	-1.78	**4.22**	**-4.63**	1.62
Amyloid beta A4 protein-like isoform X3	c73051_g3_i3	-1.70	**3.58**	**-2.22**	**2.72**
Amyloid beta precursor protein b	c73051_g1_i1	1.14	**4.75**	-1.55	**2.67**
Chondroitin sulfate N-acetylgalactosaminyltransferase	c74740_g1_i3	1.54	**3.78**	1.08	**2.73**
Chondroitin sulfate proteoglycan 4	c78627_g1_i1	1.21	**8.44**	-1.68	**4.49**
Chondroitin sulfate synthase 1	c76672_g2_i1	1.31	**2.88**	-1.33	1.66
Dermatan-sulfate epimerase isoform X1	c78896_g7_i3	-1.18	**2.82**	-1.75	1.91
Fibroblast growth factor 2-like	c77976_g11_i1	1.78	**3.28**	-1.02	1.82
Fibroblast growth factor 23 precursor	c81950_g3_i1	1.20	**2.88**	-1.89	1.26
Fibroblast growth factor receptor 1-A-like isoform X2	c80308_g6_i5	-1.08	**2.63**	-1.56	1.83
Fibroblast growth factor receptor 2 isoform X3	c84177_g1_i15	-1.43	**3.18**	-2.43	1.94
Fibroblast growth factor receptor 3 isoform X4	c82940_g11_i8	-1.40	**23.41**	-11.39	2.75
Fibroblast growth factor receptor 3 isoform X5	c82940_g2_i2	2.90	**8.71**	-1.05	2.85
Hyaluronan synthase 1-like	c75446_g1_i4	2.33	**18.41**	-6.94	1.16
Vascular endothelial growth factor	c74074_g2_i1	2.30	**3.06**	1.77	**2.30**

Table 2.8 Differentially expressed genes in the gill between Actigen® and basal-fed channel catfish in different functional classifications. Positive values indicate higher expression at Actigen® treatment while negative values indicate higher expression at Basal treatment. Bold values indicate a significant fold change (FDR-corrected $P < 0.05$).

Validation of RNA-seq Profiles by QPCR

For validation of differentially expressed genes identified from this study and previous RNA-seq, we selected 10 genes for QPCR confirmation, choosing from those with different expression patterns and from genes of interest based on functional enrichment and pathway results. Expression changes in these genes by QPCR were significantly correlated with those shown by RNA-seq ($R = 0.88$; Figure 2.2), indicating that while absolute degree of expression change of the two methods can be different, the patterns and general magnitude of expression change captured by RNA-seq were largely accurate.

One key aspect of the expression patterns of particular interest to us based on previous findings was the divergent patterns of rhamnose binding lectin 1a (RBL) between the basal control diet and the Actigen®-enriched diet. Previously, we have shown that higher RBL expression in catfish is linked to greater susceptibility to acute columnaris outbreaks (Beck et al., 2012). While RBL1a was identified from sequenced contigs, it was not found to be differentially expressed by RNA-seq analysis. However, additional QPCR analysis of expression at 1 h and 2 h, as well as 8 h, showed that while both dietary treatments upregulated RBL at 1 h post-challenge, expression levels dropped dramatically by 2 h and continued to decline to 8 h in the Actigen® treatment, while they remained significantly higher in the control diet (Figure 2.3). These patterns closely mimic those previously observed in catfish resistant and susceptible to columnaris (Peatman et al., 2013). The RNA-seq assembly process may have merged reads from both RB1a and the highly similar RBL1b (Thongda et al., 2014), masking differences at 8 h, whereas QPCR primers were designed to only amplify RBL1a.

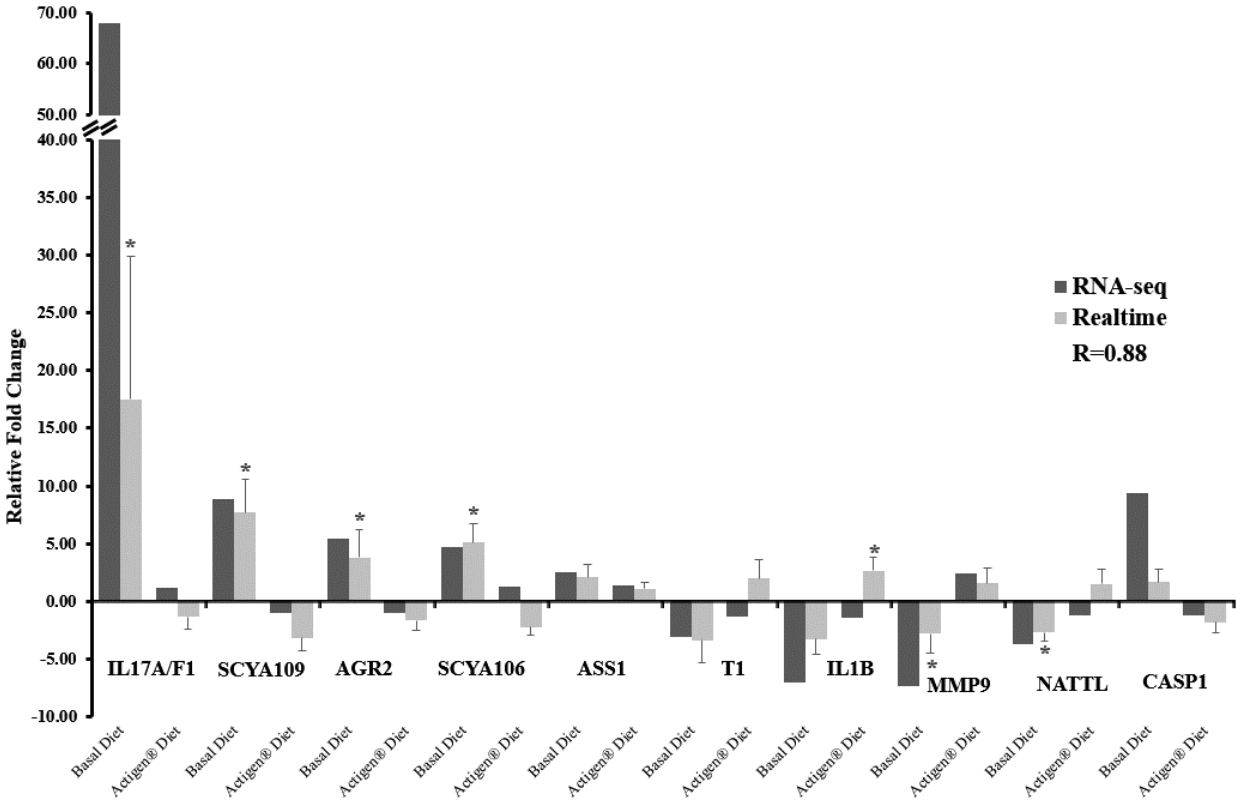

Figure 2.2 Comparison of relative fold changes between RNA-seq and QPCR results in the gill from Actigen® (8 h vs 0 h) and basal diet fed catfish (8 h vs 0 h). Gene abbreviations are: Interleukin 17a/f1 precursor, IL17A/F1; CC chemokine SCYA109, SCYA109; Anterior gradient protein 2 homolog precursor, ARG2; CC chemokine SCYA106, SCYA106; Argininosuccinate synthase, ASS1; Toxin-1 precursor, T1; Interleukin-1 beta, IL1B; Matrix metalloproteinase-9 precursor, MMP9; Natterin-like protein, NATTL; Caspase-1, CASP1. Results are presented as mean ± log standard error (SE) of fold changes and the asterisk indicates statistical significance at $P < 0.05$

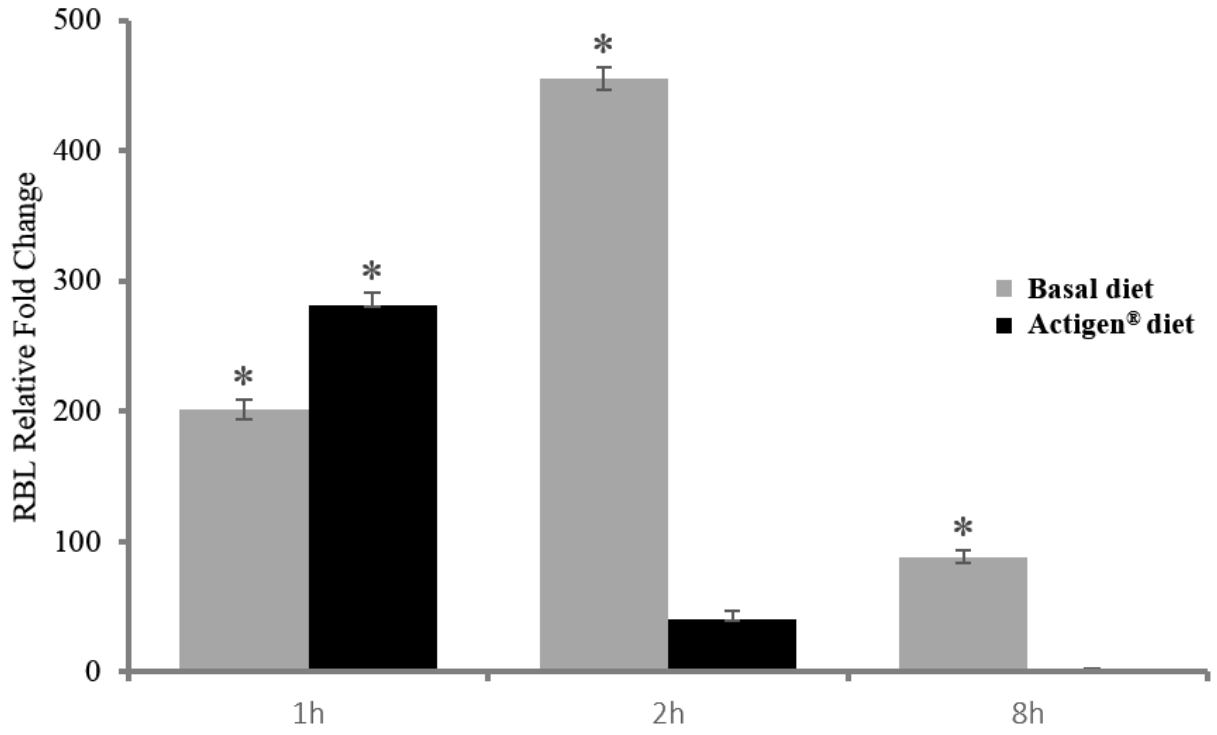

Figure 2.3 QPCR analysis of RBL1a expression following *Flavobacterium columnare* infection. RBL1a expression at 1 h, 2 h, 8 h relative to control (0 h) in catfish fed Actigen® and basal diets, respectively. Results are presented as mean ± log standard error (SE) of fold changes and the asterisk indicates statistical significance at $P < 0.05$

Discussion

Our understanding of dietary-driven protection of surface mucosa has been limited. However, the gill, skin, and nares of fish are critically important routes of infection (Gomez et al.,

2013). Recent research, for example, has revealed the importance of nasal surfaces in trout as routes of infection and vaccination (Tacchi et al., 2014). Work by our group has previously shown the critical interaction between nutritional status (fasted vs fed) and immunity in the skin and gill of channel catfish (Liu et al., 2013b) and blue catfish (Li et al., 2014). Our present work examined the effectiveness of two prebiotic feed additives, a yeast mannan oligosaccharide (Saraiva et al., 2011) product (Actigen®) and a fungal enzyme product (Allzyme® SSF) to modulate infectivity of a virulent genomovar of *F. columnare* in channel catfish. Our results indicated a protective benefit gained through addition of Actigen® to a basal catfish diet leading us to examine gene expression patterns in the gill tissue of catfish fed both diets.

While the use of mannan oligosaccharide (Saraiva et al., 2011) products have increased in livestock feeds in recent years, the mechanisms by which they provide protection against disease are still poorly understood. Two main protective effects are hypothesized, direct blocking of pathogen colonization blocking and immune stimulation (Torrecillas et al., 2014). Bacterial adhesion can be mediated by interactions with carbohydrate-binding lectins (Bavington and Page, 2005), and this interaction can be disrupted through the presence of exogenous sugar ligands (Beck et al., 2012). MOS can also act as a non-pathogenic microbial antigen, stimulating pathogen recognition and downstream signaling cascades which prime and prepare host immune responses for subsequent infection. A recent review by Torrecillas et al. (Torrecillas et al., 2014) summarizes a diverse set of experiments on MOS-enhanced diets in fish species and examines the shared modes of action they reveal. In general, diets containing MOS promote gut epithelial integrity, change microbial flora composition, stimulate increased mucin secretion, and increase production of

bactericidal proteins such as lysozyme. Beyond fish, similar mechanisms and effects have been observed in chickens (Xiao et al., 2012) and pigs (Che et al., 2011). Analyses of gene expression changes induced by dietary MOS in fish have largely focused on key genes determined *ab initio* to be important for immune health in the gut based on mammalian models (Liu et al., 2013a; Lokesh et al., 2012; Torrecillas et al., 2015). In contrast, we utilized RNA-seq to examine global gene expression in baseline and post-challenge samples taken from gill tissues of catfish fed diets with and without MOS. While not immediately intuitive, the prevalence of aquaculture pathogens using mucosal routes of entry other than the gut necessitates examination of the potential for cross-protection and cross-presentation of beneficial antigens (Ag) introduced through the diet. It would be expected that a small amount of dietary additives may be solubilized and contacting surface mucosa from uneaten, partially digested feeds breaking apart in the water (Lazado and Caipang, 2014). However, a larger impact would be expected if common signaling and cross-presentation occurs among fish mucosal barriers. The presence of a common-mucosal immune system in fish, such that Ag encounters at one mucosal site induce protection and memory at distant mucosal sites, while still under debate, is supported by a growing body of research (Salinas et al., 2011).

Baseline/Pre-Challenge Differential Expression (0 h)

Direct comparison between basal and Actigen®-fed catfish at 0 h (pre-challenge) revealed relatively few differentially expressed genes following the eight week feeding trial (Table 2.8). This small number of genes was particularly striking in light of the large-scale up-regulation of genes we observed in Actigen®-fed fish soon after *F. columnare* challenge. However, among the

148 genes determined to be differentially expressed at 0 h were key signatures likely linked to a dramatic divergence in immune responses observed at 8 h. As illustrated in Figure 2.4, continual antigen stimulation by MOS appears to have polarized the catfish gill mucosa toward a toleragenic/resolution phenotype modulated in other species by Th2 and alternative (M2) macrophage cell profiles (Yamaguchi et al., 2013; Yoon et al., 2015). While baseline helper T cell and macrophage cell populations in catfish have described (Majji et al., 2009; Miller et al., 1985), further work will be needed to confirm the precise cellular actors contributing to the observed expression patterns in catfish.

At the top of this cascade are receptors responsible for mannose recognition, predominantly C-type lectin receptors. C-type lectin receptors (CLRs) have been found to play critical roles in determining T cell polarization fates in mammals (Geijtenbeek and Gringhuis, 2009). CLRs are expressed predominantly on dendritic cells (DC) and macrophages, where, they sample antigen and present it to T cell subsets to channel the direction of subsequent immune cascades. Group I CLRs (mannose receptor family) include the mannose receptors (MR1 and MR2) and DEC205 (Ly75). Among these, mannose receptors are expressed on both macrophages and myeloid DCs, while DEC205 is expressed on myeloid DC subsets alone (Geijtenbeek and Gringhuis, 2009; Tel et al., 2011). Interestingly, CLRs are valued in vaccine design strategies for their role in enhancing antigen-specific immune responses through robust antigen presentation. A series of studies have attempted to differentiate the roles of MRs and DEC205. They have revealed that: a) DEC205 is >30 times more effective in delivery of mannosylated Ags than MR; and b) DEC205 is highly upregulated on mature DC, while MR is upregulated on macrophages and dendritic cells by Th2-

derived cytokines, including IL-4 (Chieppa et al., 2003; Linehan et al., 2000; Mahnke et al., 2000). Of great relevance here, research has shown that Ag targeting to DEC205^{+} dendritic cells induces T cell anergy and peripheral tolerance in steady-state conditions (Chieppa et al., 2003; Hawiger et al., 2001; Ring et al., 2013). With this background, a comparison of expression profiles at 0 h revealed upregulation (2.6-fold) of DEC205 in MOS-fed fish, suggesting the presence of mannose Ag-sampling dendritic cell populations in the gill lymphoid tissue. Supporting this assertion was the similar upregulation of CD103 (2.67-fold), a well-known marker of dendritic cell subsets, in MOS-fed fish. Indeed, pulmonary CD103^{+} DCs prime Th2 responses to inhaled allergens (Nakano et al., 2012). Another marker of CD103^{+} DCs, Jagged 2, was upregulated at 8 h (but not 0 h) in Actigen® (Saraiva et al., 2011) fed fish relative to the control diet (Table 2.8). In a study of epithelial DC populations active in Ag sampling in the lung, Sung et al. (Sung et al., 2006) again noted CD103^{+} DCs, pointing out high levels of expression of tight junction proteins in these populations. A tight junction protein (ZO-3 like) was also upregulated here in MOS-fed fish. Notably, another receptor of immature DCs, DC-SIGN (CD209), was also differentially expressed at 0 h (down-regulated -5.59 fold). DC-SIGN, a group II CLR, interacts with a wide range of pathogens through mannose recognition and is also limited to expression on myeloid DCs (Geijtenbeek and Gringhuis, 2009). Unlike DEC205, DC-SIGN can induce the differentiation of a variety of pro-inflammatory T cell classes, and has been found to be expressed on different DC subsets than DEC205 and MR (Engering et al., 2002). Down-regulation in MOS-fed fish may reflect a shift in Ag sampling and presentation towards the more toleragenic DEC205 (van Kooyk et al., 2013).

Among the differentially expressed genes at 0 h, additional putative evidence of MOS-driven Th2 proliferation was found. In mice, Th2 cells stimulate marked increases in mucus production, through a process dependent on IL4Rα (Cohn et al., 1999). We observed upregulation of both mucin 2 (3.46-fold) and IL4Rα (2.15-fold) at 0 h. Mucus secretion, while widely perceived as beneficial in preventing invasion of gut mucosa, can be linked with excessive inflammation and airway obstruction in the context of the mammalian lung (James and Carroll, 1995). Our previous study of catfish susceptible to *F. columnare* highlighted significantly higher mucin levels (Mucin 2, -5AC, -19) in these fish relative to resistant fish at 0 h, with declining differences at 8 h. Here Actigen®-fed fish had higher disease resistance with higher mucin expression predominantly evident at 8 h. Given the multifactorial nature of pathogenesis, further study is needed to better understand the contexts wherein mucus secretion is beneficial or detrimental in responses to *F. columnare*. Perhaps linked to increased secretion of mucus in the gill, we did observe higher levels of lysozyme in Actigen® fed fish at 0 h as we have reported previously in *F. columnare* resistant fish (Peatman et al., 2013). Lysozyme is an abundant component of mucus, linked to *F. columnare* resistance in zebrafish (Yazawa et al., 2006), and a common component of MOS-generated responses (Welker et al., 2012; Xiao et al., 2012).

Also pointing to a role for IL-4 in the observed transcriptional responses at 0 h was the down-regulation of caspase-1. IL-4 signaling is reported to suppress caspase-1 activation, but not NLRC4, disrupting the assembly of excessive inflammasomes (Hwang et al., 2015). We observed lower levels caspase-1 (-7.46 fold) in Actigen®-fed fish relative to the basal diet, with a NLRC5-like gene showing higher expression (2.2 fold). IL4Rα is strongly expressed on M2-alternatively-

activated monocytes and macrophages and signals through Jak3 (2.11-fold higher than basal diet). Supporting the presence of M2 macrophages in higher numbers at 0 h in MOS-fed fish was the differential expression of ASS-1, involved in arginine pathways which play critical roles in the balance between M1 and M2 macrophages (Rath et al., 2014). Furthermore, 0 h expression differences included the CC chemokine SCYA116 (3.71-fold higher), previously identified as a catfish orthologue of mammalian CCL17/CCL22 (Peatman and Liu, 2007). CCL17/CCL22 are well-established as chemokines important for establishing and maintaining alternatively-activated macrophage populations through signaling and positive-feedback loops between dendritic cells and macrophages (Chieppa et al., 2003; Martinez and Gordon, 2014; Rajaiah et al., 2013). Taken together, the relative handful of differentially expressed genes following the 8 week feeding trial includes important receptors involved in mannose Ag sampling, Th2 proliferation, and M2 macrophage activation which would be predicted to generate responses linked to tolerance and tissue repair. Indeed, the 3,042 differentially expressed genes following *F. columnare* challenge show the widespread transcriptional consequences of this dietary-based polarization.

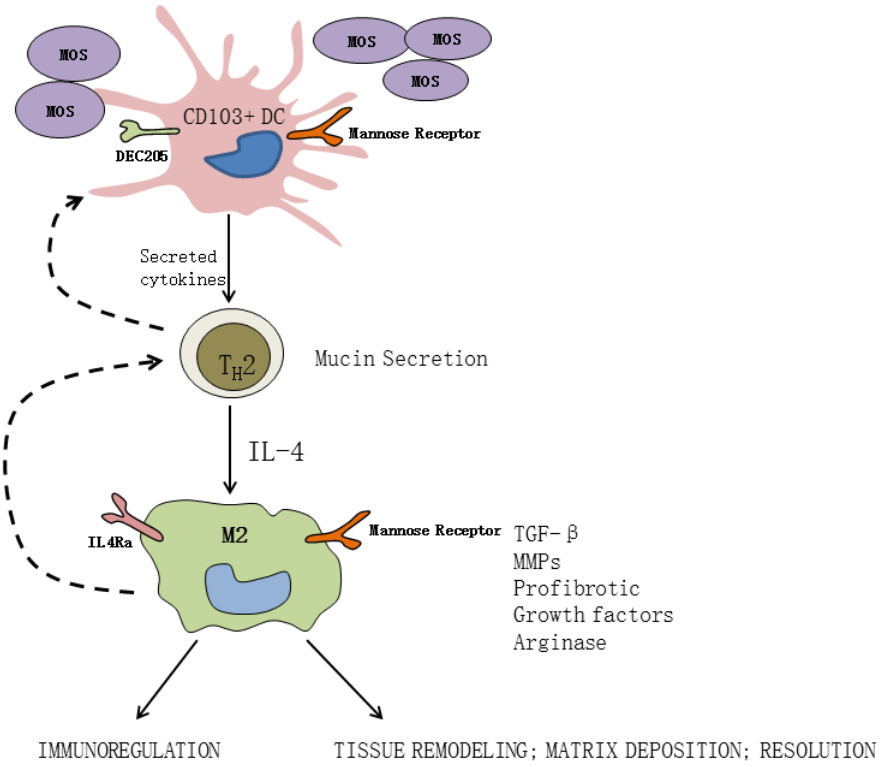

Figure 2.4 Proposed MOS recognition and signaling pathways in the gill of Actigen®-fed fish, based upon RNA-seq expression signatures

Post-challenge Differential Expression (8 h)

The transcriptomes of Actigen®-fed and basal diet-fed catfish gill 8 h following exposure to virulent *F. columnare* were profoundly different (Table 2.6-2.7), as the presence of the pathogen was met with drastically different early responses, likely due to the polarization of DC, macrophage, and T cell responses established by MOS-feeding.

Expression of components of the IL4 signaling pathway downstream of IL4Rα/JAK3 was broadly induced in Actigen®-fed fish, likely due to the increasing presence and cellular activity of M2 activated macrophages (Table 2.8) (Pernis et al., 1995). These included STAT6 (5.13-fold), PTPN11 (3.78-fold), IRS2 (3.44-fold) and ubiquitin ligase CBL (6.88-fold) among others (Heller et al., 2012). While functional studies on IL-4 are lacking in catfish, recent research in other teleost fish indicates conservation of function and signaling (Wang and Secombes, 2015; Zhu et al., 2012)

M2 macrophages, upon polarization through IL-4Rα signaling, are characterized by higher mannose receptor expression, secretion of chitinases, and production of anti-inflammatory cytokines (Martinez and Gordon, 2014; Rajaiah et al., 2013). Expression of mannose receptors 1 and 2 (CD206 and CD280) in Actigen®-fed fish was higher relative to fish fed the basal diet (2.61-fold and 6.91-fold respectively). Expression of mannose-sampling DEC205 also continued to be higher (8.31-fold) at 8 h in Actigen®-fed fish, suggesting the continued presence of toleragenic DC cells likely reinforcing polarization. A chitinase-like protein was strongly induced (15.71-fold). In mammals, chitinase-like proteins inhibit oxidant-induced lung injury, augment Th2 immunity, regulate apoptosis, stimulate M2 macrophage activation, and contribute to wound healing (Lee et al., 2011), all processes evident in 8 h post-infection signaling in Actigen®-fed fish. TGF-β, a potent anti-inflammatory cytokine, was 3.32-fold higher in Actigen®-fed fish at 8 h. In mice, TGF-β has been found to critical for the development of airway tolerance to inhaled allergens (Michael et al., 2015).

In contrast, catfish fed the basal diet had higher expression levels of several pro-inflammatory chemokines and cytokines. The CC chemokines SCYA106, SCYA109, and

SCYA113, orthologous to CCL19/21 in humans (Peatman and Liu, 2007), were upregulated in basal fed fish. CCL19/21 signaling in mammals is important for programming of DCs for induction of Th1 responses, including release of pro-inflammatory cytokines (Marsland et al., 2005). Induction of Th17 cytokines IL-17/IL-22 was particularly pronounced in basal-diet fed fish (Table 8), rising greater than 10-fold following challenge. During lung infections, IL-17 and IL-22 drive inflammation and pathogen clearance, but can also be linked to destructive, over-exuberant responses (Manni et al., 2014). The lack of a strong IL-17 response in the gill tissue of Actigen®-fed fish following *F. columnare* infection differs sharply from previous studies by our group and indicates the strength of the toleragenic programming induced by MOS (Peatman et al., 2013; Sun et al., 2012; Xiao et al., 2012).

Recent research has indicated that mannose receptors present on M2 macrophages are responsible for many of the immunosuppressive and tissue remodeling functions carried out by that cell type, acting as a unique bridge between innate immunity and homeostasis (Geijtenbeek and Gringhuis, 2009; Martinez and Gordon, 2014). Indeed, in another potential feedback mechanism, mucins serve as MR ligands to enforce continuation of an anti-inflammatory program, particularly in toleragenic APC subsets in the gut and lung (Chieppa et al., 2003; Engering et al., 2002). Higher levels of MUC17, MUC2, and MUC5AC were observed at 8 h in Actigen®-fed fish, expanding from the modestly higher mucin levels observed at 0 h (Table 2.8).

During proliferative and resolution phases of inflammation, M2 macrophages play a critically important role in clearance, enhancing the capacity to turnover extracellular matrix (ECM), internalizing and degrading collagen in some locations, and directing and promoting

deposition in others (Wermuth and Jimenez, 2015). The mannose receptors in mammals are also critical for these functions, directly recognizing, internalizing, and degrading collagen to support ECM remodeling (Madsen et al., 2013; Martinez-Pomares et al., 2006). Collagen degradation and turnover occurs through two pathways, an extracellular pathway in which collagen is degraded by proteases, such as matrix metalloproteinases, followed by an intracellular pathway in which M2 macrophages bind collagen through their MRs, internalize it, and degrade it using lysosomal cysteine proteinases (Madsen et al., 2013; McKleroy et al., 2013). It is believed that M2 macrophages may coordinate both pathways to limit peripheral damage of healthy tissue, first releasing MMPs to cleave collagen fibrils and then taking up the resulting fragments (McKleroy et al., 2013). These wound healing/profibrotic macrophages additionally release TGF-β, which beyond its anti-inflammatory roles, helps to activate myofibroblasts to increase production of fibrillar collagens.

In spite of the early sampling timepoint following *F. columnare* challenge, our expression results showed abundant evidence of ECM remodeling in Actigen®-fed fish, but not in basal-diet fed fish (Table 8). Over 30 collagen isoform genes had higher expression in Actigen®-fed fish by direct comparison across diets, with within-diet comparisons showing only down-regulation of these genes in the basal diet. Similarly, MMP -9,-13,-15,-16, and -19 all had significantly higher expression in Actigen®-fed fish gill tissues, potentially indicating simultaneous degradation and deposition in different areas of the gill. Cathepsin K, a lysosomal cysteine proteinase, was additionally upregulated in Actigen®-fed fish but not in the basal diet-fed fish. These observed

expression signatures may represent provisional, temporary ECM repair efforts by M2 macrophages following initial pathogen entry.

The multi-purpose nature of mannose receptors and their signaling pathways may provide a powerful connection between recognition of dietary mannose Ag, development of an immunosuppressive cellular phenotype, and the abundance of M2-polarized macrophages primed for rapid repair and resolution, in not only the gut but also surface mucosa (Figure 2.4). While this polarization was associated with significantly higher survival and delayed onset of mortality in Actigen®-fed fish here, further research is needed to examine whether it tilts the scale too far in the direction of tolerance in surface mucosa. Challenge with a less virulent *F. columnare* strain or at a lower CFU dose, may have resulted in near complete protection for Actigen®-fed fish.

References

Abid A., Davies S. J., Waines P., Emery M., Castex M., Gioacchini G., Carnevali O., Bickerdike R., Romero J. and Merrifield D. L., 2013. Dietary synbiotic application modulates Atlantic salmon (*Salmo salar*) intestinal microbial communities and intestinal immunity. Fish Shellfish Immunol 35, 1948-56.

Arias C. R., Cai W., Peatman E. and Bullard S. A., 2012. Catfish hybrid Ictalurus punctatus x I. furcatus exhibits higher resistance to columnaris disease than the parental species. Dis Aquat Organ 100, 77-81.

Arias C. R., Welker T. L., Shoemaker C. A., Abernathy J. W. and Klesius P. H., 2004. Genetic fingerprinting of *Flavobacterium columnare* isolates from cultured fish. J Appl Microbiol 97, 421-8.

Baggerly K. A., Deng L., Morris J. S. and Aldaz C. M., 2003. Differential expression in SAGE: accounting for normal between-library variation. Bioinformatics 19, 1477-1483.

Bauer S., Grossmann S., Vingron M. and Robinson P. N., 2008. Ontologizer 2.0--a multifunctional tool for GO term enrichment analysis and data exploration. Bioinformatics 24, 1650-1.

Bavington C. and Page C., 2005. Stopping bacterial adhesion: a novel approach to treating infections. Respiration; international review of thoracic diseases 72, 335-44.

Beck B. H., Farmer B. D., Straus D. L., Li C. and Peatman E., 2012. Putative roles for a rhamnose binding lectin in *Flavobacterium columnare* pathogenesis in channel catfish *Ictalurus punctatus*. Fish shellfish immunol 33, 1008-1015.

Breton T. S. and Berlinsky D. L., 2014. Characterizing ovarian gene expression during oocyte growth in Atlantic cod (*Gadus morhua*). Comp Biochem Physiol Part D Genomics Proteomics 9, 1-10.

Che T. M., Johnson R. W., Kelley K. W., Van Alstine W. G., Dawson K. A., Moran C. A. and Pettigrew J. E., 2011. Mannan oligosaccharide modulates gene expression profile in pigs experimentally infected with porcine reproductive and respiratory syndrome virus. J Anim Sci 89, 3016-29.

Chee S., Iji P., Choct M., Mikkelsen L. and Kocher A., 2010. Characterisation and response of intestinal microflora and mucins to manno-oligosaccharide and antibiotic supplementation in broiler chickens. Br Poult Sci 51, 368-380.

Chieppa M., Bianchi G., Doni A., Del Prete A., Sironi M., Laskarin G., Monti P., Piemonti L., Biondi A., Mantovani A., Introna M. and Allavena P., 2003. Cross-linking of the mannose receptor on monocyte-derived dendritic cells activates an anti-inflammatory immunosuppressive program. J immunol (Baltimore, Md. : 1950) 171, 4552-60.

Chowdhury B. and Wakabayashi H., 1988. Effects of sodium, potassium, calcium and magnesium ions on *Flexibacter columnaris* infection in fish [common carp, *Cyprinus caprio* and loach, *Misgurnus anguillicaudatus*]. Fish Pathol (Japan).

Cohn L., Homer R. J., MacLeod H., Mohrs M., Brombacher F. and Bottomly K., 1999. Th2-induced airway mucus production is dependent on IL-4Rα, but not on eosinophils. J Immunol 162, 6178-6183.

Davis H. S., 1922. A new bacterial disease of fresh-water fishes: Bulletin of the United States Bureau of Fisheries. Washington: GPO. p. 261–280

Declercq A. M., Haesebrouck F., Van den Broeck W., Bossier P. and Decostere A., 2013. Columnaris disease in fish: a review with emphasis on bacterium-host interactions. Vet Res 44, 27.

Decostere A, Haesebrouck F, Van Driessche E, Charlier G, Ducatelle R., 1999 Characterization of the adhesion of *Flavobacterium columnare* (*Flexibacter columnaris*) to gill tissue. J Fish Dis 22, 465–474

Engering A., Geijtenbeek T. B., van Vliet S. J., Wijers M., van Liempt E., Demaurex N., Lanzavecchia A., Fransen J., Figdor C. G., Piguet V. and van Kooyk Y., 2002. The dendritic cell-specific adhesion receptor DC-SIGN internalizes antigen for presentation to T cells. J Immunol (Baltimore, Md. : 1950) 168, 2118-26.

FAO, 2014. FAO yearbook. Fishery and Aquaculture Statistics. 2012.

Farmer B. D., Mitchell A. J. and Straus D. L., 2011. The effect of high total ammonia concentration on the survival of channel catfish experimentally infected with *Flavobacterium columnare*. J Aquat Anim Health 23, 162-8.

Geijtenbeek T. B. and Gringhuis S. I., 2009. Signalling through C-type lectin receptors: shaping immune responses. Nature reviews. Immunol 9, 465-79.

Gomez D., Sunyer J. O. and Salinas I., 2013. The mucosal immune system of fish: the evolution of tolerating commensals while fighting pathogens. Fish Shellfish Immunol 35, 1729-39.

Grabherr M. G., Haas B. J., Yassour M., Levin J. Z., Thompson D. A., Amit I., Adiconis X., Fan L., Raychowdhury R. and Zeng Q., 2011. Full-length transcriptome assembly from RNA-Seq data without a reference genome. Nat Biotechnol 29, 644-652.

Grossmann S., Bauer S., Robinson P. N. and Vingron M., 2007. Improved detection of overrepresentation of Gene-Ontology annotations with parent–child analysis. Bioinformatics 23, 3024-3031.

Gutierrez N. L., Hilborn R. and Defeo O., 2011. Leadership, social capital and incentives promote successful fisheries. Nature 470, 386-9.

Haas B. J., Papanicolaou A., Yassour M., Grabherr M., Blood P. D., Bowden J., Couger M. B., Eccles D., Li B. and Lieber M., 2013. *De novo* transcript sequence reconstruction from RNA-seq using the Trinity platform for reference generation and analysis. Nat Protoc 8, 1494-1512.

Hawiger D., Inaba K., Dorsett Y., Guo M., Mahnke K., Rivera M., Ravetch J. V., Steinman R. M. and Nussenzweig M. C., 2001. Dendritic cells induce peripheral T cell unresponsiveness under steady state conditions in vivo. J Exp Med 194, 769-79.

Heller N. M., Gwinn W. M., Donnelly R. P., Constant S. L. and Keegan A. D., 2012. IL-4 engagement of the type I IL-4 receptor complex enhances mouse eosinophil migration to eotaxin-1 in vitro. PLoS One 7, e39673.

Hooge D., Pierce J., McBride K. and Rigolin P., 2010. Meta-analysis of Broiler Chicken Trials Using Diets With or Without Allzyme SSF Enzyme Complex®. Int J Poult Sci 9, 819-823.

Hoseinifar S. H., Soleimani N. and Ringo E., 2014. Effects of dietary fructo-oligosaccharide supplementation on the growth performance, haemato-immunological parameters, gut microbiota and stress resistance of common carp (*Cyprinus carpio*) fry. Br J Nutr 112, 1296-302.

Hwang I., Yang J., Hong S., Ju Lee E., Lee S. H., Fernandes-Alnemri T., Alnemri E. S. and Yu J. W., 2015. Non-transcriptional regulation of NLRP3 inflammasome signaling by IL-4. Immunol Cell Biol.

James A. and Carroll N., 1995. Theoretic effects of mucus gland discharge on airway resistance in asthma. Chest 107, 110s.

Lazado C. C. and Caipang C. M., 2014. Mucosal immunity and probiotics in fish. Fish Shellfish Immunol 39, 78-89.

Lee C. G., Da Silva C. A., Dela Cruz C. S., Ahangari F., Ma B., Kang M. J., He C. H., Takyar S. and Elias J. A., 2011. Role of chitin and chitinase/chitinase-like proteins in inflammation, tissue remodeling, and injury. Annu Rev Physiol 73, 479-501.

Li C., Beck B. H. and Peatman E., 2014. Nutritional impacts on gene expression in the surface mucosa of blue catfish (*Ictalurus furcatus*). Dev Comp Immunol 44, 226-234.

Li C., Wang R., Su B., Luo Y., Terhune J., Beck B. and Peatman E., 2013b. Evasion of mucosal defenses during *Aeromonas hydrophila* infection of channel catfish (*Ictalurus punctatus*) skin. Dev Comp Immunol 39, 447-55.

Linehan S. A., Martinez-Pomares L. and Gordon S., 2000. Mannose receptor and scavenger receptor: two macrophage pattern recognition receptors with diverse functions in tissue homeostasis and host defense. Adv Exp Med Biol 479, 1-14.

Liu B., Xu L., Ge X., Xie J., Xu P., Zhou Q., Pan L. and Zhang Y., 2013a. Effects of mannan oligosaccharide on the physiological responses, *HSP70* gene expression and disease resistance of Allogynogenetic crucian carp (*Carassius auratus* gibelio) under *Aeromonas hydrophila* infection. Fish Shellfish Immunol 34, 1395-403.

Liu L., Li C., Su B., Beck B. H. and Peatman E., 2013b. Short-term feed deprivation alters immune status of surface mucosa in channel catfish (*Ictalurus punctatus*). PloS one 8, e74581.

Lokesh J., Fernandes J. M., Korsnes K., Bergh O., Brinchmann M. F. and Kiron V., 2012. Transcriptional regulation of cytokines in the intestine of Atlantic cod fed yeast derived mannan oligosaccharide or beta-glucan and challenged with *Vibrio anguillarum*. Fish Shellfish Immunol 33, 626-31.

Madsen D. H., Leonard D., Masedunskas A., Moyer A., Jurgensen H. J., Peters D. E., Amornphimoltham P., Selvaraj A., Yamada S. S., Brenner D. A., Burgdorf S., Engelholm L. H., Behrendt N., Holmbeck K., Weigert R. and Bugge T. H., 2013. M2-like macrophages are responsible for collagen degradation through a mannose receptor-mediated pathway. J Cell Biol 202, 951-66.

Mahnke K., Guo M., Lee S., Sepulveda H., Swain S. L., Nussenzweig M. and Steinman R. M., 2000. The dendritic cell receptor for endocytosis, DEC-205, can recycle and enhance antigen presentation via major histocompatibility complex class II-positive lysosomal compartments. J Cell Biol 151, 673-84.

Majji S., Thodima V., Arnizaut A., Deng Y., May W., Sittman D., Waldbieser G. C., Hanson L., Cuchens M. A., Bengten E. and Chinchar V. G., 2009. Expression profiles of cloned channel catfish (*Ictalurus punctatus*) lymphoid cell lines and mixed lymphocyte cultures. Dev Comp Immunol. 33, 224-34.

Manni M. L., Robinson K. M. and Alcorn J. F., 2014. A tale of two cytokines: IL-17 and IL-22 in asthma and infection. Expert Rev Respir Med 8, 25-42.

Marsland B. J., Battig P., Bauer M., Ruedl C., Lassing U., Beerli R. R., Dietmeier K., Ivanova L., Pfister T., Vogt L., Nakano H., Nembrini C., Saudan P., Kopf M. and Bachmann M. F., 2005. CCL19 and CCL21 induce a potent proinflammatory differentiation program in licensed dendritic cells. Immunity 22, 493-505.

Martinez-Pomares L., Wienke D., Stillion R., McKenzie E. J., Arnold J. N., Harris J., McGreal E., Sim R. B., Isacke C. M. and Gordon S., 2006. Carbohydrate-independent recognition of collagens by the macrophage mannose receptor. Eur J Immunol 36, 1074-82.

Martinez F. O. and Gordon S., 2014. The M1 and M2 paradigm of macrophage activation: time for reassessment. F1000prime reports 6, 13.

McKleroy W., Lee T. H. and Atabai K., 2013. Always cleave up your mess: targeting collagen degradation to treat tissue fibrosis. Am J Physiol Lung Cell Mol Physiol 304, L709-21.

Michael H., Li Y., Wang Y., Xue D., Shan J., Mazer B. D. and McCusker C. T., 2015. TGF-beta-mediated airway tolerance to allergens induced by peptide-based immunomodulatory mucosal vaccination. Mucosal Immunol.

Miller N. W., Sizemore R. C. and Clem L.W., 1985. Phylogeny of lymphocyte heterogeneity: the cellular requirements for in vitro antibody responses of channel catfish leukocytes. J Immunol. 134, 2884-8.

Nakano H., Free M. E., Whitehead G. S., Maruoka S., Wilson R. H., Nakano K. and Cook D. N., 2012. Pulmonary CD103(+) dendritic cells prime Th2 responses to inhaled allergens. Mucosal Immunol 5, 53-65.

Naylor R. L., Goldburg R. J., Primavera J. H., Kautsky N., Beveridge M. C., Clay J., Folke C., Lubchenco J., Mooney H. and Troell M., 2000. Effect of aquaculture on world fish supplies. Nature 405, 1017-1024.

Olivares-Fuster O., Bullard S. A., McElwain A., Llosa M. J. and Arias C. R., 2011. Adhesion dynamics of *Flavobacterium columnare* to channel catfish Ictalurus punctatus and zebrafish *Danio rerio* after immersion challenge. Dis Aquat Organ 96, 221.

Peatman E., Li C., Peterson B. C., Straus D. L., Farmer B. D. and Beck B. H., 2013. Basal polarization of the mucosal compartment in *Flavobacterium columnare* susceptible and resistant channel catfish (*Ictalurus punctatus*). Mol Immunol 56, 317-327.

Peatman E. and Liu Z., 2007. Evolution of CC chemokines in teleost fish: a case study in gene duplication and implications for immune diversity. Immunogenetics 59, 613-23.

Pernis A., Witthuhn B., Keegan A. D., Nelms K., Garfein E., Ihle J. N., Paul W. E., Pierce J. H. and Rothman P., 1995. Interleukin 4 signals through two related pathways. Proc Natl Acad Sci U S A 92, 7971-5.

Peterson B. C., Booth N. J., Barrows F. T. and Manning B. B., 2012. Improved survival in channel catfish fed mannanoligosaccharides in an extruded diet. Open J Anim Sci 2, 57.

Peterson B. C., Bramble T. C. and Manning B. B., 2010. Effects of Bio-Mos® on Growth and Survival of Channel Catfish Challenged with *Edwardsiella ictaluri*. J World Aquac Soc 41, 149-155.

Pfaffl M. W., Horgan G. W. and Dempfle L., 2002. Relative expression software tool (REST©) for group-wise comparison and statistical analysis of relative expression results in real-time PCR. Nucleic Acids Res 30, e36-e36.

Rajaiah R., Perkins D. J., Polumuri S. K., Zhao A., Keegan A. D. and Vogel S. N., 2013. Dissociation of endotoxin tolerance and differentiation of alternatively activated macrophages. J Immunol (Baltimore, Md. : 1950) 190, 4763-72.

Rath M., Muller I., Kropf P., Closs E. I. and Munder M., 2014. Metabolism via Arginase or Nitric Oxide Synthase: Two Competing Arginine Pathways in Macrophages. Front Immunol 5, 532.

Ring S., Maas M., Nettelbeck D. M., Enk A. H. and Mahnke K., 2013. Targeting of autoantigens to DEC205(+) dendritic cells in vivo suppresses experimental allergic encephalomyelitis in mice. J Immunol (Baltimore, Md. : 1950) 191, 2938-47.

Robinson M. D. and Oshlack A., 2010. A scaling normalization method for differential expression analysis of RNA-seq data. Genome Biol 11, R25.

Salinas I., Zhang Y. A. and Sunyer J. O., 2011. Mucosal immunoglobulins and B cells of teleost fish. Dev Comp Immunol 35, 1346-65.

Saraiva T. C., Grund L. Z., Komegae E. N., Ramos A. D., Conceicao K., Orii N. M., Lopes-Ferreira M. and Lima C., 2011. Nattectin a fish C-type lectin drives Th1 responses in vivo: licenses macrophages to differentiate into cells exhibiting typical DC function. Int Immunopharmacol 11, 1546-56.

Shahzad K. and Loor J. J., 2012. Application of Top-Down and Bottom-up Systems Approaches in Ruminant Physiology and Metabolism. Curr Genomics 13, 379-94.

Shoemaker C., Klesius P., Lim C. and Yildirim M., 2003. Feed deprivation of channel catfish, *Ictalurus punctatus* (Rafinesque), influences organosomatic indices, chemical composition and susceptibility to *Flavobacterium columnare*. J Fish Diseases 26, 553-561.

Sun F., Peatman E., Li C., Liu S., Jiang Y., Zhou Z. and Liu Z., 2012. Transcriptomic signatures of attachment, NF-κB suppression and IFN stimulation in the catfish gill following columnaris bacterial infection. Dev Comp Immunol 38, 169-180.

Sung S. S., Fu S. M., Rose C. E., Jr., Gaskin F., Ju S. T. and Beaty S. R., 2006. A major lung CD103 (alphaE)-beta7 integrin-positive epithelial dendritic cell population expressing Langerin and tight junction proteins. J Immunol (Baltimore, Md. : 1950) 176, 2161-72.

Tacchi L., Musharrafieh R., Larragoite E. T., Crossey K., Erhardt E. B., Martin S. A., LaPatra S. E. and Salinas I., 2014. Nasal immunity is an ancient arm of the mucosal immune system of vertebrates. Nat Commun 5, 5205.

Tel J., Benitez-Ribas D., Hoosemans S., Cambi A., Adema G. J., Figdor C. G., Tacken P. J. and de Vries I. J., 2011. DEC-205 mediates antigen uptake and presentation by both resting and activated human plasmacytoid dendritic cells. Eur J Immunol 41, 1014-23.

Thongda W., Li C., Luo Y., Beck B. H. and Peatman E., 2014. L-rhamnose-binding lectins (RBLs) in channel catfish, *Ictalurus punctatus*: Characterization and expression profiling in mucosal tissues. Dev Comp Immunol 44, 320-331.

Torrecillas S., Montero D., Caballero M. J., Robaina L., Zamorano M. J., Sweetman J. and Izquierdo M., 2015. Effects of dietary concentrated mannan oligosaccharides supplementation on growth, gut mucosal immune system and liver lipid metabolism of European sea bass (*Dicentrarchus labrax*) juveniles. Fish Shellfish Immunol 42, 508-16.

Torrecillas S., Montero D. and Izquierdo M., 2014. Improved health and growth of fish fed mannan oligosaccharides: Potential mode of action. Fish Shellfish Immunology 36, 525-544.

Van Kooyk Y., Unger W. W., Fehres C. M., Kalay H. and Garcia-Vallejo J. J., 2013. Glycan-based DC-SIGN targeting vaccines to enhance antigen cross-presentation. Mol Immunol 55, 143-5.

Wakabayashi H., 1991. Effect of environmental conditions on the infectivity of *Flexibacter columnaris* to fish. J Fish Dis 14, 279-290.

Wang T., and Secombes C. J., 2015 The evolution of IL-4 and IL-13 and their receptor subunits. Cytokin. pii: S1043-4666(15)00163-5. doi: 10.1016/j.cyto.2015.04.012. [Epub ahead of print] Review. PubMed PMID: 26005057

Wang Z., Gerstein M. and Snyder M., 2009. RNA-Seq: a revolutionary tool for transcriptomics. Nat Rev Genet 10, 57-63.

Welker T. L., Lim C., Yildirim-Aksoy M. and Klesius P. H., 2012. Effect of short-term feeding duration of diets containing commercial whole-cell yeast or yeast subcomponents on

immune function and disease resistance in channel catfish, *Ictalurus punctatus*. J Anim Physiol Anim Nutr (Berl) 96, 159-71.

Wermuth P. J. and Jimenez S. A., 2015. The significance of macrophage polarization subtypes for animal models of tissue fibrosis and human fibrotic diseases. Clin Transl Med 4, 2.

Xiao R., Power R. F., Mallonee D., Routt K., Spangler L., Pescatore A. J., Cantor A. H., Ao T., Pierce J. L. and Dawson K. A., 2012. Effects of yeast cell wall-derived mannan-oligosaccharides on jejunal gene expression in young broiler chickens. Poult Sci 91, 1660-9.

Yamaguchi T., Katakura F., Someya K., Dijkstra J. M., Moritomo T., and Nakanishi T., 2013. Clonal growth of carp (*Cyprinus carpio*) T cells in vitro: long-term proliferation of Th2-like cells. Fish Shellfish Immunol. 34, 433-42.

Yazawa R., Hirono I. and Aoki T., 2006. Transgenic zebrafish expressing chicken lysozyme show resistance against bacterial diseases. Transgenic Res 15, 385-91.

Yoon S., Mitra S., Wyse C., Alnabulsi A., Zou J., Weerdenburg E. M., M van der Sar A., Wang D., Secombes C. J., Bird S., 2015. First demonstration of antigen induced cytokine expression by CD4-1+ lymphocytes in a Poikilotherm: Studies in Zebrafish (*Danio rerio*). PLoS One. 10, e0126378.

Zhu L. Y., Pan P. P., Fang W., Shao J. Z. and Xiang L. X., 2012. Essential role of IL-4 and IL-4Rα interaction in adaptive immunity of zebrafish: insight into the origin of Th2-like regulatory mechanism in ancient vertebrates. J Immunol. 188, 5571-84.

Appendix Differentially expressed contigs before (0 h) and following challenge (8 h) with *F. columnare* in control (basal) and Actigen®-fed catfish gill tissue. The differentially expressed genes were categorized in within-group comparison of Basal (A) and Actigen® (B) treatments, and between-group comparison of 0 h (pre-challenge, C) and 8 h (post-challenge, D).

A

Feature ID	Accession Version .	Description	Fold change
c77175_g6_i2	XP_007232878.1	1-phosphatidylinositol 4,5-bisphosphate phosphodiesterase	3.75
c78233_g7_i4	NP_919388.1	1-phosphatidylinositol-4,5-bisphosphate phosphodiesterase gamma-1	2.16
c81095_g3_i3	XP_006786523.1	3-ketodihydrosphingosine reductase-like	3.28
c83288_g2_i11	XP_005163374.1	5'-3' exoribonuclease 1 isoform X1	3.53
c80530_g2_i5	NP_958830.1	5'-nucleotidase, cytosolic IIa	2.03
c82426_g7_i13	XP_005170627.1	6-phosphofructo-2-kinase/fructose-2,6-biphosphatase 2a	2.15
c80598_g1_i11	3OHT	A Chain A, Crystal Structure Of Salmo Salar P38alpha	2.31
c73258_g1_i2	NP_001091649.2	A kinase anchor protein 1, mitochondrial	2.2
c82643_g12_i4	XP_007260290.1	Abhydrolase domain-containing protein 2-A-like	3.22
c81455_g5_i1	EZA51692.1	Acetylcholine receptor subunit alpha-like protein	2.07
c82520_g4_i10	XP_005162010.1	Acetyl-coenzyme A synthetase, cytoplasmic isoform X3	2.88
c82232_g14_i6	XP_007235226.1	Activating molecule in BECN1-regulated autophagy protein 1	4.05
c79795_g8_i3	XP_007249644.1	Activating signal cointegrator 1 complex subunit 3	2.85
c82999_g1_i4	XP_007259399.1	Acyl-CoA synthetase family member 2, mitochondrial	4.09
c82522_g9_i2	XP_007254583.1	ADAMTS-like protein 4	2.17
c82417_g13_i2	XP_006006795.1	Adapter molecule crk isoform X1	3.24
c76886_g6_i1	NP_001017804.1	Adenylosuccinate synthetase isozyme 2	4.1
c79536_g6_i4	XP_007247161.1	Adipocyte enhancer-binding protein 1-like isoform X3	3.43
c79965_g9_i6	XP_007247092.1	AF4/FMR2 family member 4 isoform X2	2.91
c78018_g3_i3	XP_007255419.1	Afadin-like isoform X10	2.03
c81650_g10_i5	XP_007255420.1	Afadin-like isoform X11	2.62
c18174_g1_i1	XP_686182.6	Aggrecan core protein isoform X2	4.7
c76196_g1_i3	XP_007234416.1	Aggrecan core protein-like	4.64

c82159_g3_i1	NP_001170923.1	Agrin precursor	4.22
c81249_g1_i6	XP_007246278.1	A-kinase anchor protein 13-like	3.81
c81249_g1_i4	XP_005447751.1	A-kinase anchor protein 13-like isoform X3	3.87
c80789_g2_i4	XP_005740661.1	A-kinase anchor protein 9-like isoform X1	2.76
c80789_g1_i1	XP_007242296.1	A-kinase anchor protein 9-like, partial	2.52
c77022_g4_i2	XP_001342996.2	Alpha/beta hydrolase domain-containing protein 17A	2.46
c81056_g10_i1	NP_001038776.1	Alpha-1,6-mannosylglycoprotein 6-beta-N-acetylglucosaminyltransferase	5.8
c82650_g4_i7	XP_007247642.1	Alpha-actinin-1 isoform X6	2.47
c82650_g4_i3	XP_003445506.2	Alpha-actinin-1 isoformX1	2.09
c78349_g4_i1	XP_005160998.1	Alpha-adducin isoform X3	2.83
c81452_g2_i1	XP_007228197.1	Alpha-mannosidase 2x-like isoform X6	2.25
c80591_g3_i5	NP_956928.1	Amyloid beta A4 precursor protein-binding family B member	2.1
c73051_g3_i3	XP_007227940.1	Amyloid beta A4 protein-like isoform X3	2.72
c73051_g1_i1	AFN73055.1	Amyloid beta precursor protein b	2.67
c78660_g11_i2	XP_005173944.1	Angiomotin isoform X1	2.53
c73769_g12_i1	XP_007259833.1	Angiopoietin-related protein 1-like	2.07
c77437_g9_i1	XP_007260371.1	Ankyrin repeat domain-containing protein 50	2.92
c80851_g12_i1	XP_005156099.1	Ankyrin-3 isoform X5	2.66
c78042_g7_i6	NP_001155062.1	Anoctamin-1	2.13
c78659_g10_i3	XP_007237158.1	Anoctamin-10-like	2.42
c73912_g3_i1	XP_007255212.1	Antigen KI-67-like isoform X1	3.56
c81964_g3_i2	XP_005165223.1	AP-1 complex subunit beta-1 isoform X1	2.81
c81964_g3_i4	XP_005165224.1	AP-1 complex subunit beta-1 isoform X2	2.11
c83893_g8_i3	NP_955976.1	AP-1 complex subunit gamma-1	2.19
c79193_g3_i1	XP_003802841.1	AP-2 complex subunit alpha-2	2.09
c80164_g4_i6	XP_006796965.1	AP-3 complex subunit beta-1-like	2.3
c76179_g5_i5	XP_003448631.1	AP-3 complex subunit mu-2	2.65
c79671_g18_i8	XP_007250278.1	Apoptotic chromatin condensation inducer in the	2.66
c81295_g16_i8	ABV22635.1	Argonaute 2	7.08
c78170_g2_i2	XP_007248176.1	Arrestin red cell isoform 1-like	2.16
c80512_g2_i5	XP_007254580.1	Aryl hydrocarbon receptor nuclear translocator	2.71
c78786_g8_i4	XP_007244938.1	Asc-type amino acid transporter 1	2.86
c83440_g5_i2	XP_004074161.1	Asparagine synthetase	2.24
c83786_g6_i6	NP_997849.1	Ataxin-2-like protein	2.16
c76842_g9_i1	XP_007245883.1	ATP-binding cassette sub-family D member 1-like isoform X1	3.74

c79783_g7_i3	XP_007244293.1	ATP-dependent RNA helicase DDX3X isoform X8	2.13
c81914_g10_i2	XP_007255595.1	AT-rich interactive domain-containing protein 1B-like	2.95
c74743_g1_i2	XP_007238012.1	AT-rich interactive domain-containing protein 2 isoform X3	3.24
c79924_g4_i4	XP_007255224.1	AT-rich interactive domain-containing protein 5B-like,	2.2
c78699_g11_i8	3B13	B Chain B, Crystal Structure Of The Dhr-2 Domain Of Dock2 In Complex	2.2
c83590_g2_i1	XP_001336902.1	Baculoviral IAP repeat-containing protein 6 isoform X1	9.4
c82508_g3_i3	XP_007259768.1	Band 4.1-like protein 2	2.24
c78023_g10_i1	XP_005158197.1	Basal cell adhesion molecule isoform X1	2.43
c78023_g9_i5	XP_005158198.1	Basal cell adhesion molecule isoform X2	2.08
c82752_g15_i8	XP_003201256.2	Basement membrane-specific heparan sulfate proteoglycan	9.01
c83210_g2_i1	XP_007249084.1	Basic helix-loop-helix domain-containing protein KIAA2018	4.28
c80219_g17_i1	XP_002698632.3	Basic proline-rich protein	3.25
c79310_g1_i1	XP_005171042.1	B-cell CLL/lymphoma 9 protein isoform X4	4.07
c78366_g4_i1	NP_001035481.1	B-cell lymphoma/leukemia 11A	2.62
c79908_g11_i2	XP_007255483.1	B-cell lymphoma/leukemia 11A-like	2.12
c79620_g13_i2	ADO27970.1	Bcl2/adenovirus e1b 19 kda protein-interacting protein 3-like	2.54
c75322_g1_i1	XP_005456098.1	Beta-1,4-galactosyltransferase 3-like isoform X2	2.21
c82308_g10_i4	XP_007237710.1	Beta-1,4-galactosyltransferase 5-like	2.87
c74927_g16_i2	XP_007257075.1	Beta-1,4-galactosyltransferase 6	2.82
c71564_g2_i2	XP_003439613.1	Beta-2-syntrophin-like	2.23
c80473_g6_i1	NP_001004554.1	Beta-citryl-glutamate synthase B	2.24
c76624_g17_i3	NP_001153386.1	Beta-galactoside alpha-2,6-sialyltransferase 2	3.04
c78645_g7_i2	XP_007234368.1	Bifunctional 3'-phosphoadenosine 5'-phosphosulfate	2.26
c80759_g1_i7	XP_005802573.1	Bifunctional glutamate/proline--tRNA ligase-like	-2.55
c80759_g1_i2	XP_007252601.1	Bifunctional glutamate/proline--tRNA ligase-like isoform	2.31
c76804_g4_i1	NP_001180469.1	BMP-2-inducible protein kinase isoform 1	2.71
c74006_g2_i1	XP_007234827.1	Bone morphogenetic protein 1-like	2.4
c77805_g7_i2	XP_007235690.1	Bone morphogenetic protein 2-like	3.44
c77269_g20_i7	XP_007240943.1	Bromodomain and WD repeat-containing protein 1	3.3
c83224_g16_i1	XP_007229122.1	Bromodomain-containing protein 4-like isoform X3	3.71
c80908_g6_i1	XP_007234758.1	BTB/POZ domain-containing adapter for CUL3-mediated RhoA	2
c82639_g2_i2	XP_007258262.1	BTB/POZ domain-containing protein 7-like	2.62
c76709_g6_i2	XP_007244111.1	C2 domain-containing protein 5-like isoform X4	2.45
c76709_g6_i3	XP_007244116.1	C2 domain-containing protein 5-like isoform X9	4.54

c76010_g4_i2	NP_571289.1	Cadherin-11 precursor	2.44
c80426_g7_i2	XP_006786505.1	Cadherin-2-like isoform X2	2.29
c80544_g10_i1	XP_006151360.1	Calcineurin subunit B type 1 isoform X1	3.56
c81070_g10_i5	XP_004556129.1	Calcium uniporter protein, mitochondrial-like isoform X3	2.62
c82894_g8_i5	XP_007228658.1	Calcium/calmodulin-dependent protein kinase kinase 1-like	4.5
c81421_g10_i1	XP_007228794.1	Calcium/calmodulin-dependent protein kinase type 1-like	2.61
c81994_g12_i15	XP_005162429.1	Calcium-binding and coiled-coil domain-containing protein	2.62
c77738_g2_i3	XP_007253904.1	Calmodulin-regulated spectrin-associated protein 1-B-like	4.06
c78755_g3_i3	AFU11025.1	Calpain-1 catalytic subunit	2.8
c83753_g10_i8	XP_003971307.1	Calpain-5-like	2.64
c81990_g4_i1	XP_005725441.1	Calpain-5-like isoform X3	-2.74
c77752_g3_i3	XP_007246767.1	CAMP-dependent protein kinase catalytic subunit PRKX	2.81
c82225_g6_i1	XP_005156043.1	CAMP-dependent protein kinase type I-alpha regulatory	2.12
c82859_g1_i15	XP_007471410.1	CAMP-responsive element modulator isoform X7	-2.08
c77648_g2_i1	XP_007257301.1	Canalicular multispecific organic anion transporter 2-like	4.1
c80246_g8_i5	XP_006789759.1	CAP-Gly domain-containing linker protein 1-like isoform X1	3.41
c77245_g5_i5	XP_005164116.1	Carnitine O-palmitoyltransferase 1, liver isoform isoform	2.65
c84222_g10_i1	XP_007244922.1	Cartilage intermediate layer protein 1 isoform X1	2.04
c81677_g4_i11	XP_007251317.1	Casein kinase I isoform epsilon-like	3.07
c75440_g1_i2	XP_007249765.1	Casein kinase II subunit alpha-like isoform X1	2.05
c79457_g7_i1	XP_007249871.1	Caspase-2 isoform X4	2.77
c77848_g7_i3	XP_007232852.1	Caspase-3-like isoform X1	2.36
c77095_g1_i4	ELK23720.1	Catenin alpha-1	2.32
c71256_g1_i3	ADO28234.1	Cathepsin K	2.76
c76532_g16_i1	XP_007254191.1	Cationic amino acid transporter 3-like isoform X1	2.08
c82152_g15_i7	XP_007254569.1	CCR4-NOT transcription complex subunit 3-like isoform X4	4.47
c76364_g1_i2	CAZ61328.1	CD34a molecule	2.23
c81793_g5_i4	XP_007258998.1	Cell cycle control protein 50B-like	2.03
c78811_g9_i1	XP_007243560.1	Cell cycle progression protein 1-like	2.27
c79964_g11_i2	XP_005172070.1	Cell surface glycoprotein MUC18 isoform X2	7.44
c83368_g8_i3	XP_004564784.1	Centromere-associated protein E-like isoform X3	3.03
c73646_g1_i2	XP_005168600.1	Ceramide kinase isoform X1	2.13
c76394_g1_i1	XP_007238221.1	CGMP-inhibited 3',5'-cyclic phosphodiesterase A isoform X1	3.51
c78437_g6_i4	XP_691883.4	CGMP-inhibited 3',5'-cyclic phosphodiesterase B	3.61

c77519_g3_i10	XP_007239190.1	Chaperone activity of bc1 complex-like,	2.86
c79153_g4_i4	NP_932334.1	Chemokine (C-X-C motif) ligand 12b (stromal cell-derived factor 1)	2.44
c77776_g5_i2	XP_005461757.1	Chitinase-like protein PB1E7.04c-like	3.49
c79964_g6_i9	XP_007247725.1	Chloride channel protein 2-like	2.23
c81245_g2_i1	XP_007012624.1	Chloroplast, high sulfur B2-like protein	4.71
c74740_g1_i3	XP_001333479.4	Chondroitin sulfate N-acetylgalactosaminyltransferase	2.73
c78627_g1_i1	XP_007228617.1	Chondroitin sulfate proteoglycan 4	4.49
c82779_g10_i6	XP_007260134.1	Chorion-specific transcription factor GCMb	-2.18
c77578_g7_i2	XP_007254530.1	Chromodomain-helicase-DNA-binding protein 2 isoform X2	3.02
c83141_g4_i1	XP_005171369.1	Chromodomain-helicase-DNA-binding protein 8 isoform X1	2.68
c81704_g3_i3	XP_005169071.1	Chromodomain-helicase-DNA-binding protein 9 isoform X4	2.34
c81704_g3_i7	XP_005169074.1	Chromodomain-helicase-DNA-binding protein 9 isoform X7	2.1
c82263_g4_i1	XP_007258316.1	Chromosomal protein D1-like	2.24
c83142_g4_i1	XP_007230614.1	Cingulin-like	2.19
c76014_g2_i4	XP_003199047.1	Cingulin-like 1	2.2
c82692_g5_i2	XP_689920.3	Cingulin-like isoform X2	2.54
c79536_g3_i1	XP_007252141.1	Cip1-interacting zinc finger protein	2.05
c77300_g14_i2	XP_007251473.1	Claudin-19 isoform X2	2.36
c80860_g9_i16	XP_007227964.1	CLIP-associating protein 1-A-like isoform X6	13.25
c78826_g3_i3	XP_005159786.1	CLIP-associating protein 2 isoform X1	3.02
c76502_g1_i3	NP_001071028.1	Clustered mitochondria protein homolog	2.33
c82480_g2_i3	XP_007251010.1	C-Maf-inducing protein	2.48
c82639_g3_i5	XP_005171318.1	Coatomer subunit alpha isoform X1	2.48
c75720_g6_i4	XP_007232723.1	Cohesin subunit SA-1	2.2
c80927_g7_i8	XP_003972110.1	Coiled-coil and C2 domain-containing protein 1A-like	5.65
c75376_g2_i2	XP_007251173.1	Coiled-coil domain-containing protein 47-like	2.24
c84151_g2_i1	XP_005162870.1	Collagen alpha-1(XI) chain isoform X1	2.55
c80532_g3_i16	XP_005478458.1	Collagen alpha-1(XI) chain-like isoform X6	2.56
c77224_g7_i6	XP_002665305.3	Collagen alpha-1(XII) chain isoform X1	3.72
c82683_g8_i3	XP_004561109.1	Collagen alpha-1(XII) chain-like	37.4
c77224_g5_i3	XP_007253882.1	Collagen alpha-1(XII) chain-like isoform X3	8.46
c77224_g7_i3	XP_007253883.1	Collagen alpha-1(XII) chain-like isoform X4	11.65
c77224_g5_i1	XP_007253884.1	Collagen alpha-1(XII) chain-like isoform X5	7.56
c82903_g6_i8	XP_007249492.1	Collagen alpha-1(XVI) chain-like	2.6

c81631_g7_i9	XP_007230503.1	Collagen alpha-1(XVIII) chain-like isoform X2	2.97
c81631_g7_i4	XP_007230504.1	Collagen alpha-1(XVIII) chain-like isoform X3	2.39
c80585_g3_i8	NP_001074044.1	Collagen alpha-1(XXVII) chain B precursor	5.13
c84294_g1_i2	XP_007228914.1	Collagen alpha-3(VI) chain-like	2.77
c81110_g2_i5	XP_007233591.1	Collagen alpha-4(IV) chain-like	4.14
c77834_g9_i4	NP_001170943.1	Collagen type IV alpha1 precursor	3.5
c76517_g9_i4	AAH63249.1	Collagen, type I, alpha 1	2.58
c76437_g11_i2	XP_007231269.1	Complement C1q tumor necrosis factor-related protein	2.72
c79400_g2_i1	XP_007232667.1	Connector enhancer of kinase suppressor of ras 3-like	2.22
c82020_g4_i4	XP_005169315.1	Copine-1 isoform X2	3.06
c79785_g1_i7	XP_007250439.1	Copine-3-like isoform X1	3.05
c78794_g4_i1	XP_003445126.1	Copine-8-like isoform X1	3.41
c81248_g18_i7	XP_005163782.1	CREB-binding protein isoform X1	5.1
c83329_g5_i16	XP_005161827.1	CREB-binding protein isoform X2	6.67
c79468_g6_i1	AFP33464.1	Cryptochrome 1	3.13
c79310_g5_i3	XP_001344010.4	C-type mannose receptor 2	3.31
c75736_g6_i6	XP_006641111.1	CUE domain-containing protein 1-like	3.08
c81332_g2_i11	XP_007258472.1	Cullin-3	2.33
c82928_g3_i5	XP_007247432.1	Cullin-9-like isoform X3	3.19
c82928_g3_i11	XP_007247433.1	Cullin-9-like isoform X4	2.1
c83488_g2_i1	XP_005464376.1	Cyclic AMP-dependent transcription factor ATF-6 beta-like	2.01
c81481_g4_i5	NP_001074120.1	Cyclic AMP-responsive element-binding protein 3-like protein 2	2.46
c81389_g4_i1	XP_005159752.1	Cyclin-dependent kinase 6 isoform X1	4.26
c75300_g3_i3	XP_003966607.1	Cystathionine beta-synthase-like	2
c81195_g1_i2	XP_007252627.1	Cysteine-rich motor neuron 1 protein-like	3.87
c79724_g3_i3	NP_999847.1	Cytohesin-1	2.37
c80772_g7_i11	XP_005171695.1	Cytohesin-1 isoform X2	2.31
c75090_g2_i2	XP_007255248.1	Cytoplasmic aconitate hydratase-like isoform X1	2.19
c79772_g11_i7	XP_007258963.1	Cytoplasmic dynein 1 heavy chain 1 isoform X1	4.43
c79772_g11_i4	XP_007258964.1	Cytoplasmic dynein 1 heavy chain 1 isoform X2	3.46
c83679_g6_i8	XP_004068358.1	Cytoplasmic FMR1-interacting protein 1 homolog	6.05
c83679_g5_i4	XP_007249165.1	Cytoplasmic FMR1-interacting protein 1 homolog isoform X1	2.2
c80899_g3_i10	XP_006631741.1	Cytoplasmic polyadenylation element-binding protein 4-like	2.62
c78727_g12_i9	XP_007253821.1	Cytoplasmic protein NCK1 isoform X2	2.12

c81392_g2_i6	XP_005458430.1	Cytoskeleton-associated protein 5 isoform X4	2.96
c81816_g5_i2	XP_007259061.1	Decorin	2.5
c79009_g5_i3	XP_005804172.1	Dedicator of cytokinesis protein 10-like	3.48
c79009_g5_i11	XP_004543764.1	Dedicator of cytokinesis protein 10-like isoform X5	4.78
c81865_g7_i2	XP_006630472.1	Dedicator of cytokinesis protein 1-like	2.96
c80966_g9_i3	XP_007248265.1	Dedicator of cytokinesis protein 7 isoform X22	4.25
c83105_g11_i12	XP_007231916.1	Dedicator of cytokinesis protein 8-like isoform X1	2.71
c82462_g2_i6	XP_007260736.1	DENN domain-containing protein 3-like isoform X2	2.76
c77125_g4_i4	XP_007255254.1	DENN domain-containing protein 4C isoform X1	2.87
c82308_g2_i10	NP_001153405.1	Deoxynucleoside triphosphate triphosphohydrolase SAMHD1	3.02
c70253_g1_i1	XP_002713465.1	Desmocollin 2-like	-2.17
c80247_g1_i5	XP_005476418.1	Desmoplakin isoform X2	2.39
c80247_g1_i3	XP_007240950.1	Desmoplakin-like isoform X1	2.15
c79724_g6_i1	XP_006629915.1	Diacylglycerol kinase theta-like	3.35
c77326_g3_i3	XP_007242179.1	Dihydropyrimidinase	2.38
c78258_g3_i2	XP_693702.4	Discoidin domain-containing receptor 2	2.48
c78258_g4_i4	XP_007258428.1	Discoidin domain-containing receptor 2 isoform X2	2.87
c78993_g3_i9	NP_998128.1	Disco-interacting protein 2 homolog B-A	2.36
c75716_g15_i1	XP_005171457.1	Disco-interacting protein 2 homolog C isoform X1	3.16
c75716_g13_i4	XP_007233709.1	Disco-interacting protein 2 homolog C-like	2.48
c79056_g6_i3	XP_005158712.1	Disheveled-associated activator of morphogenesis 1 isoform	3.04
c81052_g5_i1	XP_005934030.1	Disheveled-associated activator of morphogenesis 2-like	2.85
c77471_g6_i1	XP_003458982.1	Disks large homolog 1-like isoformX3	2.65
c75813_g11_i5	XP_697562.6	Disks large-associated protein 4 isoform X4	2.02
c83274_g6_i6	XP_007260867.1	DmX-like protein 1	10.31
c75824_g22_i4	XP_007260514.1	DNA (cytosine-5)-methyltransferase 3A-like isoform X1	3.72
c77806_g15_i3	XP_005926028.1	DNA (cytosine-5)-methyltransferase 3A-like isoform X5	5.93
c75878_g5_i4	XP_007231584.1	DNA helicase INO80	2.3
c79039_g12_i5	XP_004078727.1	DNA ligase 1-like	2.56
c79208_g17_i3	XP_007227823.1	DNA-binding protein SATB2 isoform X3	3.11
c81047_g2_i4	XP_005808344.1	DNA-directed RNA polymerase II subunit RPB9-like	-2.11
c83398_g22_i2	XP_007249219.1	Dual specificity mitogen-activated protein kinase kinase 1	2.17
c79103_g3_i7	XP_004066368.1	Dynamin-2-like isoform 3	4.43
c79103_g3_i16	XP_005468739.1	Dynamin-2-like isoform X5	2.4
c79141_g6_i2	XP_007249131.1	Dynamin-like 120 kDa protein, mitochondrial isoform X5	2.09

c77577_g13_i3	AAI54269.1	Dynein, cytoplasmic 1, light intermediate chain 2	2.08
c78472_g2_i2	XP_005172350.1	Dysferlin isoform X3	5.19
c83762_g12_i3	XP_003449930.1	Dystrophin isoform X1	3.62
c83109_g6_i11	XP_005454705.1	Dystrophin isoform X5	3.57
c77761_g2_i5	NP_001187227.1	E2A-1 transcription factor	3.44
c78522_g4_i2	NP_001007331.1	E3 ubiquitin-protein ligase CBL	3.09
c82320_g14_i1	XP_001921961.4	E3 ubiquitin-protein ligase CBL-B	3.65
c81580_g6_i1	XP_005456015.1	E3 ubiquitin-protein ligase HECTD1 isoform X4	2.87
c81580_g6_i19	XP_007257971.1	E3 ubiquitin-protein ligase HECTD1 isoform X6	3.52
c78468_g10_i13	XP_007246832.1	E3 ubiquitin-protein ligase HUWE1 isoform X3	2.38
c83212_g5_i3	XP_007246836.1	E3 ubiquitin-protein ligase HUWE1 isoform X7	6.37
c79026_g5_i1	BAO04456.1	E3 ubiquitin-protein ligase Itchy-a	2.48
c84124_g4_i11	XP_007252712.1	E3 ubiquitin-protein ligase MARCH2	2.11
c82649_g6_i4	XP_003197917.1	E3 ubiquitin-protein ligase MARCH6 isoformX2	2.04
c81278_g1_i6	NP_775393.2	E3 ubiquitin-protein ligase mib1	3.02
c76102_g14_i6	XP_007244686.1	E3 ubiquitin-protein ligase pellino homolog 1-like isoform	2.66
c81044_g14_i3	XP_007231443.1	E3 ubiquitin-protein ligase RNF170-like	2.19
c82087_g4_i3	XP_001921030.4	E3 ubiquitin-protein ligase RNF213	3.6
c81152_g1_i1	XP_004559460.1	E3 ubiquitin-protein ligase RNF213-like isoform X1	13
c79444_g6_i4	XP_007235822.1	E3 ubiquitin-protein ligase RNF5-like	2.15
c78425_g3_i2	XP_007252193.1	E3 ubiquitin-protein ligase SMURF2 isoform X1	2.07
c84366_g2_i1	XP_007251679.1	E3 ubiquitin-protein ligase TRIP12-like isoform X1	2.68
c81265_g2_i1	XP_005162253.1	E3 ubiquitin-protein ligase UBR4 isoform X7	6.18
c81265_g2_i2	XP_005162255.1	E3 ubiquitin-protein ligase UBR4 isoform X9	4.68
c81265_g1_i1	XP_007246402.1	E3 ubiquitin-protein ligase UBR4-like isoform X11	13.55
c81265_g1_i2	XP_007246396.1	E3 ubiquitin-protein ligase UBR4-like isoform X5	10.43
c76317_g10_i7	XP_007230670.1	E3 ubiquitin-protein ligase UHRF2-like	3.26
c79648_g8_i9	XP_007250620.1	Early endosome antigen 1 isoform X5	4.15
c77974_g10_i1	CAP71948.1	Efnb1	2.22
c80420_g5_i1	AAH97084.1	Elk4 protein	3.74
c79257_g15_i4	XP_007245414.1	EMILIN-1-like, partial	8.95
c76199_g4_i3	ADO27819.1	Endophilin-a2	2.49
c76285_g16_i4	XP_003965609.1	Endoplasmic reticulum metallopeptidase 1-like	2.57
c74986_g12_i2	XP_007231181.1	Endothelial cell-selective adhesion molecule-like	2.4
c80660_g3_i6	XP_695262.6	Endothelial PAS domain-containing protein 1 isoform X2	2.5
c77765_g7_i2	AAI62564.1	Endothelin receptor type A	2.24

c79198_g1_i7	XP_005935840.1	Engulfment and cell motility protein 3-like isoform X1	2.81
c81615_g3_i2	XP_007239199.1	Envoplakin-like	2.22
c81775_g9_i3	NP_571489.1	Eph receptor B4a precursor	2.97
c83835_g3_i1	XP_007250643.1	Ephrin-B2a-like	2.34
c78169_g15_i1	XP_003966872.1	Ephrin-B2-like	3.11
c78398_g2_i6	AAI63725.1	Epidermal growth factor receptor	2.78
c81668_g1_i1	XP_005170141.1	Epiplakin-like	2.64
c69095_g4_i2	XP_007249992.1	Epithelial membrane protein 3-like isoform X1	-8.16
c78100_g8_i3	XP_007236574.1	Epithelial splicing regulatory protein 1 isoform X1	2.15
c75783_g2_i6	XP_005165758.1	ErbB-3a isoform X1	2.4
c81698_g7_i6	XP_007251461.1	Ethanolamine kinase 1-like	2.33
c81568_g16_i1	XP_005164599.1	ETS domain-containing protein Elk-3 isoform X1	2.03
c83366_g4_i5	XP_007254866.1	ETS-related transcription factor Elf-1-like	2.39
c82118_g6_i4	XP_007247727.1	Eukaryotic translation initiation factor 4 gamma 1-like	3.59
c79871_g4_i10	XP_007249319.1	Eukaryotic translation initiation factor 4 gamma 2-like	2.28
c79580_g2_i2	XP_007234185.1	Eukaryotic translation initiation factor 4E type 2-like	-2.13
c76019_g4_i2	NP_001025305.1	Exocyst complex component 4	2.13
c79327_g2_i6	XP_007248158.1	Exocyst complex component 6B isoform X2	3.99
c77689_g8_i2	XP_003961112.1	Exocyst complex component 7-like isoform 3	2.56
c83035_g1_i8	XP_007248020.1	Exosome component 10	2.18
c82852_g3_i5	XP_004549004.1	Exostosin-1b-like	2.32
c78409_g5_i8	XP_004067068.1	Exostosin-2-like	-6.56
c81371_g7_i2	XP_007255532.1	Exostosin-like 3 isoform X1	3.04
c79605_g6_i2	XP_004554652.1	Exportin-1-like isoform X1	2.75
c81900_g4_i6	NP_919355.1	Exportin-6	2.64
c82765_g7_i5	XP_699731.6	Extended synaptotagmin-1	3.8
c78210_g9_i1	BAD23843.1	Extracellular signal regulated protein kinase 2	2.05
c81969_g3_i10	XP_003968027.1	Extracellular sulfatase Sulf-1-like	3.02
c79849_g2_i5	XP_686077.3	Family with sequence similarity 120C	3.76
c78405_g10_i5	XP_007243241.1	Far upstream element-binding protein 1-like isoform X6	2.13
c78097_g1_i3	NP_001007777.1	Far upstream element-binding protein 3	2.22
c79053_g10_i6	XP_007238508.1	F-box only protein 11-like	2.57
c74857_g1_i3	XP_002661149.1	F-box/WD repeat-containing protein 9	3.12
c79054_g14_i1	XP_006627869.1	FCH and double SH3 domains protein 2-like	2.42
c74900_g12_i1	NP_001129262.1	Fibrillin-2 precursor	3.67
c80308_g6_i4	XP_007235296.1	Fibroblast growth factor receptor 1-A-like isoform X3	3.49

c84233_g5_i9	BAF42760.1	Fibronectin	2.05
c76568_g3_i3	XP_007232744.1	Fibronectin type III domain-containing protein 3B-like	3.92
c79826_g17_i6	XP_007236779.1	Fibronectin type-III domain-containing protein 3a isoform	3.55
c82732_g3_i3	XP_005169394.1	Fibulin-2 isoform X2	2.64
c78050_g1_i14	NP_001092114.1	FIg-Hepta protein	13.9
c79677_g1_i12	XP_007249947.1	Filamin-A-like isoform X1	3.34
c79677_g1_i11	XP_007249950.1	Filamin-A-like isoform X4	2.97
c80389_g1_i1	XP_001919520.4	Filamin-B	3.91
c79836_g2_i3	XP_007251592.1	Filamin-B-like	3.64
c79836_g2_i4	XP_006631014.1	Filamin-B-like isoform X3	2.79
c81522_g2_i1	XP_005165320.1	Flotillin-2a isoform X1	12.53
c77297_g3_i2	AAI62574.1	Fn1 protein	3.79
c78665_g11_i1	XP_007233993.1	Folliculin-interacting protein 1-like isoform X1	4.79
c79955_g11_i4	XP_001922273.1	Forkhead box protein J3	4.04
c77692_g12_i1	AGS58227.1	Forkhead box protein O3	3.83
c81037_g12_i17	XP_005161060.1	Formin-binding protein 1-like isoform X4	2.5
c82095_g6_i1	XP_005162275.1	Formin-like 3 isoform X5	3.24
c77869_g3_i6	XP_007230012.1	Formin-like protein 1-like isoform X1	3.41
c81547_g12_i2	XP_007253553.1	Formin-like protein 2-like isoform X3	3.03
c81830_g7_i1	XP_003968645.1	Foxhead box protein O1-A-like isoform 1	3.05
c82848_g7_i3	XP_005157693.1	Fras1 related extracellular matrix protein 2b isoform X1	5.24
c82354_g1_i1	ADI46635.1	Fraser syndrome protein 1	4.48
c76693_g7_i1	XP_007234790.1	Frizzled-6-like	2.96
c82998_g10_i9	XP_003197998.1	FYVE and coiled-coil domain-containing protein 1-like	3.61
c78124_g10_i4	XP_007243217.1	FYVE and coiled-coil domain-containing protein 1-like,	2.84
c78950_g1_i1	XP_005468876.1	G patch domain-containing protein 8-like isoform X1	9.52
c82648_g22_i1	XP_007257626.1	Gap junction beta-4 protein-like	2.28
c78470_g3_i3	XP_007235721.1	Glioma tumor suppressor candidate region gene 1	4.11
c83942_g7_i2	XP_007240503.1	Glucosidase 2 subunit beta	2.16
c78099_g3_i1	NP_001103670.1	Glucoside xylosyltransferase 2 precursor	3.12
c83580_g5_i9	XP_005167956.1	Glutaminase kidney isoform, mitochondrial isoform X1	2.27
c75095_g5_i2	XP_007234822.1	Glutamine--fructose-6-phosphate aminotransferase	2.22
c72793_g1_i1	XP_007244351.1	Glutenin, high molecular weight subunit PW212-like	2.64
c79510_g17_i7	XP_005165897.1	Glycerol-3-phosphate dehydrogenase, mitochondrial isoform	2.65
c79015_g4_i7	XP_007229763.1	Glycerophosphocholine phosphodiesterase GPCPD1	2.34

c82470_g4_i3	NP_997974.2	Glycogen phosphorylase, brain form	2.05
c77819_g2_i3	XP_007233135.1	Glycogen synthase kinase-3 beta isoform X1	2.67
c77009_g12_i1	NP_957314.1	Glypican 1b precursor	2.31
c83290_g4_i4	XP_007244318.1	Golgi apparatus protein 1-like isoform X1	2.11
c82600_g3_i1	XP_007260221.1	Golgi membrane protein 1-like	2.15
c83519_g3_i15	XP_007240415.1	Golgi-specific brefeldin A-resistance guanine nucleotide	2.92
c83177_g15_i1	NP_001018301.1	Goliath homolog	2.33
c78808_g6_i2	XP_007250514.1	Grainyhead-like protein 2 homolog	2.26
c83539_g3_i15	XP_005158322.1	GRAM domain-containing protein 1A isoform X4	2.94
c78510_g4_i13	XP_005920962.1	GRAM domain-containing protein 3-like isoform X2	2.41
c78646_g4_i8	XP_005164025.1	Granulins isoform X5	3.16
c77862_g5_i1	XP_006638573.1	GTP-binding protein 2-like	2.23
c82077_g5_i4	XP_006806389.1	Guanine nucleotide exchange factor VAV3-like	2.62
c79813_g5_i1	XP_005159128.1	Guanine nucleotide-binding protein G(o) subunit alpha	2.83
c78218_g1_i1	XP_007250249.1	H(+)/Cl(-) exchange transporter 5-like	3.12
c76646_g7_i1	XP_007249183.1	Heme transporter hrg1-A-like	2.25
c84270_g5_i5	XP_005160777.1	Hemicentin-1 isoform X1	7.63
c75693_g1_i3	XP_005924055.1	Hepatoma-derived growth factor-related protein 3-like	2.15
c80496_g3_i7	XP_007261041.1	Heterogeneous nuclear ribonucleoprotein L-like isoform	2.02
c80660_g3_i7	NP_001187163.1	HIF 2 alpha	2.81
c79853_g10_i3	XP_007248993.1	High affinity cAMP-specific 3',5'-cyclic phosphodiesterase	2.42
c81047_g3_i3	XP_697383.4	Histone acetyltransferase KAT6B	2.38
c80768_g6_i8	XP_005168667.1	Histone acetyltransferase MYST3 isoform X1	4.57
c83329_g5_i1	XP_006636936.1	Histone acetyltransferase p300-like	3.1
c83329_g5_i14	XP_006798037.1	Histone acetyltransferase p300-like isoform X1	3.04
c75976_g2_i3	XP_007259140.1	Histone acetyltransferase p300-like isoform X3	4.43
c78538_g7_i3	XP_006785340.1	Histone deacetylase 7-like	2.5
c77815_g7_i1	XP_007246804.1	Histone lysine demethylase PHF8-like isoform X1	2.88
c77015_g2_i2	XP_007232774.1	Histone-lysine N-methyltransferase 2E-like isoform X3	2.63
c81514_g18_i4	XP_007237666.1	Histone-lysine N-methyltransferase EZH1	2.64
c82794_g5_i2	XP_005163352.1	Histone-lysine N-methyltransferase MLL3 isoform X2	9.76
c83210_g11_i3	XP_005162604.1	Histone-lysine N-methyltransferase MLL3 isoform X4	9.04
c83131_g10_i7	XP_005162605.1	Histone-lysine N-methyltransferase MLL3 isoform X5	10.83
c79275_g2_i1	XP_007251187.1	Histone-lysine N-methyltransferase SETD1A	2.96
c82800_g1_i5	XP_005158071.1	Histone-lysine N-methyltransferase SETDB1-B isoform X2	4.36
c82590_g17_i7	XP_005080448.1	Homeobox protein cut-like 1 isoform X4	3.45

c83398_g26_i1	XP_007251398.1	Homeobox protein PKNOX1-like isoform X1	5.16
c78787_g2_i8	XP_007255526.1	Homeobox-containing protein 1-like isoform X4	3.77
c78940_g6_i1	XP_700792.4	Homeodomain-interacting protein kinase 1	2.06
c83402_g11_i2	XP_007251022.1	Homeodomain-interacting protein kinase 2 isoform X1	4.79
c82845_g6_i6	XP_007245529.1	Human immunodeficiency virus type I enhancer-binding protein	3.11
c32959_g1_i1	XP_007234380.1	Hyaluronan and proteoglycan link protein 3	2.48
c78631_g1_i2	NP_001187230.1	Hypoxia induced factor 1 alpha	2.29
c81062_g4_i1	NP_997868.1	Hypoxia up-regulated protein 1 precursor	2.04
c76549_g1_i1	XP_001921732.1	IgGFc-binding protein-like	5.25
c79364_g3_i1	AAH91841.1	Im:7149628 protein, partial	2.56
c80650_g11_i3	XP_007252202.1	Inactive rhomboid protein 2	3.55
c82551_g1_i12	NP_001116737.1	Inhibitor of nuclear factor kappa-B kinase subunit beta	2.64
c79637_g11_i2	XP_005172967.1	Inositol 1,4,5-trisphosphate receptor type 1 isoform X2	2.37
c83631_g5_i1	XP_007430767.1	Inositol 1,4,5-trisphosphate receptor type 1-like,	8
c82722_g12_i1	XP_700746.4	Insulin receptor substrate 2	2.34
c81109_g3_i3	XP_007258746.1	Insulin-degrading enzyme	2.25
c81803_g10_i1	AAM51549.1	Insulin-like growth factor binding protein 5	2.38
c83443_g8_i4	XP_699485.4	Integrin alpha-1	2.58
c82135_g3_i11	XP_003199352.2	Integrin alpha-2-like	2.63
c78267_g4_i1	XP_696861.6	Integrin alpha-3 isoform X2	3.12
c79286_g3_i8	NP_001004288.2	Integrin alpha-5 precursor	2.49
c81949_g1_i7	XP_007237009.1	Integrin beta-4 isoform X1	2.45
c81949_g1_i6	XP_007237010.1	Integrin beta-4 isoform X2	2.18
c76232_g7_i4	XP_007254309.1	Integrin beta-7-like	2.03
c83435_g3_i6	NP_001013466.1	Integrin, alpha 6b precursor	2.38
c77179_g12_i1	XP_006008495.1	Interferon regulatory factor 2	4.97
c78422_g4_i12	XP_007247534.1	Interferon regulatory factor 2 isoform X1	2.23
c78110_g5_i1	NP_001106979.2	Interleukin 7 receptor precursor	2.81
c82350_g8_i4	XP_005165780.1	Interleukin enhancer binding factor 3a isoform X1	2.1
c80717_g11_i10	XP_007260876.1	Interleukin-11 receptor subunit alpha isoform X1	4.94
c81756_g1_i6	XP_007255345.1	Interleukin-6 receptor subunit beta	2.31
c78102_g6_i2	XP_007255339.1	Interleukin-6 receptor subunit beta-like isoform X1	2.38
c80791_g7_i1	XP_007257461.1	Intron-binding protein aquarius isoform X1	3.21
c82661_g6_i7	XP_007239820.1	Isoleucine--tRNA ligase, cytoplasmic-like, partial	2.21
c73751_g3_i1	XP_007259715.1	Junctional protein associated with coronary artery disease	2.82

c77004_g5_i5	XP_005171653.1	KAT8 regulatory NSL complex subunit 1-like isoform X1	2.31
c82322_g2_i1	NP_996964.1	Kelch-like protein 21	3.03
c77877_g3_i1	XP_007236437.1	Kelch-like protein 24-like	2.9
c81377_g3_i10	XP_007246535.1	Kelch-like protein 4-like	3.17
c74074_g2_i3	XP_005173315.1	Kinase insert domain receptor like isoform X1	3.02
c82388_g6_i2	XP_700210.2	Kinesin family member 13Ba isoform X4	3.11
c77781_g5_i2	XP_699081.6	Kinesin family member 21B	14.78
c80341_g4_i6	XP_006638769.1	Kinesin light chain 1-like	2.97
c82388_g6_i7	XP_005934893.1	Kinesin-like protein KIF13A-like	2.91
c82388_g6_i1	XP_003758133.1	Kinesin-like protein KIF13B	4.46
c81821_g1_i4	XP_007257777.1	KN motif and ankyrin repeat domain-containing protein	3.42
c81198_g6_i1	XP_005164396.1	KN motif and ankyrin repeat domain-containing protein 1	5.09
c79639_g2_i2	XP_007246548.1	Krueppel-like factor 13-like	3.63
c77108_g2_i2	Q1LVF0.2	LAMC1_DANRE RecName: Full=Laminin subunit gamma-1; Flags: Precursor	2.53
c80606_g1_i4	XP_005476396.1	Laminin subunit alpha-3 isoform X2	4.91
c78262_g2_i1	XP_007259965.1	Laminin subunit alpha-4 isoform X1	3.18
c81822_g5_i7	XP_692838.6	Laminin subunit beta-1 isoform X2	2.24
c80630_g6_i1	NP_001264059.1	Laminin, beta 1b precursor	2.71
c79279_g3_i1	XP_007246229.1	Lamin-L(II)-like	2.87
c77918_g6_i4	XP_007236338.1	La-related protein 1 isoform X3	2.1
c81583_g1_i3	NP_001121830.1	Large neutral amino acids transporter small subunit 1	2.71
c74367_g1_i2	XP_007260952.1	Large neutral amino acids transporter small subunit 4-like	3.48
c83028_g10_i1	XP_007260970.1	Large proline-rich protein BAG6-like	4.37
c81258_g13_i2	XP_007261087.1	Latent-transforming growth factor beta-binding protein	2.3
c82975_g4_i16	XP_005158769.1	Latent-transforming growth factor beta-binding protein 1	3.27
c82550_g3_i10	XP_007230959.1	LETM1 and EF-hand domain-containing protein 1,	3.6
c82066_g4_i1	XP_007255018.1	LETM1 domain-containing protein LETM2, mitochondrial	2.15
c83715_g6_i2	XP_007260310.1	Leucine-rich repeat serine/threonine-protein kinase 1	2.62
c80275_g1_i2	XP_007244011.1	Leucyl-cystinyl aminopeptidase	2.34
c81065_g1_i10	NP_001108201.1	LIM and calponin homology domains-containing protein 1	4.3
c82671_g15_i8	XP_002663732.2	LIM domain and actin-binding protein 1 isoform X1	2.3
c81810_g14_i1	XP_688621.1	LIM domain-containing protein 2-like	2.59
c76402_g6_i11	XP_007228904.1	Lipid phosphate phosphohydrolase 1	-2.26
c78888_g9_i2	XP_007258495.1	Lipid phosphate phosphohydrolase 2-like	2.02
c76911_g5_i3	XP_001919561.1	Lipid phosphate phosphohydrolase 3 isoform 1	2.21
c81073_g9_i1	NP_957492.1	Lipoma-preferred partner homolog	2.02

c79278_g4_i8	XP_006808291.1	Liprin-alpha-1-like isoform X12	2.8
c79137_g11_i4	AAH54565.1	LOC407638 protein	2.93
c84205_g1_i4	AAI55173.1	LOC794796 protein	2.91
c84100_g12_i1	NP_001264163.1	LON peptidase N-terminal domain and RING finger protein 1	2.89
c80502_g19_i1	XP_005451431.1	Long-chain fatty acid transport protein 4-like isoform X2	2.33
c77771_g14_i3	XP_007230089.1	Long-chain-fatty-acid--CoA ligase ACSBG2-like isoform X1	2.47
c82650_g4_i16	XP_005934060.1	LOW QUALITY PROTEIN: alpha-actinin-1-like	-4.05
c73995_g1_i3	XP_004071707.1	LOW QUALITY PROTEIN: ATP-binding cassette sub-family A	4.71
c80420_g2_i4	XP_007251466.1	LOW QUALITY PROTEIN: ETS domain-containing protein Elk-4	2.64
c79563_g7_i2	XP_002663045.1	LOW QUALITY PROTEIN: myotubularin-related protein 13	2.91
c75629_g1_i2	XP_007251026.1	LOW QUALITY PROTEIN: nuclear pore complex protein Nup205	2.91
c82773_g9_i7	XP_007247866.1	LOW QUALITY PROTEIN: protein tweety homolog 3-like	2.11
c78659_g14_i3	XP_007251710.1	LOW QUALITY PROTEIN: ras GTPase-activating protein 2,	2.54
c81592_g4_i3	XP_001341635.3	LOW QUALITY PROTEIN: titin	2.46
c81753_g14_i3	XP_007254741.1	Low-density lipoprotein receptor class A	2.02
c76168_g2_i3	XP_005163927.1	Low-density lipoprotein receptor isoform X1	2.08
c83782_g7_i4	XP_005162276.1	Low-density lipoprotein receptor-related protein 1 isoform	7.33
c83782_g2_i2	XP_005739640.1	Low-density lipoprotein receptor-related protein 1-like	2.83
c78655_g2_i2	XP_005454311.1	Low-density lipoprotein receptor-related protein 5	3.27
c78655_g7_i7	XP_005163047.1	Low-density lipoprotein receptor-related protein 5 isoform	2.16
c82362_g3_i6	XP_002660488.3	LPS-responsive vesicle trafficking, beach and anchor	4.56
c83066_g2_i1	XP_007237400.1	Lymphocyte antigen 75	2.95
c77033_g3_i9	XP_007234688.1	Lysine-specific demethylase 5C isoform X1	2.97
c75585_g1_i4	XP_007236108.1	Lysine-specific demethylase 6B-like isoform X1	2.46
c78543_g9_i3	XP_007228424.1	Lysine-specific demethylase 7A-like	2.82
c77366_g8_i2	XP_007232779.1	Lysine-specific demethylase 7A-like isoform X2	2.84
c77375_g2_i1	XP_005169348.1	Lysine-specific demethylase phf2 isoform X1	5.12
c80720_g8_i4	XP_007246943.1	Lysophosphatidylcholine acyltransferase 2	3.33
c82891_g2_i3	NP_001013551.1	Lysosomal membrane glycoprotein 2 precursor	2.11
c77905_g3_i7	XP_007244026.1	Lysosome membrane protein 2	2.24
c74977_g8_i4	XP_007254918.1	Lysosome-associated membrane glycoprotein 1	2.42
c78063_g1_i1	XP_007240023.1	Lysyl oxidase homolog 1-like	3.22

c80828_g1_i2	XP_002663014.2	Macrophage mannose receptor 1	2.35
c81913_g13_i3	XP_001919596.4	Maestro heat-like repeat family member 1 isoform X1	2.62
c77689_g2_i1	XP_007247199.1	Malectin	2.32
c80383_g12_i1	XP_007250437.1	Matrix metalloproteinase-16-like isoform X2	2.92
c76595_g2_i4	NP_001073429.2	Matrix-remodelling associated 8b precursor	2.29
c80478_g2_i3	XP_006639922.1	MAU2 chromatid cohesion factor homolog	2.57
c83510_g5_i2	XP_006007052.1	Max dimerization protein 4	2.22
c75717_g9_i2	XP_007245984.1	Max-binding protein MNT	2.3
c80671_g4_i5	XP_007250174.1	MBT domain-containing protein 1-like isoform X1	2.33
c83412_g2_i9	XP_007258633.1	Mediator of RNA polymerase II transcription subunit	3.89
c77776_g2_i8	XP_004066104.1	Mesothelin-like	-4.89
c81012_g11_i9	XP_003199529.2	Metal transporter CNNM3-like	2.94
c81012_g12_i1	XP_005165113.1	Metal transporter CNNM4 isoform X1	4.36
c78111_g2_i1	XP_005159960.1	Methylcytosine dioxygenase TET2-like	3.86
c82564_g3_i1	AGO18314.1	MHC class I antigen alpha 2, partial	2.6
c83838_g1_i1	AHA37373.1	MHC class I antigen ZBA transcript variant 3	2.58
c76888_g1_i2	XP_007239102.1	MICAL-like protein 1-like	4.43
c83925_g1_i1	XP_003200751.2	Midasin	2.26
c78854_g14_i4	XP_005170493.1	Midnolin isoform X1	4.34
c80680_g17_i6	XP_005472097.1	Misshapen-like kinase 1-like	3.22
c80680_g8_i1	XP_003971178.1	Misshapen-like kinase 1-like isoform 1	3.95
c81729_g5_i1	ADO28181.1	Mitochondrial glutamate carrier 1	2.03
c78143_g7_i2	XP_007242383.1	Mitogen-activated protein kinase 6-like isoform X1	2.06
c77600_g5_i1	XP_007233629.1	Mitogen-activated protein kinase 8B isoform X1	3.98
c83508_g8_i3	XP_007230232.1	Mitogen-activated protein kinase kinase kinase 11 isoform	4.4
c81887_g11_i10	XP_007248944.1	Mitogen-activated protein kinase kinase kinase 2-like	3.24
c81635_g1_i1	XP_007251171.1	Mitogen-activated protein kinase kinase kinase 3-like	2.92
c82581_g4_i21	NP_001155222.1	Mitogen-activated protein kinase kinase kinase 5	2.62
c81546_g1_i2	NP_956207.1	Mitogen-activated protein kinase kinase kinase kinase 5	2.22
c81083_g4_i8	Q90336.1	MK14A_CYPCA RecName: Full=Mitogen-activated protein kinase 14A; Short=MAP	2.06
c79516_g1_i1	XP_007244700.1	Monoacylglycerol lipase ABHD12-like	2.92
c79971_g2_i8	NP_956591.1	Monoglyceride lipase	2.85
c83690_g1_i1	XP_007256745.1	Msx2-interacting protein-like isoform X3	2
c78080_g3_i5	XP_694345.6	Mucin-17 isoform X2	23.06
c75765_g1_i9	XP_005166357.1	Mucin-2-like isoform X2	3.87

c77449_g2_i4	XP_002936537.2	Mucin-5AC-like	9.99
c83581_g8_i2	XP_007259561.1	Mucin-5AC-like isoform X1	2.08
c73607_g2_i3	XP_007253182.1	Mucolipin-1-like isoform X1	5.41
c80232_g9_i5	NP_001093520.2	Muscleblind-like protein 1 isoform 2	2.35
c80232_g9_i1	ABX80001.1	Muscleblind-like protein 1C	2.87
c80232_g9_i8	ABX80002.1	Muscleblind-like protein 1D	3.32
c80232_g9_i2	XP_007232969.1	Muscleblind-like protein 1-like	3.3
c76574_g3_i2	XP_006637488.1	Muscleblind-like protein 1-like isoform X2	2.46
c75183_g2_i1	XP_002665608.1	Myelin basic protein isoform X5	3.25
c72943_g3_i6	XP_007236691.1	Myelin protein P0-like isoform X1	2.59
c72943_g3_i5	XP_007236692.1	Myelin protein P0-like isoform X2	2.92
c82226_g1_i1	NP_001187207.1	Myeloid differentiation primary response protein MyD88	2.34
c79624_g1_i5	AAH60675.1	Myh9 protein	3.2
c76907_g17_i2	XP_005159101.1	Myocyte-specific enhancer factor 2A isoform X3	2.64
c79334_g7_i3	XP_007249799.1	Myocyte-specific enhancer factor 2D homolog isoform X2	5.44
c79334_g7_i2	XP_005158101.1	Myocyte-specific enhancer factor 2D isoform X3	2.88
c80664_g12_i1	XP_007237676.1	Myomegalin-like	3.47
c80667_g1_i3	XP_007253555.1	Myosin light chain kinase, smooth muscle-like isoform X2	3.91
c84026_g6_i1	XP_003964413.1	Myosin-10	2.34
c84026_g4_i3	XP_006635254.1	Myosin-10-like isoform X2	2.11
c76153_g5_i1	XP_005934540.1	Myosin-10-like isoform X4	6.8
c84026_g4_i8	XP_007257218.1	Myosin-11-like isoform X3	2.62
c80687_g1_i12	XP_007257004.1	Myosin-6-like	3.96
c79624_g11_i1	XP_005470244.1	Myosin-9-like isoform X2	4.8
c81417_g3_i9	ELK27722.1	Myosin-Ib	4.77
c81861_g2_i1	CBN81695.1	Myosin-Id	3.28
c78248_g1_i6	XP_007250392.1	Myosin-IIIa-like	2.95
c80982_g10_i3	NP_001155104.1	Myosin-Vb	2.4
c75939_g5_i4	XP_003219847.1	Myosin-X-like	3.66
c83949_g5_i3	Q90339.2	MYSS_CYPCA RecName: Full=Myosin heavy chain, fast skeletal muscle	2.07
c79847_g5_i3	AGV06212.1	Na+/K+-ATPase alpha 1	2.2
c78081_g1_i2	NP_999921.1	NAD(P) transhydrogenase, mitochondrial	2.13
c80510_g1_i5	NP_001082825.1	NADP-dependent malic enzyme, mitochondrial	-3.08
c81732_g5_i1	XP_005167980.1	Nck-associated protein 1 isoform X3	2.47
c81732_g5_i4	XP_005809580.1	Nck-associated protein 1-like isoform X4	3.15
c83345_g4_i3	XP_005160569.1	Nesprin-2 isoform X1	6.63

c83345_g4_i1	XP_687789.2	Nesprin-2 isoform X2	4.02
c75909_g14_i1	XP_007253581.1	Neurabin-1-like isoform X2	2.94
c77904_g11_i1	XP_686514.3	Neurabin-2-like	2.63
c77014_g8_i3	ADV17404.1	Neural cell adhesion molecule 1 isoform 1	5.67
c82472_g8_i7	XP_007256416.1	Neural cell adhesion molecule L1-like protein-like isoform	3.13
c82705_g2_i2	XP_002662311.2	Neurobeachin-like 1 isoform X1	2.45
c78229_g1_i7	NP_571624.2	Neurogenic locus notch homolog protein 3 precursor	3.93
c76397_g3_i5	XP_007238715.1	Neuropilin-1a-like isoform X1	2.23
c79089_g14_i1	XP_007234219.1	Neuropilin-2-like isoform X3	2.83
c83927_g5_i6	XP_007244851.1	Nipped-B-like protein B-like isoform X1	3.22
c84282_g1_i12	ABD83886.1	NOD3 protein-like	2.03
c75203_g3_i1	XP_696713.3	Nuclear envelope pore membrane protein POM 121	3.71
c82426_g5_i1	XP_005723858.1	Nuclear export mediator factor NEMF-like	2.03
c81644_g3_i1	XP_005281412.1	Nuclear factor 1 X-type isoform X4	3.48
c82203_g9_i2	XP_007260690.1	Nuclear factor 1 X-type-like isoform X3	3.26
c76991_g4_i1	XP_007246953.1	Nuclear factor of activated T-cells, cytoplasmic 3-like	2.5
c79786_g7_i1	NP_571013.1	Nuclear oncoprotein skib	2.54
c78527_g1_i2	XP_007244856.1	Nuclear pore complex protein Nup155-like isoform X1	2.41
c81449_g4_i1	XP_006640849.1	Nuclear pore complex protein Nup214-like	3.49
c83032_g4_i5	XP_007245506.1	Nuclear receptor coactivator 1-like	4.51
c80139_g3_i7	NP_956570.2	Nuclear receptor corepressor 1	4.41
c80139_g3_i2	XP_007233615.1	Nuclear receptor corepressor 1-like	2.52
c83280_g9_i9	XP_007229425.1	Nuclear receptor corepressor 2 isoform X1	4.03
c82759_g11_i5	XP_007229426.1	Nuclear receptor corepressor 2 isoform X2	3.24
c82759_g11_i12	XP_007229427.1	Nuclear receptor corepressor 2 isoform X3	3.14
c80952_g2_i1	XP_006634384.1	Nuclear receptor-binding protein 2-like	2.52
c83188_g6_i17	XP_007244582.1	Nuclear RNA export factor 1-like	2.43
c82222_g1_i1	XP_007245485.1	Nucleoprotein TPR-like isoform X2	2.15
c81689_g1_i1	XP_005171685.1	Nucleosome-remodeling factor subunit BPTF isoform X3	10.23
c81689_g1_i6	XP_005171689.1	Nucleosome-remodeling factor subunit BPTF isoform X7	6.93
c78824_g4_i5	XP_007237839.1	Nucleus accumbens-associated protein 1-like isoform X1	4.52
c78824_g3_i2	XP_003455024.1	Nucleus accumbens-associated protein 2-like isoform X1	4.54
c77072_g1_i8	NP_001187099.1	Oct1 transcription factor	2.17
c82495_g10_i1	XP_007239051.1	Ornithine aminotransferase, mitochondrial	2.01
c73944_g1_i1	CBN81273.1	Orphan sodium-and chloride-dependent neurotransmitter transporter	2.26

c83628_g1_i6	XP_004574810.1	Otoancorin-like	11.92
c82690_g2_i10	XP_006794841.1	Oxidation resistance protein 1-like isoform X3	4.37
c80831_g4_i7	NP_957073.2	Oxoglutarate (alpha-ketoglutarate) dehydrogenase (lipoamide)	2.56
c77560_g7_i3	XP_007260028.1	Oxysterol-binding protein-related protein 11	2.74
c76501_g3_i1	XP_007256395.1	Oxysterol-binding protein-related protein 2	2.35
c78936_g1_i3	XP_005170502.1	P66 alpha isoform X2	2.56
c80323_g5_i7	XP_007249052.1	PAB-dependent poly(A)-specific ribonuclease subunit 3	2.12
c82676_g5_i7	XP_006633086.1	Palmitoyltransferase ZDHHC9-like	2.7
c81156_g5_i4	XP_007238714.1	Partitioning defective 3 homolog isoform X2	3.44
c80929_g4_i1	XP_007228579.1	Partitioning defective 6 homolog gamma-like	2.09
c79124_g1_i6	XP_007251184.1	Perforin-1-like, partial	2.12
c84014_g5_i7	XP_006642068.1	Period circadian protein homolog 2-like	3.78
c76909_g2_i8	AHM24918.1	Periostin	2.78
c81337_g2_i4	NP_001071254.1	Periostin isoform 1 precursor	2.25
c83536_g5_i5	XP_007233792.1	Periplakin	2.29
c76652_g21_i2	XP_007236114.1	PERQ amino acid-rich with GYF domain-containing protein	2.1
c80566_g5_i1	XP_007255330.1	PH and SEC7 domain-containing protein 3-like isoform X1	3.46
c80566_g5_i6	XP_007255332.1	PH and SEC7 domain-containing protein 3-like isoform X3	2.17
c82040_g1_i1	XP_005796163.1	PH domain leucine-rich repeat-containing protein	2.14
c83734_g10_i3	XP_007228108.1	PHD and RING finger domain-containing protein 1 isoform X2	2.83
c78462_g10_i9	XP_698221.5	PH-interacting protein isoform X2	5
c83808_g1_i6	XP_007228232.1	Phosphate carrier protein, mitochondrial-like isoform X1	-2.78
c77335_g7_i2	XP_001341899.2	Phosphatidate cytidylyltransferase 1	3.49
c81355_g2_i4	XP_005945187.1	Phosphatidate cytidylyltransferase 2-like	3.5
c77579_g2_i13	XP_007228599.1	Phosphatidylinositide phosphatase SAC1-B-like	2.06
c82239_g3_i1	XP_699627.3	Phosphatidylinositol 3,4,5-trisphosphate-dependent Rac	3.25
c78986_g1_i3	NP_001122174.1	Phosphatidylinositol-5-phosphate 4-kinase type-2 alpha	2.67
c82919_g10_i12	XP_005172377.1	Phosphatidylinositol-binding clathrin assembly protein	3.67
c80473_g1_i10	XP_005453238.1	Phosphofurin acidic cluster sorting protein 1-like isoform	2.11
c75780_g4_i1	XP_003201197.2	Phosphofurin acidic cluster sorting protein 2 isoform X1	2.5
c79246_g5_i4	XP_007245245.1	Phospholipase D1	-3.48
c80974_g5_i3	XP_007229879.1	Phosphomannomutase 1	2.63
c83432_g9_i4	XP_696355.4	Piezo-type mechanosensitive ion channel component 1	3.52
c81748_g13_i1	XP_002662884.1	Plakophilin-3-like	2.52

c77087_g6_i12	XP_007235565.1	Plastin-2-like	2
c78526_g4_i6	XP_007232268.1	Platelet-derived growth factor receptor beta isoform X1	2.8
c80664_g6_i3	EDL17685.1	Pleckstrin homology domain containing, family A (phosphoinositide	2.12
c83937_g9_i3	XP_005170112.1	Plectin a isoform X1	4.47
c83624_g1_i9	XP_007257339.1	Plectin-like isoform X2	6.97
c81607_g5_i4	XP_007253387.1	Plexin-B1-like isoform X1	2.18
c80882_g5_i1	XP_007229785.1	Plexin-B2-like isoform X1	2.77
c83103_g16_i3	XP_694914.4	Plexin-B3 isoform X2	3.3
c84348_g2_i1	CBN81178.1	Pol polyprotein	2.42
c83657_g5_i1	XP_007250915.1	Poliovirus receptor-related protein 2-like isoform X1	2.27
c83657_g5_i3	XP_007250916.1	Poliovirus receptor-related protein 2-like isoform X2	2.23
c79385_g11_i1	XP_005449062.1	Poly(U)-binding-splicing factor PUF60-like isoform X6	10.15
c78481_g9_i1	XP_007239828.1	Polymerase I and transcript release factor-like	2.09
c77965_g1_i1	XP_007258916.1	Polypeptide N-acetylgalactosaminyltransferase 12-like	2.11
c81385_g5_i1	NP_001018313.1	Polypyrimidine tract binding protein 1a	2.53
c78044_g6_i3	XP_001335967.2	Polypyrimidine tract-binding protein 3	3.11
c80591_g6_i2	XP_005167362.1	PR domain zinc finger protein 16 isoform X7	5.71
c80591_g6_i3	XP_006642023.1	PR domain zinc finger protein 16-like isoform X2	6.74
c80591_g10_i1	XP_007247972.1	PR domain zinc finger protein 16-like isoform X5	3.06
c75508_g2_i2	XP_007260950.1	Pre-mRNA-processing-splicing factor 8	2.03
c76699_g8_i6	NP_571589.2	Presenilin-2	2.22
c83095_g5_i3	XP_007246416.1	Probable cation-transporting ATPase 13A2-like	3.8
c84163_g4_i2	XP_005168975.1	Probable E3 ubiquitin-protein ligase HERC1-like isoform X1	7.96
c74188_g2_i2	NP_001138254.1	Probable E3 ubiquitin-protein ligase MGRN1	2.46
c83167_g2_i4	XP_004568069.1	Probable E3 ubiquitin-protein ligase MYCBP2-like isoform X12	5.1
c79737_g1_i2	XP_007255462.1	Probable E3 ubiquitin-protein ligase RNF217 isoform X2	2.48
c77914_g1_i3	XP_007256617.1	Probable helicase senataxin isoform X1	3.57
c74622_g6_i1	XP_002664465.3	Probable phospholipid-transporting ATPase IG isoform X1	3.35
c74622_g10_i3	XP_005173286.1	Probable phospholipid-transporting ATPase IG isoform X4	2.6
c78840_g9_i2	XP_003438982.1	Probable phospholipid-transporting ATPase IIA	3.5
c83523_g4_i14	XP_007227911.1	Probable ubiquitin carboxyl-terminal hydrolase FAF-X	3.03
c82986_g1_i1	NP_001007378.2	Procollagen-lysine,2-oxoglutarate 5-dioxygenase 2 isoform 1 precursor	2.14
c82861_g6_i2	XP_007245726.1	Programmed cell death 6-interacting protein isoform X2	3.12
c79909_g5_i1	AEL21374.1	Proliferator-activated receptor gamma coactivator 1 alpha	2.32

c78808_g2_i5	XP_007252552.1	Proline and serine-rich protein 1-like	3.07
c77209_g8_i6	XP_005173950.1	Prolyl 4-hydroxylase subunit alpha-2 isoform X2	2.04
c76245_g2_i4	XP_005156134.1	Prolyl 4-hydroxylase, alpha polypeptide I a isoform X1	2.11
c77418_g12_i2	XP_006638186.1	Proteasome activator complex subunit 3-like isoform X2	-4.84
c77632_g3_i3	XP_007254842.1	Protein AF-10 isoform X5	2.89
c81295_g21_i1	XP_007258334.1	Protein argonaute-3-like isoform X2	4.64
c79312_g5_i1	XP_007234703.1	Protein bicaudal D homolog 2-like	2.35
c80455_g11_i1	XP_007237106.1	Protein bicaudal D homolog 2-like isoform X1	2.27
c83303_g1_i1	XP_007253159.1	Protein capicua homolog isoform X1	9.15
c75556_g6_i2	XP_005808955.1	Protein C-ets-1-like	2.02
c81473_g4_i5	XP_007252607.1	Protein Daple	4.78
c77790_g7_i6	XP_006803314.1	Protein diaphanous homolog 2-like	3.35
c77052_g7_i5	NP_001186666.1	Protein disulfide-isomerase A3 precursor	2.2
c82534_g7_i8	XP_005922642.1	Protein disulfide-isomerase TMX3-like	2.09
c80138_g4_i2	XP_004569518.1	Protein EFR3 homolog A-like isoform X2	3.61
c77623_g2_i2	XP_697727.4	Protein ELYS	2.09
c76813_g9_i4	XP_007255862.1	Protein FAM102A	2.56
c78432_g12_i3	XP_007230014.1	Protein FAM134C	2.86
c78871_g1_i2	XP_007253770.1	Protein FAM13A isoform X1	2.14
c76066_g2_i3	XP_006627867.1	Protein FAM168A-like isoform X4	8.5
c81937_g3_i9	XP_698926.5	Protein FAM63B	3.16
c69396_g2_i2	XP_005463310.1	Protein furry homolog	5.62
c84197_g8_i2	XP_005157427.1	Protein furry homolog isoform X6	4.05
c83105_g16_i2	XP_006790274.1	Protein furry homolog-like isoform X5	6
c79203_g8_i5	XP_007230331.1	Protein KHNYN-like	2.36
c81334_g12_i1	XP_004084041.1	Protein KIAA0284 homolog	5.33
c78364_g1_i2	XP_005156660.1	Protein kinase C epsilon type isoform X2	2.33
c79310_g8_i2	NP_001116528.1	Protein kinase C eta type	2.1
c78545_g4_i3	XP_007238413.1	Protein NLRC3-like isoform X1	3.49
c78312_g1_i1	NP_001186995.1	Protein NLRC5	2.66
c83420_g6_i2	XP_007253872.1	Protein numb homolog isoform X5	4.21
c83811_g9_i5	XP_007257313.1	Protein outspread-like	2.38
c75571_g2_i2	XP_005163536.1	Protein patched homolog 1 isoform X1	4.2
c79864_g4_i3	XP_007231660.1	Protein patched homolog 1 isoform X2	5.21
c75937_g8_i7	XP_007231418.1	Protein phosphatase 1 regulatory subunit 12C-like isoform	3.34
c83946_g6_i3	CBN81872.1	Protein phosphatase 1 regulatory subunit 16A	2.05

c77516_g3_i1	XP_007235688.1	Protein phosphatase 1 regulatory subunit 37	2.12
c67684_g3_i1	XP_007232452.1	Protein phosphatase 1H-like	2.79
c78200_g21_i5	XP_007238242.1	Protein phosphatase Slingshot homolog 1-like	6.46
c84355_g2_i2	XP_007245605.1	Protein phosphatase Slingshot homolog 3-like	2.25
c79667_g5_i8	XP_005157381.1	Protein phosphatase Slingshot homolog 3-like isoform X1	2.31
c80603_g11_i3	NP_001154804.1	Protein phosphatase, Mg2+/Mn2+ dependent, 1Ab	2.45
c77322_g2_i3	XP_007244024.1	Protein prenyltransferase alpha subunit repeat-containing	2.67
c78000_g16_i2	XP_007259000.1	Protein quaking-A-like isoform X1	2.48
c81346_g16_i2	XP_007230663.1	Protein RIC1 homolog	6.21
c76591_g1_i1	XP_007248556.1	Protein SCAF8	2.8
c83334_g6_i3	XP_005166472.1	Protein scribble homolog isoform X9	3.54
c77270_g15_i1	XP_007258093.1	Protein SMG7 isoform X4	2.3
c81989_g6_i7	XP_007249414.1	Protein spire homolog 1-like isoform X6	3.09
c83194_g1_i4	XP_007254674.1	Protein SSXT isoform X2	2.7
c78515_g14_i1	XP_007252704.1	Protein strawberry notch homolog 2-like isoform X2	3.4
c83379_g4_i2	XP_007244442.1	Protein SZT2	5.49
c84059_g3_i1	XP_005171661.1	Protein TANC2 isoform X1	6.6
c79372_g2_i10	XP_007256662.1	Protein transport protein Sec16A-like isoform X1	2.84
c79372_g2_i8	XP_007256663.1	Protein transport protein Sec16A-like isoform X2	3.17
c82260_g1_i4	XP_007259391.1	Protein transport protein Sec24C-like isoform X3	2.82
c81023_g7_i3	XP_005158252.1	Protein tyrosine phosphatase, non-receptor type 23, a	6.25
c80164_g4_i8	XP_007237050.1	Protein VPRBP isoform X1	2.47
c81905_g8_i2	XP_007229477.1	Protein yippee-like 1 isoform X2	2.46
c82702_g4_i6	XP_003201274.1	Protein-methionine sulfoxide oxidase mical1	2.15
c81035_g8_i13	XP_007254721.1	Protein-methionine sulfoxide oxidase MICAL2-like isoform	2.04
c83740_g5_i3	XP_005168402.1	Protocadherin Fat 1 isoform X5	2.4
c81427_g5_i6	XP_007246503.1	Protocadherin Fat 2-like isoform X2	7.12
c72789_g1_i1	XP_006632080.1	Protocadherin gamma-C5-like	2.3
c79077_g8_i1	XP_007240588.1	Protocadherin-12-like	3.11
c83110_g11_i2	XP_007252964.1	Protocadherin-1-like isoform X1	3.46
c83110_g1_i2	XP_007252965.1	Protocadherin-1-like isoform X2	2.37
c76169_g2_i3	XP_007245747.1	Proto-oncogene tyrosine-protein kinase Yrk-like isoform X3	2.7
c81023_g4_i3	XP_001921602.2	Pseudopodium-enriched atypical kinase 1-like	2.9
c81161_g1_i2	AAI62720.1	Ptpn4 protein	2.26
c81879_g10_i8	XP_007068550.1	Puratrophin-1	3.52

c79783_g6_i6	XP_007227914.1	Putative ATP-dependent RNA helicase an3-like isoform X2	2.74
c80708_g17_i7	XP_007257899.1	Putative glycerol kinase 5-like	8.01
c82086_g8_i3	XP_007244570.1	Pyruvate carboxylase, mitochondrial-like	2.61
c82769_g11_i2	XP_007250661.1	R3H domain-containing protein 2-like isoform X4	4.19
c75561_g2_i5	XP_007233187.1	R3H domain-containing protein 4-like	3.24
c82325_g7_i1	XP_003438868.1	Rab GDP dissociation inhibitor alpha-like isoform X1	3.09
c76522_g3_i1	NP_001116759.1	Rab GTPase-binding effector protein 1	2.05
c79334_g2_i6	XP_007257654.1	Rab3 GTPase-activating protein non-catalytic subunit	2.35
c75411_g3_i2	XP_007259131.1	Radixin	3.83
c82547_g6_i1	XP_007248646.1	Ragulator complex protein LAMTOR1	2.27
c79539_g2_i7	XP_005158700.1	Ral GTPase-activating protein subunit alpha-1 isoform X4	5.15
c84057_g3_i1	XP_005158963.1	Ral GTPase-activating protein subunit alpha-2 isoform X5	4.51
c77788_g5_i8	XP_007240936.1	Rap guanine nucleotide exchange factor 6-like isoform X2	2.57
c75141_g4_i2	XP_007247809.1	Ras association domain-containing protein 5	2.1
c80491_g4_i2	XP_007253934.1	Ras GTPase-activating protein 1 isoform X1	2.34
c84179_g3_i1	XP_006780404.1	Ras GTPase-activating protein 3-like	2.26
c75666_g19_i1	XP_001332688.5	Ras GTPase-activating protein nGAP isoform X1	3.43
c81088_g4_i3	NP_001121812.1	Ras GTPase-activating-like protein IQGAP1	4.67
c75471_g12_i5	XP_003459795.1	Ras-related protein Rab-1A-like isoformX1	2.22
c82392_g17_i1	XP_007258515.1	Ras-related protein Rab-31, partial	2.12
c82392_g13_i1	XP_005924659.1	Ras-related protein Rab-31-like isoform X2	2.27
c81498_g10_i1	XP_005803252.1	Ras-related protein Rab-40C-like isoform X1	6.01
c83502_g6_i1	NP_001187853.1	Ras-related protein Rab-6B	2.21
c83200_g2_i2	NP_001005931.2	Ras-related protein R-Ras	2.3
c81402_g8_i3	XP_007238700.1	Ras-responsive element-binding protein 1 isoform X3	2.95
c75363_g1_i1	XP_007244664.1	Receptor expression-enhancing protein 3-like	2.78
c78979_g6_i4	NP_956413.2	Receptor tyrosine-protein kinase erbB-2 precursor	3.3
c83177_g13_i9	XP_005451978.1	Receptor tyrosine-protein kinase erbB-4-like	3.47
c81852_g15_i5	NP_919392.2	Receptor-interacting serine/threonine-protein kinase 2	2.51
c82492_g2_i5	XP_007237425.1	Receptor-type tyrosine-protein phosphatase beta-like	3.19
c73947_g1_i2	XP_002667259.3	Receptor-type tyrosine-protein phosphatase beta-like,	8.88
c82492_g1_i4	XP_007244440.1	Receptor-type tyrosine-protein phosphatase F	2.01
c82562_g1_i2	XP_005165742.1	Receptor-type tyrosine-protein phosphatase F isoform X1	5.34
c77642_g4_i2	NP_001077045.1	Receptor-type tyrosine-protein phosphatase F precursor	3.91
c79279_g4_i1	ERE88887.1	Receptor-type tyrosine-protein phosphatase gamma-like protein	2.57

c81036_g4_i2	NP_998639.1	Regulator of nonsense transcripts 1	2.13
c80699_g1_i7	XP_001919288.2	Regulatory-associated protein of mTOR isoformX1	3.91
c78276_g7_i2	XP_005159468.1	Retinoic acid receptor RXR-beta-A isoform X3	2.87
c81432_g1_i1	XP_005162076.1	Retrotransposon-derived protein PEG10-like	3.65
c80913_g5_i5	XP_007233449.1	Reversion-inducing cysteine-rich protein with Kazal	2.95
c80282_g1_i7	XP_007253460.1	Rho GTPase-activating protein 12-like isoform X2	2.51
c75779_g9_i2	XP_005163951.1	Rho GTPase-activating protein 17-like isoform X2	2.26
c81025_g4_i2	XP_007250679.1	Rho GTPase-activating protein 21-like isoform X2	3.38
c80289_g2_i14	XP_005162594.1	Rho GTPase-activating protein 21-like isoform X3	2.7
c81197_g2_i4	XP_005171660.1	Rho GTPase-activating protein 27-like isoform X2	2.31
c83570_g7_i7	XP_005163369.1	Rho GTPase-activating protein 29 isoform X1	2.21
c76749_g5_i5	XP_007260959.1	Rho GTPase-activating protein 35 isoform X1	2.13
c78474_g1_i2	XP_007250816.1	Rho GTPase-activating protein 39-like isoform X1	2.53
c79061_g2_i2	XP_007242084.1	Rho GTPase-activating protein 6-like isoform X1	2.51
c80352_g6_i6	XP_005159917.1	Rho GTPase-activating protein 7-like isoform X2	2.58
c83399_g3_i4	NP_001075100.1	Rho guanine nucleotide exchange factor (GEF) 1a	2.55
c83464_g1_i9	XP_007254648.1	Rho guanine nucleotide exchange factor 11-like isoform X1	2.77
c82992_g2_i2	XP_003200092.2	Rho guanine nucleotide exchange factor 12-like	4.01
c82419_g3_i13	XP_007232507.1	Rho guanine nucleotide exchange factor 1-like isoform X4	3.37
c81362_g6_i5	XP_007259417.1	Ribosome biogenesis protein BMS1 homolog	2.17
c77300_g13_i2	XP_007237397.1	RNA-binding motif, single-stranded-interacting protein 1	2.19
c78445_g8_i10	XP_007243731.1	RNA-binding protein 10-like isoform X1	2.55
c83339_g3_i2	NP_001108158.1	RNA-binding protein 47	3.01
c83339_g3_i5	XP_005168418.1	RNA-binding protein 47 isoform X3	3.78
c80700_g1_i1	XP_007237372.1	RNA-binding protein 6	3.26
c81555_g2_i2	XP_007228836.1	RNA-binding protein EWS isoform X1	2.11
c77341_g8_i2	XP_007242231.1	RNA-binding protein MEX3B-like	3.65
c75639_g13_i15	XP_007236681.1	RNA-binding protein MEX3D	2.43
c75431_g11_i4	XP_005813457.1	RNA-binding protein with multiple splicing-like	2.02
c77466_g6_i1	XP_007231520.1	Roquin-2-like	3.25
c77260_g5_i1	XP_697108.5	Sarcoplasmic/endoplasmic reticulum calcium ATPase 1	2.13
c81971_g11_i7	XP_007259021.1	Scavenger receptor class F member 2-like, partial	2.27
c81523_g2_i5	XP_007235023.1	SCY1-like protein 2-like isoform X2	3.67
c79282_g4_i10	XP_006635264.1	SEC14-like protein 1-like	5.05
c79282_g4_i5	XP_007252219.1	SEC14-like protein 1-like isoform X2	3.22
c79282_g4_i9	XP_007252221.1	SEC14-like protein 1-like isoform X4	4.21

c83372_g4_i4	XP_007230631.1	Secretory carrier-associated membrane protein 3-like	2.1
c79169_g6_i2	XP_007237401.1	Secretory phospholipase A2 receptor	4.04
c78917_g5_i4	NP_001116184.1	Semaphorin-3G precursor	4.14
c76420_g13_i3	XP_007237178.1	Semaphorin-4C-like	2.08
c82867_g3_i1	NP_001071211.1	Septin-7 isoform 1	2.84
c79435_g4_i2	XP_004564407.1	Serine/arginine repetitive matrix protein 1-like isoform	2.24
c82563_g8_i8	XP_006631941.1	Serine/threonine-protein kinase 10-like	2.18
c78741_g3_i1	XP_003451900.1	Serine/threonine-protein kinase 3/4-like isoform X1	2.07
c76207_g10_i4	XP_007249398.1	Serine/threonine-protein kinase 3-like isoform X2	2.33
c82590_g16_i1	XP_007249689.1	Serine/threonine-protein kinase 40	2.08
c78600_g14_i2	XP_007255655.1	Serine/threonine-protein kinase LATS2	2.46
c81307_g6_i1	XP_007239017.1	Serine/threonine-protein kinase LMTK2-like	3.26
c79700_g17_i1	XP_005161432.1	Serine/threonine-protein kinase MARK2 isoform X10	2.45
c82888_g8_i3	XP_007256678.1	Serine/threonine-protein kinase MRCK beta isoform X2	2.25
c83062_g4_i4	XP_007246220.1	Serine/threonine-protein kinase PAK 2 isoform X2	-2.13
c81717_g9_i7	NP_998614.1	Serine/threonine-protein kinase PRP4 homolog	3.01
c82688_g3_i2	XP_007253283.1	Serine/threonine-protein kinase SIK2-like isoform X1	2.64
c78594_g5_i6	XP_005454385.1	Serine/threonine-protein kinase SIK3 homolog	2.19
c81142_g12_i1	CBN81378.1	Serine/threonine-protein kinase TAO2	3.13
c82317_g7_i8	XP_007246109.1	Serine/threonine-protein kinase ULK1 isoform X4	3.58
c80680_g15_i1	XP_005164609.1	Serine/threonine-protein kinase WNK1 isoform X5	3.58
c78834_g5_i2	XP_007233936.1	Serine/threonine-protein kinase WNK1-like	4.34
c83458_g11_i7	XP_007252935.1	Serine/threonine-protein kinase WNK1-like isoform X1	9.88
c81512_g17_i2	NP_001018164.1	Serine/threonine-protein phosphatase 6 regulatory ankyrin repeat	5.88
c80443_g5_i3	XP_007253385.1	SET domain-containing protein 5	2.16
c78536_g2_i2	XP_007244010.1	SET-binding protein	2.55
c77174_g4_i1	XP_003198643.1	SH2B adapter protein 3	2.76
c76281_g7_i1	XP_007232483.1	SH3 domain-binding protein 4-like	2.91
c80555_g5_i18	AAI24137.1	Si:ch211-114c12.2	2.15
c75049_g4_i8	AAI29043.1	Si:dkey-11e23.5 protein	2.16
c77067_g6_i5	XP_005162817.1	Si:dkey-11p10.8 isoform X2	3.08
c79702_g1_i2	XP_697494.6	Si:dkey-266m15.6	2.89
c83488_g7_i3	XP_005163499.1	Sickle tail protein homolog isoform X2	4.25
c83947_g4_i1	XP_007233518.1	Signal peptide, CUB and EGF-like domain-containing protein	2.21
c83777_g2_i5	XP_007249195.1	Signal transducer and activator of transcription	2.59

c78505_g14_i6	XP_005163853.1	Signal transducer and activator of transcription 3 isoform	2
c78505_g14_i10	XP_003964845.1	Signal transducer and activator of transcription 3-like	5.17
c82916_g2_i3	ACU12487.1	Signal transducer and activator of transcription 5	2.2
c79892_g8_i11	XP_005162290.1	Signal transducer and activator of transcription 6,	3.1
c78465_g3_i5	AAH60933.1	Signal transduction and activation of transcription 1a	2.06
c78028_g17_i9	XP_004552784.1	Single-stranded DNA-binding protein 3-like	2.06
c76906_g3_i1	XP_007234425.1	Ski-like protein	2.35
c80370_g2_i3	XP_007242724.1	SLAM family member 9-like, partial	2.32
c84057_g6_i1	XP_007247811.1	SLIT-ROBO Rho GTPase-activating protein 2 isoform X2	4.37
c71587_g2_i1	Q9I8V2.1	SMAD1_DANRE RecName: Full=Mothers against decapentaplegic homolog 1; Short=MAD	3.25
c76651_g7_i2	XP_007233096.1	Small integral membrane protein 19-like isoform X1	2.14
c78985_g3_i3	AAH44407.1	Smarca4 protein, partial	2.16
c82319_g2_i9	XP_007236254.1	Smoothelin-like	2.45
c82700_g3_i1	NP_957127.1	SNF-related serine/threonine-protein kinase	3.43
c80630_g3_i2	XP_007250479.1	SNF-related serine/threonine-protein kinase	2.31
c79524_g3_i2	BAB83084.1	Sodium bicarbonate cotransporter	3.4
c84209_g5_i4	AAT48993.1	Sodium potassium ATPase alpha subunit	2.28
c72975_g1_i4	XP_007242934.1	Sodium/potassium-transporting ATPase subunit alpha-1-like,	2.85
c79862_g11_i1	XP_007253156.1	Sodium/potassium-transporting ATPase subunit alpha-3-like	2.24
c82928_g6_i2	XP_007238009.1	Sodium-coupled neutral amino acid transporter 2 isoform X2	2.01
c79287_g12_i4	NP_001082989.1	Sodium-dependent glucose transporter 1	2.76
c79858_g1_i2	XP_007257867.1	Sodium-dependent phosphate transporter 1-B-like	2.33
c81422_g1_i5	XP_007231665.1	Sodium-dependent phosphate transporter 2-like isoform X1	2.25
c81786_g8_i6	XP_007256975.1	Solute carrier family 12 member 7-like isoform X2	11.73
c83845_g10_i3	NP_001107912.1	Solute carrier family 4, anion exchanger, member 2b	2.69
c82571_g11_i12	NP_001032750.1	Solute carrier family 6, member 6	2.66
c79805_g5_i3	ADD17065.1	Solute carrier family 7 member 8-like protein	2.19
c81009_g6_i1	XP_003200086.2	Sortilin-related receptor isoform X1	4.47
c80211_g2_i1	XP_007230646.1	Sorting nexin-27-like	2.18
c77594_g2_i1	XP_007258595.1	Spartin-like isoform X3	2.16
c83720_g4_i6	XP_007231836.1	Spectrin beta chain, non-erythrocytic 1 isoform X1	4.14
c83367_g16_i3	XP_006639926.1	Spindlin-1-like	3.21
c80148_g1_i9	XP_006911198.1	Splicing factor 1-like	2.88

c77626_g11_i1	XP_007249238.1	Splicing factor 3B subunit 3	2.35
c83916_g1_i10	AAI62653.1	Spon1b protein	2.03
c73967_g4_i1	NP_001099164.1	SPRY domain-containing protein 3	2.21
c81176_g1_i2	XP_005170707.1	SRSF protein kinase 2-like isoform X4	3.25
c72612_g1_i2	XP_692994.3	StAR-related lipid transfer protein 7, mitochondrial	2.74
c82585_g2_i1	XP_005171942.1	StAR-related lipid transfer protein 8 isoform X1	2.51
c83289_g6_i10	XP_007255720.1	Sterile alpha motif domain-containing protein 5-like	2.36
c81634_g15_i3	XP_005169761.1	Striatin-4 isoform X1	2.73
c82224_g6_i8	XP_007429955.1	Striatin-interacting protein 1	-2.08
c80295_g3_i1	XP_007258067.1	Stromal interaction molecule 1-like isoform X1	2.07
c80816_g17_i3	XP_007249440.1	Stromal membrane-associated protein 2	3.03
c82305_g6_i1	XP_004070486.1	Structural maintenance of chromosomes protein 1A	2.4
c82305_g6_i7	NP_001155103.1	Structural maintenance of chromosomes protein 1A	-5.32
c75059_g18_i1	XP_007229905.1	Sugar phosphate exchanger 3-like	2.14
c81973_g3_i1	XP_007231032.1	Suppressor of cytokine signaling 5-like	3.03
c83753_g6_i1	XP_007233872.1	Sushi, von Willebrand factor type A, EGF and pentraxin	5.32
c78528_g3_i3	XP_006635727.1	SWI/SNF complex subunit SMARCC1-like	2.38
c79002_g1_i1	XP_695864.3	SWI/SNF complex subunit SMARCC2	2.8
c82693_g1_i1	XP_007236281.1	Synaptotagmin-like protein 2 isoform X3	3.2
c81015_g2_i4	XP_007240149.1	Syntaxin-6	7.19
c83162_g1_i4	XP_007255352.1	Talin-1-like isoform X4	4.11
c77213_g7_i5	XP_687410.3	Tankyrase-1 isoform X2	3.65
c82535_g4_i7	XP_007257685.1	Target of Nesh-SH3-like isoform X4	3.48
c77712_g12_i5	XP_689617.6	TBC1 domain family member 1 isoform X4	2.22
c77897_g1_i13	XP_007238168.1	TBC1 domain family member 12-like	3.56
c76498_g3_i1	XP_007228323.1	TBC1 domain family member 2B	2.69
c79299_g1_i1	CAM13370.1	Tenascin C	8.33
c81598_g3_i2	XP_005171321.1	Tenascin W isoform X1	2.65
c81826_g5_i1	XP_003199292.2	Tensin-1 isoform X1	2.44
c81826_g5_i2	XP_005464106.1	Tensin-1-like isoform X11	9.92
c83908_g6_i2	XP_007240897.1	Tetraspanin-15-like	2.06
c79163_g7_i3	XP_005157191.1	THO complex subunit 2 isoform X1	2.32
c77308_g8_i1	XP_007258392.1	Threonine--tRNA ligase, cytoplasmic-like	2.06
c79089_g2_i2	XP_007258230.1	Thrombospondin-1-like isoform X1	3.34
c70328_g3_i3	XP_007229873.1	Thyrotroph embryonic factor	3.8
c76166_g6_i2	XP_007244918.1	Tight junction protein ZO-1-like isoform X10	2.35

c81503_g3_i9	XP_007244919.1	Tight junction protein ZO-1-like isoform X11	4.82
c81503_g3_i5	XP_007244910.1	Tight junction protein ZO-1-like isoform X2	4.7
c76166_g11_i6	XP_007244917.1	Tight junction protein ZO-1-like isoform X9	4.18
c83258_g4_i4	XP_007252708.1	Tight junction protein ZO-3-like isoform X2	2.12
c82804_g7_i22	XP_007244481.1	Titin-like	15.69
c82710_g3_i4	ABE99696.1	TNF receptor associated factor 2	2.3
c76936_g6_i8	XP_007257814.1	TNFAIP3-interacting protein 1-like	2.05
c83579_g6_i3	CAI96518.1	TPA: leukemia inhibitory factor receptor.a	9.97
c80851_g13_i4	NP_998440.1	Transcription cofactor vestigial-like protein 4	3.1
c81312_g1_i1	XP_007236371.1	Transcription cofactor vestigial-like protein 4-like	2.76
c80881_g11_i1	XP_002710633.1	Transcription factor CP2-like 3	2.03
c77867_g5_i13	XP_007245893.1	Transcription factor E3-like isoform X3	2.23
c80680_g6_i2	XP_005455658.1	Transcription factor EC-like isoform X2	5.21
c81051_g17_i4	AHB37083.1	Transcription factor NfKB p65 subunit	2.09
c82127_g9_i7	XP_005450158.1	Transcription factor SOX-13-like isoform X3	2.68
c81312_g8_i2	XP_007234563.1	Transcription regulator protein BACH1-like isoform X1	2.84
c81912_g3_i1	XP_005157218.1	Transcriptional activator protein Pur-alpha-like	2.38
c78967_g9_i9	XP_006070974.1	Transcriptional enhancer factor TEF-1 isoform X4	3.81
c83257_g13_i2	XP_007228484.1	Transcriptional regulator ATRX-like isoform X1	3.21
c75139_g5_i1	XP_007254494.1	Transcriptional regulator Kaiso isoform X1	2.97
c82766_g5_i3	XP_007252395.1	Transferrin receptor protein 1-like	2.68
c81898_g10_i5	XP_698488.6	Transforming acidic coiled-coil-containing protein 2-like	3.44
c81254_g6_i2	NP_878293.1	Transforming growth factor, beta 1a precursor	2.12
c84098_g4_i4	XP_004450492.1	Translation initiation factor IF-2-like	-19.29
c76329_g2_i4	NP_001135200.1	Transmembrane 9 superfamily member 3 precursor	2.3
c71797_g2_i2	NP_001018325.1	Transmembrane protein 179B	2.12
c79756_g2_i4	XP_007250453.1	Transmembrane protein 56-B-like	3.99
c81718_g10_i9	CDJ82928.1	Transposase domain containing protein	6.29
c80778_g2_i3	XP_007251326.1	Trinucleotide repeat-containing gene 6B protein-like	2.15
c79815_g5_i7	ABC75556.1	Tropomyosin 3	2.61
c73326_g3_i2	XP_007251785.1	TSC22 domain family protein 1 isoform X1	2.76
c81496_g11_i2	XP_007229242.1	TSC22 domain family protein 2-like	3.22
c76122_g2_i4	XP_003454643.2	Tubulin beta chain-like	2.24
c75595_g8_i3	XP_007234837.1	Tubulin polymerization-promoting protein	2.32
c79592_g1_i1	XP_007250247.1	Tumor necrosis factor ligand superfamily member 10-like	3.78
c83501_g2_i2	XP_006796369.1	Tumor protein p53-inducible nuclear protein 2-like isoform	3.16

c78370_g12_i1	XP_007232965.1	Tumor protein p53-inducible protein 11-like isoform X1	4.67
c77145_g2_i1	XP_006640804.1	Tyrosine-protein kinase ABL1-like	2.42
c83517_g5_i5	NP_571148.1	Tyrosine-protein kinase JAK1	2.07
c81343_g12_i4	XP_005474876.1	Tyrosine-protein kinase receptor UFO-like isoform X1	2.64
c81543_g3_i3	XP_007235354.1	Tyrosine-protein kinase yes-like isoform X1	2.08
c82371_g13_i4	XP_007237278.1	Tyrosine-protein phosphatase non-receptor type 14	5.05
c77760_g2_i4	XP_690659.5	Tyrosine-protein phosphatase non-receptor type 9	2.55
c82792_g7_i3	XP_005163458.1	U2 snRNP-associated SURP domain containing isoform X1	2.6
c77219_g7_i5	NP_001116729.1	U5 small nuclear ribonucleoprotein 200 kDa helicase	2.24
c74617_g1_i4	NP_001073638.1	Ubinuclein 2	4.64
c82438_g5_i6	XP_007237677.1	Ubiquitin carboxyl-terminal hydrolase 10 isoform X1	2.3
c81466_g5_i3	XP_002663119.3	Ubiquitin carboxyl-terminal hydrolase 11	2.07
c81011_g5_i4	XP_007260731.1	Ubiquitin carboxyl-terminal hydrolase 24	5.5
c81011_g5_i2	XP_005170208.1	Ubiquitin carboxyl-terminal hydrolase 24 isoform X2	3.9
c83411_g7_i3	XP_005454651.1	Ubiquitin carboxyl-terminal hydrolase 25 isoform X6	2.77
c77595_g13_i1	XP_007260704.1	Ubiquitin carboxyl-terminal hydrolase 34-like	3.1
c81177_g2_i1	XP_001920291.2	Ubiquitin carboxyl-terminal hydrolase 43-like isoform X1	3.44
c80421_g4_i12	XP_007254707.1	Ubiquitin carboxyl-terminal hydrolase 47 isoform X2	2.89
c80711_g7_i5	XP_007245618.1	Ubiquitin carboxyl-terminal hydrolase 7 isoform X1	2.79
c81092_g2_i8	XP_007260218.1	Ubiquitin-associated protein 2-like isoform X1	2.86
c80887_g14_i1	XP_007230585.1	Ubiquitin-associated protein 2-like isoform X6	4.66
c83303_g7_i7	NP_958897.1	Ubiquitin-conjugating enzyme E2 H	2.5
c81534_g3_i4	XP_007253247.1	Uncharacterized protein C10orf12-like	7.36
c77150_g3_i2	XP_007251918.1	Uncharacterized protein KIAA0355 homolog isoform X1	3.4
c77615_g5_i2	XP_001344050.1	Uncharacterized protein LOC100004848	3.47
c79509_g4_i4	NP_001108400.1	Uncharacterized protein LOC100141364	3.84
c81683_g8_i1	NP_001121845.1	Uncharacterized protein LOC100148025	3.28
c84098_g1_i12	XP_004482538.1	Uncharacterized protein LOC101444772, partial	-4.2
c82242_g2_i9	XP_007254932.1	Uncharacterized protein LOC103024880	2.47
c80362_g6_i2	XP_007258478.1	Uncharacterized protein LOC103026154	3.76
c78285_g4_i1	XP_005173755.1	Uncharacterized protein LOC567193 isoform X1	5.59
c81417_g3_i11	XP_007251732.1	Unconventional myosin-Ib-like isoform X3	2.35
c81417_g3_i12	XP_007251733.1	Unconventional myosin-Ib-like isoform X4	4.48
c82380_g4_i8	XP_007231911.1	Unconventional myosin-IXa isoform X7	2.42
c84065_g2_i1	XP_007244417.1	Unconventional myosin-IXa-like isoform X1	8.35
c83912_g5_i7	XP_005171392.1	Unconventional myosin-IXb isoform X2	2.07

c83874_g2_i5	XP_005157672.1	Unconventional myosin-XVIIIa isoform X8	3.5
c81328_g5_i3	XP_007260197.1	Vacuolar protein sorting-associated protein 13A isoform X3	5.09
c83041_g1_i2	XP_007246421.1	Vacuolar protein sorting-associated protein 13D	15.78
c77519_g10_i6	XP_007229545.1	Vacuolar protein sorting-associated protein 37C-like	2.43
c84015_g8_i1	XP_007259108.1	Vang-like protein 1-like isoform X1	2.9
c79261_g11_i1	XP_007232243.1	Vasorin	2.09
c80866_g11_i1	XP_007241278.1	Vasorin-like isoform X1	2.63
c77013_g2_i1	AAH66463.1	Vat1 protein, partial	2.5
c81417_g3_i2	NP_001106204.1	Ventricular myosin heavy chain	2.93
c84055_g1_i2	XP_007258393.1	Versican core protein-like, partial	23.87
c78654_g10_i3	XP_005156393.1	Vesicle transport through interaction with t-SNAREs	2.52
c77802_g3_i11	XP_007249184.1	Vitamin D3 receptor B-like isoform X1	2.14
c83203_g2_i1	XP_005165449.1	WD repeat and FYVE domain-containing protein 3 isoform X5	9.68
c82658_g2_i18	XP_005164183.1	WD repeat domain, phosphoinositide interacting 2 isoform	2.97
c75109_g7_i3	XP_687231.3	WD repeat-containing protein 11	2.64
c76428_g6_i3	XP_007259932.1	WD repeat-containing protein 26-like	2.25
c77021_g4_i2	XP_007251868.1	WD repeat-containing protein 26-like isoform X2	3.09
c79441_g25_i1	XP_007254066.1	WW domain binding protein 1-like	2.57
c76825_g2_i3	XP_007234341.1	WW domain-containing transcription regulator protein 1	3.05
c81455_g1_i1	AAI33083.1	Zgc:158327 protein	4.47
c83828_g10_i1	XP_007230416.1	Zinc finger and BTB domain-containing protein 18.2-like	2.38
c79066_g14_i2	XP_001339146.1	Zinc finger and BTB domain-containing protein 38	3.2
c78823_g18_i1	XP_007233361.1	Zinc finger and BTB domain-containing protein 7A	2.43
c77105_g11_i1	XP_007256963.1	Zinc finger and BTB domain-containing protein 7B-like	2.11
c82235_g2_i5	NP_956816.2	Zinc finger CCCH domain-containing protein 13	2.91
c83472_g1_i14	XP_007251331.1	Zinc finger CCCH domain-containing protein 7B-like isoform	2.9
c77972_g6_i1	AGS58238.1	Zinc finger E-box binding homeobox 1	2.85
c81067_g7_i2	XP_007234581.1	Zinc finger FYVE domain-containing protein 1-like	2.17
c83881_g8_i5	XP_007259953.1	Zinc finger protein 292 isoform X3	4
c76405_g11_i2	XP_007231360.1	Zinc finger protein 418-like	2.08
c82134_g2_i1	XP_005173109.1	Zinc finger protein 518B-like	3.06
c76970_g1_i3	XP_007247901.1	Zinc finger protein 598	2.7
c77553_g1_i1	XP_005168813.1	Zinc finger protein 644-like isoform X2	3.12
c80890_g1_i1	XP_007230573.1	Zinc finger protein 687-like isoform X3	4.64
c79012_g4_i3	XP_002666496.3	Zinc finger protein 704 isoform X1	4.52

c82057_g1_i1	XP_007249374.1	Zinc finger protein 704-like isoform X2	4.26
c81413_g4_i1	XP_005159955.1	Zinc finger protein basonuclin-2 isoform X4	2.84
c79767_g6_i5	XP_007230435.1	Zinc finger protein DPF3-like	3.21
c83955_g1_i3	XP_002666356.3	Zinc finger protein GLIS2-like	2.9
c75876_g1_i1	XP_005754656.1	Zinc finger protein Xfin-like	2.05
c79307_g5_i4	XP_007258777.1	Zinc finger SWIM domain-containing protein 8 isoform X1	2.14
c79307_g5_i6	XP_005812146.1	Zinc finger SWIM domain-containing protein 8-like	-3.12
c83540_g6_i1	XP_001922332.3	Zinc finger ZZ-type and EF-hand domain-containing protein	2.36
c80999_g5_i1	XP_007255563.1	Zinc transporter 1	2.12
c79065_g16_i1	XP_001340102.4	Zinc transporter ZIP14-like isoform X1	2.01

B

Feature ID	Accession Version .	Description	Fold change
c79004_g3_i8	XP_004071213.1	17-beta-hydroxysteroid dehydrogenase 14-like	3.03
c79898_g7_i4	XP_007256321.1	2',3'-cyclic-nucleotide 3'-phosphodiesterase	2.11
c77305_g1_i2	NP_001074162.1	28S ribosomal protein S2, mitochondrial	-2.24
c76694_g2_i1	XP_007229080.1	39S ribosomal protein L12, mitochondrial	-2.03
c78748_g7_i2	NP_001188238.1	60S ribosomal protein l7-like 1	-3.01
c82885_g2_i1	ADO29331.1	60S ribosomal protein l8	2.35
c76260_g8_i1	XP_007246942.1	72 kDa type IV collagenase	-2.19
c81266_g1_i1	XP_001088409.2	Actin, alpha cardiac muscle 1 isoform 3	-2.69
c81266_g2_i2	ERE79102.1	Actin, aortic smooth muscle-like isoform 1	-2.16
c81423_g3_i4	NP_001071071.1	Activating transcription factor 7-interacting protein 1	2.5
c59887_g2_i1	NP_958888.1	ADP-ribosylation factor 1 like	-2.21
c83140_g9_i3	NP_001188198.1	ADP-ribosylation factor 5	-2.01
c66748_g2_i1	NP_001188241.1	ADP-ribosylation factor-like 4	2.17
c76396_g8_i4	AAG44592.1	AF251292_1 DC21	-2.3
c75588_g10_i1	AAL54865.1	AF306854_1 CCAAT/enhancer binding protein beta	-2.16
c81869_g4_i5	NP_001187785.1	Alpha-ketoglutarate-dependent dioxygenase alkb-like protein 3	2.06
c82991_g3_i8	XP_007237818.1	Amyloid beta A4 protein isoform X2	-4.63
c73051_g3_i3	XP_007227940.1	Amyloid beta A4 protein-like isoform X3	-2.22
c77671_g13_i2	XP_005170768.1	Ankyrin repeat and BTB/POZ domain-containing protein 2	2.55
c80160_g3_i1	XP_007227810.1	Ankyrin repeat domain-containing protein 50-like	-4.14
c77599_g5_i9	XP_007231488.1	Annexin A1-like	2.42

c74607_g1_i2	NP_001187667.1	Anterior gradient protein 2 homolog precursor	5.4
c74607_g1_i1	ADO28316.1	Anterior gradient protein 2-like protein	6.74
c83655_g4_i2	AHB37084.1	AP-1 transcription factor c-Jun subunit	-2.05
c76993_g1_i4	XP_007229911.1	Apoptosis facilitator Bcl-2-like protein 14-like	-2.03
c82175_g7_i2	NP_001134536.1	Argininosuccinate synthase	2.55
c82992_g3_i3	NP_001187827.1	Arylamine n-acetyltransferase pineal gland isozyme nat-10	3.83
c77684_g3_i2	XP_007229664.1	Asporin	-2
c84209_g5_i3	EZG34701.1	ATPase, partial	-9.92
c81887_g2_i3	NP_001187129.1	Bactericidal permeability-increasing protein precursor	2.12
c81327_g4_i5	XP_007248159.1	Bcl2 antagonist of cell death-like isoform X1	2.05
c80193_g4_i4	AAF35883.1	Beta-1 integrin	-2.34
c81859_g2_i4	XP_007237035.1	Biglycan-like	-2.86
c73914_g1_i1	XP_007258902.1	Bone morphogenetic protein 8A	-2.8
c75771_g3_i18	XP_005170179.1	Bromodomain-containing protein 9 isoform X1	2.45
c82780_g7_i2	NP_001133923.1	Butyrate response factor 1	-2.34
c73156_g2_i1	AAH42320.1	C20orf24 homolog (H. sapiens)	-2.27
c80426_g7_i2	XP_006786505.1	Cadherin-2-like isoform X2	-2.98
c81990_g4_i1	XP_005725441.1	Calpain-5-like isoform X3	3.01
c76007_g5_i2	XP_007235912.1	Calphotin-like	2.2
c75201_g3_i5	XP_005809271.1	Carbonic anhydrase-like	-3.86
c76646_g2_i2	XP_007240443.1	Cartilage acidic protein 1-like	-2.36
c79903_g3_i6	XP_007245741.1	Cartilage matrix protein isoform X1	-2.15
c71179_g1_i1	XP_006641010.1	Caspase-1-A-like	9.34
c71752_g1_i2	XP_007248894.1	C-C chemokine receptor type 7-like	2.33
c78989_g3_i3	AAT52140.1	CC chemokine SCYA106	4.7
c77257_g5_i3	ABA54956.1	CC chemokine SCYA109	8.84
c74352_g3_i4	ABA54960.1	CC chemokine SCYA113	14.1
c70509_g1_i1	ABA54963.1	CC chemokine SCYA116	6.58
c75953_g9_i1	BAM36375.1	CCAAT/enhancer binding protein delta2 protein	-2.07
c75853_g2_i11	XP_007250952.1	CD209 antigen-like protein 2-like isoform X1	-2.86
c77482_g1_i2	ABD93355.1	CD4-like protein 1	3.38
c76656_g2_i4	NP_001187156.1	CD4-like protein 2 precursor	3.1
c71525_g1_i1	XP_007229167.1	Centromere protein H-like	5.28
c80846_g2_i14	NP_001019378.1	Ceramide glucosyltransferase	-2.29
c79153_g4_i4	NP_932334.1	Chemokine (C-X-C motif) ligand 12b (stromal cell-derived factor 1)	-2.11
c83497_g4_i13	NP_001187344.1	Chitinase domain-containing protein 1	2.01

c69995_g1_i3	XP_007244261.1	Claudin-10-like isoform X2	-2.04
c82454_g8_i2	XP_004546286.1	Collagen alpha-1(II) chain-like isoform X2	-3.13
c77834_g9_i2	XP_007228052.1	Collagen alpha-1(IV) chain	-2.73
c79446_g1_i2	XP_698253.3	Collagen alpha-1(VI) chain	-2.08
c78022_g2_i1	XP_007240888.1	Collagen alpha-1(X) chain-like	-3.07
c84151_g2_i1	XP_005162870.1	Collagen alpha-1(XI) chain isoform X1	-2.73
c84151_g2_i7	XP_005162874.1	Collagen alpha-1(XI) chain isoform X5	-2.44
c77224_g7_i6	XP_002665305.3	Collagen alpha-1(XII) chain isoform X1	-3.32
c79746_g5_i1	XP_007252649.1	Collagen alpha-2(VI) chain-like	-3.3
c84125_g1_i14	XP_694013.6	Collagen alpha-5(IV) chain	-2.2
c80641_g14_i7	NP_001003765.1	Collagen triple helix repeat-containing protein 1 precursor	-2.17
c83429_g1_i12	BAG72201.1	Collagen type I alpha 2	-4.13
c76517_g9_i4	AAH63249.1	Collagen, type I, alpha 1	-4.45
c75516_g1_i2	XP_007244874.1	Collagenase 3-like	2.84
c81647_g6_i2	XP_007255892.1	Complement component 1 Q subcomponent-binding protein,	-2.1
c78785_g6_i3	ABU24332.1	Connective tissue growth factor	-2.14
c78785_g6_i1	XP_007233529.1	Connective tissue growth factor-like	-2.76
c73362_g2_i1	XP_001347769.1	Conserved Plasmodium protein	2.06
c82321_g5_i1	XP_007231232.1	Cornifelin homolog isoform X1	2.01
c81570_g10_i4	XP_007229972.1	Coxsackievirus and adenovirus receptor homolog isoform X1	2.15
c80311_g7_i4	XP_004551009.1	CTP synthase 1-like isoform X1	2.79
c74889_g2_i1	AAH66625.1	Ctssa protein	4.63
c68344_g1_i1	XP_007254708.1	C-type lectin domain family 3 member A	-2.16
c83794_g2_i3	XP_007246102.1	C-type mannose receptor 2-like isoform X1	2.12
c78829_g1_i5	XP_007238757.1	C-X-C motif chemokine 10-like	4.8
c81581_g14_i3	ADO27834.1	Cyclic amp-dependent transcription factor atf-3	-2.85
c76923_g7_i1	XP_007256771.1	Cyclin-dependent kinase inhibitor 1-like isoform X2	-2.49
c74805_g3_i1	AGD94422.1	Cystatin-like protein	2.18
c77977_g1_i1	ACX31198.1	Cysteine-rich angiogenic inducer 61 protein-like protein 1	-2.78
c79607_g11_i3	XP_007250160.1	Cysteinyl leukotriene receptor 2-like	3.06
c81997_g5_i1	XP_001919426.1	Cystine/glutamate transporter-like	-2.31
c77122_g2_i6	XP_007231574.1	DDB1- and CUL4-associated factor 4	2.22
c80632_g8_i8	XP_005168459.1	DENN domain-containing protein 1C-like	2.42
c79231_g1_i6	ACO09676.1	Deoxyribonuclease gamma precursor	2.92
c63600_g1_i2	XP_007236703.1	Dermatopontin	-2.06

c81624_g4_i6	XP_005162385.1	Diacylglycerol kinase alpha isoform X1	2.19
c74297_g1_i3	XP_007250187.1	DNA damage-inducible transcript 4 protein	-2.27
c80177_g8_i1	XP_007240408.1	DNA replication complex GINS protein PSF1	4.59
c78480_g2_i2	NP_001167212.1	DNA replication licensing factor MCM4	-2.95
c79270_g1_i8	XP_004545896.1	DNA replication licensing factor mcm7-like isoform X2	2.31
c76152_g4_i4	ACO08926.1	DNA-directed RNA polymerase II 23 kDa polypeptide	-2.08
c75757_g5_i1	XP_007254762.1	DNA-directed RNA polymerase III subunit RPC7-like	-3.39
c79139_g3_i2	XP_007230450.1	DnaJ homolog subfamily A member 2	-2.19
c83611_g4_i2	XP_007240773.1	Dual specificity protein phosphatase 1	-3.02
c77262_g1_i1	XP_005163056.1	Dual specificity protein phosphatase 6 isoform X1	-2.3
c77262_g2_i1	XP_004086284.1	Dual specificity protein phosphatase 6-like	-2.33
c79612_g2_i1	XP_002758781.1	E3 ubiquitin-protein ligase DTX3L	3.93
c72672_g1_i4	XP_007250434.1	E3 ubiquitin-protein ligase DTX3L-like	2.65
c76858_g1_i2	XP_005165434.1	E3 ubiquitin-protein ligase RNF31-like isoform X1	2.84
c79785_g3_i1	XP_005158926.1	Early growth response 2a isoform X1	-5.03
c81722_g2_i2	XP_007235544.1	Early growth response protein 3 isoform X2	-5
c77263_g4_i1	AAK40312.1	Egr-1	-2.37
c79785_g2_i2	AAH58293.1	Egr2a protein, partial	-3.06
c77230_g3_i4	XP_005171323.1	ELAV (embryonic lethal, abnormal vision, Drosophila)-like	-2.75
c79194_g4_i9	XP_007240261.1	ELAV-like protein 1-like isoform X3	-2.15
c80399_g6_i3	XP_007250351.1	Elongation of very long chain fatty acids protein 7	-3.55
c79251_g14_i1	XP_007238445.1	EMILIN-1-like	-2.05
c83985_g5_i4	XP_007243778.1	Endonuclease domain-containing 1 protein-like, partial	3.05
c76235_g10_i3	XP_007247239.1	Epigen	-2.68
c77426_g3_i3	ABD65556.1	Epithelial cadherin 1-like	-2.07
c78413_g2_i2	XP_007251508.1	ERBB receptor feedback inhibitor 1-like	-2.15
c75783_g2_i3	NP_001005320.1	ErbB-3a precursor	3.34
c69442_g1_i1	XP_007228477.1	ES1 protein homolog, mitochondrial-like isoform X1	3.37
c75477_g1_i3	XP_007228213.1	ETS homologous factor isoform X2	3.12
c77689_g8_i3	XP_006635241.1	Exocyst complex component 7-like isoform X6	4.59
c56152_g2_i1	CDJ08760.1	Expressed conserved protein	9.1
c80737_g10_i5	XP_007235920.1	Extended synaptotagmin-3-like	2.68
c81039_g11_i1	XP_007238884.1	Fat storage-inducing transmembrane protein 2	-2.31
c60585_g1_i1	XP_005806495.1	Fatty acid-binding protein, brain-like	-4.36
c81655_g14_i2	XP_007230294.1	F-box/WD repeat-containing protein 7 isoform X5	-4.28
c58599_g1_i1	XP_007230364.1	Fibroblast growth factor-binding protein 2-like	-2.45

c81870_g6_i1	XP_007239111.1	Fibroblast growth factor-binding protein 2-like isoform	-4.01
c77046_g14_i2	XP_007233130.1	Follistatin-related protein 1 isoform X1	-2.1
c77748_g6_i1	XP_007237377.1	Forkhead box protein J1	2.8
c75491_g11_i4	NP_001187902.1	Four and a half LIM domains protein 3	-2.2
c78859_g2_i2	XP_007233194.1	FYN-binding protein-like isoform X2	2.66
c80609_g3_i2	XP_007247166.1	G protein-coupled receptor kinase 5-like isoform X1	2.9
c80609_g3_i3	XP_007247167.1	G protein-coupled receptor kinase 5-like isoform X2	3.26
c73578_g1_i3	XP_007236730.1	G2/mitotic-specific cyclin-B1 isoform X1	2.41
c81096_g9_i3	XP_007245187.1	Gamma-interferon-inducible-lysosomal thiol	2.26
c78776_g1_i1	ADZ76342.1	Gig2-like protein CauD	2.46
c83307_g6_i4	ADZ76345.1	Gig2-like protein DreA	2.95
c82836_g4_i4	AGN52748.1	Glutamine synthetase	-2.18
c77851_g11_i5	NP_001188001.1	Golgi apparatus membrane protein TVP23 homolog B	2.68
c82451_g6_i15	XP_007239676.1	G-protein-signaling modulator 1-like isoform X1	-3.04
c78386_g8_i3	ACM08360.1	Growth arrest and DNA-damage-inducible protein GADD45 alpha	-2.39
c82924_g5_i2	XP_007242640.1	GTPase IMAP family member 2-like, partial	3.08
c65250_g1_i2	ACO10105.1	Guanine nucleotide-binding protein GI/GS/GO gamma-5 subunit	2.08
c83754_g2_i2	NP_001002343.1	Guanylate binding protein 1	3.36
c82532_g1_i3	ADX32514.1	Heat shock 70 kDa protein	-9.24
c77734_g4_i5	XP_007247088.1	Heat shock 70 kDa protein 4	-2.16
c78147_g10_i5	XP_007230794.1	Heat shock protein HSP 90-alpha	-2.44
c78147_g2_i1	XP_006643588.1	Heat shock protein HSP 90-alpha-like, partial	-3.01
c83408_g1_i1	XP_005171855.1	Hematopoietic death receptor isoform X1	-4.04
c69321_g1_i3	AHA82583.1	Hemoglobin alpha 1	-8.38
c82701_g1_i1	AHA82590.1	Hemoglobin beta 2	-2.97
c77831_g2_i7	AAQ97793.1	Heterogeneous nuclear ribonucleoprotein	-2.36
c76052_g5_i4	NP_956394.1	HIG1 domain family member 1A	-2.51
c79820_g2_i5	XP_002430908.1	Histone H4, putative	3.16
c78523_g1_i1	XP_003441731.1	Homeobox protein BarH-like 2-like	2.03
c80547_g11_i2	XP_007234509.1	Hyaluronidase-2-like isoform X1	-3.02
c83358_g15_i6	XP_007237697.1	Hydroxyacid-oxoacid transhydrogenase, mitochondrial	2.71
c81039_g13_i5	YP_001957515.1	Hypothetical protein Aasi_0363	71.55
c79289_g1_i1	XP_002603652.1	Hypothetical protein BRAFLDRAFT_98594	2.23
c76176_g3_i3	EKC41687.1	Hypothetical protein CGI_10028433	3.09
c83593_g1_i1	ACN10147.1	Ig kappa chain V-III region CLL precursor	4.2

c197216_g1_i1	XP_005015939.1	IgGFc-binding protein-like	-2.71
c69807_g1_i1	XP_007237842.1	Immediate early response gene 2 protein	-2.16
c83492_g3_i4	AAA16654.1	Immunoglobulin light chain	2.59
c76331_g2_i5	XP_003963056.1	Inosine-5'-monophosphate dehydrogenase 2-like isoform 2	-3.4
c74876_g4_i1	XP_005167761.1	Integrin, beta-like 1 isoform X1	-2.01
c82962_g6_i7	XP_007233760.1	Integrin-alpha FG-GAP repeat-containing protein 2	2.06
c78112_g5_i6	XP_007233990.1	Interferon regulatory factor 1-like	3.8
c82194_g3_i4	XP_007244056.1	Interferon regulatory factor 8	2.76
c61233_g1_i2	XP_007235107.1	Interferon-induced transmembrane protein 5-like	-2.32
c78925_g2_i12	NP_001187148.1	Interleukin 1, beta	-7.01
c77837_g8_i2	NP_001018623.1	Interleukin 17a/f1 precursor	67.92
c62007_g1_i1	NP_001018634.1	Interleukin 17a/f2 precursor	37.83
c70125_g2_i1	NP_001018628.1	Interleukin 22	11.16
c77237_g2_i3	NP_001107203.1	Interleukin-13 receptor subunit alpha-2 precursor	2.43
c79884_g5_i2	XP_006639896.1	Krueppel-like factor 2-like	-2.02
c81067_g15_i5	XP_007244510.1	Krueppel-like factor 5-like	-2.48
c82691_g6_i1	XP_007250746.1	Krueppel-like factor 9-like	-3.07
c82671_g15_i10	XP_007248398.1	LIM domain and actin-binding protein 1-like isoform X3	3.3
c76540_g2_i10	XP_004549533.1	Long-chain-fatty-acid--CoA ligase 1-like isoform X1	3.31
c78761_g2_i4	XP_007247481.1	Long-chain-fatty-acid--CoA ligase 4-like isoform X1	-2.26
c76235_g10_i9	XP_005284050.1	LOW QUALITY PROTEIN: epigen	-2.71
c79858_g4_i8	XP_006780707.1	LOW QUALITY PROTEIN: nicotinamide	-3.12
c83330_g9_i5	XP_002807611.2	LOW QUALITY PROTEIN: transcription factor SOX-2-like	-2.25
c78450_g5_i3	XP_007231365.1	Low-density lipoprotein receptor-like	-2.27
c77087_g6_i13	AAD40680.1	L-plastin	2.79
c78518_g2_i1	XP_007259063.1	Lumican isoform X1	-5.17
c81080_g10_i3	XP_007240442.1	Lysyl oxidase homolog 4	-2.58
c84067_g2_i5	ADD84682.1	Matrix metalloproteinase 13	-2.15
c79228_g1_i1	NP_001187157.1	Matrix metalloproteinase-9 precursor	-7.34
c76595_g2_i4	NP_001073429.2	Matrix-remodelling associated 8b precursor	-2.18
c78997_g12_i2	XP_007233741.1	Mediator of RNA polymerase II transcription subunit 21	-3.53
c80520_g3_i2	XP_007259250.1	Metalloproteinase inhibitor 2-like	-3.39
c79768_g3_i17	XP_007232116.1	Metastasis suppressor protein 1-like isoform X6	-6.45
c78704_g16_i2	NP_998150.1	Meteorin-like protein precursor	-2.22
c79605_g16_i4	NP_001277009.1	Methionine adenosyltransferase II, alpha a	-2.2

c77410_g5_i10	CAD27727.1	MHC class II antigen beta chain	4.07
c77410_g5_i3	CBX11173.1	MHC class II beta chain, partial	3.76
c79083_g6_i3	ADM21330.1	MHC class IIA antigen	4.14
c83838_g3_i7	AAH76561.1	Mhc1ze protein, partial	-3.28
c80625_g2_i2	XP_007238405.1	Microfibril-associated glycoprotein 4-like isoform X1	4.11
c78083_g1_i1	XP_007249957.1	Mimecan-like	-2.84
c78637_g4_i9	XP_007234238.1	Mitochondrial inner membrane protein isoform X1	-2.34
c81261_g1_i3	XP_007259714.1	Mitogen-activated protein kinase kinase kinase 8 isoform	2.39
c69365_g2_i1	NP_001187908.1	Mitotic spindle assembly checkpoint protein mad2a	3.06
c75936_g2_i10	XP_007235393.1	Mpv17-like protein-like	-4.21
c81635_g1_i5	P23735.1	MUCM_ICTPU RecName: Full=Ig mu chain C region membrane-bound form	2.98
c77573_g1_i5	NP_001002042.1	Myb-binding protein 1A-like protein	-2.06
c75183_g2_i1	XP_002665608.1	Myelin basic protein isoform X5	-6.66
c76219_g1_i2	XP_007259531.1	Myocilin isoform X1	-3.45
c79952_g11_i2	NP_001187837.1	Myosin, light polypeptide 9, regulatory	-2.33
c81412_g1_i4	XP_007243576.1	Myosin-2 heavy chain-like	2.47
c84322_g1_i6	XP_002666777.2	Myosin-7-like	-2.99
c74022_g1_i1	ADD60471.1	Na+/K+ ATPase alpha subunit	-2.28
c77582_g3_i4	NP_001187374.1	N-acetyl-d-glucosamine kinase	2.22
c77537_g3_i1	NP_956938.1	N-acetyltransferase 10	-2.05
c73723_g1_i2	XP_007244028.1	N-acylethanolamine-hydrolyzing acid amidase	2.31
c83837_g6_i3	ADO27823.1	Natterin-like protein	-3.7
c79678_g3_i9	NP_001092918.1	NEDD4-like E3 ubiquitin-protein ligase WWP2	-2.62
c82398_g1_i4	XP_694481.6	Neural cell adhesion molecule 1-like	-2.66
c79458_g5_i2	NP_001177684.1	Neutral amino acid transporter B(0)	-2.25
c77460_g5_i3	XP_007236020.1	Nicotinamide riboside kinase 2-like isoform X1	2.3
c71085_g1_i3	XP_003456807.1	Normal mucosa of esophagus-specific gene 1 protein-like	3.68
c76844_g2_i2	XP_004074887.1	Notch-regulated ankyrin repeat-containing protein A-like	-2.04
c80546_g5_i7	XP_007256553.1	Nuclear factor 7, brain-like isoform X1	3.35
c76678_g1_i1	XP_007240713.1	Nuclear factor erythroid 2-related factor 1-like	-2.4
c77888_g11_i2	XP_005170622.1	Nuclear receptor coactivator 6 isoform X2	3.53
c75059_g11_i1	XP_007241502.1	Nucleoporin-like protein 2-like	2.54
c76681_g3_i3	AAI14288.1	Olfactomedin-like 3	-3.39
c42835_g1_i1	BAM62632.1	Osteocalcin	-4.83
c71451_g1_i2	NP_001077326.1	Osteocalcin precursor	-2.58
c78767_g5_i1	XP_007251844.1	Palmitoyltransferase ZDHHC18 isoform X1	2.68

c79333_g7_i5	XP_007232336.1	Pendrin-like isoform X3	-2.22
c79124_g1_i6	XP_007251184.1	Perforin-1-like, partial	-2.3
c76909_g2_i8	AHM24918.1	Periostin	-4.67
c81337_g2_i4	NP_001071254.1	Periostin isoform 1 precursor	-2.16
c76992_g1_i2	XP_005164723.1	Periphilin-1 isoform X1	2.61
c83188_g6_i8	XP_007244580.1	Peroxiredoxin-5, mitochondrial-like	2.67
c76348_g2_i1	XP_003451160.1	Persulfide dioxygenase ETHE1, mitochondrial-like	3.37
c76463_g1_i11	XP_007241263.1	Phospholipase B-like 1-like	2.25
c74596_g1_i1	XP_003445994.1	Phytanoyl-CoA dioxygenase domain-containing protein 1-like	16.28
c79593_g1_i3	XP_007259651.1	Pigment epithelium-derived factor	-3.28
c81919_g10_i1	XP_007248568.1	Placenta-specific protein 9	-2.53
c75054_g3_i3	XP_007258683.1	Platelet-derived growth factor receptor-like protein	-3.99
c69161_g1_i1	NP_001134210.1	Pleckstrin homology domain-containing family F member 1	-2.42
c83222_g6_i14	XP_007259317.1	Pleckstrin homology domain-containing family S member 1	5.72
c81352_g8_i1	NP_001134998.1	Pleckstrin homology-like domain family A member 2	-2.41
c76482_g1_i5	AAI63875.1	Polymerase (DNA directed), delta 1, catalytic subunit	2.26
c81047_g12_i1	XP_007248083.1	Polyubiquitin 4-like	3.89
c78153_g12_i1	NP_571236.1	POU domain, class 3, transcription factor 1	8.07
c83163_g5_i6	XP_007230595.1	Pre-B-cell leukemia transcription factor-interacting	-2.01
c71280_g3_i1	XP_007246233.1	Pre-rRNA processing protein FTSJ3-like	-2.25
c75305_g1_i1	XP_007245961.1	Pre-rRNA-processing protein TSR1 homolog isoform X1	-2.48
c72255_g1_i1	XP_007254280.1	Probable ATP-dependent RNA helicase DDX10	-2.1
c78697_g3_i4	XP_007239643.1	Probable ATP-dependent RNA helicase DDX5-like isoform X2	-2.02
c75856_g1_i2	NP_001134826.1	Probable E3 ubiquitin-protein ligase RNF144A-A	3.39
c81535_g13_i1	XP_005156853.1	Probable palmitoyltransferase ZDHHC16 isoform X3	3.77
c83812_g20_i10	XP_007234409.1	Probable phospholipid-transporting ATPase IA isoform X9	18.44
c83812_g20_i5	XP_004073108.1	Probable phospholipid-transporting ATPase IA-like	13.71
c82720_g4_i4	XP_007248524.1	Proenkephalin-A-like	3.7
c77320_g10_i4	XP_007257668.1	Programmed cell death protein 4	-2.04
c83191_g8_i1	XP_007247803.1	Prolargin	-2.67
c80345_g5_i10	XP_007255325.1	Pro-neuregulin-1, membrane-bound isoform isoform X10	-5.78
c83270_g6_i2	XP_007252992.1	Prostaglandin E2 receptor EP2 subtype-like	-2.58
c82978_g2_i2	XP_007245479.1	Prostaglandin G/H synthase 2-like	-3.12
c81254_g4_i1	NP_001244040.1	Protein arginine N-methyltransferase 1	-2.5

c74564_g4_i2	XP_007256780.1	Protein BTG1-like isoform X1	-2.11
c75139_g4_i1	NP_001187877.1	Protein CREG1 precursor	4.08
c80568_g4_i1	XP_007249691.1	Protein eva-1 homolog B-like isoform X1	-2.15
c79837_g8_i5	XP_007229174.1	Protein FAM173B-like isoform X2	4.8
c82461_g1_i2	XP_007260707.1	Protein LTV1 homolog	-2.53
c83475_g2_i4	XP_007247834.1	Protein Mdm4 isoform X1	2.1
c75000_g2_i7	NP_001076497.1	Protein PAT1 homolog 1	-2.8
c82840_g6_i7	NP_001071069.2	Protein pellino homolog 1	3.14
c82678_g1_i1	XP_007260372.1	Protein sprouty homolog 1	-2.14
c80810_g13_i1	XP_007258870.1	Protein tyrosine phosphatase type IVA 2-like isoform X1	-2.42
c74005_g1_i2	XP_007228864.1	Protein-lysine 6-oxidase-like isoform X1	-2.71
c81427_g7_i4	XP_007243286.1	Protocadherin Fat 2-like	-2.92
c70011_g1_i2	XP_007259928.1	Proto-oncogene c-Fos-like	-5.28
c80535_g1_i2	XP_007260497.1	Putative methyltransferase DDB_G0268948-like	3.1
c83730_g3_i3	WP_020846978.1	Putative peptidoglycan bound protein	-2.5
c70081_g2_i2	XP_007249862.1	Putative ribosomal RNA methyltransferase NOP2-like	-2.2
c78122_g1_i1	XP_007251926.1	Pygopus homolog 1 isoform X1	-2.05
c76766_g1_i1	NP_001020727.1	Radical S-adenosyl methionine domain-containing protein 2	2.04
c80497_g20_i1	XP_007256099.1	Ras-related and estrogen-regulated growth inhibitor	2.67
c73570_g3_i2	ADO28034.1	Ras-related protein rab-7a	2.36
c80519_g2_i1	XP_002824419.1	Ras-related protein Rap-2a	-2.29
c80519_g1_i1	XP_006637497.1	Ras-related protein Rap-2a-like isoform X1	-2.17
c79211_g1_i4	XP_007246693.1	Receptor-type tyrosine-protein phosphatase zeta	2.63
c84040_g2_i1	XP_007251830.1	Regulator of chromosome condensation-like	-2.13
c79536_g13_i1	XP_007230523.1	Retinal dehydrogenase 2	-3.04
c78696_g2_i1	XP_007237359.1	Rho-related GTP-binding protein RhoN	2.09
c84357_g1_i3	XP_005952229.1	Ribonuclease inhibitor-like	2.39
c76090_g9_i6	XP_007249677.1	Ribonuclease ZC3H12A isoform X1	2.76
c80159_g6_i5	XP_007254952.1	Ribonuclease ZC3H12A-like isoform X1	2.47
c83893_g6_i1	NP_956356.1	Ribosome biogenesis regulatory protein homolog	-3.59
c76662_g2_i5	XP_007245388.1	RING finger protein 166-like	13.92
c74388_g1_i1	XP_007253730.1	RING finger protein 224-like isoform X1	3.1
c75554_g10_i2	XP_007234598.1	Securin-like	3.88
c80501_g7_i10	AAI71677.1	Serac1 protein	2.28
c81889_g3_i2	XP_002662541.1	Serine protease 27	3.15
c81198_g4_i8	XP_005932251.1	Serine protease HTRA1B-like	-2.26

c72529_g3_i2	XP_007245686.1	Shugoshin-like 1-like	4.68
c80769_g3_i2	AAO88245.1	Signal transducer and activator of transcription 1	5.37
c83833_g4_i4	XP_005167937.1	Signal transducer and activator of transcription 4 isoform	2.69
c82849_g1_i10	XP_007255674.1	Sodium/hydrogen exchanger 2	3.07
c79805_g5_i3	ADD17065.1	Solute carrier family 7 member 8-like protein	-3.09
c80167_g13_i1	XP_007250466.1	Sorting nexin-7 isoform X2	2.61
c83330_g9_i3	ADB45218.1	SOX4 HMG-box protein	-2.03
c83999_g5_i4	XP_007246498.1	SPARC-like	-2.29
c82873_g5_i1	XP_003197782.1	Sperm acrosome-associated protein 5-like	-2.27
c83455_g2_i1	XP_004079236.1	Splicing factor 3A subunit 2-like	-3.92
c82575_g3_i1	ABC75548.1	Spp1	-2.34
c68313_g1_i1	NP_001158341.1	SRY-box containing gene 7	-2.31
c79191_g1_i2	XP_007244186.1	STE20-related kinase adapter protein beta isoform X1	-2.68
c81360_g2_i2	XP_005924590.1	Stress response protein NST1-like isoform X1	5.07
c82389_g4_i12	AAI55751.1	Svil protein	5.52
c78025_g4_i8	XP_005913479.1	Syntaxin-3-like isoform X1	-2.25
c77651_g1_i1	XP_007258827.1	Synuclein-like isoform X3	-2.09
c83360_g3_i2	AER30065.1	T cell receptor alpha, partial	3.22
c77668_g3_i1	AER30050.1	T cell receptor gamma 2	3.14
c83049_g3_i8	XP_007250515.1	Tapasin-related protein-like	2.83
c83360_g3_i3	AAA99774.1	T-cell antigen receptor alpha, partial	3.62
c80911_g1_i7	AAA99773.1	T-cell antigen receptor beta	3.26
c47906_g2_i2	XP_007234205.1	T-cell-specific surface glycoprotein CD28-like	5.23
c75426_g1_i1	XP_005158103.1	Testis-expressed sequence 10 protein homolog isoform X1	2.82
c83208_g5_i2	XP_007256833.1	Tetratricopeptide repeat protein 14	2.19
c73542_g1_i1	XP_007237794.1	Thioredoxin-interacting protein	-2.08
c73491_g1_i3	XP_007230403.1	Thrombospondin-1-like	-2.18
c77777_g4_i5	XP_007235980.1	Thymidine kinase 2, mitochondrial isoform X1	-2.8
c83091_g3_i13	NP_001187508.1	Thymidine kinase cytosolic	3.36
c181355_g1_i1	ABY26310.1	Thyroid-stimulating hormone beta subunit	22.22
c73875_g2_i6	XP_005165278.1	Titin isoform X1	2.88
c83426_g5_i2	AAZ66788.1	TNF receptor	-2.1
c82831_g4_i1	NP_001117782.1	Toxin-1 precursor	-3.04
c77621_g2_i8	AAH76530.1	Tp63 protein	2.83
c76852_g9_i1	NP_001122207.1	Transcobalamin like precursor	5.61
c81356_g4_i1	XP_004071881.1	Transcription factor jun-B-like	-2.06

c81493_g10_i2	NP_001118094.1	Transcription factor Myc	-2.53
c81073_g3_i1	XP_007256839.1	Transcription factor Sox-2	-2.34
c79584_g8_i6	XP_005908398.1	Transcription factor SOX-30, partial	4.34
c78972_g3_i2	NP_001032508.1	Transcription initiation factor TFIID subunit 5	2.67
c82312_g1_i4	XP_007238341.1	Transmembrane and coiled-coil domains protein 1 isoform X2	-2.4
c76023_g11_i5	XP_007254701.1	Transmembrane protein 41B	-2.48
c82215_g1_i1	XP_005163616.1	Tripartite motif-containing protein 16 isoform X1	6.79
c77669_g4_i2	XP_007247605.1	TRNA (guanine(37)-N1)-methyltransferase	-2.29
c81354_g5_i10	XP_007255357.1	Tropomyosin alpha-4 chain-like isoform X5	-2.03
c82032_g2_i17	XP_007228115.1	Tumor susceptibility gene 101 protein-like	2.1
c82443_g6_i1	XP_007236048.1	Twisted gastrulation protein homolog 1-A-like	-2.1
c78698_g1_i4	Q1LWB0.2	TXB1A_DANRE RecName: Full=Tax1-binding protein 1 homolog A	2.91
c65408_g1_i1	NP_001266368.1	Type III iodothyronine deiodinase	-4.4
c77429_g12_i1	XP_001844638.1	Tyrosine phosphatase	-2.17
c79545_g1_i1	XP_007252093.1	Tyrosine-protein kinase Src42A-like	5.76
c82425_g1_i10	XP_007234768.1	Ubiquitin carboxyl-terminal hydrolase 36-like isoform X2	2.5
c75344_g1_i1	NP_001188171.1	UDP-glcnac:betagal beta-13-n-acetylglucosaminyltransferase 5a	2.11
c74787_g2_i1	XP_007234463.1	Uncharacterized protein C17orf67 homolog	-2.1
c82173_g5_i8	XP_004071251.1	Uncharacterized protein LOC101157454	2.05
c83045_g3_i9	XP_004070953.1	Uncharacterized protein LOC101160557	3.79
c80302_g4_i4	XP_005937488.1	Uncharacterized protein LOC102311409	16.93
c74362_g1_i1	XP_006643192.1	Uncharacterized protein LOC102693926	3.01
c61414_g1_i1	XP_007250109.1	Uncharacterized protein LOC103022870 isoform X1	4.31
c80578_g9_i5	XP_007251489.1	Uncharacterized protein LOC103023712 isoform X1	2.86
c78232_g6_i4	XP_007249859.1	Uncharacterized protein LOC103025907 isoform X8	2.16
c78939_g2_i8	XP_007245285.1	Uncharacterized protein LOC103029795 isoform X1	2.5
c74129_g3_i1	XP_007260556.1	Uncharacterized protein LOC103030094	3.7
c67079_g1_i5	XP_007249591.1	Uncharacterized protein LOC103030769	2.47
c75856_g1_i4	XP_007248082.1	Uncharacterized protein LOC103036756	3.5
c81169_g3_i12	XP_007230454.1	Uncharacterized protein LOC103047594	7.61
c18646_g1_i1	NP_001139031.1	Uncharacterized protein LOC555790 precursor	13.1
c76858_g1_i5	NP_001121817.1	Uncharacterized protein LOC566600	3.25
c79716_g4_i2	XP_005173757.1	Uncharacterized protein LOC567193 isoform X3	-3.4
c84232_g1_i11	NP_001119932.1	Uncharacterized protein LOC796658	-2.85
c77423_g11_i1	XP_001334950.1	Uncharacterized protein LOC798209	-2.17

c82743_g2_i1	XP_001339640.2	Uncharacterized protein LOC799264	-2.43
c79734_g4_i7	XP_007236040.1	Unconventional myosin-Ie-like	2.13
c73878_g1_i2	NP_001188097.1	Upf0609 protein c4orf27-like protein	2.65
c77833_g2_i4	NP_001187816.1	Upper zone of growth plate and cartilage matrix associated precursor	-2.4
c81771_g7_i1	AAH74058.1	Uxs1 protein	-3.45
c77756_g11_i1	AAB47406.1	Ventral neural cadherin, partial	-2.19
c81417_g3_i2	NP_001106204.1	Ventricular myosin heavy chain	-3.03
c75415_g2_i2	XP_003438114.1	Vimentin-like	-2.22
c79166_g1_i2	ADO29268.1	Vitelline membrane outer layer protein 1	14.18
c74155_g3_i2	XP_005800051.1	Von Willebrand factor C domain-containing protein 2-like	-2.1
c81124_g10_i3	NP_942574.1	WD repeat-containing protein 3	-2.28
c75430_g1_i4	Q6NX08.1	WDR12_DANRE RecName: Full=Ribosome biogenesis protein wdr12; AltName: Full=WD	-2.13
c79231_g1_i11	XP_005161685.1	Zgc:101000 isoform X1	2.46
c82293_g4_i5	AAI35078.1	Zgc:171226 protein	2.04
c72574_g3_i1	CAP08017.1	Zgc:77123	-2.34
c77529_g24_i2	ADO27742.1	Zinc finger mynd domain-containing protein 19	-2.41

C

Feature ID	Accession Version .	Description	Fold change
c76882_g1_i6	XP_007230743.1	26S protease regulatory subunit 7 isoform X2	2.74
c83351_g10_i2	XP_005157745.1	28S ribosomal protein S23, mitochondrial isoform X1	3.42
c80530_g2_i5	NP_958830.1	5'-nucleotidase, cytosolic IIa	2.06
c83567_g5_i3	XP_006799564.1	Acetyl-CoA carboxylase 1-like isoform X5	23.62
c82417_g13_i2	XP_006006795.1	Adapter molecule crk isoform X1	2.74
c77974_g4_i5	AAF24169.1	AF148993_1 janus kinase 3	2.11
c80983_g8_i10	XP_007230448.1	Alanine aminotransferase 2	2
c74687_g2_i4	XP_001923689.3	Alpha-L-iduronidase	2.48
c78660_g11_i2	XP_005173944.1	Angiomotin isoform X1	4.51
c78660_g17_i1	XP_007244522.1	Angiomotin-like isoform X4	2.12
c78937_g4_i4	XP_007230983.1	Apoptosis-stimulating of p53 protein 1 isoform X5	3.28
c82175_g7_i2	NP_001134536.1	Argininosuccinate synthase	2.05
c83440_g5_i1	AAH52127.1	Asparagine synthetase	2.06
c80991_g3_i3	XP_007250692.1	B-cell lymphoma 6 protein-like	2.42
c78340_g14_i8	XP_007256923.1	Bone morphogenetic protein 7-like	-2.67

c81990_g4_i1	XP_005725441.1	Calpain-5-like isoform X3	2.45
c75201_g3_i5	XP_005809271.1	Carbonic anhydrase-like	-6.64
c197216_g1_i1	XP_005015939.1	Caspase-1-like, partial	-7.46
c71752_g1_i2	XP_007248894.1	C-C chemokine receptor type 7-like	2.25
c70509_g1_i1	ABA54963.1	CC chemokine SCYA116	3.71
c75853_g2_i11	XP_007250952.1	CD209 antigen-like protein 2-like isoform X1 (DC-SIGN)	-5.56
c77578_g7_i2	XP_007254530.1	Chromodomain-helicase-DNA-binding protein 2 isoform X2	2.41
c64942_g1_i2	AGM34086.1	C-type lysozyme	2.71
c81003_g1_i2	NP_001112372.1	Cysteinyl-tRNA synthetase, cytoplasmic	2
c77520_g5_i1	XP_003979361.1	Cytochrome c oxidase subunit 8B, mitochondrial-like	-3.97
c79772_g11_i4	XP_007258964.1	Cytoplasmic dynein 1 heavy chain 1 isoform X2	2.54
c80632_g8_i8	XP_005168459.1	DENN domain-containing protein 1C-like	2.27
c77125_g4_i4	XP_007255254.1	DENN domain-containing protein 4C isoform X1	3.86
c81624_g4_i6	XP_005162385.1	Diacylglycerol kinase alpha isoform X1	2.51
c82111_g2_i7	XP_007250521.1	Dihydropyrimidine dehydrogenase	6.93
c78480_g2_i10	XP_007234931.1	DNA replication licensing factor mcm4-B-like	2.74
c75855_g13_i5	XP_007254223.1	DNA-directed RNA polymerase III subunit RPC9	-2.23
c77283_g4_i4	XP_007231545.1	Drebrin-like protein B-like isoform X4	2.41
c79219_g1_i2	XP_007259310.1	Dynamin-binding protein-like isoform X2	2.82
c83976_g5_i19	XP_002664120.3	Dystonin	3.93
c78820_g5_i1	ACA48503.1	E1A binding protein p300, partial	2.96
c83966_g2_i13	XP_005160355.1	E3 ubiquitin-protein ligase HECW2 isoform X2	3.06
c75157_g1_i2	XP_007236890.1	Echinoderm microtubule-associated protein-like 1-like	2.49
c79198_g1_i7	XP_005935840.1	Engulfment and cell motility protein 3-like isoform X1	4.96
c81615_g3_i2	XP_007239199.1	Envoplakin-like	2.09
c77123_g4_i1	XP_005157943.1	Epsin 1 isoform X2	4.1
c83366_g4_i5	XP_007254866.1	ETS-related transcription factor Elf-1-like	2.27
c81629_g1_i6	XP_001350534.1	Eukaryotic translation initiation factor 3 subunit 10, putative	2.39
c79055_g7_i2	NP_955939.1	Eukaryotic translation initiation factor 4E-binding protein 1	2.02
c81900_g4_i6	NP_919355.1	Exportin-6	3.09
c79182_g7_i5	XP_007250168.1	F-box only protein 11-like isoform X1	2.25
c79836_g2_i4	XP_006631014.1	Filamin-B-like isoform X3	2.71
c83667_g1_i13	XP_005737865.1	Flotillin-2a-like isoform X3	3.06
c76169_g2_i1	AAH81616.1	Fructose-bisphosphate aldolase A	2.04

c73286_g1_i2	ADO27974.1	Fructose-bisphosphate aldolase A	-2.02
c81684_g7_i1	NP_001187525.1	G1/s-specific cyclin-d2	2.08
c82924_g5_i2	XP_007242640.1	GTPase IMAP family member 2-like, partial	2.33
c77862_g5_i1	XP_006638573.1	GTP-binding protein 2-like	2.25
c79299_g13_i1	XP_006004715.1	Homeobox protein GHOX-7-like	2.17
c77877_g15_i2	XP_007258295.1	Hornerin-like isoform X1	2.55
c81085_g5_i1	EGT30783.1	Hypothetical protein CAEBREN_30032	2.86
c81712_g5_i5	XP_002666768.1	Im:7147678 isoform X1	2.12
c80490_g8_i2	XP_007257332.1	Inhibitor of Bruton tyrosine kinase	2.36
c80604_g3_i2	XP_003200076.2	Integrin alpha-E-like (CD103)	2.67
c78112_g5_i6	XP_007233990.1	Interferon regulatory factor 1-like	2
c61233_g1_i2	XP_007235107.1	Interferon-induced transmembrane protein 5-like	-2.07
c82350_g9_i4	XP_007257251.1	Interleukin enhancer-binding factor 3 homolog, partial	2.12
c81765_g4_i1	XP_007232139.1	Interleukin-4 receptor subunit alpha isoform X3	2.15
c73884_g9_i4	P12115.2	KAD1_CYPCA RecName: Full=Adenylate kinase isoenzyme 1; Short=AK 1; AltName:	-3.99
c81997_g1_i1	XP_007240384.1	Kinesin light chain 1 isoform X5	2.12
c83470_g4_i4	XP_007257807.1	Leucine-rich repeat-containing protein 16A-like	2.38
c80189_g1_i2	ABD85556.1	Leukemia inhibitory factor receptor	4.89
c83708_g6_i5	XP_007256539.1	Leukocyte receptor cluster member 9-like isoform X2	2.75
c74417_g4_i4	XP_004072634.1	LOW QUALITY PROTEIN: selenoprotein M-like	-2.85
c78518_g2_i1	XP_007259063.1	Lumican isoform X1	-4.66
c83066_g2_i1	XP_007237400.1	Lymphocyte antigen 75 (DEC205)	2.6
c75585_g1_i4	XP_007236108.1	Lysine-specific demethylase 6B-like isoform X1	2.51
c76804_g9_i7	ERE81247.1	Matrin-3-like protein	-3.92
c82944_g8_i1	XP_005162981.1	Microtubule-associated protein 4-like isoform X5	2.09
c82798_g2_i15	XP_002661418.2	Mitochondrial 10-formyltetrahydrofolate dehydrogenase	4.21
c75765_g1_i9	XP_005166357.1	Mucin-2-like isoform X2	3.26
c79361_g2_i7	AFO11027.1	Muscle carnitine palmitoyltransferase 1B	3.03
c79624_g1_i5	AAH60675.1	Myh9 protein	4.04
c80695_g2_i5	XP_002667379.3	Myosin heavy chain, fast skeletal muscle isoform X1	-2.14
c84026_g4_i8	XP_007257218.1	Myosin-11-like isoform X3	2.08
c79624_g11_i1	XP_005470244.1	Myosin-9-like isoform X2	5
c79678_g3_i9	NP_001092918.1	NEDD4-like E3 ubiquitin-protein ligase WWP2	-2.51
c83643_g1_i1	AAI62497.1	Nfe2l1 protein	2.09
c79082_g8_i9	XP_006036285.1	N-lysine methyltransferase SMYD2	5.83

c71085_g1_i3	XP_003456807.1	Normal mucosa of esophagus-specific gene 1 protein-like	3.09
c82222_g1_i1	XP_007245485.1	Nucleoprotein TPR-like isoform X2	2.22
c76681_g3_i3	AAI14288.1	Olfactomedin-like 3	-3.92
c80469_g11_i6	XP_007256471.1	Oligophrenin-1	2.93
c65003_g1_i1	AET79256.1	Parvalbumin 1	-7.57
c78462_g10_i5	XP_007257952.1	PH-interacting protein	2.27
c81919_g10_i1	XP_007248568.1	Placenta-specific protein 9	-2.02
c75054_g3_i3	XP_007258683.1	Platelet-derived growth factor receptor-like protein	-3.67
c77220_g2_i2	XP_006635864.1	Probable C-mannosyltransferase DPY19L4-like	2.58
c81561_g2_i4	XP_007238583.1	Probable E3 ubiquitin-protein ligase HERC4-like isoform X3	2
c76836_g12_i1	NP_001018308.1	Probable sodium-coupled neutral amino acid transporter 6	2.38
c75395_g4_i2	XP_005160907.1	Programmed cell death protein 6 isoform X1	-2.59
c82299_g2_i1	XP_007241385.1	Protein NLRC5-like	2.2
c78515_g14_i1	XP_007252704.1	Protein strawberry notch homolog 2-like isoform X2	2.77
c81427_g7_i4	XP_007243286.1	Protocadherin Fat 2-like	-2.49
c75644_g1_i18	AAH28733.1	PTK2 protein	2.66
c79776_g8_i13	XP_007245101.1	Putative homeodomain transcription factor 2, partial	2.61
c74189_g1_i1	XP_007250433.1	Ras suppressor protein 1 isoform X2	3.04
c80497_g20_i1	XP_007256099.1	Ras-related and estrogen-regulated growth inhibitor	2.47
c84260_g1_i6	XP_007228142.1	Receptor-type tyrosine-protein phosphatase eta-like	2.67
c81036_g4_i3	XP_005163697.1	Regulator of nonsense transcripts 1 isoform X1	2.58
c83570_g7_i7	XP_005163369.1	Rho GTPase-activating protein 29 isoform X1	2.38
c76090_g9_i6	XP_007249677.1	Ribonuclease ZC3H12A isoform X1	2.62
c77081_g6_i7	XP_007253435.1	RISC-loading complex subunit tarbp2-like	6.38
c81220_g6_i5	NP_571679.2	Runt-related transcription factor 3	2.23
c82392_g22_i6	XP_006627604.1	Serine/arginine-rich splicing factor 7-like	2.52
c76309_g1_i2	NP_956829.1	Serine/threonine-protein kinase 17B	2.23
c83671_g7_i2	XP_007248136.1	Serine/threonine-protein kinase MARK2 isoform X3	2.22
c79317_g5_i1	XP_002942523.2	Serum response factor	2.86
c72529_g3_i2	XP_007245686.1	Shugoshin-like 1-like	4.59
c77067_g6_i5	XP_005162817.1	Si:dkey-11p10.8 isoform X2	3.3
c83845_g10_i3	NP_001107912.1	Solute carrier family 4, anion exchanger, member 2b	2.4
c80167_g13_i1	XP_007250466.1	Sorting nexin-7 isoform X2	2.53
c81640_g6_i2	XP_007227828.1	Splicing factor 3B subunit 1 isoform X1	2.19
c82575_g3_i1	ABC75548.1	Spp1	-2.01

c82916_g2_i9	AAI39518.1	Stat5.2 protein	2.25
c81716_g2_i6	XP_007252032.1	Syntaxin-binding protein 5-like isoform X3	2.82
c80172_g1_i1	XP_007239365.1	Telethonin-like	-2.51
c75426_g1_i1	XP_005158103.1	Testis-expressed sequence 10 protein homolog isoform X1	2.98
c83258_g4_i4	XP_007252708.1	Tight junction protein ZO-3-like isoform X2	2.04
c77621_g2_i8	AAH76530.1	Tp63 protein	3.07
c84098_g4_i4	XP_004450492.1	Translation initiation factor IF-2-like	21.18
c77703_g12_i2	XP_007251123.1	Transmembrane gamma-carboxyglutamic acid protein 2	-4.15
c76623_g1_i6	XP_003443288.1	Transmembrane protein 50B-like isoform X1	-3.01
c74053_g1_i7	XP_007254965.1	Tripartite motif-containing protein 16-like isoform X1	3.77
c80980_g2_i1	XP_695912.6	Tuberin, partial	2.01
c81448_g3_i2	XP_005167130.1	Tumor necrosis factor receptor superfamily member 14	10.29
c78698_g1_i4	Q1LWB0.2	TXB1A_DANRE RecName: Full=Tax1-binding protein 1 homolog A	2.58
c77145_g4_i3	XP_007254055.1	Tyrosine-protein kinase ABL1 isoform X1	2.11
c78218_g9_i2	XP_006626296.1	Tyrosine-protein kinase FRK-like	2.09
c84042_g2_i2	XP_005161522.1	Tyrosine-protein phosphatase non-receptor type 13 isoform	2.36
c82425_g1_i10	XP_007234768.1	Ubiquitin carboxyl-terminal hydrolase 36-like isoform X2	2.21
c78082_g1_i2	XP_005158483.1	Uncharacterized protein LOC101887158	-2.42
c84215_g4_i7	XP_006808885.1	Uncharacterized protein LOC102782322	2.46
c78050_g1_i19	XP_007245554.1	Uncharacterized protein LOC103029909	13.16
c84366_g1_i4	XP_007247137.1	Uncharacterized protein LOC103035935	2.63
c78652_g2_i1	XP_007229291.1	Uncharacterized protein LOC103036972, partial	4.88
c76140_g1_i1	XP_005174040.1	Uncharacterized protein LOC566957	7.62
c84232_g1_i11	NP_001119932.1	Uncharacterized protein LOC796658	-2.32
c73878_g1_i2	NP_001188097.1	Upf0609 protein c4orf27-like protein	2.86
c81426_g7_i7	XP_005164936.1	USP6 N-terminal like isoform X3	2.25
c81771_g7_i1	AAH74058.1	Uxs1 protein	-2.74
c82095_g10_i1	XP_005166584.1	Zinc finger protein 280D isoform X4	3.6
c84032_g7_i1	ERE52467.1	Zinc finger protein, partial	-2.7

D

Feature ID	Accession Version .	Description	Fold change
c78075_g1_i1	NP_001187565.1	14-3-3 protein gamma-1	7.25

c82269_g5_i1	XP_006012044.1	14-3-3 protein zeta/delta	2.05
c78189_g3_i10	ACI68006.1	15.5 kDa protein	2.93
c79004_g3_i8	XP_004071213.1	17-beta-hydroxysteroid dehydrogenase 14-like	-2.37
c73057_g1_i3	NP_001071200.1	1-acyl-sn-glycerol-3-phosphate acyltransferase alpha	2.32
c77175_g6_i2	XP_007232878.1	1-phosphatidylinositol 4,5-bisphosphate phosphodiesterase	7.22
c75958_g4_i1	NP_001155125.1	1-phosphatidylinositol-4,5-bisphosphate phosphodiesterase epsilon-1	4.79
c78233_g7_i4	NP_919388.1	1-phosphatidylinositol-4,5-bisphosphate phosphodiesterase gamma-1	3.02
c77383_g4_i6	XP_007256830.1	26S proteasome non-ATPase regulatory subunit 1-like	2.05
c76462_g1_i2	NP_001019590.1	2-oxoisovalerate dehydrogenase subunit alpha, mitochondrial	2.21
c69043_g5_i3	XP_007251099.1	3 beta-hydroxysteroid dehydrogenase type 7	4.27
c81095_g3_i3	XP_006786523.1	3-ketodihydrosphingosine reductase-like	3.89
c81083_g4_i10	NP_991262.1	3-phosphoinositide-dependent protein kinase 1	2.04
c79153_g17_i1	XP_006637159.1	3-phosphoinositide-dependent protein kinase 1-like	2.53
c78274_g12_i3	NP_001187246.1	40S ribosomal protein S24	-2.32
c80549_g8_i2	NP_998252.1	45 kDa calcium-binding protein precursor	2.27
c74563_g2_i2	NP_958906.2	4-aminobutyrate aminotransferase, mitochondrial	6.45
c77234_g5_i4	XP_007245012.1	4-hydroxy-2-oxoglutarate aldolase, mitochondrial-like	2.61
c83288_g2_i11	XP_005163374.1	5'-3' exoribonuclease 1 isoform X1	10.37
c82488_g12_i1	XP_007257031.1	5'-AMP-activated protein kinase catalytic subunit	2.35
c76904_g6_i5	XP_005156442.1	5-azacytidine-induced protein 1-like isoform X2	6.08
c80530_g2_i5	NP_958830.1	5'-nucleotidase, cytosolic IIa	2.89
c82473_g7_i6	XP_002192767.1	60S ribosomal protein L23	-2.04
c75869_g2_i2	NP_001187214.1	60S ribosomal protein L26	-2.26
c78395_g6_i3	XP_003222499.1	60S ribosomal protein L27-like	-2.08
c78748_g7_i2	NP_001188238.1	60S ribosomal protein l7-like 1	2.34
c82885_g2_i1	ADO29331.1	60S ribosomal protein l8	-2.05
c82943_g5_i2	XP_007244097.1	60S ribosome subunit biogenesis protein NIP7 homolog	2.48
c82426_g7_i13	XP_005170627.1	6-phosphofructo-2-kinase/fructose-2,6-biphosphatase 2a	2.68
c83250_g14_i13	XP_007247857.1	7,8-dihydro-8-oxoguanine triphosphatase	3
c76260_g8_i1	XP_007246942.1	72 kDa type IV collagenase	2.6
c75628_g19_i2	XP_007252148.1	78 kDa glucose-regulated protein	2.11
c83812_g6_i3	XP_007257722.1	85/88 kDa calcium-independent phospholipase A2	2.99
c80598_g1_i11	3OHT	A Chain A, Crystal Structure Of Salmo Salar P38alpha	4.45

c81994_g6_i3	3TKL	A Chain A, Crystal Structure Of The Gtp-Bound Rab1a In Complex With	3.73
c78926_g3_i3	NP_001116746.1	A disintegrin and metalloproteinase with thrombospondin motifs 10	6.05
c73258_g1_i2	NP_001091649.2	A kinase anchor protein 1, mitochondrial	5.01
c82643_g12_i4	XP_007260290.1	Abhydrolase domain-containing protein 2-A-like	5.15
c81527_g8_i2	XP_007248926.1	Abl interactor 2-like isoform X2	7.43
c81455_g5_i1	EZA51692.1	Acetylcholine receptor subunit alpha-like protein	2.6
c82520_g4_i10	XP_005162010.1	Acetyl-coenzyme A synthetase, cytoplasmic isoform X3	5.03
c79579_g4_i8	NP_944590.1	Aconitate hydratase, mitochondrial	2.27
c78886_g13_i1	XP_005156285.1	Actin filament-associated protein 1-like isoform X2	2.33
c81266_g2_i2	ERE79102.1	Actin, aortic smooth muscle-like isoform 1	2.49
c82751_g4_i4	XP_696875.6	Actin-binding LIM protein 2	6.65
c76897_g10_i5	XP_007247416.1	Actin-related protein 2-A-like isoform X1	2.4
c82404_g3_i5	XP_007248206.1	Activated CDC42 kinase 1-like	2.66
c83085_g7_i4	XP_001919038.4	Activated CDC42 kinase 1-like isoform X1	4.18
c82232_g14_i6	XP_007235226.1	Activating molecule in BECN1-regulated autophagy protein 1	9.47
c74386_g3_i5	XP_007246019.1	Activating signal cointegrator 1 complex subunit 2	2.08
c79795_g8_i3	XP_007249644.1	Activating signal cointegrator 1 complex subunit 3	6.6
c76428_g7_i2	XP_007253830.1	Activin receptor type-1	3.28
c83970_g17_i3	XP_004558823.1	Activin receptor type-1B-like	2.34
c80863_g5_i2	XP_007257610.1	Activin receptor type-2A-like isoform X2	4.57
c82999_g1_i4	XP_007259399.1	Acyl-CoA synthetase family member 2, mitochondrial	3.4
c78613_g2_i5	NP_001074125.3	Acyl-CoA synthetase short-chain family member 1	3.16
c82073_g5_i6	XP_007255560.1	Acyl-CoA:lysophosphatidylglycerol acyltransferase 1	2.5
c83864_g5_i5	XP_003198947.2	ADAMTS-like 3, partial	7
c82522_g9_i2	XP_007254583.1	ADAMTS-like protein 4	3.55
c82417_g13_i2	XP_006006795.1	Adapter molecule crk isoform X1	6.83
c83356_g3_i8	XP_007245996.1	Adapter molecule crk-like	2.62
c78243_g13_i5	XP_007256751.1	Adaptin ear-binding coat-associated protein 2	2.01
c81856_g11_i6	XP_005169040.1	Adenylate cyclase type 7 isoform X1	2.55
c81856_g11_i9	XP_005169042.1	Adenylate cyclase type 7 isoform X3	3.01
c80681_g1_i3	XP_003201145.1	Adenylate cyclase type 9	9.82
c76886_g6_i1	NP_001017804.1	Adenylosuccinate synthetase isozyme 2	5.13
c78715_g6_i3	XP_007250322.1	Adipocyte enhancer-binding protein 1-like	3.26
c79536_g6_i4	XP_007247161.1	Adipocyte enhancer-binding protein 1-like isoform X3	3.36

c81688_g3_i2	XP_003452294.1	ADP/ATP translocase 1-like	-2.77
c59887_g2_i1	NP_958888.1	ADP-ribosylation factor 1 like	3.19
c83140_g9_i3	NP_001188198.1	ADP-ribosylation factor 5	2.52
c82059_g1_i2	ACI34125.1	ADP-ribosylation factor 6	2.74
c72179_g1_i1	NP_956287.1	ADP-ribosylation factor 6a	2.11
c79641_g13_i1	XP_005155677.1	ADP-ribosylation factor-like 15b isoform X3	4.59
c66748_g2_i1	NP_001188241.1	ADP-ribosylation factor-like 4	-2.18
c81430_g7_i4	XP_007254614.1	ADP-ribosylation factor-like protein 8B-A-like	2.65
c78633_g3_i10	XP_007253634.1	Advillin-like	9.96
c82678_g5_i1	AAF63413.1	AF142418_1 QUAKING isoform 2	5.07
c77974_g4_i5	AAF24169.1	AF148993_1 janus kinase 3	2.03
c82740_g2_i2	AAF14560.1	AF181248_1 kinesin-like protein 2	-3.75
c79401_g1_i5	AAK15300.1	AF324478_1 receptor tyrosine kinase Fms	2.26
c79965_g9_i6	XP_007247092.1	AF4/FMR2 family member 4 isoform X2	5.73
c78018_g3_i3	XP_007255419.1	Afadin-like isoform X10	2.75
c81650_g10_i5	XP_007255420.1	Afadin-like isoform X11	4.69
c81650_g10_i7	XP_007255414.1	Afadin-like isoform X5	2.19
c77802_g3_i8	XP_007229597.1	Aftiphilin	4.43
c82091_g2_i2	XP_007245648.1	Agglutinin-like protein 7-like	7.04
c18174_g1_i1	XP_686182.6	Aggrecan core protein isoform X2	14.51
c76196_g1_i3	XP_007234416.1	Aggrecan core protein-like	13.1
c82159_g3_i1	NP_001170923.1	Agrin precursor	22.15
c75051_g6_i2	NP_001188148.1	AHA1, activator of heat shock protein ATPase homolog 1	2.01
c82342_g1_i4	XP_007253957.1	A-kinase anchor protein 12-like	4.33
c81249_g1_i6	XP_007246278.1	A-kinase anchor protein 13-like	7.52
c81249_g1_i4	XP_005447751.1	A-kinase anchor protein 13-like isoform X3	7.7
c81249_g1_i5	XP_003198954.2	A-kinase anchor protein 13-like, partial	7.82
c80789_g2_i4	XP_005740661.1	A-kinase anchor protein 9-like isoform X1	4.07
c80789_g1_i1	XP_007242296.1	A-kinase anchor protein 9-like, partial	2.89
c80983_g8_i10	XP_007230448.1	Alanine aminotransferase 2	2.17
c80938_g7_i3	XP_007249234.1	Alanine--tRNA ligase, cytoplasmic-like isoform X1	4.84
c79860_g1_i4	NP_001073423.2	Aldehyde dehydrogenase family 16 member A1	2.43
c78087_g3_i3	NP_956407.1	Alkyldihydroxyacetonephosphate synthase, peroxisomal	2.4
c77703_g2_i2	AAB61138.1	Allele: hi2	2.07
c76533_g12_i3	ADO28397.1	Allograft inflammatory factor 1-like	2.7

c77022_g4_i2	XP_001342996.2	Alpha/beta hydrolase domain-containing protein 17A	4.03
c77022_g2_i2	XP_007236984.1	Alpha/beta hydrolase domain-containing protein 17A-like	3.73
c83359_g3_i3	XP_006804244.1	Alpha/beta hydrolase domain-containing protein 17C-like	2.37
c81056_g10_i9	XP_003440902.1	Alpha-1,6-mannosylglycoprotein	3.22
c81056_g10_i1	NP_001038776.1	Alpha-1,6-mannosylglycoprotein 6-beta-N-acetylglucosaminyltransferase	6.13
c79255_g2_i1	XP_007252759.1	Alpha-1-syntrophin	3.13
c82650_g4_i7	XP_007247642.1	Alpha-actinin-1 isoform X6	4.64
c82650_g4_i3	XP_003445506.2	Alpha-actinin-1 isoformX1	4.47
c82650_g4_i8	NP_955880.1	Alpha-actinin-4	3.56
c82650_g4_i19	XP_007240478.1	Alpha-actinin-4-like	2.51
c78349_g4_i1	XP_005160998.1	Alpha-adducin isoform X3	4.65
c83075_g1_i8	XP_007246636.1	Alpha-aminoadipic semialdehyde synthase, mitochondrial	6.92
c81759_g6_i5	XP_003216683.1	Alpha-globin transcription factor CP2-like isoform 1	4.01
c81452_g2_i1	XP_007228197.1	Alpha-mannosidase 2x-like isoform X6	4.42
c78603_g1_i3	XP_007254716.1	Alpha-parvin-like isoform X1	3.08
c77357_g1_i2	XP_007236473.1	Alstrom syndrome protein 1-like isoform X1	4.13
c77357_g1_i3	XP_007236474.1	Alstrom syndrome protein 1-like isoform X2	-3.42
c81770_g1_i11	XP_007236741.1	Aminomethyltransferase, mitochondrial-like	2.35
c80516_g1_i3	XP_007228190.1	Ammonium transporter Rh type C isoform X1	3.11
c80591_g3_i5	NP_956928.1	Amyloid beta A4 precursor protein-binding family B member	3.46
c79266_g8_i8	XP_693392.6	Amyloid beta A4 precursor protein-binding family B member	2.59
c82991_g3_i8	XP_007237818.1	Amyloid beta A4 protein isoform X2	4.22
c73051_g3_i3	XP_007227940.1	Amyloid beta A4 protein-like isoform X3	3.58
c73051_g1_i1	AFN73055.1	Amyloid beta precursor protein b	4.75
c80941_g10_i2	XP_007238566.1	AN1-type zinc finger protein 3-like	2.51
c78100_g6_i1	XP_007236989.1	AN1-type zinc finger protein 5-like	2.06
c74899_g2_i1	AFU35774.1	Androgen receptor	2.75
c80183_g5_i11	XP_007247048.1	Angiogenic factor with G patch and FHA domains 1-like	-3.61
c78660_g11_i2	XP_005173944.1	Angiomotin isoform X1	5.48
c78660_g11_i3	XP_007244519.1	Angiomotin-like isoform X1	7.5
c78660_g10_i2	XP_007244520.1	Angiomotin-like isoform X2	2.02
c78660_g11_i1	XP_007244521.1	Angiomotin-like isoform X3	7.42
c78660_g17_i1	XP_007244522.1	Angiomotin-like isoform X4	4.29

c73769_g12_i1	XP_007259833.1	Angiopoietin-related protein 1-like	2.96
c76281_g6_i2	XP_005466227.1	Angiopoietin-related protein 5-like isoform X2	3.45
c78639_g6_i8	XP_005161412.1	Ankyrin repeat and KH domain-containing protein 1 isoform	2.32
c75085_g2_i2	XP_007243438.1	Ankyrin repeat and SOCS box protein 8-like isoform X1	2.42
c79667_g3_i6	XP_007233546.1	Ankyrin repeat domain-containing protein 13A	2.51
c78704_g17_i1	XP_007231843.1	Ankyrin repeat domain-containing protein 13C-A-like	2.44
c77437_g9_i1	XP_007260371.1	Ankyrin repeat domain-containing protein 50	3.62
c80160_g3_i1	XP_007227810.1	Ankyrin repeat domain-containing protein 50-like	6.57
c80851_g12_i1	XP_005156099.1	Ankyrin-3 isoform X5	4.21
c75929_g2_i2	XP_005168948.1	Anoctamin 5b isoform X1	3.58
c78659_g10_i3	XP_007237158.1	Anoctamin-10-like	2.08
c82337_g5_i4	XP_007228293.1	Anoctamin-5 isoform X1	4.85
c73912_g3_i1	XP_007255212.1	Antigen KI-67-like isoform X1	8.41
c80649_g1_i2	XP_002665053.1	Antigen peptide transporter 1	3.34
c81867_g1_i1	ACM08205.1	Antileukoproteinase precursor	-2.62
c81964_g3_i2	XP_005165223.1	AP-1 complex subunit beta-1 isoform X1	9.74
c81964_g3_i4	XP_005165224.1	AP-1 complex subunit beta-1 isoform X2	4.95
c82703_g3_i1	XP_004561876.1	AP-1 complex subunit beta-1-like isoform X1	2.34
c83893_g8_i3	NP_955976.1	AP-1 complex subunit gamma-1	4.53
c80651_g9_i1	XP_006158015.1	AP-1 complex subunit sigma-2-like isoform X4	3.63
c83655_g4_i2	AHB37084.1	AP-1 transcription factor c-Jun subunit	2.26
c79193_g3_i1	XP_003802841.1	AP-2 complex subunit alpha-2	3.7
c79193_g11_i1	XP_007260314.1	AP-2 complex subunit alpha-2-like	4.32
c79428_g11_i1	XP_007251129.1	AP-2 complex subunit alpha-2-like isoform X4	4.6
c79428_g11_i2	XP_007251131.1	AP-2 complex subunit alpha-2-like isoform X6	2.82
c83231_g7_i4	XP_005167372.1	AP2-associated protein kinase 1 isoform X4	4.8
c82386_g4_i6	XP_005451327.1	AP2-associated protein kinase 1-like isoform X2	5.89
c80164_g4_i6	XP_006796965.1	AP-3 complex subunit beta-1-like	5.75
c78107_g4_i7	XP_007233354.1	AP-3 complex subunit delta-1-like isoform X1	-2.32
c80603_g6_i1	XP_007252323.1	AP-3 complex subunit mu-1	2.26
c66190_g2_i1	ACT76163.1	Apelin	7.7
c83355_g2_i1	XP_007257553.1	Apoptosis-inducing factor 1, mitochondrial-like isoform X5	2.55
c76021_g1_i1	XP_007257372.1	Apoptosis-resistant E3 ubiquitin protein ligase 1	5.61
c82345_g3_i6	XP_007230982.1	Apoptosis-stimulating of p53 protein 1 isoform X4	9.84
c78937_g4_i4	XP_007230983.1	Apoptosis-stimulating of p53 protein 1 isoform X5	4.26

c79046_g1_i1	XP_005456601.1	Apoptosis-stimulating of p53 protein 2-like isoform X2	3.93
c79671_g18_i8	XP_007250278.1	Apoptotic chromatin condensation inducer in the	3.23
c56612_g1_i1	NP_001129154.1	Aquaporin 1a, tandem duplicate 2	11.14
c78842_g1_i1	AGT57408.1	Aquaporin-3a	-2.7
c77872_g7_i3	XP_007230337.1	Arfaptin-1 isoform X2	2.2
c80722_g1_i3	XP_007242056.1	Arf-GAP with coiled-coil, ANK repeat and PH	2.06
c82724_g8_i4	XP_007234643.1	Arf-GAP with GTPase, ANK repeat and PH domain-containing	3.1
c81603_g7_i4	XP_007254358.1	Arginine-glutamic acid dipeptide repeats protein-like	2.17
c81295_g16_i8	ABV22635.1	Argonaute 2	27.93
c78292_g7_i4	AAI28807.1	Arntl2 protein	2.6
c77381_g2_i10	XP_005171840.1	Arrestin domain containing 1a isoform X2	2.15
c80791_g9_i3	XP_007246115.1	Arrestin domain-containing protein 1-like	4.15
c78300_g2_i6	XP_007253927.1	Arrestin domain-containing protein 3-like	2.24
c78170_g2_i2	XP_007248176.1	Arrestin red cell isoform 1-like	2.7
c78170_g1_i2	XP_007236277.1	Arrestin red cell isoform 3-like isoform X3	3.97
c77413_g12_i1	ACT79400.1	Aryl hydrocarbon receptor 1	3.3
c80512_g2_i5	XP_007254580.1	Aryl hydrocarbon receptor nuclear translocator	5.6
c83187_g7_i9	XP_007229012.1	Aryl hydrocarbon receptor-like	3.83
c78786_g8_i4	XP_007244938.1	Asc-type amino acid transporter 1	5.71
c83440_g5_i2	XP_004074161.1	Asparagine synthetase	5.34
c83727_g11_i2	ADO27780.1	Astrocytic phosphoprotein pea-15	4.31
c76489_g1_i3	AAH61959.1	Asxl1 protein, partial	5.82
c83786_g6_i6	NP_997849.1	Ataxin-2-like protein	4.4
c76757_g2_i6	XP_007228774.1	Ataxin-7	4.84
c77025_g1_i4	XP_005816662.1	ATP synthase subunit alpha, mitochondrial-like isoform X1	2.13
c74965_g7_i2	AAI21781.1	Atp2b1a protein	7.54
c78900_g5_i3	F1Q4S1.1	ATP9B_DANRE RecName: Full=Probable phospholipid-transporting ATPase IIB; AltName:	6.35
c79847_g6_i3	AAY86965.1	ATPase Na-K transporting polypeptide	3.19
c83039_g9_i6	XP_007228101.1	ATP-binding cassette sub-family A member 1 isoform X1	4.1
c83951_g3_i2	XP_007253322.1	ATP-binding cassette sub-family A member 12	3.91
c73995_g1_i1	XP_003450114.1	ATP-binding cassette sub-family A member 3	9.02
c76842_g9_i1	XP_007245883.1	ATP-binding cassette sub-family D member 1-like isoform X1	5.17
c79157_g2_i5	NP_998351.1	ATP-binding cassette sub-family F member 1	2.29
c81956_g2_i8	XP_007254665.1	ATP-binding cassette sub-family F member 3-like	2.84

c82116_g2_i2	AAH47181.1	ATP-binding cassette, sub-family F (GCN20), member 2	2.05
c82497_g2_i5	XP_005928270.1	ATP-citrate synthase-like isoform X2	4.5
c77221_g12_i1	XP_007227993.1	ATP-dependent (S)-NAD(P)H-hydrate dehydratase isoform X1	4.23
c77221_g12_i10	XP_007227994.1	ATP-dependent (S)-NAD(P)H-hydrate dehydratase isoform X2	4.43
c75732_g1_i6	XP_007258096.1	ATP-dependent RNA helicase A-like isoform X1	2.96
c75732_g1_i2	XP_007258097.1	ATP-dependent RNA helicase A-like isoform X2	4.1
c79783_g7_i3	XP_007244293.1	ATP-dependent RNA helicase DDX3X isoform X8	4.05
c79783_g6_i3	XP_005475316.1	ATP-dependent RNA helicase DDX3X-like isoform X6	7.42
c79944_g2_i2	XP_007254057.1	ATP-dependent RNA helicase DDX54-like isoform X1	4.27
c81502_g7_i5	XP_007228894.1	ATP-dependent RNA helicase DHX29 isoform X2	4.39
c80385_g18_i5	XP_007259202.1	ATP-dependent RNA helicase DHX8	4.46
c78925_g2_i16	XP_007249640.1	ATP-dependent zinc metalloprotease YME1L1-like isoform X2	2.48
c77055_g12_i1	XP_007247340.1	ATP-sensitive inward rectifier potassium channel 15	5.61
c81963_g9_i2	XP_007253084.1	AT-rich interactive domain-containing protein 1A-like	2.89
c81914_g10_i2	XP_007255595.1	AT-rich interactive domain-containing protein 1B-like	7.84
c74743_g1_i2	XP_007238012.1	AT-rich interactive domain-containing protein 2 isoform X3	12.58
c79749_g11_i1	NP_001093509.1	AT-rich interactive domain-containing protein 3A	6.01
c81767_g5_i1	XP_007240305.1	AT-rich interactive domain-containing protein 3A-like	3.51
c78517_g2_i4	XP_007251977.1	AT-rich interactive domain-containing protein 4A isoform	3.17
c79924_g4_i4	XP_007255224.1	AT-rich interactive domain-containing protein 5B-like,	4.15
c76719_g10_i1	XP_007259242.1	Attractin-like protein 1	2.87
c80672_g2_i4	XP_004071966.1	Autoimmune regulator-like	6.27
c82840_g9_i1	CAJ31278.1	Autophagy protein 5	2.56
c79827_g6_i6	XP_006637931.1	Autophagy-related protein 16-1-like isoform X1	2.49
c79513_g2_i2	XP_007239332.1	Autophagy-related protein 9A-like	3.54
c81890_g2_i3	NP_571636.1	Axin-2	2.31
c83590_g2_i1	XP_001336902.1	Baculoviral IAP repeat-containing protein 6 isoform X1	20.63
c80943_g15_i1	NP_001243658.1	BAG family molecular chaperone regulator 4	2.54
c72900_g2_i1	XP_007240388.1	BAG family molecular chaperone regulator 5 isoform X2	3.88
c81467_g1_i1	XP_007255201.1	Band 3 anion exchange protein-like	3.31
c82508_g3_i3	XP_007259768.1	Band 4.1-like protein 2	3.24
c83428_g1_i10	XP_004555433.1	Band 4.1-like protein 3-like	3.18

c78023_g10_i1	XP_005158197.1	Basal cell adhesion molecule isoform X1	3.91
c78023_g9_i5	XP_005158198.1	Basal cell adhesion molecule isoform X2	2.81
c82752_g15_i8	XP_003201256.2	Basement membrane-specific heparan sulfate proteoglycan	33.03
c83210_g2_i1	XP_007249084.1	Basic helix-loop-helix domain-containing protein KIAA2018	15.12
c80219_g17_i1	XP_002698632.3	Basic proline-rich protein	3.48
c82703_g10_i1	XP_007251411.1	B-cell CLL/lymphoma 9 protein isoform X1	2.43
c79310_g1_i1	XP_005171042.1	B-cell CLL/lymphoma 9 protein isoform X4	4.92
c83450_g10_i1	XP_007259598.1	B-cell CLL/lymphoma 9-like protein isoform X1	4.45
c72202_g1_i4	XP_007242050.1	B-cell lymphoma 6 protein homolog	2.61
c70269_g4_i1	XP_007242956.1	B-cell lymphoma/leukemia 10-like	2.36
c78366_g4_i1	NP_001035481.1	B-cell lymphoma/leukemia 11A	3.35
c79908_g11_i2	XP_007255483.1	B-cell lymphoma/leukemia 11A-like	2.58
c80816_g19_i1	XP_007247272.1	BCL2/adenovirus E1B 19 kDa protein-interacting protein	2.12
c79620_g13_i2	ADO27970.1	Bcl2/adenovirus e1b 19 kda protein-interacting protein 3-like	4.01
c75541_g3_i3	NP_001013314.1	Bcl2-associated X protein, b	2.77
c84003_g3_i3	XP_005914479.1	Bcl-2-modifying factor-like isoform X3	3.41
c83759_g9_i1	XP_007237483.1	BDNF/NT-3 growth factors receptor isoform X1	2.71
c80193_g4_i4	AAF35883.1	Beta-1 integrin	5.1
c83198_g12_i1	XP_005924103.1	Beta-1,4-galactosyltransferase 1-like	3.24
c75322_g1_i5	XP_005801890.1	Beta-1,4-galactosyltransferase 3-like	7.33
c75322_g1_i1	XP_005456098.1	Beta-1,4-galactosyltransferase 3-like isoform X2	4.59
c82308_g10_i4	XP_007237710.1	Beta-1,4-galactosyltransferase 5-like	5.05
c74927_g16_i2	XP_007257075.1	Beta-1,4-galactosyltransferase 6	4.03
c71564_g2_i2	XP_003439613.1	Beta-2-syntrophin-like	3
c79236_g12_i1	XP_003444954.1	Beta-catenin-interacting protein 1-like	2.37
c80473_g6_i1	NP_001004554.1	Beta-citryl-glutamate synthase B	3.64
c76624_g17_i3	NP_001153386.1	Beta-galactoside alpha-2,6-sialyltransferase 2	3.91
c79045_g4_i1	XP_007255872.1	Beta-glucuronidase	2.63
c78645_g7_i2	XP_007234368.1	Bifunctional 3'-phosphoadenosine 5'-phosphosulfate	3.85
c74825_g1_i6	XP_006635163.1	Bifunctional arginine demethylase and lysyl-hydroxylase	2.37
c80759_g1_i2	XP_007252601.1	Bifunctional glutamate/proline--tRNA ligase-like isoform	3.87
c81859_g2_i4	XP_007237035.1	Biglycan-like	2.64
c76804_g4_i1	NP_001180469.1	BMP-2-inducible protein kinase isoform 1	8.21

c74006_g2_i1	XP_007234827.1	Bone morphogenetic protein 1-like	3
c77805_g7_i2	XP_007235690.1	Bone morphogenetic protein 2-like	3.46
c73914_g1_i1	XP_007258902.1	Bone morphogenetic protein 8A	2.74
c76623_g4_i1	XP_007261122.1	Bone morphogenetic protein receptor type-2-like	3.09
c73927_g4_i4	XP_007244504.1	Brain mitochondrial carrier protein 1-like isoform X1	2.87
c71395_g1_i4	XP_005172649.1	BRCA1-associated protein isoform X1	2.62
c83224_g16_i2	F1R5H6.1	BRD4_DANRE RecName: Full=Bromodomain-containing protein 4	43.7
c79070_g16_i3	XP_005159196.1	Breast cancer anti-estrogen resistance 1 isoform X2	3.14
c82108_g1_i4	XP_005166943.1	Breast cancer anti-estrogen resistance protein 3 isoform	5.21
c82878_g4_i12	XP_003201354.2	Brefeldin A-inhibited guanine nucleotide-exchange protein	4.26
c81528_g4_i5	XP_007240535.1	Bromodomain adjacent to zinc finger domain protein 1A	2.37
c84023_g9_i17	XP_007248875.1	Bromodomain adjacent to zinc finger domain protein 2B-like	4.17
c77269_g20_i7	XP_007240943.1	Bromodomain and WD repeat-containing protein 1	8.54
c76423_g2_i1	XP_007232459.1	Bromodomain-containing protein 1	4.66
c78531_g2_i1	XP_007233788.1	Bromodomain-containing protein 2-like isoform X3	2.15
c83224_g16_i1	XP_007229122.1	Bromodomain-containing protein 4-like isoform X3	4.82
c78015_g9_i5	XP_007253675.1	Bromodomain-containing protein 8-like isoform X12	3.25
c77349_g1_i5	XP_007249081.1	Brother of CDO-like	2.36
c76864_g6_i3	NP_001103929.1	BTB (POZ) domain containing 10a	2.64
c80908_g6_i1	XP_007234758.1	BTB/POZ domain-containing adapter for CUL3-mediated RhoA	3.14
c80786_g18_i3	XP_006642564.1	BTB/POZ domain-containing protein 10-like isoform X1	2.09
c82524_g14_i5	XP_005168501.1	BTB/POZ domain-containing protein 2	4.51
c82639_g2_i2	XP_007258262.1	BTB/POZ domain-containing protein 7-like	5.14
c78656_g3_i2	XP_007251912.1	BTB/POZ domain-containing protein kctd15 isoform X1	4.45
c77935_g6_i5	NP_996932.1	BTB/POZ domain-containing protein KCTD5	2.29
c76117_g1_i1	XP_006013953.1	Butyrophilin subfamily 3 member A2-like	4.71
c75179_g1_i1	XP_007259486.1	C2 domain-containing protein 2 isoform X4	2.59
c77926_g1_i4	XP_007248664.1	C2 domain-containing protein 3-like	10.59
c76709_g6_i2	XP_007244111.1	C2 domain-containing protein 5-like isoform X4	4.32
c76709_g6_i3	XP_007244116.1	C2 domain-containing protein 5-like isoform X9	13.93
c81158_g1_i5	XP_005160868.1	CAD protein isoform X1	3.96
c81158_g1_i6	XP_005160869.1	CAD protein isoform X2	4.43
c76010_g4_i2	NP_571289.1	Cadherin-11 precursor	4.85

c84258_g1_i2	XP_007241648.1	Cadherin-1-like	2.51
c75948_g3_i3	XP_007233080.1	Cadherin-2-like	5.73
c80426_g7_i2	XP_006786505.1	Cadherin-2-like isoform X2	6.27
c81046_g14_i3	NP_001003983.1	Cadherin-5 precursor	3.68
c82371_g11_i1	XP_007252457.1	Cadherin-like and PC-esterase domain-containing protein 1	3.47
c80544_g10_i1	XP_006151360.1	Calcineurin subunit B type 1 isoform X1	6
c19831_g2_i1	XP_005167946.1	Calcitonin gene-related peptide type 1 receptor isoform X1	2.18
c81070_g10_i5	XP_004556129.1	Calcium uniporter protein, mitochondrial-like isoform X3	5.89
c82894_g8_i5	XP_007228658.1	Calcium/calmodulin-dependent protein kinase kinase 1-like	13.62
c81927_g8_i2	NP_001116532.1	Calcium/calmodulin-dependent protein kinase type 1D	4.08
c81927_g5_i1	XP_006633415.1	Calcium/calmodulin-dependent protein kinase type 1D-like	3.44
c81421_g10_i1	XP_007228794.1	Calcium/calmodulin-dependent protein kinase type 1-like	2.77
c81994_g12_i15	XP_005162429.1	Calcium-binding and coiled-coil domain-containing protein	3.82
c79257_g22_i1	NP_001187351.1	Calcium-binding protein 39-like	3.25
c76960_g13_i8	NP_001187843.1	Calcium-binding protein p22	2.49
c83008_g10_i1	ETK82424.1	Calmodulin, partial	2.28
c83008_g9_i3	XP_001112409.2	Calmodulin-2-like isoform 5	-2.24
c81923_g12_i1	XP_005170653.1	Calmodulin-binding transcription activator 2-like, partial	21.95
c77738_g2_i3	XP_007253904.1	Calmodulin-regulated spectrin-associated protein 1-B-like	7.37
c83996_g5_i4	XP_007229131.1	Calmodulin-regulated spectrin-associated protein 3-like	2
c80301_g3_i1	XP_007253758.1	Calnexin-like	2.99
c78755_g3_i3	AFU11025.1	Calpain-1 catalytic subunit	3.92
c78755_g3_i6	XP_007236092.1	Calpain-1 catalytic subunit-like	2.48
c82879_g5_i1	XP_002663893.2	Calpain-15 isoform X1	4.66
c82879_g5_i4	XP_005174254.1	Calpain-15 isoform X2	3.1
c82922_g9_i1	XP_007232683.1	Calpain-3 isoform X1	-2.05
c81990_g4_i1	XP_005725441.1	Calpain-5-like isoform X3	-3.34
c80350_g1_i7	XP_007254021.1	Calpastatin, partial	2.69
c76007_g5_i2	XP_007235912.1	Calphotin-like	-2.01
c78587_g1_i1	NP_001187699.1	Calumenin precursor	2.95
c76118_g3_i2	XP_003975318.1	CAMP-dependent protein kinase catalytic subunit	4.01
c81288_g4_i5	XP_007233254.1	CAMP-dependent protein kinase catalytic subunit beta	4

c77752_g3_i3	XP_007246767.1	CAMP-dependent protein kinase catalytic subunit PRKX	3.45
c82225_g6_i1	XP_005156043.1	CAMP-dependent protein kinase type I-alpha regulatory	3.3
c63061_g3_i1	XP_007256091.1	CAMP-responsive element-binding protein-like 2	2.85
c82346_g16_i2	XP_007248288.1	CAMP-specific 3',5'-cyclic phosphodiesterase 4B-like	4.54
c77648_g2_i1	XP_007257301.1	Canalicular multispecific organic anion transporter 2-like	7.53
c80246_g8_i5	XP_006789759.1	CAP-Gly domain-containing linker protein 1-like isoform X1	8.38
c77111_g1_i7	XP_007245375.1	CAP-Gly domain-containing linker protein 2	4.93
c81073_g13_i9	XP_683282.4	Carbamoyl-phosphate synthase	4.33
c79980_g1_i1	XP_007241727.1	Carbohydrate sulfotransferase 3-like	2.32
c75201_g3_i1	NP_001166020.1	Carbonic anhydrase II	2.41
c83029_g7_i1	ADO27995.1	Carboxy-terminal domain RNA polymerase II polypeptide A small	2.47
c77245_g5_i5	XP_005164116.1	Carnitine O-palmitoyltransferase 1, liver isoform isoform	2.34
c76646_g2_i2	XP_007240443.1	Cartilage acidic protein 1-like	3.65
c84222_g10_i1	XP_007244922.1	Cartilage intermediate layer protein 1 isoform X1	2.77
c82548_g3_i16	XP_005953971.1	Casein kinase I isoform alpha isoform X3	2.14
c81677_g4_i2	XP_007233817.1	Casein kinase I isoform delta-B isoform X1	2.07
c82727_g3_i2	XP_006635194.1	Casein kinase I isoform delta-B-like isoform X1	3.12
c81677_g4_i11	XP_007251317.1	Casein kinase I isoform epsilon-like	3.63
c76807_g15_i1	XP_007244374.1	Casein kinase I isoform gamma-1-like isoform X4	5.39
c75440_g1_i2	XP_007249765.1	Casein kinase II subunit alpha-like isoform X1	2.21
c83511_g7_i20	XP_003199651.2	Caskin-2 isoform X1	3.06
c197216_g1_i1	XP_005015939.1	Caspase-1-like, partial	-3.66
c79457_g7_i1	XP_007249871.1	Caspase-2 isoform X4	2.93
c77848_g7_i3	XP_007232852.1	Caspase-3-like isoform X1	2.85
c84093_g2_i11	XP_007228409.1	Cat eye syndrome critical region protein 2-like isoform X1	13.5
c77095_g1_i4	ELK23720.1	Catenin alpha-1	10.18
c77095_g1_i7	XP_003970564.1	Catenin alpha-1-like	3.34
c82489_g5_i6	XP_007250492.1	Catenin beta-1 isoform X2	2.63
c79844_g3_i7	XP_007256120.1	Catenin delta-1-like isoform X2	2.32
c79844_g3_i3	XP_007256122.1	Catenin delta-1-like isoform X4	4.52
c76532_g16_i1	XP_007254191.1	Cationic amino acid transporter 3-like isoform X1	3.47
c81805_g2_i9	XP_007255427.1	Cation-independent mannose-6-phosphate receptor-like	3.1
c83414_g7_i9	NP_001158878.1	CB055 protein	3.09

c75341_g3_i2	XP_002665081.2	CBL-interacting serine/threonine-protein kinase 25-like	3.44
c78140_g4_i2	XP_007252878.1	CBP80/20-dependent translation initiation factor, partial	3.84
c77257_g5_i3	ABA54956.1	CC chemokine SCYA109	-2.94
c79899_g2_i4	XP_007228425.1	CCR4-NOT transcription complex subunit 1 isoform X1	2.13
c75782_g1_i4	XP_007246649.1	CCR4-NOT transcription complex subunit 2-like isoform X1	2.16
c82645_g4_i5	XP_007258304.1	CCR4-NOT transcription complex subunit 3-like isoform X2	2.23
c82152_g15_i7	XP_007254569.1	CCR4-NOT transcription complex subunit 3-like isoform X4	3.77
c79450_g2_i5	XP_007259615.1	CCR4-NOT transcription complex subunit 6-like	2.91
c84077_g1_i14	BAB39134.1	CD11-1	6.05
c80925_g8_i1	NP_571075.1	CD166 antigen homolog A precursor	2.24
c81287_g2_i6	XP_007257701.1	CD276 antigen homolog	2.15
c77557_g12_i3	XP_007245463.1	CD2-associated protein isoform X1	3.11
c76364_g1_i2	CAZ61328.1	CD34a molecule	2.81
c78616_g8_i1	NP_001013549.1	Cdc42 effector protein 2	2.85
c75005_g1_i5	XP_007240987.1	Cdc42 effector protein 4-like isoform X1	2.08
c79848_g7_i1	XP_007246284.1	CDK5 and ABL1 enzyme substrate 2-like isoform X1	3.16
c81793_g5_i4	XP_007258998.1	Cell cycle control protein 50B-like	2.99
c78811_g9_i1	XP_007243560.1	Cell cycle progression protein 1-like	3.31
c75356_g6_i1	XP_007258253.1	Cell division cycle-associated protein 4-like	4.87
c83671_g5_i6	CCA37660.1	Cell surface glycoprotein 1	5.45
c78634_g8_i3	XP_005172069.1	Cell surface glycoprotein MUC18 isoform X1	2.72
c79964_g11_i2	XP_005172070.1	Cell surface glycoprotein MUC18 isoform X2	28.4
c77021_g6_i1	XP_007230633.1	Cellular retinoic acid-binding protein 2-like	2.28
c80776_g1_i7	XP_007247498.1	Centromere protein F-like isoform X1	2.88
c83368_g8_i3	XP_004564784.1	Centromere-associated protein E-like isoform X3	4.43
c81334_g1_i3	XP_007230413.1	Centrosomal protein of 170 kDa protein B-like isoform X1	5.13
c76419_g1_i2	XP_007255439.1	Centrosomal protein of 85 kDa-like isoform X1	2.87
c78864_g3_i6	XP_007252196.1	Centrosomal protein of 95 kDa	9.52
c80846_g2_i14	NP_001019378.1	Ceramide glucosyltransferase	3.79
c73646_g1_i2	XP_005168600.1	Ceramide kinase isoform X1	3.23
c76394_g1_i1	XP_007238221.1	CGMP-inhibited 3',5'-cyclic phosphodiesterase A isoform X1	4.46
c78437_g6_i4	XP_691883.4	CGMP-inhibited 3',5'-cyclic phosphodiesterase B	4.24
c77519_g3_i10	XP_007239190.1	Chaperone activity of bc1 complex-like,	3.1

c61572_g1_i2	XP_007251792.1	Charged multivesicular body protein 2b isoform X2	3.49
c79153_g4_i4	NP_932334.1	Chemokine (C-X-C motif) ligand 12b (stromal cell-derived factor 1)	3.88
c82623_g13_i2	XP_007250873.1	Chemokine-like receptor 1-like isoform X1	2.93
c77776_g5_i2	XP_005461757.1	Chitinase-like protein PB1E7.04c-like	15.71
c79964_g6_i9	XP_007247725.1	Chloride channel protein 2-like	10.19
c77617_g5_i2	XP_003452471.1	Chloride intracellular channel protein 1-like isoform X1	2.52
c81245_g2_i1	XP_007012624.1	Chloroplast, high sulfur B2-like protein	6.6
c81128_g3_i9	NP_001133839.1	Choline transporter-like protein 2	4.44
c78353_g1_i1	NP_001138264.1	Choline/ethanolamine phosphotransferase 1a	2.51
c81854_g5_i1	XP_007256787.1	Choline/ethanolaminephosphotransferase 1-like isoform X2	2.28
c74740_g1_i3	XP_001333479.4	Chondroitin sulfate N-acetylgalactosaminyltransferase	3.78
c78627_g1_i1	XP_007228617.1	Chondroitin sulfate proteoglycan 4	8.44
c76672_g2_i1	XP_007260278.1	Chondroitin sulfate synthase 1	2.88
c80940_g1_i1	XP_007234628.1	Chondroitin sulfate synthase 2-like	3.7
c75643_g15_i3	XP_007247718.1	Chordin-like	2.41
c77661_g2_i4	XP_007255404.1	Chromodomain-helicase-DNA-binding protein 1-like	3.44
c77578_g7_i2	XP_007254530.1	Chromodomain-helicase-DNA-binding protein 2 isoform X2	6.41
c76836_g10_i1	XP_007248104.1	Chromodomain-helicase-DNA-binding protein 3 isoform X3	2.21
c83141_g4_i11	XP_007245156.1	Chromodomain-helicase-DNA-binding protein 7 isoform X2	2.48
c83141_g4_i1	XP_005171369.1	Chromodomain-helicase-DNA-binding protein 8 isoform X1	2.81
c81704_g3_i3	XP_005169071.1	Chromodomain-helicase-DNA-binding protein 9 isoform X4	4.11
c81704_g3_i7	XP_005169074.1	Chromodomain-helicase-DNA-binding protein 9 isoform X7	2.43
c82263_g4_i1	XP_007258316.1	Chromosomal protein D1-like	2.32
c82328_g5_i1	XP_007260874.1	Ciliary neurotrophic factor receptor subunit alpha-like	2.14
c75491_g6_i1	XP_004554543.1	Ciliary neurotrophic factor-like	4.69
c83142_g4_i1	XP_007230614.1	Cingulin-like	4.92
c76014_g2_i4	XP_003199047.1	Cingulin-like 1	3.1
c82692_g5_i2	XP_689920.3	Cingulin-like isoform X2	5.81
c83386_g4_i12	XP_007244412.1	Cingulin-like protein 1-like	2.45
c79536_g3_i1	XP_007252141.1	Cip1-interacting zinc finger protein	3.41
c79509_g10_i1	XP_007259584.1	Circadian locomoter output cycles protein kaput isoform X1	24.74

c79474_g9_i1	XP_007256896.1	Circadian transcriptional repressor C1orf51-like	8.53
c76521_g4_i2	XP_007235983.1	CKLF-like MARVEL transmembrane domain-containing protein	2.46
c78752_g8_i7	XP_007231094.1	Clathrin heavy chain 1 isoform X4	2.68
c82101_g4_i3	XP_007244262.1	Claudin-10-like	2.15
c79431_g6_i3	XP_007260460.1	Claudin-10-like isoform X1	4.6
c69995_g1_i3	XP_007244261.1	Claudin-10-like isoform X2	2.41
c77300_g14_i2	XP_007251473.1	Claudin-19 isoform X2	4.23
c82012_g1_i1	XP_007237973.1	Claudin-8-like	2
c75536_g2_i1	XP_007237970.1	Claudin-8-like isoform X1	2.22
c82386_g1_i2	XP_006780754.1	Cleavage and polyadenylation specificity factor subunit	2.06
c80860_g9_i8	XP_007227959.1	CLIP-associating protein 1-A-like isoform X1	3.72
c80860_g9_i16	XP_007227964.1	CLIP-associating protein 1-A-like isoform X6	17.23
c78826_g3_i3	XP_005159786.1	CLIP-associating protein 2 isoform X1	8.61
c78826_g3_i4	XP_007245829.1	CLIP-associating protein 2-like	6.11
c78826_g4_i7	XP_007243495.1	CLIP-associating protein 2-like isoform X4	10.07
c80658_g5_i6	XP_005173710.1	CLK4-associating serine/arginine rich protein isoform X1	2.09
c78640_g5_i1	XP_007230770.1	CLOCK-interacting circadian protein-like isoform X1	3.03
c76502_g1_i3	NP_001071028.1	Clustered mitochondria protein homolog	6.79
c82480_g2_i3	XP_007251010.1	C-Maf-inducing protein	6.18
c74731_g1_i2	XP_007255368.1	CMP-N-acetylneuraminate-poly-alpha-2,8-sialyltransferase	2.66
c78830_g8_i4	XP_007249222.1	C-myc promoter-binding protein isoform X2	5.94
c82639_g3_i5	XP_005171318.1	Coatomer subunit alpha isoform X1	5.5
c82863_g4_i5	XP_005989713.1	Coatomer subunit beta	-2.54
c79267_g9_i4	XP_007231493.1	Coatomer subunit delta-like	2.24
c75720_g6_i4	XP_007232723.1	Cohesin subunit SA-1	4.11
c80927_g7_i8	XP_003972110.1	Coiled-coil and C2 domain-containing protein 1A-like	8.67
c80927_g7_i5	XP_005163592.1	Coiled-coil and C2 domain-containing protein 1A-like,	7.94
c78824_g9_i2	XP_005171255.1	Coiled-coil and C2 domain-containing protein 1B isoform X1	5.76
c75376_g2_i2	XP_007251173.1	Coiled-coil domain-containing protein 47-like	4.13
c83989_g2_i1	XP_007251545.1	Coiled-coil domain-containing protein 66 isoform X3	6.46
c81538_g6_i3	XP_005158733.1	Coiled-coil domain-containing protein 85C-A isoform X1	2.75
c82712_g9_i2	XP_007253369.1	Coiled-coil-helix-coiled-coil-helix domain-containing	2.05
c83306_g10_i2	AAH78424.1	Col9a2 protein	2.37
c82454_g8_i2	XP_004546286.1	Collagen alpha-1(II) chain-like isoform X2	5.96

c81123_g1_i2	XP_007237407.1	Collagen alpha-1(IX) chain-like	2.86
c79446_g1_i2	XP_698253.3	Collagen alpha-1(VI) chain	3.08
c78022_g2_i1	XP_007240888.1	Collagen alpha-1(X) chain-like	2.75
c84151_g2_i1	XP_005162870.1	Collagen alpha-1(XI) chain isoform X1	7.24
c84151_g2_i7	XP_005162874.1	Collagen alpha-1(XI) chain isoform X5	2.6
c83057_g1_i7	XP_003198223.2	Collagen alpha-1(XI) chain-like	3.6
c80532_g3_i16	XP_005478458.1	Collagen alpha-1(XI) chain-like isoform X6	7.82
c77224_g7_i6	XP_002665305.3	Collagen alpha-1(XII) chain isoform X1	13.08
c82683_g8_i3	XP_004561109.1	Collagen alpha-1(XII) chain-like	78.02
c82683_g7_i11	XP_005170810.1	Collagen alpha-1(XII) chain-like isoform X2	3.46
c77224_g5_i3	XP_007253882.1	Collagen alpha-1(XII) chain-like isoform X3	50.72
c77224_g7_i3	XP_007253883.1	Collagen alpha-1(XII) chain-like isoform X4	45.89
c77224_g5_i1	XP_007253884.1	Collagen alpha-1(XII) chain-like isoform X5	27.77
c77222_g1_i3	XP_001922046.4	Collagen alpha-1(XIV) chain	4.23
c82903_g6_i8	XP_007249492.1	Collagen alpha-1(XVI) chain-like	4.59
c81631_g7_i9	XP_007230503.1	Collagen alpha-1(XVIII) chain-like isoform X2	8.06
c81631_g7_i4	XP_007230504.1	Collagen alpha-1(XVIII) chain-like isoform X3	2.92
c77456_g2_i6	NP_001278305.1	Collagen alpha-1(XXII) chain precursor	16.19
c78447_g11_i5	XP_006781553.1	Collagen alpha-1(XXIII) chain-like	2.71
c80585_g3_i8	NP_001074044.1	Collagen alpha-1(XXVII) chain B precursor	8.89
c82843_g3_i2	XP_007227991.1	Collagen alpha-2(IV) chain isoform X2	2.05
c75359_g3_i4	XP_004081859.1	Collagen alpha-2(V) chain-like	3.62
c79746_g5_i5	XP_696164.2	Collagen alpha-2(VI) chain isoform X2	2.12
c79746_g5_i1	XP_007252649.1	Collagen alpha-2(VI) chain-like	3.69
c80532_g3_i7	XP_005159507.1	Collagen alpha-2(XI) chain isoform X9	11.25
c84294_g1_i2	XP_007228914.1	Collagen alpha-3(VI) chain-like	5.1
c81110_g2_i5	XP_007233591.1	Collagen alpha-4(IV) chain-like	5.03
c84125_g1_i14	XP_694013.6	Collagen alpha-5(IV) chain	2.82
c77834_g7_i1	XP_007242131.1	Collagen alpha-6(IV) chain	2.01
c83429_g1_i12	BAG72201.1	Collagen type I alpha 2	5.34
c77834_g9_i4	NP_001170943.1	Collagen type IV alpha1 precursor	5.94
c77391_g9_i3	XP_003455207.1	Collagen type IV alpha-3-binding protein-like isoform X1	2.1
c76517_g9_i4	AAH63249.1	Collagen, type I, alpha 1	9.15
c80401_g3_i2	XP_007230391.1	Collectin-12-like	2.14
c81468_g1_i4	NP_001187772.1	Comm domain-containing protein 8	4.45
c76437_g11_i2	XP_007231269.1	Complement C1q tumor necrosis factor-related protein	5.08

c83218_g2_i10	BAB03284.1	Complement C4-1	2.81
c78785_g6_i1	XP_007233529.1	Connective tissue growth factor-like	3.16
c79400_g2_i1	XP_007232667.1	Connector enhancer of kinase suppressor of ras 3-like	3.25
c77178_g1_i10	XP_007256131.1	Conserved oligomeric Golgi complex subunit 2	2.69
c73362_g2_i1	XP_001347769.1	Conserved Plasmodium protein	-2.13
c80491_g1_i4	XP_001338473.5	Contactin associated protein-like 5 isoform X1	6.75
c82020_g4_i7	XP_005169314.1	Copine-1 isoform X1	2.04
c82020_g4_i4	XP_005169315.1	Copine-1 isoform X2	4.13
c79785_g1_i7	XP_007250439.1	Copine-3-like isoform X1	7.97
c78794_g4_i1	XP_003445126.1	Copine-8-like isoform X1	5.95
c79985_g6_i2	XP_007241817.1	Copper chaperone for superoxide dismutase-like	3.36
c77691_g2_i3	XP_007256270.1	Core-binding factor subunit beta-like isoform X1	3.01
c78069_g1_i6	XP_005173773.1	Cortactin isoform X2	2.42
c72363_g1_i3	XP_007241786.1	Coxsackievirus and adenovirus receptor homolog, partial	2.58
c81248_g18_i7	XP_005163782.1	CREB-binding protein isoform X1	22.46
c83329_g5_i16	XP_005161827.1	CREB-binding protein isoform X2	19.65
c78698_g7_i6	XP_007233418.1	CREB-regulated transcription coactivator 2-like isoform X2	8.25
c76903_g1_i5	XP_698544.6	CREB-regulated transcription coactivator 3 isoform X2	8.08
c79468_g6_i1	AFP33464.1	Cryptochrome 1	3.14
c77384_g1_i3	AHA91700.1	Cryptochrome 1a	2.39
c80391_g5_i1	XP_007256204.1	CTTNBP2 N-terminal-like protein-like isoform X2	3.86
c79310_g5_i3	XP_001344010.4	C-type mannose receptor 2	6.91
c75736_g6_i6	XP_006641111.1	CUE domain-containing protein 1-like	5.71
c80629_g10_i10	XP_007244949.1	CUGBP Elav-like family member 1 isoform X6	6.32
c81332_g2_i11	XP_007258472.1	Cullin-3	3.82
c81332_g2_i1	XP_004075805.1	Cullin-3-like isoform 1	2.02
c81252_g2_i6	NP_001116316.1	Cullin-4B	5.92
c82928_g3_i5	XP_007247432.1	Cullin-9-like isoform X3	6.43
c82928_g3_i11	XP_007247433.1	Cullin-9-like isoform X4	4.64
c83488_g2_i1	XP_005464376.1	Cyclic AMP-dependent transcription factor ATF-6 beta-like	2.49
c77521_g17_i1	NP_001025376.1	Cyclic AMP-dependent transcription factor ATF-7	3.97
c80742_g13_i7	XP_007254302.1	Cyclic AMP-dependent transcription factor ATF-7-like	2.5
c77396_g5_i1	XP_007244981.1	Cyclic AMP-responsive element-binding protein 3-like	4.45
c81481_g4_i5	NP_001074120.1	Cyclic AMP-responsive element-binding protein 3-like protein 2	4.02

c81369_g11_i2	XP_007237099.1	Cyclin-dependent kinase 11B isoform X4	2.5
c79701_g13_i7	XP_007230849.1	Cyclin-dependent kinase 12 isoform X3	2.86
c79701_g13_i3	XP_007238721.1	Cyclin-dependent kinase 13	3.96
c79795_g7_i6	XP_003446245.1	Cyclin-dependent kinase 14-like isoform X1	3.46
c79795_g7_i5	XP_005472434.1	Cyclin-dependent kinase 14-like isoform X2	3.35
c80515_g2_i5	XP_001335575.1	Cyclin-dependent kinase 16 isoform X1	3.29
c76978_g10_i1	XP_007232322.1	Cyclin-dependent kinase 17 isoform X1	3.09
c83065_g4_i4	XP_007248446.1	Cyclin-dependent kinase 4	2.23
c81389_g4_i1	XP_005159752.1	Cyclin-dependent kinase 6 isoform X1	6.6
c78866_g3_i2	XP_007249065.1	Cyclin-dependent kinase 8 isoform X1	2.49
c76865_g1_i1	XP_007229906.1	Cyclin-dependent kinase inhibitor 1-like	2.81
c78561_g2_i2	XP_005459853.1	Cyclin-G-associated kinase isoform X2	5.64
c74673_g1_i3	XP_007242585.1	Cyclin-K-like	3.51
c79850_g5_i3	XP_007257141.1	Cyclin-T2-like isoform X1	4.09
c82892_g1_i5	XP_007238684.1	Cyclin-Y isoform X2	4.38
c75300_g3_i3	XP_003966607.1	Cystathionine beta-synthase-like	2.8
c74805_g3_i1	AGD94422.1	Cystatin-like protein	-2.48
c67377_g2_i2	XP_007250047.1	Cysteine string protein-like	2.67
c81380_g6_i2	XP_007253614.1	Cysteine/serine-rich nuclear protein 1-like	2.16
c77977_g1_i1	ACX31198.1	Cysteine-rich angiogenic inducer 61 protein-like protein 1	3.66
c81195_g1_i2	XP_007252627.1	Cysteine-rich motor neuron 1 protein-like	7.75
c83878_g10_i3	XP_007260148.1	Cysteine-rich secretory protein LCCL domain-containing	3.17
c81997_g5_i1	XP_001919426.1	Cystine/glutamate transporter-like	5.66
c81581_g10_i4	NP_956873.1	Cytochrome b-245, alpha polypeptide	2.72
c76480_g5_i2	NP_998041.1	Cytochrome b5 type B	3.81
c82422_g5_i2	BAN16583.1	Cytochrome P450 family 8 subfamily b polypeptide 1-1	-2.74
c82832_g5_i1	NP_001187243.1	Cytochrome P4501B	4.74
c79724_g3_i3	NP_999847.1	Cytohesin-1	3.35
c80772_g7_i11	XP_005171695.1	Cytohesin-1 isoform X2	2.64
c78059_g4_i3	AGW21650.1	Cytokine receptor family member B1	2.57
c74355_g3_i4	XP_005168017.1	Cytokine receptor family member b2 isoform X1	9.48
c78915_g3_i2	NP_001071095.1	Cytokine receptor family member b6 precursor	2.37
c78658_g12_i6	NP_001002650.1	Cytokine receptor-like factor 1 precursor	3.25
c79486_g11_i4	XP_007239956.1	Cytokine receptor-like factor 3-like isoform X1	2.46
c71792_g1_i3	XP_007240751.1	Cytokine-like protein 1	2.47

c75090_g2_i2	XP_007255248.1	Cytoplasmic aconitate hydratase-like isoform X1	2.94
c79772_g11_i7	XP_007258963.1	Cytoplasmic dynein 1 heavy chain 1 isoform X1	7.53
c79772_g11_i4	XP_007258964.1	Cytoplasmic dynein 1 heavy chain 1 isoform X2	9.35
c83679_g5_i4	XP_007249165.1	Cytoplasmic FMR1-interacting protein 1 homolog isoform X1	3.96
c73152_g4_i1	XP_005816338.1	Cytoplasmic FMR1-interacting protein 2-like, partial	6.96
c79470_g3_i6	XP_005157947.1	Cytoplasmic phosphatidylinositol transfer protein 1	-4.21
c80899_g3_i9	XP_006799105.1	Cytoplasmic polyadenylation element-binding protein 3-like	3.6
c80899_g3_i10	XP_006631741.1	Cytoplasmic polyadenylation element-binding protein 4-like	6.06
c78727_g12_i9	XP_007253821.1	Cytoplasmic protein NCK1 isoform X2	5.3
c81392_g2_i5	XP_005458429.1	Cytoskeleton-associated protein 5 isoform X3	4.81
c81392_g2_i6	XP_005458430.1	Cytoskeleton-associated protein 5 isoform X4	4.49
c82978_g1_i3	XP_007252985.1	Cytosolic 5'-nucleotidase 1A-like	2.12
c82978_g1_i4	XP_003971840.1	Cytosolic 5'-nucleotidase 1B-like	2.65
c80530_g2_i1	XP_005878286.1	Cytosolic purine 5'-nucleotidase isoform X4	3.11
c80562_g5_i12	XP_007233969.1	Cytospin-A-like isoform X2	2.79
c83788_g13_i1	XP_005163331.1	DCN1-like protein 1 isoform X1	2.08
c79814_g3_i5	XP_682800.2	DDB1- and CUL4-associated factor 15	7.74
c82335_g7_i3	XP_007247645.1	DDB1- and CUL4-associated factor 5	3.56
c77516_g4_i2	AGS58204.1	Death-associated protein 1-like protein	2.07
c82054_g1_i1	XP_007233045.1	Death-inducer obliterator 1-like	3.84
c80475_g1_i6	XP_007247762.1	Death-inducer obliterator 1-like isoform X4	2.24
c81816_g5_i2	XP_007259061.1	Decorin	5.83
c79009_g5_i3	XP_005804172.1	Dedicator of cytokinesis protein 10-like	6.69
c79009_g5_i11	XP_004543764.1	Dedicator of cytokinesis protein 10-like isoform X5	14.99
c82825_g5_i4	XP_007255815.1	Dedicator of cytokinesis protein 11 isoform X1	14.35
c81865_g7_i2	XP_006630472.1	Dedicator of cytokinesis protein 1-like	7.7
c80966_g9_i2	XP_007248255.1	Dedicator of cytokinesis protein 7 isoform X12	2.8
c80966_g9_i3	XP_007248265.1	Dedicator of cytokinesis protein 7 isoform X22	14.08
c80966_g3_i1	XP_007248252.1	Dedicator of cytokinesis protein 7 isoform X9	7.88
c83105_g11_i12	XP_007231916.1	Dedicator of cytokinesis protein 8-like isoform X1	4.01
c79463_g16_i1	NP_001093518.1	Dehydrogenase/reductase SDR family member 11	2.72
c78184_g8_i6	XP_007244826.1	Dehydrogenase/reductase SDR family member 13-like isoform	2
c84225_g1_i4	XP_003198303.2	Deleted in malignant brain tumors 1 protein	2.26
c84225_g1_i6	XP_007241462.1	Deleted in malignant brain tumors 1 protein-like	5.31

c81341_g11_i2	XP_007259272.1	Delta-1-pyrroline-5-carboxylate synthase isoform X3	2.59
c82462_g2_i6	XP_007260736.1	DENN domain-containing protein 3-like isoform X2	8.99
c77804_g11_i4	XP_007237802.1	DENN domain-containing protein 4B-like	3.47
c77125_g4_i4	XP_007255254.1	DENN domain-containing protein 4C isoform X1	8.87
c77125_g4_i2	XP_007255256.1	DENN domain-containing protein 4C isoform X3	2.25
c78071_g12_i1	XP_001340162.4	DENN domain-containing protein 5A isoform X1	2.27
c81467_g2_i1	XP_007255982.1	Dentin sialophosphoprotein-like isoform X6	6.67
c82308_g2_i10	NP_001153405.1	Deoxynucleoside triphosphate triphosphohydrolase SAMHD1	5.24
c79231_g1_i6	ACO09676.1	Deoxyribonuclease gamma precursor	-2.76
c78896_g7_i3	XP_003453027.2	Dermatan-sulfate epimerase isoform X1	2.82
c70253_g1_i1	XP_002713465.1	Desmocollin 2-like	-2.09
c83928_g1_i9	XP_005171176.1	Desmoglein-2	5.08
c83867_g7_i6	XP_001919901.3	Desmoplakin isoform X1	5.38
c80247_g1_i5	XP_005476418.1	Desmoplakin isoform X2	3.7
c80247_g1_i3	XP_007240950.1	Desmoplakin-like isoform X1	4.22
c76396_g7_i6	AAI24420.1	Dgcr8 protein	3.97
c82734_g1_i7	XP_005172375.1	Diacylglycerol kinase delta isoform X4	12.1
c79326_g12_i3	XP_007237988.1	Diacylglycerol kinase delta-like	3.16
c72314_g1_i1	XP_005751679.1	Diacylglycerol kinase delta-like isoform X1	3.85
c79724_g6_i1	XP_006629915.1	Diacylglycerol kinase theta-like	7.74
c83598_g1_i8	NP_956024.1	Diacylglycerol O-acyltransferase 1	4.18
c77423_g9_i1	XP_007247675.1	Digestive organ expansion factor	5.12
c82318_g9_i6	NP_997832.1	Dihydrolipoyllysine-residue acetyltransferase component of pyruvate	2.91
c77326_g3_i3	XP_007242179.1	Dihydropyrimidinase	3.5
c77563_g3_i3	NP_001018353.1	Dihydropyrimidinase-related protein 2	2.35
c78033_g21_i1	CBN80722.1	Diphosphoinositol polyphosphate phosphohydrolase 1	4.28
c77143_g6_i8	XP_007257219.1	Disabled homolog 2-interacting protein-like	3.98
c78258_g3_i2	XP_693702.4	Discoidin domain-containing receptor 2	4.66
c78258_g4_i1	XP_007258427.1	Discoidin domain-containing receptor 2 isoform X1	10.72
c78258_g4_i4	XP_007258428.1	Discoidin domain-containing receptor 2 isoform X2	3.69
c78993_g3_i9	NP_998128.1	Disco-interacting protein 2 homolog B-A	5.76
c78097_g10_i1	XP_007257956.1	Disco-interacting protein 2 homolog B-A-like	3.11
c78993_g3_i7	XP_007254300.1	Disco-interacting protein 2 homolog B-A-like isoform X4	3.58
c75716_g15_i1	XP_005171457.1	Disco-interacting protein 2 homolog C isoform X1	6.43
c75716_g13_i4	XP_007233709.1	Disco-interacting protein 2 homolog C-like	5.8

c82905_g9_i5	XP_005163731.1	Discs, large (Drosophila) homolog 1, like isoform X8	2.5
c79056_g6_i3	XP_005158712.1	Disheveled-associated activator of morphogenesis 1 isoform	8.35
c81052_g5_i1	XP_005934030.1	Disheveled-associated activator of morphogenesis 2-like	6.47
c75507_g3_i1	CBN81565.1	Disintegrin and metalloproteinase domain-containing protein 12	5.2
c77471_g6_i1	XP_003458982.1	Disks large homolog 1-like isoformX3	4.49
c78543_g1_i2	XP_005156739.1	Disks large homolog 5 isoform X2	2.65
c75813_g11_i5	XP_697562.6	Disks large-associated protein 4 isoform X4	3.17
c76493_g1_i4	XP_007254267.1	Dixin-like isoform X2	4.84
c83274_g6_i6	XP_007260867.1	DmX-like protein 1	23.22
c75824_g22_i4	XP_007260514.1	DNA (cytosine-5)-methyltransferase 3A-like isoform X1	8.92
c75824_g19_i2	XP_007260517.1	DNA (cytosine-5)-methyltransferase 3A-like isoform X4	4.09
c77806_g15_i3	XP_005926028.1	DNA (cytosine-5)-methyltransferase 3A-like isoform X5	8.1
c75878_g5_i4	XP_007231584.1	DNA helicase INO80	3.34
c79039_g12_i5	XP_004078727.1	DNA ligase 1-like	3.55
c80268_g5_i6	NP_001003879.1	DNA polymerase beta	2.21
c77176_g1_i5	XP_696859.4	DNA repair protein RAD50 isoform X3	6.39
c79270_g1_i8	XP_004545896.1	DNA replication licensing factor mcm7-like isoform X2	-2.73
c76260_g10_i4	NP_001038656.1	DNA topoisomerase 2-beta	2.26
c77610_g1_i2	XP_007229495.1	DNA topoisomerase 3-beta-1-like	-3.64
c79032_g1_i2	XP_007244415.1	DNA-binding protein RFX7-like	4.17
c79208_g17_i3	XP_007227823.1	DNA-binding protein SATB2 isoform X3	6.75
c79527_g1_i4	XP_001922839.2	DNA-directed RNA polymerase I subunit RPA1	2.67
c76152_g4_i4	ACO08926.1	DNA-directed RNA polymerase II 23 kDa polypeptide	2.5
c81047_g2_i4	XP_005808344.1	DNA-directed RNA polymerase II subunit RPB9-like	-2.05
c81854_g2_i6	XP_006630330.1	DNA-directed RNA polymerase III subunit RPC1-like	3.96
c75757_g5_i1	XP_007254762.1	DNA-directed RNA polymerase III subunit RPC7-like	3.95
c75877_g4_i2	XP_007249524.1	DNA-directed RNA polymerases I and III subunit RPAC1-like	2.97
c71632_g1_i3	NP_001003571.1	DnaJ (Hsp40) homolog, subfamily B, member 1a	3.31
c79139_g3_i2	XP_007230450.1	DnaJ homolog subfamily A member 2	2.16
c84232_g1_i5	XP_007246902.1	DnaJ homolog subfamily C member 11-like	2.69
c83518_g1_i14	XP_004551997.1	DnaJ homolog subfamily C member 13-like isoform X1	2.25
c78692_g3_i5	XP_007248370.1	DnaJ homolog subfamily C member 14-like	2.66

c75467_g1_i8	XP_005163930.1	DnaJ homolog subfamily C member 7 isoform X1	2.03
c79139_g3_i3	NP_998658.1	DnaJ subfamily A member 2	3.63
c74628_g2_i2	XP_001341514.5	Docking protein 1 isoform X1	7.68
c78458_g9_i1	XP_007229549.1	Docking protein 1-like isoform X1	2.79
c77382_g3_i6	XP_697365.2	Docking protein 4-like	2.5
c73535_g3_i1	ACN10979.1	Dolichyl-diphosphooligosaccharide--protein glycosyltransferase	2.28
c74584_g2_i4	ABD77516.1	Dolichyl-di-phosphooligosaccharide-protein glycotransferase	-7.2
c71973_g1_i3	XP_007235585.1	Doublesex- and mab-3-related transcription factor A2-like	-2.5
c81915_g5_i7	XP_007253438.1	Double-stranded RNA-binding protein Staufen homolog 1-like	2.34
c81915_g5_i3	XP_007260160.1	Double-stranded RNA-binding protein Staufen homolog 2	4.25
c82321_g6_i6	XP_007255997.1	Double-stranded RNA-specific adenosine deaminase-like	2.79
c79938_g11_i3	XP_007244491.1	Drebrin isoform X1	2.51
c82297_g9_i6	XP_007258380.1	Drebrin-like protein A-like isoform X1	2.42
c83398_g22_i2	XP_007249219.1	Dual specificity mitogen-activated protein kinase kinase 1	2.59
c83611_g4_i2	XP_007240773.1	Dual specificity protein phosphatase 1	2.52
c70826_g2_i1	XP_007259199.1	Dual specificity protein phosphatase 3	4.4
c77262_g1_i1	XP_005163056.1	Dual specificity protein phosphatase 6 isoform X1	2.99
c77262_g2_i1	XP_004086284.1	Dual specificity protein phosphatase 6-like	2.51
c82919_g3_i2	NP_956068.2	Dual specificity protein phosphatase 7	2.14
c79253_g6_i1	XP_005161773.1	Dual specificity protein phosphatase CDC14A isoform X2	3.35
c79103_g3_i2	NP_998407.1	Dynamin-2	2.71
c84270_g5_i11	XP_005164298.1	Dynamin-2 isoform X1	2.75
c84270_g5_i9	XP_005164300.1	Dynamin-2 isoform X3	2.69
c79103_g3_i7	XP_004066368.1	Dynamin-2-like isoform 3	5.45
c79103_g3_i16	XP_005468739.1	Dynamin-2-like isoform X5	5.43
c79141_g6_i2	XP_007249131.1	Dynamin-like 120 kDa protein, mitochondrial isoform X5	3.89
c77577_g13_i3	AAI54269.1	Dynein, cytoplasmic 1, light intermediate chain 2	3.8
c78472_g2_i2	XP_005172350.1	Dysferlin isoform X3	15.8
c83976_g5_i19	XP_002664120.3	Dystonin	3.44
c83762_g12_i3	XP_003449930.1	Dystrophin isoform X1	6.62
c83109_g6_i11	XP_005454705.1	Dystrophin isoform X5	7.46
c83498_g6_i17	XP_007240819.1	Dystrophin-like isoform X3	4.6

c78820_g5_i1	ACA48503.1	E1A binding protein p300, partial	4.3
c77761_g2_i5	NP_001187227.1	E2A-1 transcription factor	4.85
c84071_g4_i12	XP_007249207.1	E3 SUMO-protein ligase PIAS1-like isoform X1	4.11
c81315_g4_i1	XP_007249229.1	E3 ubiquitin-protein ligase arih1-like	2.01
c79442_g11_i3	XP_001922708.2	E3 ubiquitin-protein ligase Arkadia isoform X1	2.91
c79442_g11_i1	XP_005168982.1	E3 ubiquitin-protein ligase Arkadia isoform X4	4.69
c78522_g4_i2	NP_001007331.1	E3 ubiquitin-protein ligase CBL	6.88
c82320_g14_i1	XP_001921961.4	E3 ubiquitin-protein ligase CBL-B	4.9
c79612_g2_i1	XP_002758781.1	E3 ubiquitin-protein ligase DTX3L	-2.61
c78363_g4_i3	XP_007248609.1	E3 ubiquitin-protein ligase DTX4-like isoform X1	3.67
c81580_g6_i1	XP_005456015.1	E3 ubiquitin-protein ligase HECTD1 isoform X4	5.74
c81580_g6_i19	XP_007257971.1	E3 ubiquitin-protein ligase HECTD1 isoform X6	12.58
c84094_g3_i7	XP_007249200.1	E3 ubiquitin-protein ligase HERC2-like	3.66
c78468_g10_i13	XP_007246832.1	E3 ubiquitin-protein ligase HUWE1 isoform X3	4.73
c83212_g5_i3	XP_007246836.1	E3 ubiquitin-protein ligase HUWE1 isoform X7	27.55
c79026_g5_i1	BAO04456.1	E3 ubiquitin-protein ligase Itchy-a	4.69
c80273_g2_i3	XP_007257100.1	E3 ubiquitin-protein ligase LNX isoform X1	3.41
c84124_g4_i11	XP_007252712.1	E3 ubiquitin-protein ligase MARCH2	2.36
c82649_g6_i4	XP_003197917.1	E3 ubiquitin-protein ligase MARCH6 isoformX2	3.6
c81278_g1_i6	NP_775393.2	E3 ubiquitin-protein ligase mib1	3.44
c76102_g14_i6	XP_007244686.1	E3 ubiquitin-protein ligase pellino homolog 1-like isoform	5.59
c78066_g1_i7	XP_005003925.1	E3 ubiquitin-protein ligase RBX1 isoform X2	-2.02
c82852_g6_i1	XP_007257793.1	E3 ubiquitin-protein ligase RNF139-like	2.41
c81840_g2_i5	XP_007236842.1	E3 ubiquitin-protein ligase RNF169-like	3.4
c81044_g14_i3	XP_007231443.1	E3 ubiquitin-protein ligase RNF170-like	4.47
c75753_g7_i4	XP_007230877.1	E3 ubiquitin-protein ligase RNF19A	2.02
c82087_g4_i3	XP_001921030.4	E3 ubiquitin-protein ligase RNF213	6.26
c81152_g1_i1	XP_004559460.1	E3 ubiquitin-protein ligase RNF213-like isoform X1	22.61
c81973_g2_i3	XP_007229370.1	E3 ubiquitin-protein ligase RNF220-like isoform X6	3.15
c81486_g7_i9	XP_004573002.1	E3 ubiquitin-protein ligase RNF31-like	2.13
c74974_g6_i4	XP_004074979.1	E3 ubiquitin-protein ligase RNF34-like	-2.67
c79444_g6_i4	XP_007235822.1	E3 ubiquitin-protein ligase RNF5-like	2.79
c74304_g1_i4	XP_007258650.1	E3 ubiquitin-protein ligase SH3RF1-like	3.79
c78425_g3_i2	XP_007252193.1	E3 ubiquitin-protein ligase SMURF2 isoform X1	5.29
c75789_g3_i2	XP_005468522.1	E3 ubiquitin-protein ligase SMURF2-like isoform X1	7.54

c74425_g2_i1	XP_007251497.1	E3 ubiquitin-protein ligase TRIM62-like isoform X1	6.92
c84366_g2_i1	XP_007251679.1	E3 ubiquitin-protein ligase TRIP12-like isoform X1	5.72
c84170_g1_i2	XP_007247459.1	E3 ubiquitin-protein ligase UBR2 isoform X2	3.75
c81265_g2_i1	XP_005162253.1	E3 ubiquitin-protein ligase UBR4 isoform X7	16.58
c81265_g2_i2	XP_005162255.1	E3 ubiquitin-protein ligase UBR4 isoform X9	24.11
c81265_g1_i1	XP_007246402.1	E3 ubiquitin-protein ligase UBR4-like isoform X11	62.42
c81265_g1_i2	XP_007246396.1	E3 ubiquitin-protein ligase UBR4-like isoform X5	36.41
c81153_g10_i6	XP_005306097.1	E3 ubiquitin-protein ligase UBR5 isoform X6	2.89
c76317_g10_i7	XP_007230670.1	E3 ubiquitin-protein ligase UHRF2-like	5.91
c79648_g8_i9	XP_007250620.1	Early endosome antigen 1 isoform X5	5.8
c79785_g3_i1	XP_005158926.1	Early growth response 2a isoform X1	5.24
c81722_g2_i2	XP_007235544.1	Early growth response protein 3 isoform X2	9.92
c84086_g3_i3	NP_001187011.1	EB1	2.1
c80447_g7_i1	NP_001180527.1	Echinoderm microtubule-associated protein-like 1	3.24
c73428_g1_i5	XP_007239695.1	Echinoderm microtubule-associated protein-like 4-like	2.27
c77977_g7_i4	XP_007233678.1	Ecotropic viral integration site 5 protein-like isoform X3	3.06
c75824_g17_i4	XP_007254657.1	EF-hand calcium-binding domain-containing protein 14-like	2.15
c77974_g10_i1	CAP71948.1	Efnb1	3.15
c78169_g6_i1	AAH95605.1	Efnb3 protein	4.94
c78674_g1_i4	XP_005171094.1	EGF-like module-containing mucin-like hormone	2.5
c77913_g6_i3	AAH76001.1	Egl nine homolog 1 (C. elegans)	4.03
c77263_g4_i1	AAK40312.1	Egr-1	3.21
c84314_g2_i1	NP_001004578.1	EH domain-containing protein 1	2.52
c82995_g1_i3	NP_956357.1	EH domain-containing protein 2	2.47
c77230_g3_i4	XP_005171323.1	ELAV (embryonic lethal, abnormal vision, Drosophila)-like	3.28
c79194_g4_i9	XP_007240261.1	ELAV-like protein 1-like isoform X3	3.88
c80420_g5_i1	AAH97084.1	Elk4 protein	7.68
c81086_g5_i2	XP_005814230.1	Elongation factor G, mitochondrial-like	3.13
c77683_g6_i5	NP_001188041.1	Elongation of very long chain fatty acids protein 5	4.59
c80399_g6_i3	XP_007250351.1	Elongation of very long chain fatty acids protein 7	2.53
c82376_g1_i15	XP_007230084.1	Embigin	2.99
c75875_g1_i5	XP_007256487.1	Embryonic stem cell-specific	-2.4
c81050_g6_i2	XP_007249944.1	Emerin-like isoform X1	2.06
c79257_g15_i4	XP_007245414.1	EMILIN-1-like, partial	12.36
c76199_g4_i3	ADO27819.1	Endophilin-a2	2.55

c82932_g8_i5	ADO27938.1	Endophilin-b1	2.04
c75643_g3_i1	XP_007230882.1	Endoplasmic reticulum mannosyl-oligosaccharide	3.07
c76285_g16_i4	XP_003965609.1	Endoplasmic reticulum metallopeptidase 1-like	4.29
c74986_g12_i2	XP_007231181.1	Endothelial cell-selective adhesion molecule-like	4.34
c80660_g3_i6	XP_695262.6	Endothelial PAS domain-containing protein 1 isoform X2	6.57
c82023_g1_i2	XP_007235715.1	Endothelial PAS domain-containing protein 1-like	2.48
c77765_g7_i5	BAB64335.1	Endothelin receptor A	2.85
c77765_g7_i2	AAI62564.1	Endothelin receptor type A	3.16
c81565_g4_i10	NP_001071260.1	Endothelin-converting enzyme 1	2.34
c77424_g7_i3	XP_007258922.1	Engulfment and cell motility protein 1-like isoform X4	2.63
c77424_g7_i8	XP_007258923.1	Engulfment and cell motility protein 1-like isoform X5	2.04
c79198_g1_i7	XP_005935840.1	Engulfment and cell motility protein 3-like isoform X1	5.52
c82135_g7_i3	XP_001373701.1	Enhancer of mRNA-decapping protein 4 isoform X1	3.05
c80307_g17_i7	XP_007259737.1	Enhancer of polycomb homolog 1 isoform X2	2.84
c81514_g19_i2	XP_005164197.1	Enhancer of zeste 1 isoform X1	3.53
c78884_g8_i21	XP_007238974.1	Ensconsin-like isoform X2	3.77
c81615_g3_i2	XP_007239199.1	Envoplakin-like	2.3
c81775_g9_i3	NP_571489.1	Eph receptor B4a precursor	7.06
c80981_g2_i4	XP_007253452.1	Ephrin type-A receptor 2-like	6.71
c81775_g8_i5	XP_007234186.1	Ephrin type-B receptor 4-like	2.79
c79452_g9_i1	XP_007256796.1	Ephrin-A5-like	2.8
c83835_g3_i1	XP_007250643.1	Ephrin-B2a-like	4.02
c78169_g15_i1	XP_003966872.1	Ephrin-B2-like	4.77
c70261_g1_i1	AGS58214.1	Epidermal differentiation-specific protein, partial	6.38
c78398_g2_i6	AAI63725.1	Epidermal growth factor receptor	5.53
c79395_g5_i5	XP_002663145.3	Epidermal growth factor receptor substrate 15 isoform X1	2.27
c77064_g4_i10	XP_007240310.1	Epidermal growth factor receptor substrate 15-like 1-like	11.02
c81668_g1_i1	XP_005170141.1	Epiplakin-like	3.99
c77426_g3_i3	ABD65556.1	Epithelial cadherin 1-like	3.65
c83961_g1_i8	XP_007255956.1	Epithelial discoidin domain-containing receptor 1-like	8.6
c78100_g8_i3	XP_007236574.1	Epithelial splicing regulatory protein 1 isoform X1	4
c78646_g5_i2	XP_007246955.1	Epithelial splicing regulatory protein 2-like isoform X2	9.43
c77123_g4_i1	XP_005157943.1	Epsin 1 isoform X2	3.44
c76290_g4_i1	XP_007247914.1	Epsin-2 isoform X1	5.49

c75533_g5_i2	XP_005166083.1	ER degradation enhancer, mannosidase alpha-like 1 isoform	2.3
c78413_g2_i2	XP_007251508.1	ERBB receptor feedback inhibitor 1-like	2.75
c75783_g2_i6	XP_005165758.1	ErbB-3a isoform X1	2.56
c83622_g4_i8	XP_005162227.1	ErbB-3b isoform X1	2.55
c83622_g4_i4	NP_001014826.1	ErbB-3b precursor	2.66
c77671_g6_i2	XP_007248637.1	Erlin-1-like	2.18
c76923_g1_i4	XP_007246193.1	ERO1-like protein beta isoform X1	4.92
c80493_g4_i1	NP_571833.1	Erythrocyte band 7 integral membrane protein	2.09
c82508_g3_i1	XP_002665683.3	Erythrocyte membrane protein band 4.1-like 2	4.01
c79129_g1_i6	XP_007244314.1	Estradiol 17-beta-dehydrogenase 12-A-like isoform X1	2.08
c79738_g5_i4	NP_001187003.1	Estrogen receptor	3.49
c83825_g4_i1	XP_007244584.1	Estrogen-related receptor gamma-like isoform X1	4.62
c81698_g7_i6	XP_007251461.1	Ethanolamine kinase 1-like	6.39
c81680_g3_i3	XP_007236102.1	Ethanolamine-phosphate cytidylyltransferase-like,	3.12
c81568_g16_i1	XP_005164599.1	ETS domain-containing protein Elk-3 isoform X1	3.12
c83423_g4_i1	XP_007245910.1	ETS domain-containing protein Elk-3-like	6.16
c83366_g4_i5	XP_007254866.1	ETS-related transcription factor Elf-1-like	3.2
c74689_g1_i3	AGS58216.1	ETS-related transcription factor, partial	4.51
c75469_g8_i4	NP_001187588.1	Eukaryotic initiation factor 4a-i	2.47
c77757_g3_i4	XP_003444613.1	Eukaryotic peptide chain release factor subunit 1-like	2.24
c78756_g9_i7	XP_005916972.1	Eukaryotic translation initiation factor 2-alpha kinase	2.87
c81629_g1_i6	XP_001350534.1	Eukaryotic translation initiation factor 3 subunit 10, putative	4.13
c77215_g2_i2	XP_007238562.1	Eukaryotic translation initiation factor 3 subunit L-like	2.48
c82118_g6_i4	XP_007247727.1	Eukaryotic translation initiation factor 4 gamma 1-like	7.7
c79871_g4_i10	XP_007249319.1	Eukaryotic translation initiation factor 4 gamma 2-like	4.59
c79871_g5_i1	XP_005166672.1	Eukaryotic translation initiation factor 4, gamma 2a	3.57
c79580_g2_i2	XP_007234185.1	Eukaryotic translation initiation factor 4E type 2-like	-2.08
c77757_g3_i6	ACH85334.1	Eukaryotic translation termination factor 1-like	3.84
c82151_g8_i9	XP_007258235.1	Exocyst complex component 2 isoform X1	2.25
c83427_g7_i1	NP_997880.1	Exocyst complex component 3	2.13
c76019_g4_i2	NP_001025305.1	Exocyst complex component 4	2.73
c83441_g2_i3	XP_007252554.1	Exocyst complex component 5	3.29
c83309_g1_i4	XP_007255171.1	Exocyst complex component 6 isoform X3	3.1
c79327_g2_i6	XP_007248158.1	Exocyst complex component 6B isoform X2	2.93
c77689_g8_i17	XP_003448678.1	Exocyst complex component 7 isoformX4	2.11

c77689_g8_i2	XP_003961112.1	Exocyst complex component 7-like isoform 3	5.92
c83035_g1_i8	XP_007248020.1	Exosome component 10	4.8
c82925_g16_i5	XP_007233780.1	Exostosin-1a-like isoform X1	3.85
c82852_g3_i5	XP_004549004.1	Exostosin-1b-like	5.48
c79939_g5_i4	NP_001008400.1	Exostosin-2	2.15
c81371_g7_i2	XP_007255532.1	Exostosin-like 3 isoform X1	4.38
c83563_g12_i4	XP_007260671.1	Exportin-1	3.2
c79605_g6_i2	XP_004554652.1	Exportin-1-like isoform X1	3.01
c81900_g4_i6	NP_919355.1	Exportin-6	8.26
c81700_g7_i1	XP_007235114.1	Exportin-T-like	2.28
c82765_g7_i5	XP_699731.6	Extended synaptotagmin-1	10.16
c81687_g11_i7	XP_007232231.1	Extended synaptotagmin-2-A isoform X4	2.24
c78210_g9_i1	BAD23843.1	Extracellular signal regulated protein kinase 2	2.48
c81969_g3_i2	XP_007253630.1	Extracellular sulfatase Sulf-1	4.41
c81969_g3_i10	XP_003968027.1	Extracellular sulfatase Sulf-1-like	6.94
c81753_g1_i4	XP_005162041.1	Extracellular sulfatase Sulf-2 isoform X1	15.22
c81294_g7_i8	XP_007252752.1	Eyes absent homolog 2-like	3.89
c79984_g5_i2	NP_001091053.1	FACT complex subunit SPT16	2.12
c79849_g2_i5	XP_686077.3	Family with sequence similarity 120C	8.24
c78405_g10_i5	XP_007243241.1	Far upstream element-binding protein 1-like isoform X6	4.15
c78532_g1_i9	XP_007229619.1	Far upstream element-binding protein 2-like	2.54
c78097_g1_i3	NP_001007777.1	Far upstream element-binding protein 3	3.12
c82155_g5_i2	NP_001074029.1	Farnesyltransferase, CAAX box, alpha	2.16
c75726_g3_i1	NP_001164290.1	Fas-activated serine/threonine kinase	10.86
c81290_g2_i2	XP_007247867.1	Fascin-like	2.65
c81039_g11_i1	XP_007238884.1	Fat storage-inducing transmembrane protein 2	2.38
c77207_g1_i5	XP_007235649.1	Fatty acyl-CoA reductase 1-like	2.29
c78512_g9_i1	XP_007228394.1	Fatty acyl-CoA reductase 1-like isoform X1	4.48
c79053_g10_i6	XP_007238508.1	F-box only protein 11-like	6.3
c80673_g4_i3	XP_007251481.1	F-box only protein 2-like	2.37
c81828_g3_i3	NP_001035397.1	F-box only protein 8	2.43
c78878_g9_i3	XP_007230830.1	F-box/LRR-repeat protein 19-like isoform X1	2.26
c80166_g3_i7	XP_002664757.2	F-box/LRR-repeat protein 20-like isoformX1	2.58
c80433_g7_i5	XP_007237549.1	F-box/LRR-repeat protein 5-like	2.42
c82622_g12_i3	XP_007228057.1	F-box/WD repeat-containing protein 11-like isoform X2	2.09

c74857_g1_i3	XP_002661149.1	F-box/WD repeat-containing protein 9	6.96
c79054_g14_i1	XP_006627869.1	FCH and double SH3 domains protein 2-like	5.13
c75393_g2_i5	XP_001922658.2	FERM, RhoGEF and pleckstrin domain-containing protein 2	2.97
c77391_g4_i6	XP_007257467.1	Fermitin family homolog 2 isoform X4	2.56
c77721_g2_i1	CAM60064.1	Fgfr1	3.14
c82981_g9_i1	XP_005169063.1	FH1/FH2 domain-containing protein 1 isoform X2	6.87
c79428_g13_i1	XP_003456833.1	Fibrillin-1 isoform X1	-3.22
c79428_g13_i2	XP_006628762.1	Fibrillin-1-like	2.13
c74900_g12_i1	NP_001129262.1	Fibrillin-2 precursor	10.68
c81950_g3_i1	NP_001009564.2	Fibroblast growth factor 23 precursor	2.88
c77976_g11_i1	XP_006629228.1	Fibroblast growth factor 2-like	3.28
c80308_g6_i5	XP_007235295.1	Fibroblast growth factor receptor 1-A-like isoform X2	2.63
c80308_g6_i4	XP_007235296.1	Fibroblast growth factor receptor 1-A-like isoform X3	4.1
c84177_g1_i15	XP_007228823.1	Fibroblast growth factor receptor 2 isoform X3	3.18
c82940_g11_i8	XP_007230954.1	Fibroblast growth factor receptor 3 isoform X4	23.41
c82940_g2_i2	XP_007230955.1	Fibroblast growth factor receptor 3 isoform X5	8.71
c84233_g5_i9	BAF42760.1	Fibronectin	4
c84233_g5_i3	AAU14809.1	Fibronectin 1b	2.16
c80599_g1_i7	XP_007260924.1	Fibronectin type III domain-containing protein 1 isoform	5.6
c76568_g3_i6	XP_002666718.1	Fibronectin type III domain-containing protein 3B	2.6
c76568_g3_i3	XP_007232744.1	Fibronectin type III domain-containing protein 3B-like	13.11
c79826_g17_i6	XP_007236779.1	Fibronectin type-III domain-containing protein 3a isoform	7.05
c73322_g1_i1	XP_007231654.1	Fibulin-1-like	2.23
c82732_g3_i3	XP_005169394.1	Fibulin-2 isoform X2	6.18
c77486_g1_i3	XP_006631180.1	Fibulin-2-like	6.2
c76925_g1_i4	NP_001005979.1	Fibulin-5 precursor	-3.58
c78050_g1_i14	NP_001092114.1	FIg-Hepta protein	10.92
c79677_g1_i12	XP_007249947.1	Filamin-A-like isoform X1	7.81
c83521_g1_i13	XP_007249949.1	Filamin-A-like isoform X3	2.63
c79677_g1_i11	XP_007249950.1	Filamin-A-like isoform X4	7.41
c80389_g1_i1	XP_001919520.4	Filamin-B	10.52
c79505_g4_i2	XP_007256801.1	Filamin-binding LIM protein 1, partial	3.09
c79836_g2_i3	XP_007251592.1	Filamin-B-like	13.81
c79836_g2_i4	XP_006631014.1	Filamin-B-like isoform X3	6.56
c79677_g1_i4	XP_698846.6	Filamin-C, partial	5.38

c79677_g1_i8	XP_005475780.1	Filamin-C-like isoform X3	47.61
c76626_g2_i1	XP_004550909.1	Flotillin-1-like	2.54
c81522_g2_i1	XP_005165320.1	Flotillin-2a isoform X1	13.15
c77297_g3_i2	AAI62574.1	Fn1 protein	9.55
c78665_g11_i1	XP_007233993.1	Folliculin-interacting protein 1-like isoform X1	5.67
c80979_g6_i4	AAS88750.1	Follistatin	2.03
c77046_g14_i2	XP_007233130.1	Follistatin-related protein 1 isoform X1	2.71
c79955_g11_i4	XP_001922273.1	Forkhead box protein J3	9.39
c80212_g10_i1	XP_007247881.1	Forkhead box protein K1 isoform X2	2.35
c73915_g3_i1	XP_007257258.1	Forkhead box protein K2-like isoform X2	2.28
c78732_g9_i3	XP_005156261.1	Forkhead box protein N2 isoform X1	2.11
c81258_g9_i1	XP_007236771.1	Forkhead box protein O1-A-like isoform X1	4.83
c77692_g12_i1	AGS58227.1	Forkhead box protein O3	4.89
c78559_g12_i1	XP_007258711.1	Forkhead box protein O6-like isoform X1	2.45
c82284_g2_i6	XP_007247814.1	Forkhead box protein P4-like	8.94
c80858_g4_i6	NP_001003634.1	Formin-binding protein 1-like	4.07
c81037_g12_i17	XP_005161060.1	Formin-binding protein 1-like isoform X4	4.7
c81616_g4_i3	XP_007246638.1	Formin-binding protein 4 isoform X1	2.33
c78436_g9_i2	XP_001920583.2	Formin-like 3 isoform X1	2.29
c82095_g6_i1	XP_005162275.1	Formin-like 3 isoform X5	6.15
c77869_g3_i6	XP_007230012.1	Formin-like protein 1-like isoform X1	3.78
c81547_g9_i3	XP_007253552.1	Formin-like protein 2-like isoform X2	2.01
c81547_g12_i2	XP_007253553.1	Formin-like protein 2-like isoform X3	5.98
c74317_g1_i1	XP_007232442.1	Formin-like protein 5-like	2.38
c83816_g1_i2	XP_007248508.1	Fos-related antigen 2-like isoform X2	2.17
c75491_g11_i4	NP_001187902.1	Four and a half LIM domains protein 3	3.43
c81830_g7_i1	XP_003968645.1	Foxhead box protein O1-A-like isoform 1	4.7
c82666_g6_i4	XP_007256836.1	Fragile X mental retardation syndrome-related protein 1	2.05
c82848_g7_i3	XP_005157693.1	Fras1 related extracellular matrix protein 2b isoform X1	11.6
c82354_g1_i1	ADI46635.1	Fraser syndrome protein 1	8.44
c83157_g2_i1	XP_005808957.1	Friend leukemia integration 1 transcription factor-like	2.45
c76693_g7_i1	XP_007234790.1	Frizzled-6-like	3.98
c79590_g9_i1	NP_001038571.1	Furin A precursor	2.55
c82998_g10_i9	XP_003197998.1	FYVE and coiled-coil domain-containing protein 1-like	5.53

c78124_g10_i4	XP_007243217.1	FYVE and coiled-coil domain-containing protein 1-like,	6.45
c82023_g2_i2	XP_007228777.1	FYVE, RhoGEF and PH domain-containing protein 5-like	3.73
c78950_g1_i1	XP_005468876.1	G patch domain-containing protein 8-like isoform X1	21.1
c84039_g3_i8	XP_005166446.1	G protein-coupled receptor 56 isoform X1	2.34
c78654_g6_i4	XP_007244489.1	G protein-coupled receptor kinase 6	2.49
c77138_g2_i2	NP_001073657.1	G protein-coupled receptor kinase interacting ArfGAP 2	3.07
c81885_g8_i4	NP_001003992.1	G1 to S phase transition 1	2.09
c61710_g1_i1	XP_007250305.1	Galactosylceramide sulfotransferase-like	2.96
c78285_g4_i1	XP_005173755.1	Galectin-4 like	121.89
c78285_g2_i4	XP_007242701.1	Galectin-4-like, partial	11.67
c83182_g4_i3	XP_007255488.1	Galectin-8-like isoform X1	2.1
c78148_g12_i7	XP_007260744.1	Gamma-glutamylcyclotransferase	2.54
c83647_g2_i8	NP_001116770.1	Gamma-glutamyltransferase 5	2.41
c82528_g7_i5	XP_007255093.1	Gamma-glutamyltransferase 5-like	2.73
c77347_g5_i5	XP_006796372.1	Gamma-glutamyltransferase 7-like isoform X1	3.45
c82648_g22_i1	XP_007257626.1	Gap junction beta-4 protein-like	4.38
c83034_g10_i5	XP_005450300.1	GATA-binding factor 2-like isoform X4	2.99
c83322_g10_i1	ADJ94947.2	GDNF family receptor alpha-1a	4.97
c75803_g4_i2	NP_001095945.1	GDP-mannose 4,6 dehydratase isoform 1	2.85
c80515_g7_i3	ACN60223.1	Gelsolin precursor	-3.79
c81531_g3_i2	XP_007254015.1	Gelsolin-like	2
c78783_g8_i2	CAK05004.1	Geminin, DNA replication inhibitor	-2.23
c79504_g3_i3	XP_006787123.1	General vesicular transport factor p115-like isoform X1	2.4
c77483_g11_i13	XP_007244066.1	Genetic suppressor element 1 isoform X5	3.06
c82152_g7_i8	XP_007228224.1	Genetic suppressor element 1-like isoform X1	4.13
c82656_g3_i1	XP_007260851.1	Geranylgeranyl transferase type-1 subunit beta	2.1
c81151_g3_i3	XP_007260035.1	Germinal-center associated nuclear protein isoform X1	2.51
c80740_g12_i7	XP_005474410.1	Girdin isoform X2	4.15
c77595_g20_i2	NP_001187736.1	Glia maturation factor beta	2.33
c78470_g3_i3	XP_007235721.1	Glioma tumor suppressor candidate region gene 1	8.63
c83510_g10_i6	XP_007259367.1	GLTSCR1-like protein isoform X1	4.92
c79584_g2_i3	AAS93685.1	Glucagon receptor precursor	3.45
c80677_g3_i2	XP_007247079.1	Glucocorticoid receptor isoform X1	6.25
c77218_g5_i9	XP_684147.2	Glucosamine-6-phosphate isomerase 2-like	2.19

c83942_g7_i2	XP_007240503.1	Glucosidase 2 subunit beta	2.72
c78099_g3_i1	NP_001103670.1	Glucoside xylosyltransferase 2 precursor	4.46
c75210_g3_i1	XP_007258824.1	Glutamate dehydrogenase 1, mitochondrial-like	2.23
c83604_g4_i2	NP_955839.2	Glutamate dehydrogenase 1b	2.03
c80567_g6_i7	XP_007240117.1	Glutamate--cysteine ligase catalytic subunit	2.03
c83580_g5_i9	XP_005167956.1	Glutaminase kidney isoform, mitochondrial isoform X1	4.62
c83580_g5_i3	XP_005167957.1	Glutaminase kidney isoform, mitochondrial isoform X2	17.79
c75095_g5_i2	XP_007234822.1	Glutamine--fructose-6-phosphate aminotransferase	2.69
c78661_g2_i5	XP_004562970.1	Glutaryl-CoA dehydrogenase, mitochondrial-like	-2.63
c80258_g2_i3	XP_004070335.1	Glutathione synthetase-like isoform 2	3.39
c72793_g1_i1	XP_007244351.1	Glutenin, high molecular weight subunit PW212-like	6.03
c73358_g2_i4	ADO28487.1	Glyceraldehyde-3-phosphate dehydrogenase	-2.25
c79088_g1_i5	XP_002664023.2	Glycerol-3-phosphate acyltransferase 1, mitochondrial	2.63
c72605_g1_i1	NP_001035339.2	Glycerol-3-phosphate acyltransferase 4	2.18
c79510_g17_i7	XP_005165897.1	Glycerol-3-phosphate dehydrogenase, mitochondrial isoform	6.47
c79015_g4_i7	XP_007229763.1	Glycerophosphocholine phosphodiesterase GPCPD1	2.31
c77389_g9_i1	NP_001004118.1	Glycerophosphodiester phosphodiesterase domain-containing protein 1	5.3
c80644_g1_i2	XP_007253924.1	Glycine dehydrogenase (decarboxylating),	2.16
c80795_g2_i12	XP_007249113.1	Glycine--tRNA ligase-like	2.36
c82470_g4_i3	NP_997974.2	Glycogen phosphorylase, brain form	2.6
c77819_g2_i3	XP_007233135.1	Glycogen synthase kinase-3 beta isoform X1	5.71
c79238_g1_i2	XP_697186.1	Glycolipid transfer protein-like	2.62
c77009_g12_i1	NP_957314.1	Glypican 1b precursor	3.64
c80156_g14_i1	XP_007258721.1	Glypican-4	2.14
c80347_g11_i2	XP_007227778.1	Glypican-6	5.99
c82403_g13_i6	NP_956881.2	GMP synthase	4.35
c83563_g4_i2	XP_006641307.1	Golgi apparatus protein 1-like	8.16
c83290_g4_i4	XP_007244318.1	Golgi apparatus protein 1-like isoform X1	2.82
c82600_g3_i1	XP_007260221.1	Golgi membrane protein 1-like	2.47
c81721_g20_i5	XP_007260907.1	Golgi resident protein GCP60-like isoform X1	2.53
c83538_g13_i14	XP_007229387.1	Golgin subfamily A member 1 isoform X1	3.21
c83538_g13_i17	XP_007229392.1	Golgin subfamily A member 1 isoform X6	2.65
c75999_g1_i1	XP_007252137.1	Golgin subfamily A member 2-like isoform X3	2.18

c79398_g1_i2	XP_007240632.1	Golgin subfamily A member 3	3.53
c83493_g3_i3	XP_007238314.1	Golgin-45-like	2.4
c83519_g3_i15	XP_007240415.1	Golgi-specific brefeldin A-resistance guanine nucleotide	7.24
c83177_g15_i1	NP_001018301.1	Goliath homolog	3.94
c82229_g3_i9	XP_007260205.1	G-protein coupled receptor 124-like	8.1
c82451_g6_i15	XP_007239676.1	G-protein-signaling modulator 1-like isoform X1	2.98
c78165_g1_i6	XP_005158796.1	Grainyhead-like protein 1 homolog isoform X3	2.55
c78808_g6_i2	XP_007250514.1	Grainyhead-like protein 2 homolog	3.32
c77036_g4_i6	XP_007240648.1	Grainyhead-like protein 3 homolog isoform X3	2.08
c80412_g5_i1	XP_005158320.1	GRAM domain-containing protein 1A isoform X2	2.46
c83539_g3_i15	XP_005158322.1	GRAM domain-containing protein 1A isoform X4	6.55
c78510_g4_i13	XP_005920962.1	GRAM domain-containing protein 3-like isoform X2	2.16
c78646_g4_i8	XP_005164025.1	Granulins isoform X5	4.59
c78646_g4_i4	XP_007239042.1	Granulins-like	2.59
c80199_g6_i3	XP_007230384.1	GRB2-associated and regulator of MAPK protein-like	2.53
c76537_g2_i9	XP_007253783.1	GRB2-associated-binding protein 1 isoform X1	5.05
c76537_g2_i12	XP_007253786.1	GRB2-associated-binding protein 1 isoform X4	3.47
c79062_g14_i1	NP_998017.1	Gremlin 1 homolog a, cysteine knot superfamily precursor	2.03
c76985_g10_i3	XP_007237467.1	Growth arrest-specific protein 6	2.2
c76466_g4_i6	XP_007232099.1	Growth factor receptor-bound protein 10 isoform X1	4.76
c76466_g4_i3	XP_007232101.1	Growth factor receptor-bound protein 10 isoform X3	9.5
c78641_g11_i1	NP_001129727.2	GTP cyclohydrolase 1	5.69
c78931_g2_i8	XP_006770940.1	GTPase IMAP family member 4-like, partial	2.87
c76542_g1_i4	XP_007258165.1	GTPase-activating Rap/Ran-GAP domain-like protein 3-like	5.7
c77862_g5_i1	XP_006638573.1	GTP-binding protein 2-like	3.94
c79586_g4_i1	XP_007246727.1	GTP-binding protein Rab-3D-like	4.11
c79426_g6_i3	ACO09019.1	GTP-binding protein Rit1	2.13
c82077_g5_i4	XP_006806389.1	Guanine nucleotide exchange factor VAV3-like	2.71
c78690_g3_i29	ADF97618.1	Guanine nucleotide-binding protein beta polypeptide 1	4.45
c78690_g3_i18	ADO28368.1	Guanine nucleotide-binding protein g(i)/g(s)/g(t) subunit beta-1	2.68
c82755_g4_i2	XP_007241680.1	Guanine nucleotide-binding protein G(k) subunit alpha	2.15
c79813_g5_i1	XP_005159128.1	Guanine nucleotide-binding protein G(o) subunit alpha	5.13
c78690_g3_i17	XP_007232826.1	Guanine nucleotide-binding protein subunit beta-4	4.79
c78218_g1_i1	XP_007250249.1	H(+)/Cl(-) exchange transporter 5-like	4.11

c80628_g17_i1	XP_007254199.1	H(+)/Cl(-) exchange transporter 5-like isoform X1	2.71
c73537_g2_i2	XP_696744.2	H/ACA ribonucleoprotein complex non-core subunit NAF1	2.52
c83838_g3_i1	XP_007237787.1	H-2 class I histocompatibility antigen, L-D alpha	2.05
c80824_g3_i2	XP_001922615.1	HEAT repeat-containing protein 1-like isoform X1	7.31
c77261_g4_i2	XP_007244899.1	HEAT repeat-containing protein 3	3.66
c82532_g1_i3	ADX32514.1	Heat shock 70 kDa protein	5.31
c83084_g4_i11	XP_007229296.1	Heat shock 70 kDa protein 13-like	2.04
c77031_g4_i3	XP_007252431.1	Heat shock 70 kDa protein 14	2.02
c77734_g4_i5	XP_007247088.1	Heat shock 70 kDa protein 4	4.03
c82532_g1_i7	NP_001187202.1	Heat shock cognate 71 kDa protein	2.06
c78289_g3_i8	XP_005159389.1	Heat shock factor protein 1 isoform X1	2.44
c78147_g2_i1	XP_006643588.1	Heat shock protein HSP 90-alpha-like, partial	2.79
c76584_g3_i1	ABA54452.1	Hedgehog-interacting protein	2.34
c77788_g2_i2	XP_007259177.1	Helicase SRCAP-like	4.46
c83408_g1_i1	XP_005171855.1	Hematopoietic death receptor isoform X1	5.09
c76646_g7_i1	XP_007249183.1	Heme transporter hrg1-A-like	3.91
c84270_g5_i5	XP_005160777.1	Hemicentin-1 isoform X1	29.17
c80506_g3_i5	XP_005468795.1	Hemicentin-1-like isoform X4	3.26
c76771_g16_i1	ABH11455.1	Heparan sulfate 6-O-sulfotransferase 1a	2.83
c73371_g3_i1	XP_007260359.1	Heparan sulfate glucosamine 3-O-sulfotransferase 1	2.65
c76636_g11_i1	XP_004540358.1	Heparan-sulfate 6-O-sulfotransferase 1-A-like	3.91
c77650_g6_i2	NP_001073672.1	Heparan-sulfate 6-O-sulfotransferase 1-B	2.31
c75693_g1_i3	XP_005924055.1	Hepatoma-derived growth factor-related protein 3-like	2.13
c80234_g6_i1	XP_007249538.1	Hermansky-Pudlak syndrome 6 protein homolog	2.68
c74311_g2_i1	XP_006631769.1	Heterogeneous nuclear ribonucleoprotein A/B-like	2.05
c78393_g10_i2	XP_007248402.1	Heterogeneous nuclear ribonucleoprotein A1-like isoform	2.63
c80496_g3_i7	XP_007261041.1	Heterogeneous nuclear ribonucleoprotein L-like isoform	2.78
c75728_g4_i6	NP_001243560.1	Heterogeneous nuclear ribonucleoprotein M	2.13
c77643_g5_i4	XP_007240896.1	Hexokinase-1	3.36
c74294_g3_i3	XP_005165098.1	Hexokinase-2 isoform X1	2.36
c80660_g3_i7	NP_001187163.1	HIF 2 alpha	5.57
c79853_g10_i3	XP_007248993.1	High affinity cAMP-specific 3',5'-cyclic phosphodiesterase	3.58
c76142_g4_i3	XP_007236602.1	Hippocampus abundant transcript 1 protein-like	3.63
c81047_g3_i3	XP_697383.4	Histone acetyltransferase KAT6B	4.31

c80768_g6_i8	XP_005168667.1	Histone acetyltransferase MYST3 isoform X1	18.77
c83329_g5_i1	XP_006636936.1	Histone acetyltransferase p300-like	7.76
c83329_g5_i14	XP_006798037.1	Histone acetyltransferase p300-like isoform X1	5.75
c75976_g2_i3	XP_007259140.1	Histone acetyltransferase p300-like isoform X3	29.95
c83329_g5_i9	XP_007259141.1	Histone acetyltransferase p300-like isoform X4	8.02
c79789_g1_i1	XP_693858.5	Histone deacetylase 6	4.13
c78538_g7_i3	XP_006785340.1	Histone deacetylase 7-like	6.31
c79820_g2_i5	XP_002430908.1	Histone H4, putative	-4.58
c77815_g7_i1	XP_007246804.1	Histone lysine demethylase PHF8-like isoform X1	5.18
c78604_g15_i7	XP_007240214.1	Histone-binding protein RBBP7	2.08
c82794_g9_i1	XP_007229220.1	Histone-lysine N-methyltransferase 2C-like	2.09
c77015_g2_i5	XP_007232772.1	Histone-lysine N-methyltransferase 2E-like isoform X1	3.54
c77015_g2_i2	XP_007232774.1	Histone-lysine N-methyltransferase 2E-like isoform X3	7.03
c82918_g1_i3	XP_007256555.1	Histone-lysine N-methyltransferase ASH1L-like isoform X1	4.7
c81514_g18_i4	XP_007237666.1	Histone-lysine N-methyltransferase EZH1	4.17
c82794_g5_i2	XP_005163352.1	Histone-lysine N-methyltransferase MLL3 isoform X2	24.66
c83210_g11_i3	XP_005162604.1	Histone-lysine N-methyltransferase MLL3 isoform X4	66.15
c83131_g10_i7	XP_005162605.1	Histone-lysine N-methyltransferase MLL3 isoform X5	50.83
c83719_g6_i1	NP_001167383.1	Histone-lysine N-methyltransferase PRDM9	4.05
c78397_g4_i6	XP_007232920.1	Histone-lysine N-methyltransferase PRDM9-like	2.88
c79275_g2_i1	XP_007251187.1	Histone-lysine N-methyltransferase SETD1A	8.82
c79275_g9_i4	XP_005164137.1	Histone-lysine N-methyltransferase SETD1A isoform X3	3.22
c81323_g10_i2	XP_005921879.1	Histone-lysine N-methyltransferase SETD1A-like isoform X1	2.03
c79275_g9_i3	XP_007255045.1	Histone-lysine N-methyltransferase SETD1B-A-like isoform	3.16
c81657_g3_i1	XP_007256565.1	Histone-lysine N-methyltransferase SETD2	5.64
c75145_g1_i1	NP_001038232.1	Histone-lysine N-methyltransferase SETDB1-A	4.33
c82800_g1_i5	XP_005158071.1	Histone-lysine N-methyltransferase SETDB1-B isoform X2	5.68
c75551_g1_i1	XP_006808147.1	Histone-lysine N-methyltransferase SUV420H1-like isoform	4.04
c82590_g17_i7	XP_005080448.1	Homeobox protein cut-like 1 isoform X4	5.85
c82590_g17_i12	XP_007259491.1	Homeobox protein cut-like 1-like isoform X2	2.38
c83398_g26_i1	XP_007251398.1	Homeobox protein PKNOX1-like isoform X1	4.79
c78351_g6_i1	XP_007235619.1	Homeobox protein SIX5-like	5.77
c78787_g2_i8	XP_007255526.1	Homeobox-containing protein 1-like isoform X4	7.55

c78940_g6_i1	XP_700792.4	Homeodomain-interacting protein kinase 1	3.04
c77860_g6_i1	XP_007247786.1	Homeodomain-interacting protein kinase 1-like isoform X3	8.16
c83402_g18_i1	NP_001093455.2	Homeodomain-interacting protein kinase 2	2.78
c83402_g11_i2	XP_007251022.1	Homeodomain-interacting protein kinase 2 isoform X1	6.75
c80526_g6_i3	XP_005467207.1	Homeodomain-interacting protein kinase 3 isoform X2	2.41
c76352_g7_i2	XP_007232503.1	Hormone-sensitive lipase-like isoform X2	4.13
c77877_g15_i2	XP_007258295.1	Hornerin-like isoform X1	5.55
c77205_g3_i7	XP_007245938.1	Host cell factor 1-like	-3.84
c82845_g6_i6	XP_007245529.1	Human immunodeficiency virus type I enhancer-binding protein	7.67
c81551_g3_i8	XP_007239764.1	Huntingtin-interacting protein 1-related protein-like	4.1
c82643_g10_i1	XP_007234609.1	Hyaluronan and proteoglycan link protein 1-like isoform X2	2.2
c32959_g1_i1	XP_007234380.1	Hyaluronan and proteoglycan link protein 3	2.79
c75446_g1_i4	XP_007250872.1	Hyaluronan synthase 1-like	18.41
c80547_g11_i2	XP_007234509.1	Hyaluronidase-2-like isoform X1	3.87
c83358_g15_i6	XP_007237697.1	Hydroxyacid-oxoacid transhydrogenase, mitochondrial	-2.43
c70131_g1_i1	XP_005171873.1	Hydroxymethylbilane synthase a isoform X1	2.36
c68170_g1_i2	XP_007257629.1	Hydroxymethylglutaryl-CoA lyase, mitochondrial-like	2.49
c71849_g2_i1	XP_007245958.1	Hypermethylated in cancer 1 protein-like isoform X1	25.74
c79289_g1_i1	XP_002603652.1	Hypothetical protein BRAFLDRAFT_98594	-2.21
c81085_g5_i1	EGT30783.1	Hypothetical protein CAEBREN_30032	2.69
c84218_g1_i1	ELT95821.1	Hypothetical protein CAPTEDRAFT_188804, partial	18.8
c83081_g3_i11	EPY84284.1	Hypothetical protein CB1_000487048	2.99
c76176_g3_i3	EKC41687.1	Hypothetical protein CGI_10028433	-3.8
c81762_g6_i1	XP_005827915.1	Hypothetical protein GUITHDRAFT_75142, partial	-2.38
c76523_g1_i1	ETE64107.1	Hypothetical protein L345_10125, partial	3.48
c72443_g1_i1	XP_001621948.1	Hypothetical protein NEMVEDRAFT_v1g143109	2.61
c78631_g1_i2	NP_001187230.1	Hypoxia induced factor 1 alpha	2.76
c81062_g4_i1	NP_997868.1	Hypoxia up-regulated protein 1 precursor	4.21
c79673_g8_i2	NP_001187128.1	IGF2	2.43
c76549_g1_i1	XP_001921732.1	IgGFc-binding protein-like	22.12
c82167_g1_i3	XP_007242200.1	IgGFc-binding protein-like isoform X1	3.95
c78267_g4_i4	AAH92363.1	Im:7145180 protein, partial	4.8
c84262_g6_i2	AAI24802.1	Im:7147183 protein	2.19
c79364_g3_i1	AAH91841.1	Im:7149628 protein, partial	3.2
c78577_g2_i6	AAH78272.1	Im:7155315 protein	8.64

c79580_g2_i3	XP_007230716.1	Immunoglobulin superfamily member 10	2.62
c81714_g1_i1	XP_007251720.1	Immunoglobulin superfamily member 3-like isoform X2	9.4
c77126_g4_i4	XP_007231012.1	Importin subunit alpha-6	2.47
c78170_g4_i2	XP_001923921.1	Importin subunit alpha-7-like	6.06
c79202_g15_i3	XP_007230833.1	Importin subunit beta-1-like	2.34
c77396_g14_i1	NP_957199.2	Importin-7	2.06
c81017_g5_i3	XP_007248477.1	Importin-9	2.81
c78461_g2_i3	NP_001002228.1	Inactive rhomboid protein 1	2.22
c80650_g11_i3	XP_007252202.1	Inactive rhomboid protein 2	7.24
c73312_g1_i1	XP_007253061.1	Inactive serine protease 35-like	2.23
c78523_g5_i1	XP_005742459.1	Inactive tyrosine-protein kinase 7-like	5.15
c77997_g5_i2	XP_007255231.1	Inactive ubiquitin carboxyl-terminal hydrolase 53-like	2.59
c77340_g5_i7	XP_007114622.1	Inhibitor of growth protein 3 isoform X1	-2.56
c82551_g1_i12	NP_001116737.1	Inhibitor of nuclear factor kappa-B kinase subunit beta	3.22
c79619_g7_i3	XP_007259804.1	Inner nuclear membrane protein Man1	2.37
c75381_g2_i4	XP_003199216.2	INO80 complex subunit D-like	3.57
c80880_g5_i3	XP_005159066.1	Inosine-5'-monophosphate dehydrogenase 1a isoform X3	5.85
c76331_g2_i7	NP_958872.1	Inosine-5'-monophosphate dehydrogenase 2	3.7
c79637_g11_i2	XP_005172967.1	Inositol 1,4,5-trisphosphate receptor type 1 isoform X2	3.85
c83631_g5_i1	XP_007430767.1	Inositol 1,4,5-trisphosphate receptor type 1-like,	16.73
c79370_g3_i4	XP_005166067.1	Inositol hexaphosphate kinase 2 isoform X1	4.31
c73289_g3_i3	NP_001071232.1	Inositol polyphosphate 5-phosphatase OCRL-1	4.26
c83258_g4_i5	NP_001073533.1	Inositol polyphosphate multikinase	4.46
c77875_g7_i1	XP_007241888.1	Inositol polyphosphate multikinase-like	2.62
c74478_g5_i4	XP_007258258.1	Inositol-tetrakisphosphate 1-kinase	3.53
c81256_g11_i1	XP_007252574.1	Inositol-tetrakisphosphate 1-kinase-like	2.39
c73808_g1_i2	XP_006643125.1	Inositol-trisphosphate 3-kinase A-like	3.12
c80225_g12_i6	XP_007251078.1	Inositol-trisphosphate 3-kinase C	2.32
c80575_g6_i2	XP_007233587.1	Insulin receptor substrate 1-B-like isoform X2	3.8
c82722_g12_i1	XP_700746.4	Insulin receptor substrate 2	3.44
c83227_g7_i8	XP_007236388.1	Insulin receptor-like	2.52
c81109_g3_i3	XP_007258746.1	Insulin-degrading enzyme	4.38
c83664_g3_i1	NP_001188015.1	Insulin-induced gene 2 protein	3.04
c76442_g1_i3	NP_001187237.1	Insulin-like growth factor binding protein 1 precursor	2.03
c78479_g1_i4	NP_001187185.1	Insulin-like growth factor binding protein 3 precursor	4.92

c81803_g10_i1	AAM51549.1	Insulin-like growth factor binding protein 5	3.19
c82847_g4_i3	NP_001092224.1	Insulin-like growth factor binding protein 5b precursor	4.48
c78683_g8_i3	XP_007234921.1	Integral membrane protein GPR155 isoform X1	5.56
c76472_g15_i1	XP_006632944.1	Integrator complex subunit 6-like	14.5
c83443_g8_i4	XP_699485.4	Integrin alpha-1	6.9
c82839_g3_i3	XP_003200204.1	Integrin alpha-10 isoform X1	7.11
c82135_g3_i11	XP_003199352.2	Integrin alpha-2-like	5.96
c78267_g4_i1	XP_696861.6	Integrin alpha-3 isoform X2	6.71
c78267_g4_i2	XP_007241879.1	Integrin alpha-3-like	3.58
c79286_g3_i8	NP_001004288.2	Integrin alpha-5 precursor	5.25
c80757_g25_i1	XP_007242240.1	Integrin alpha-8	2.16
c84227_g2_i5	XP_005156064.1	Integrin alpha-X-like	3.1
c79865_g3_i1	XP_007259797.1	Integrin beta-3-like	3.04
c81949_g1_i7	XP_007237009.1	Integrin beta-4 isoform X1	9.13
c81949_g1_i6	XP_007237010.1	Integrin beta-4 isoform X2	5.31
c76232_g7_i4	XP_007254309.1	Integrin beta-7-like	2.68
c83435_g3_i6	NP_001013466.1	Integrin, alpha 6b precursor	4.69
c82962_g6_i7	XP_007233760.1	Integrin-alpha FG-GAP repeat-containing protein 2	-2.07
c70089_g1_i2	XP_007247330.1	Integrin-linked protein kinase-like	2.58
c78112_g5_i6	XP_007233990.1	Interferon regulatory factor 1-like	-2.02
c77179_g12_i1	XP_006008495.1	Interferon regulatory factor 2	3.84
c78422_g4_i12	XP_007247534.1	Interferon regulatory factor 2 isoform X1	2.3
c82777_g1_i2	XP_007251641.1	Interferon regulatory factor 2-binding protein 1-like	2.19
c64995_g2_i1	XP_007232429.1	Interferon regulatory factor 6-like	2.78
c78110_g5_i1	NP_001106979.2	Interleukin 7 receptor precursor	3.24
c82350_g8_i6	NP_001025236.1	Interleukin enhancer binding factor 3a	4.41
c82350_g8_i4	XP_005165780.1	Interleukin enhancer binding factor 3a isoform X1	2.92
c82485_g5_i9	XP_001339589.5	Interleukin-1 receptor type 1-like	10.1
c80717_g11_i10	XP_007260876.1	Interleukin-11 receptor subunit alpha isoform X1	12.32
c81065_g4_i1	XP_007260542.1	Interleukin-20 receptor subunit alpha-like	2.21
c81756_g1_i6	XP_007255345.1	Interleukin-6 receptor subunit beta	4.64
c78102_g6_i2	XP_007255339.1	Interleukin-6 receptor subunit beta-like isoform X1	3.7
c80791_g7_i1	XP_007257461.1	Intron-binding protein aquarius isoform X1	9.53
c78021_g1_i3	XP_007228616.1	Iron-responsive element-binding protein 2-like	3.24
c82661_g6_i7	XP_007239820.1	Isoleucine--tRNA ligase, cytoplasmic-like, partial	3.95
c83502_g13_i1	AAI62468.1	Jag1a protein	2.13

c73751_g3_i1	XP_007259715.1	Junctional protein associated with coronary artery disease	4.31
c73884_g9_i4	P12115.2	KAD1_CYPCA RecName: Full=Adenylate kinase isoenzyme 1; Short=AK 1; AltName:	-2.58
c79804_g8_i1	XP_007248796.1	KAT8 regulatory NSL complex subunit 1-like	3.03
c77004_g5_i5	XP_005171653.1	KAT8 regulatory NSL complex subunit 1-like isoform X1	4.05
c83689_g7_i2	XP_007256041.1	Kelch repeat and BTB domain-containing protein 4 isoform	3.09
c80530_g8_i1	XP_007256505.1	Kelch repeat and BTB domain-containing protein 8	2.92
c79291_g12_i4	XP_007231370.1	Kelch-like ECH-associated protein 1-like isoform X1	2.61
c82322_g2_i1	NP_996964.1	Kelch-like protein 21	5.79
c77877_g3_i1	XP_007236437.1	Kelch-like protein 24-like	3.61
c81377_g3_i10	XP_007246535.1	Kelch-like protein 4-like	7.42
c81231_g6_i1	XP_007232597.1	Kin of IRRE-like protein 1-like	3.27
c82250_g2_i14	XP_007235310.1	Kinase D-interacting substrate of 220 kDa-like isoform X4	6.05
c74074_g2_i3	XP_005173315.1	Kinase insert domain receptor like isoform X1	5.69
c78509_g6_i3	XP_005471970.1	Kinase suppressor of Ras 1-like isoform X2	7.52
c82388_g6_i2	XP_700210.2	Kinesin family member 13Ba isoform X4	14.12
c80912_g7_i1	XP_699380.2	Kinesin family member 1C isoform X3	2.09
c77781_g5_i2	XP_699081.6	Kinesin family member 21B	15.2
c76297_g4_i6	XP_696785.3	Kinesin family member C3 isoform X3	3.69
c81997_g1_i1	XP_007240384.1	Kinesin light chain 1 isoform X5	2.27
c77577_g2_i8	XP_005156694.1	Kinesin light chain 1 isoform X6	3.95
c80341_g4_i6	XP_006638769.1	Kinesin light chain 1-like	3.94
c82388_g6_i7	XP_005934893.1	Kinesin-like protein KIF13A-like	6.7
c82388_g6_i1	XP_003758133.1	Kinesin-like protein KIF13B	8.56
c81326_g13_i3	XP_007255520.1	Kinesin-like protein KIF13B-like isoform X1	2.08
c80315_g1_i12	XP_007239000.1	Kinesin-like protein KIF16B-like	5.71
c80315_g1_i4	XP_006638646.1	Kinesin-like protein KIF16B-like isoform X2	3.81
c76258_g4_i8	AAK33008.1	Kinesin-like protein Kif1b alpha	17.5
c82947_g1_i6	XP_007228274.1	Kinesin-like protein KIF21A-like isoform X4	4.43
c33525_g1_i1	XP_006625917.1	Kinesin-like protein KIF3C-like	5.68
c81821_g1_i4	XP_007257777.1	KN motif and ankyrin repeat domain-containing protein	6.42
c81198_g6_i1	XP_005164396.1	KN motif and ankyrin repeat domain-containing protein 1	21.16
c79641_g11_i4	XP_007234226.1	Kremen protein 1-like isoform X1	9.7
c79639_g2_i2	XP_007246548.1	Krueppel-like factor 13-like	6.73

c83478_g10_i1	NP_571934.2	Krueppel-like factor 3	3.57
c82807_g7_i1	XP_007230681.1	Krueppel-like factor 4	2.29
c81067_g15_i5	XP_007244510.1	Krueppel-like factor 5-like	2.24
c72128_g1_i1	XP_007227844.1	Krueppel-like factor 5-like isoform X2	2.37
c77230_g8_i1	XP_007244631.1	Krueppel-like factor 8-like	3.31
c82691_g6_i1	XP_007250746.1	Krueppel-like factor 9-like	6.55
c77108_g2_i2	Q1LVF0.2	LAMC1_DANRE RecName: Full=Laminin subunit gamma-1; Flags: Precursor	4.72
c80606_g1_i4	XP_005476396.1	Laminin subunit alpha-3 isoform X2	16.58
c78262_g2_i1	XP_007259965.1	Laminin subunit alpha-4 isoform X1	6.05
c81822_g5_i7	XP_692838.6	Laminin subunit beta-1 isoform X2	3.13
c82491_g8_i2	NP_775382.1	Laminin subunit beta-1 precursor	3.07
c80630_g6_i1	NP_001264059.1	Laminin, beta 1b precursor	4.33
c79279_g3_i1	XP_007246229.1	Lamin-L(II)-like	4.45
c77918_g7_i2	XP_005988396.1	La-related protein 1	4.88
c82194_g7_i4	XP_696560.3	La-related protein 1 isoform X2	3.43
c77918_g6_i4	XP_007236338.1	La-related protein 1 isoform X3	4.59
c76175_g1_i3	XP_007246800.1	La-related protein 4-like isoform X1	4.74
c78062_g17_i12	XP_007254306.1	La-related protein 4-like isoform X3	8.54
c81583_g1_i3	NP_001121830.1	Large neutral amino acids transporter small subunit 1	6.23
c79805_g2_i2	NP_001258826.1	Large neutral amino acids transporter small subunit 2	2.06
c74367_g1_i2	XP_007260952.1	Large neutral amino acids transporter small subunit 4-like	6.38
c83028_g10_i1	XP_007260970.1	Large proline-rich protein BAG6-like	12.32
c81258_g13_i2	XP_007261087.1	Latent-transforming growth factor beta-binding protein	3.93
c82975_g4_i16	XP_005158769.1	Latent-transforming growth factor beta-binding protein 1	8.95
c82975_g4_i10	ACN60331.1	Latent-transforming growth factor beta-binding protein 1 precursor	3.26
c82550_g3_i10	XP_007230959.1	LETM1 and EF-hand domain-containing protein 1,	8.29
c82066_g4_i1	XP_007255018.1	LETM1 domain-containing protein LETM2, mitochondrial	2.61
c82270_g16_i1	XP_007258989.1	Leucine zipper protein 1 isoform X1	7.99
c83715_g6_i2	XP_007260310.1	Leucine-rich repeat serine/threonine-protein kinase 1	4.63
c75493_g1_i2	XP_687184.4	Leucine-rich repeat-containing G-protein coupled receptor	6.04
c83470_g4_i8	XP_004565204.1	Leucine-rich repeat-containing protein 16A-like isoform X2	7.02
c68347_g1_i1	XP_007256625.1	Leucine-rich repeat-containing protein 8A	3.13

c77662_g1_i1	XP_007239012.1	Leucine-rich repeat-containing protein 8C	2.99
c80275_g1_i2	XP_007244011.1	Leucyl-cystinyl aminopeptidase	3.28
c83579_g3_i1	NP_001014328.1	Leukemia inhibitory factor receptor alpha a precursor	2.89
c83728_g3_i2	ABI23566.1	Leukocyte immune-type receptor TS32.15 L2.2b	2.86
c81373_g1_i1	XP_007250951.1	Leukocyte receptor cluster member 8 homolog	3.31
c74319_g1_i5	NP_001139049.1	LIM and calponin homology domains 1a	10.08
c81065_g1_i10	NP_001108201.1	LIM and calponin homology domains-containing protein 1	7.46
c83232_g13_i1	XP_007251547.1	LIM and cysteine-rich domains protein 1-like	3.35
c82671_g15_i8	XP_002663732.2	LIM domain and actin-binding protein 1 isoform X1	3.21
c76583_g12_i3	XP_005463777.1	LIM domain kinase 1-like isoform X3	8.71
c78182_g5_i4	XP_007251812.1	LIM domain only protein 7	4.45
c78465_g6_i8	XP_007246170.1	LIM domain-binding protein 1-like isoform X1	2.08
c81810_g14_i1	XP_688621.1	LIM domain-containing protein 2-like	5.03
c78888_g9_i2	XP_007258495.1	Lipid phosphate phosphohydrolase 2-like	2.75
c76911_g5_i4	ADO27940.1	Lipid phosphate phosphohydrolase 3	2.1
c76911_g5_i3	XP_001919561.1	Lipid phosphate phosphohydrolase 3 isoform 1	2.15
c81073_g9_i1	NP_957492.1	Lipoma-preferred partner homolog	3.14
c79278_g4_i8	XP_006808291.1	Liprin-alpha-1-like isoform X12	6.06
c81463_g4_i9	XP_003972794.1	Liprin-beta-1-like	3.25
c81720_g3_i1	XP_007260779.1	Lissencephaly-1 homolog B-like	2.37
c81720_g3_i5	NP_001188031.1	Lissencephaly-1-like protein A	3.6
c77245_g5_i2	AFO11025.1	Liver carnitine palmitoyltransferase 1A-2	2.72
c79523_g9_i3	XP_005165734.1	LMBR1 domain containing 2a isoform X1	2.11
c78679_g9_i2	NP_956238.1	LMBR1 domain-containing protein 2-B	2.53
c82567_g12_i1	AAH52560.1	LOC387763 protein	2.19
c79137_g11_i4	AAH54565.1	LOC407638 protein	6.58
c77981_g7_i1	AAH92878.1	LOC553366 protein, partial	2.57
c84205_g1_i4	AAI55173.1	LOC794796 protein	5.04
c84100_g12_i1	NP_001264163.1	LON peptidase N-terminal domain and RING finger protein 1	7.06
c80502_g19_i1	XP_005451431.1	Long-chain fatty acid transport protein 4-like isoform X2	5.07
c79842_g10_i2	XP_007235897.1	Long-chain-fatty-acid--CoA ligase 4-like	2.09
c78761_g2_i4	XP_007247481.1	Long-chain-fatty-acid--CoA ligase 4-like isoform X1	3.96
c76142_g2_i5	NP_001119851.1	Long-chain-fatty-acid--CoA ligase ACSBG2	2.67
c73995_g1_i3	XP_004071707.1	LOW QUALITY PROTEIN: ATP-binding cassette sub-family A	14.69

c81923_g12_i3	XP_007234200.1	LOW QUALITY PROTEIN: calmodulin-binding transcription	5.09
c80181_g1_i6	XP_004076492.1	LOW QUALITY PROTEIN: complement factor B-like	7.09
c81411_g2_i3	XP_003440723.2	LOW QUALITY PROTEIN: ethanolaminephosphotransferase 1-like	2.42
c80420_g2_i4	XP_007251466.1	LOW QUALITY PROTEIN: ETS domain-containing protein Elk-4	2.45
c79356_g2_i7	XP_007257903.1	LOW QUALITY PROTEIN: HBS1-like protein	3.17
c82688_g10_i3	XP_006633324.1	LOW QUALITY PROTEIN: kielin/chordin-like protein-like	2.66
c82941_g3_i2	XP_005607709.1	LOW QUALITY PROTEIN: leucine zipper putative tumor	4.21
c84273_g5_i4	XP_005459151.1	LOW QUALITY PROTEIN: microtubule-actin cross-linking	8.1
c78271_g2_i5	XP_007287854.1	LOW QUALITY PROTEIN: mitogen-activated protein kinase 13	-2.66
c82138_g5_i10	XP_007250531.1	LOW QUALITY PROTEIN: myotubularin-related protein 12	4.41
c79563_g7_i2	XP_002663045.1	LOW QUALITY PROTEIN: myotubularin-related protein 13	6.07
c79895_g1_i2	XP_684581.5	LOW QUALITY PROTEIN: neuroblast differentiation-associated	2.56
c79858_g4_i8	XP_006780707.1	LOW QUALITY PROTEIN: nicotinamide	3.87
c83399_g5_i5	XP_007256764.1	LOW QUALITY PROTEIN: NUAK family SNF1-like kinase 2-like	2.71
c75629_g1_i2	XP_007251026.1	LOW QUALITY PROTEIN: nuclear pore complex protein Nup205	4.89
c80467_g7_i6	XP_007257163.1	LOW QUALITY PROTEIN: polycomb protein suz12-B-like	2.85
c82773_g9_i7	XP_007247866.1	LOW QUALITY PROTEIN: protein tweety homolog 3-like	2.78
c84042_g2_i16	XP_007287866.1	LOW QUALITY PROTEIN: protein tyrosine phosphatase,	3.67
c78659_g14_i3	XP_007251710.1	LOW QUALITY PROTEIN: ras GTPase-activating protein 2,	3.06
c75547_g1_i3	XP_007250011.1	LOW QUALITY PROTEIN: selenide, water dikinase 2-like	2.01
c76455_g1_i1	XP_007232608.1	LOW QUALITY PROTEIN: sodium/hydrogen exchanger 1-like	4.36
c79064_g11_i10	XP_006640182.1	LOW QUALITY PROTEIN: T-box transcription factor	2.49
c81592_g4_i3	XP_001341635.3	LOW QUALITY PROTEIN: titin	2.51
c80836_g2_i1	XP_007287875.1	LOW QUALITY PROTEIN: trafficking protein, kinesin binding	2.37
c83330_g9_i5	XP_002807611.2	LOW QUALITY PROTEIN: transcription factor SOX-2-like	3.58
c78539_g6_i1	XP_007259058.1	LOW QUALITY PROTEIN: transcriptional activator GLI3-like	4.92

c81417_g3_i17	XP_006636468.1	LOW QUALITY PROTEIN: unconventional myosin-Ib-like	3.66
c74074_g2_i1	XP_007254465.1	LOW QUALITY PROTEIN: vascular endothelial growth factor	3.06
c82748_g7_i1	XP_685503.5	LOW QUALITY PROTEIN: wu:fl04e06	6.42
c82447_g9_i4	XP_006633651.1	LOW QUALITY PROTEIN: zinc finger C3H1 domain-containing	2.34
c81753_g14_i3	XP_007254741.1	Low-density lipoprotein receptor class A	3.09
c76168_g2_i3	XP_005163927.1	Low-density lipoprotein receptor isoform X1	2.87
c78450_g5_i3	XP_007231365.1	Low-density lipoprotein receptor-like	6.84
c79807_g2_i1	XP_003199120.1	Low-density lipoprotein receptor-like isoform X1	3.61
c83782_g7_i4	XP_005162276.1	Low-density lipoprotein receptor-related protein 1 isoform	18.65
c79078_g2_i1	XP_007250283.1	Low-density lipoprotein receptor-related protein 10	3.53
c83782_g2_i2	XP_005739640.1	Low-density lipoprotein receptor-related protein 1-like	5.88
c80239_g1_i5	XP_007236293.1	Low-density lipoprotein receptor-related protein 4-like	3.43
c78655_g2_i2	XP_005454311.1	Low-density lipoprotein receptor-related protein 5	6.86
c78655_g7_i7	XP_005163047.1	Low-density lipoprotein receptor-related protein 5 isoform	2.93
c78655_g7_i3	XP_007256094.1	Low-density lipoprotein receptor-related protein 6-like	4.42
c77087_g6_i13	AAD40680.1	L-plastin	-2.53
c82362_g3_i6	XP_002660488.3	LPS-responsive vesicle trafficking, beach and anchor	8.38
c67231_g1_i1	ADO28143.1	Lsm12--like protein A	3.09
c78139_g2_i2	NP_001187358.1	L-threonine 3-dehydrogenase, mitochondrial	2.59
c78518_g2_i1	XP_007259063.1	Lumican isoform X1	4.2
c83066_g2_i1	XP_007237400.1	Lymphocyte antigen 75	8.31
c83116_g1_i2	XP_007251723.1	Lymphocyte function-associated antigen 3-like isoform X1	2.35
c81210_g5_i1	XP_007229535.1	Lymphoid enhancer-binding factor 1 isoform X4	2.83
c81129_g5_i8	XP_007257889.1	Lysine-specific demethylase 4A	3.45
c80933_g3_i7	XP_001921829.2	Lysine-specific demethylase 4A-like isoform X1	3.05
c79969_g6_i6	XP_006628351.1	Lysine-specific demethylase 5B-B-like	10.92
c77033_g3_i9	XP_007234688.1	Lysine-specific demethylase 5C isoform X1	5.97
c82352_g12_i3	XP_007228047.1	Lysine-specific demethylase 6A	11.5
c82352_g12_i9	XP_005167853.1	Lysine-specific demethylase 6A isoform X3	3.59
c82352_g12_i10	XP_005167856.1	Lysine-specific demethylase 6A isoform X6	6.54
c77769_g3_i3	XP_007244296.1	Lysine-specific demethylase 6A-like isoform X1	3.8
c75585_g1_i4	XP_007236108.1	Lysine-specific demethylase 6B-like isoform X1	4.22
c78543_g9_i3	XP_007228424.1	Lysine-specific demethylase 7A-like	9.08

c77366_g8_i2	XP_007232779.1	Lysine-specific demethylase 7A-like isoform X2	3.78
c77375_g2_i1	XP_005169348.1	Lysine-specific demethylase phf2 isoform X1	6.51
c81904_g11_i4	XP_007258993.1	Lysine-specific histone demethylase 1A isoform X3	2.27
c78658_g6_i3	XP_006780198.1	Lysine--tRNA ligase-like isoform X1	2.01
c82594_g13_i1	XP_007254139.1	Lysophosphatidic acid receptor 1-A-like	2.86
c78110_g3_i6	XP_007232121.1	Lysophospholipid acyltransferase 1 isoform X1	5.49
c76162_g14_i2	XP_683208.1	Lysophospholipid acyltransferase 5	2.81
c75748_g2_i1	NP_998569.1	Lysosomal acid lipase/cholesteryl ester hydrolase precursor	2.12
c82891_g2_i1	XP_005173307.1	Lysosomal membrane glycoprotein 2 isoform X1	2.55
c82891_g2_i3	NP_001013551.1	Lysosomal membrane glycoprotein 2 precursor	2.4
c80729_g3_i1	XP_007239778.1	Lysosomal thioesterase PPT2-A-like isoform X1	3.23
c77905_g3_i7	XP_007244026.1	Lysosome membrane protein 2	4.24
c82270_g5_i6	XP_007231072.1	Lysosome membrane protein 2-like	2.65
c74977_g8_i4	XP_007254918.1	Lysosome-associated membrane glycoprotein 1	3.23
c78063_g1_i1	XP_007240023.1	Lysyl oxidase homolog 1-like	8.65
c81461_g3_i3	XP_007255010.1	Lysyl oxidase homolog 2A-like	2.9
c78790_g3_i5	XP_007247511.1	Lysyl oxidase homolog 3-like isoform X1	4.11
c81080_g10_i3	XP_007240442.1	Lysyl oxidase homolog 4	2.43
c81080_g10_i1	XP_007231531.1	Lysyl oxidase homolog 4-like	5.34
c80828_g1_i2	XP_002663014.2	Macrophage mannose receptor 1	2.61
c81913_g13_i3	XP_001919596.4	Maestro heat-like repeat family member 1 isoform X1	3.35
c79706_g2_i7	XP_007244600.1	Magnesium transporter NIPA4-like	6.12
c75862_g12_i4	XP_007244724.1	MAGUK p55 subfamily member 5-A-like	2.82
c82470_g2_i2	XP_007247627.1	Major facilitator superfamily domain-containing protein	5.17
c79473_g2_i3	NP_001076525.1	Major facilitator superfamily domain-containing protein 6-A	2.54
c77689_g2_i1	XP_007247199.1	Malectin	7.18
c78558_g2_i1	XP_001335202.2	Malignant fibrous histiocytoma-amplified sequence 1	2.57
c77978_g1_i2	XP_005807730.1	Mannose-1-phosphate guanyltransferase alpha-A-like	4.68
c73931_g4_i1	XP_007235246.1	Mannose-6-phosphate isomerase	3.81
c79845_g2_i4	XP_694435.2	Mannosyl-oligosaccharide 1,2-alpha-mannosidase IA	2.51
c80797_g2_i1	XP_003450602.2	Mannosyl-oligosaccharide 1,2-alpha-mannosidase IC isoform	2.96
c79843_g4_i7	XP_007247806.1	MAP kinase-activated protein kinase 2 isoform X1	2.3
c84151_g8_i5	XP_001923988.3	MAP kinase-activating death domain protein isoformX1	5.81
c80523_g15_i1	XP_006632239.1	MAP/microtubule affinity-regulating kinase 3-like	4.19

c81646_g18_i2	XP_005165425.1	MAP/microtubule affinity-regulating kinase 4 isoform X2	6.09
c78286_g5_i4	XP_007246029.1	MAP/microtubule affinity-regulating kinase 4 isoform X3	2.72
c77576_g3_i10	XP_005173804.1	MAP7 domain containing 1 isoform X2	2.41
c77576_g3_i9	XP_007249698.1	MAP7 domain-containing protein 1-like isoform X5	6.36
c82901_g2_i2	XP_007236836.1	Mastermind-like protein 2-like	2.95
c75276_g2_i3	XP_005803122.1	Mastermind-like protein 3-like	7.98
c76804_g9_i5	XP_005453321.1	Matrin-3-like	-5.12
c84067_g2_i5	ADD84682.1	Matrix metalloproteinase 13	2.68
c84067_g6_i2	NP_001187264.1	Matrix metalloproteinase 13 precursor	7.07
c77990_g1_i3	XP_001924042.4	Matrix metalloproteinase-15	2.12
c77990_g1_i2	XP_007254693.1	Matrix metalloproteinase-15-like	5.16
c80383_g12_i1	XP_007250437.1	Matrix metalloproteinase-16-like isoform X2	7.65
c78392_g1_i4	XP_007229705.1	Matrix metalloproteinase-19-like	2.05
c79228_g1_i1	NP_001187157.1	Matrix metalloproteinase-9 precursor	11.26
c76595_g2_i2	XP_007246894.1	Matrix-remodeling-associated protein 8	2.06
c76595_g2_i4	NP_001073429.2	Matrix-remodelling associated 8b precursor	4.13
c80478_g2_i3	XP_006639922.1	MAU2 chromatid cohesion factor homolog	2.86
c80478_g2_i1	XP_007243608.1	MAU2 chromatid cohesion factor homolog, partial	6.01
c83510_g5_i2	XP_006007052.1	Max dimerization protein 4	2.7
c75717_g9_i2	XP_007245984.1	Max-binding protein MNT	4.33
c80671_g4_i5	XP_007250174.1	MBT domain-containing protein 1-like isoform X1	2.88
c83412_g2_i9	XP_007258633.1	Mediator of RNA polymerase II transcription subunit	14.48
c83372_g4_i10	XP_007237367.1	Mediator of RNA polymerase II transcription subunit 1	5.99
c81240_g4_i5	XP_007240245.1	Membralin isoform X1	2.71
c80939_g6_i1	NP_001243118.1	Membrane protein, palmitoylated 6a (MAGUK p55 subfamily member 6)	2.33
c83630_g4_i9	BAN84489.1	Membrane-bound complement regulatory protein	3.05
c74920_g3_i4	NP_001134813.1	Membrane-spanning 4-domains subfamily A member 4A	3.58
c77776_g2_i8	XP_004066104.1	Mesothelin-like	-4.45
c83628_g1_i1	XP_007241812.1	Mesothelin-like protein-like	5.24
c82764_g4_i3	XP_007249672.1	Metal regulatory transcription factor 1	3.49
c81012_g11_i9	XP_003199529.2	Metal transporter CNNM3-like	4.2
c81012_g12_i1	XP_005165113.1	Metal transporter CNNM4 isoform X1	7.11
c81012_g12_i2	XP_005165114.1	Metal transporter CNNM4 isoform X2	2.93
c80913_g1_i5	XP_005162821.1	Metalloendopeptidase homolog PEX isoform X1	3.91

c80520_g3_i2	XP_007259250.1	Metalloproteinase inhibitor 2-like	3.86
c76431_g7_i7	XP_007236319.1	Metalloreductase STEAP4-like	2.44
c79768_g3_i17	XP_007232116.1	Metastasis suppressor protein 1-like isoform X6	11.03
c83906_g5_i2	XP_005926057.1	Metastasis-associated protein MTA1-like isoform X1	5.5
c83070_g5_i4	XP_005172244.1	Metastasis-associated protein MTA2 isoform X1	2.45
c79605_g16_i4	NP_001277009.1	Methionine adenosyltransferase II, alpha a	3.73
c79754_g3_i4	NP_932338.1	Methionine synthase	4.28
c79873_g8_i8	XP_007254825.1	Methionine synthase reductase	2.62
c81172_g1_i4	XP_007253497.1	Methionine--tRNA ligase, cytoplasmic	6.88
c78111_g2_i1	XP_005159960.1	Methylcytosine dioxygenase TET2-like	9.07
c82196_g1_i8	XP_007247987.1	Methylenetetrahydrofolate reductase	2.01
c82196_g1_i1	XP_005967447.1	Methylenetetrahydrofolate reductase isoform X1	-2.62
c79020_g4_i1	NP_001104708.1	Methylthioribose-1-phosphate isomerase	4.45
c75306_g3_i2	AAI55210.1	MGC162283 protein	2.9
c78621_g4_i17	NP_001087110.1	MGC82349 protein	3.01
c82564_g3_i1	AGO18314.1	MHC class I antigen alpha 2, partial	2.98
c83838_g1_i1	AHA37373.1	MHC class I antigen ZBA transcript variant 3	3.5
c78006_g7_i1	XP_004558506.1	MHC class II regulatory factor RFX1-like isoform X2	2.89
c83838_g3_i7	AAH76561.1	Mhc1ze protein, partial	2.28
c81344_g5_i2	AAI63627.1	Mib2 protein	3.36
c76888_g1_i2	XP_007239102.1	MICAL-like protein 1-like	4.9
c80625_g2_i2	XP_007238405.1	Microfibril-associated glycoprotein 4-like isoform X1	-2.58
c77867_g5_i6	XP_005995279.1	Microphthalmia-associated transcription factor isoform X2	-3.79
c76396_g7_i3	NP_001116221.1	Microprocessor complex subunit DGCR8	2.06
c83791_g1_i3	XP_007258893.1	Microtubule-actin cross-linking factor 1, isoforms 1/2/3/5	7.11
c82506_g4_i1	ADO28141.1	Microtubule-associated proteins 1a/1b light chain 3b	2.26
c83922_g4_i1	XP_001341305.4	Microtubule-associated serine/threonine-protein kinase 2	6.28
c80998_g4_i2	XP_005165724.1	Microtubule-associated serine/threonine-protein kinase 4	23.42
c83925_g1_i1	XP_003200751.2	Midasin	7
c78854_g14_i7	XP_007252682.1	Midnolin	4.42
c78854_g14_i4	XP_005170493.1	Midnolin isoform X1	10.03
c78854_g14_i3	XP_007238494.1	Midnolin-like	2.87
c76604_g3_i1	ACI34344.1	Minor histocompatibility antigen H13	2.23
c80680_g17_i6	XP_005472097.1	Misshapen-like kinase 1-like	8.29

c80680_g8_i1	XP_003971178.1	Misshapen-like kinase 1-like isoform 1	7.28
c82798_g2_i15	XP_002661418.2	Mitochondrial 10-formyltetrahydrofolate dehydrogenase	2.64
c79258_g6_i4	NP_001038918.1	Mitochondrial coenzyme A transporter SLC25A42	4.46
c72592_g3_i1	XP_007257620.1	Mitochondrial fission regulator 1-like	3.17
c78637_g4_i9	XP_007234238.1	Mitochondrial inner membrane protein isoform X1	3.1
c78637_g4_i8	XP_007234239.1	Mitochondrial inner membrane protein isoform X2	3.81
c79682_g11_i3	XP_007234566.1	Mitochondrial intermediate peptidase	2.61
c81728_g7_i7	XP_007247925.1	Mitochondrial Rho GTPase 1-A-like isoform X2	2.83
c80655_g1_i11	XP_007246153.1	Mitofusin-1-like isoform X1	2.15
c80459_g2_i7	XP_007247975.1	Mitofusin-2 isoform X1	2.14
c78210_g10_i3	XP_007234538.1	Mitogen-activated protein kinase 3	2.96
c78143_g7_i2	XP_007242383.1	Mitogen-activated protein kinase 6-like isoform X1	3.95
c77600_g5_i1	XP_007233629.1	Mitogen-activated protein kinase 8B isoform X1	5.31
c77032_g3_i4	XP_007244613.1	Mitogen-activated protein kinase 9 isoform X1	8.78
c81105_g3_i1	XP_003454883.1	Mitogen-activated protein kinase kinase kinase 10-like	5.5
c83508_g8_i3	XP_007230232.1	Mitogen-activated protein kinase kinase kinase 11 isoform	3.83
c81376_g7_i3	XP_007230490.1	Mitogen-activated protein kinase kinase kinase 13-like	4.32
c81887_g11_i10	XP_007248944.1	Mitogen-activated protein kinase kinase kinase 2-like	4.38
c81635_g1_i1	XP_007251171.1	Mitogen-activated protein kinase kinase kinase 3-like	5.9
c82581_g4_i21	NP_001155222.1	Mitogen-activated protein kinase kinase kinase 5	2.98
c77173_g4_i7	XP_005626291.1	Mitogen-activated protein kinase kinase kinase kinase 4,	11.93
c81546_g1_i2	NP_956207.1	Mitogen-activated protein kinase kinase kinase kinase 5	3.6
c73040_g1_i3	XP_687660.2	Mitogen-activated protein kinase kinase kinase MLT	3.34
c81083_g4_i8	Q90336.1	MK14A_CYPCA RecName: Full=Mitogen-activated protein kinase 14A; Short=MAP	2.95
c61021_g1_i1	XP_005460988.1	MKL/myocardin-like protein 2-like isoform X1	4.97
c81661_g5_i3	XP_007238332.1	MLX-interacting protein-like	2.86
c81317_g5_i1	XP_001920456.2	MMS19 nucleotide excision repair protein homolog isoform	3.98
c79922_g7_i1	NP_001099130.1	Molybdenum cofactor biosynthesis protein 1	4.88
c79516_g1_i1	XP_007244700.1	Monoacylglycerol lipase ABHD12-like	3.32
c76627_g1_i1	XP_007236445.1	Monocarboxylate transporter 1-like isoform X1	2.37
c77628_g1_i3	XP_007244354.1	MORC family CW-type zinc finger protein 2A-like isoform X2	2.95
c77537_g6_i8	XP_007260883.1	Mothers against decapentaplegic homolog 2 isoform X1	2.46

c77537_g6_i3	XP_007260884.1	Mothers against decapentaplegic homolog 2 isoform X2	3.27
c83331_g4_i1	NP_001116172.1	Mothers against decapentaplegic homolog 4	2.35
c78726_g2_i12	XP_007233216.1	Mpv17-like protein 2-like	5.97
c80341_g5_i4	XP_006639576.1	MRG/MORF4L-binding protein-like	3.05
c83690_g1_i1	XP_007256745.1	Msx2-interacting protein-like isoform X3	2.71
c81609_g15_i1	XP_007235432.1	MTSS1-like protein-like	7.57
c77991_g7_i2	NP_001116724.1	MTSS1-like protein-like	2.73
c81110_g2_i2	WP_010785772.1	Mucin 17-like protein, partial	3.88
c78080_g3_i5	XP_694345.6	Mucin-17 isoform X2	40.15
c83756_g2_i2	XP_007235013.1	Mucin-19-like isoform X1	19.15
c75765_g1_i9	XP_005166357.1	Mucin-2-like isoform X2	21.9
c77449_g2_i4	XP_002936537.2	Mucin-5AC-like	24.77
c83581_g8_i2	XP_007259561.1	Mucin-5AC-like isoform X1	3.13
c73607_g2_i3	XP_007253182.1	Mucolipin-1-like isoform X1	3.6
c81804_g6_i4	XP_001922717.3	Multidrug resistance protein 1 isoform X1	5.21
c81131_g2_i1	XP_007258821.1	Multimerin-2-like	2.63
c75891_g1_i2	NP_956778.1	Multivesicular body subunit 12A	3.3
c79361_g2_i7	AFO11027.1	Muscle carnitine palmitoyltransferase 1B	2.85
c80232_g9_i5	NP_001093520.2	Muscleblind-like protein 1 isoform 2	4.39
c80232_g9_i1	ABX80001.1	Muscleblind-like protein 1C	5.08
c80232_g9_i8	ABX80002.1	Muscleblind-like protein 1D	6.72
c80232_g9_i2	XP_007232969.1	Muscleblind-like protein 1-like	4.69
c76574_g3_i2	XP_006637488.1	Muscleblind-like protein 1-like isoform X2	3.77
c76574_g18_i8	XP_004543616.1	Muscleblind-like protein 1-like isoform X4	4.7
c77218_g5_i2	NP_001187500.1	Musculoskeletal embryonic nuclear protein 1	-2.19
c77573_g1_i5	NP_001002042.1	Myb-binding protein 1A-like protein	3.85
c75183_g2_i1	XP_002665608.1	Myelin basic protein isoform X5	14.17
c72943_g3_i6	XP_007236691.1	Myelin protein P0-like isoform X1	6.5
c72943_g3_i5	XP_007236692.1	Myelin protein P0-like isoform X2	5.61
c79592_g10_i9	XP_007247338.1	Myelin protein zero-like protein 1-like	2.13
c82226_g1_i1	NP_001187207.1	Myeloid differentiation primary response protein MyD88	3.86
c79624_g1_i5	AAH60675.1	Myh9 protein	11.22
c77866_g1_i5	XP_007257273.1	Myocardin-like isoform X8	3.67
c76219_g1_i2	XP_007259531.1	Myocilin isoform X1	3.72
c76907_g17_i1	AGS58247.1	Myocyte-specific enhancer factor 2a	2.69

c76907_g17_i2	XP_005159101.1	Myocyte-specific enhancer factor 2A isoform X3	3.03
c76907_g18_i3	XP_007253931.1	Myocyte-specific enhancer factor 2C isoform X1	2.97
c79334_g7_i3	XP_007249799.1	Myocyte-specific enhancer factor 2D homolog isoform X2	10.43
c79334_g7_i2	XP_005158101.1	Myocyte-specific enhancer factor 2D isoform X3	5.34
c82247_g4_i2	XP_005161022.1	Myomegalin isoform X5	3.3
c80664_g12_i1	XP_007237676.1	Myomegalin-like	3.36
c81366_g4_i2	XP_007256634.1	Myomegalin-like isoform X5	6.94
c52518_g1_i1	BAF93223.1	Myosin heavy chain fast skeletal type 2	-2.55
c77603_g1_i3	XP_005745390.1	Myosin heavy chain, fast skeletal muscle-like	2.6
c80667_g1_i3	XP_007253555.1	Myosin light chain kinase, smooth muscle-like isoform X2	12.29
c74994_g12_i1 1	XP_004070489.1	Myosin light polypeptide 6-like isoform 1	2.87
c79952_g11_i2	NP_001187837.1	Myosin, light polypeptide 9, regulatory	2.1
c84026_g6_i1	XP_003964413.1	Myosin-10	4.44
c84026_g4_i7	XP_683046.6	Myosin-10 isoform X3	5.15
c84026_g4_i3	XP_006635254.1	Myosin-10-like isoform X2	3.79
c76153_g5_i1	XP_005934540.1	Myosin-10-like isoform X4	6.16
c84026_g4_i8	XP_007257218.1	Myosin-11-like isoform X3	3.94
c82780_g13_i2	XP_007257282.1	Myosin-3-like isoform X2	6.18
c80687_g1_i12	XP_007257004.1	Myosin-6-like	11.95
c84322_g1_i6	XP_002666777.2	Myosin-7-like	4.34
c81417_g3_i6	XP_001923213.1	Myosin-7-like isoform 1	4.97
c84322_g1_i5	XP_696132.3	Myosin-7-like isoform X2	2.79
c79624_g11_i1	XP_005470244.1	Myosin-9-like isoform X2	13.73
c79544_g2_i1	XP_007246980.1	Myosin-binding protein C, cardiac-type-like isoform X5	24.13
c79544_g2_i2	XP_007246981.1	Myosin-binding protein C, cardiac-type-like isoform X6	4.68
c81417_g3_i9	ELK27722.1	Myosin-Ib	13.88
c81861_g2_i1	CBN81695.1	Myosin-Id	8.81
c78248_g1_i6	XP_007250392.1	Myosin-IIIa-like	4.33
c80982_g10_i3	NP_001155104.1	Myosin-Vb	3.87
c75939_g5_i4	XP_003219847.1	Myosin-X-like	9.2
c82182_g6_i10	XP_007242260.1	Myotubularin-related protein 11	2.36
c79563_g7_i8	XP_007234288.1	Myotubularin-related protein 13-like	18.72
c83813_g9_i7	XP_005164647.1	Myotubularin-related protein 5 isoform X1	6.72
c83813_g9_i20	XP_005164648.1	Myotubularin-related protein 5 isoform X2	7.51

c83949_g5_i3	Q90339.2	MYSS_CYPCA RecName: Full=Myosin heavy chain, fast skeletal muscle	2.44
c79847_g5_i2	NP_571761.1	Na+/K+ -ATPase alpha 1 subunit	12.28
c74022_g1_i1	ADD60471.1	Na+/K+ ATPase alpha subunit	5.79
c79847_g5_i3	AGV06212.1	Na+/K+-ATPase alpha 1	3.89
c74430_g1_i3	XP_007252796.1	N-acetylglucosamine-6-sulfatase-like	2.33
c84176_g5_i2	XP_685919.3	N-acetylglutamate synthase, mitochondrial-like	2.11
c82675_g5_i1	XP_003199111.1	N-acetylneuraminate lyase-like isoform X1	2.16
c77537_g3_i1	NP_956938.1	N-acetyltransferase 10	2.54
c77023_g2_i2	XP_007237103.1	NAD kinase isoform X1	2.59
c78081_g1_i2	NP_999921.1	NAD(P) transhydrogenase, mitochondrial	5.53
c82169_g2_i2	XP_003972793.1	NADH-cytochrome b5 reductase 3-like	2.01
c80510_g1_i5	NP_001082825.1	NADP-dependent malic enzyme, mitochondrial	-4.33
c77705_g12_i9	AAH50171.1	Nae1 protein	-3.8
c82376_g1_i7	XP_007253759.1	N-alpha-acetyltransferase 15, NatA auxiliary subunit-like	3.36
c78233_g7_i8	XP_005172655.1	N-alpha-acetyltransferase 25, NatB auxiliary subunit	3.97
c76626_g9_i3	NP_001017632.1	N-alpha-acetyltransferase 40	2.24
c76066_g9_i5	XP_001919340.4	Nance-Horan syndrome protein isoform X1	3.57
c78481_g3_i3	XP_694205.1	Nardilysin isoform X2	3.59
c83837_g6_i3	ADO27823.1	Natterin-like protein	4.48
c81327_g3_i2	NP_001187029.1	Natural resistance-associated macrophage protein large transcript	3.19
c81732_g5_i1	XP_005167980.1	Nck-associated protein 1 isoform X3	6.04
c81732_g5_i4	XP_005809580.1	Nck-associated protein 1-like isoform X4	4.28
c79678_g3_i5	XP_005751273.1	NEDD4-like E3 ubiquitin-protein ligase WWP2-like isoform	3.36
c80259_g13_i1	XP_005166647.1	Neogenin isoform X3	21.32
c76700_g1_i1	XP_003454836.1	Neprilysin-like isoform X1	4.64
c82896_g3_i10	XP_007254019.1	Nesprin-1-like	5.92
c74302_g1_i2	XP_007252013.1	Nesprin-1-like isoform X2	25.46
c83345_g4_i3	XP_005160569.1	Nesprin-2 isoform X1	17.89
c83345_g4_i1	XP_687789.2	Nesprin-2 isoform X2	13.06
c75987_g1_i2	NP_001038718.1	Neugrin	3.49
c71447_g1_i1	XP_007246778.1	Neurabin-1-like	7.36
c75909_g14_i1	XP_007253581.1	Neurabin-1-like isoform X2	5.06
c77904_g11_i1	XP_686514.3	Neurabin-2-like	5.31
c77014_g8_i3	ADV17404.1	Neural cell adhesion molecule 1 isoform 1	15.69

c77014_g8_i5	XP_005161197.1	Neural cell adhesion molecule 1 isoform X6	5.28
c82472_g8_i7	XP_007256416.1	Neural cell adhesion molecule L1-like protein-like isoform	3.83
c81817_g10_i9	XP_688089.3	Neural precursor cell expressed, developmentally	2.86
c78412_g3_i5	XP_003967258.1	Neural Wiskott-Aldrich syndrome protein-like	3.2
c76800_g3_i3	XP_007246614.1	Neural Wiskott-Aldrich syndrome protein-like isoform X1	2.35
c76769_g12_i9	XP_005161385.1	Neuregulin 2a isoform X2	2.57
c82705_g2_i2	XP_002662311.2	Neurobeachin-like 1 isoform X1	4.76
c82021_g1_i1	NP_001003776.1	Neurocalcin-delta B	2.68
c81084_g10_i7	XP_005164682.1	Neuroepithelial cell-transforming gene 1 protein isoform	3.17
c80766_g2_i6	XP_007229137.1	Neurogenic locus notch homolog protein 2-like	2.97
c78229_g1_i7	NP_571624.2	Neurogenic locus notch homolog protein 3 precursor	8.63
c77493_g1_i3	XP_005918027.1	Neuron navigator 1-like isoform X8	8.08
c81721_g4_i3	XP_003446904.1	Neuronal migration protein doublecortin-like isoform 1	4.18
c83129_g7_i2	XP_007253218.1	Neuropathy target esterase-like	13.31
c76397_g3_i5	XP_007238715.1	Neuropilin-1a-like isoform X1	5.16
c76397_g3_i4	XP_007238717.1	Neuropilin-1a-like isoform X3	3.08
c79089_g14_i1	XP_007234219.1	Neuropilin-2-like isoform X3	7.15
c82568_g11_i2	XP_005164029.1	Neurotrophin-3-like	3.25
c82104_g1_i3	XP_005156843.1	Neutral amino acid transporter A isoform X1	4.31
c80221_g1_i1	XP_007255552.1	NF-kappa-B inhibitor epsilon	2.6
c78886_g10_i5	XP_006634673.1	NFX1-type zinc finger-containing protein 1-like	2.85
c79731_g2_i5	XP_007253296.1	NGFI-A-binding protein 1 isoform X5	7.46
c78703_g4_i1	XP_007248489.1	NGFI-A-binding protein 2-like	4.44
c78434_g3_i2	XP_007259319.1	NHL repeat-containing protein 2	2.36
c80668_g5_i2	XP_007246267.1	Nicalin-1-like isoform X2	2.87
c77460_g5_i3	XP_007236020.1	Nicotinamide riboside kinase 2-like isoform X1	-2.31
c83270_g2_i1	XP_005163716.1	Niemann-Pick C1 protein isoform X2	3.32
c83011_g3_i2	XP_007239997.1	NIPA-like protein 3, partial	2.3
c83927_g5_i6	XP_007244851.1	Nipped-B-like protein B-like isoform X1	6.58
c82049_g1_i1	ERE75555.1	NK-tumor recognition protein, partial	20.68
c81809_g11_i1	AAH93121.1	Nlk1 protein	3.44
c83935_g8_i1	XP_005167427.1	N-lysine methyltransferase SETD8-like	8.67
c84282_g1_i12	ABD83886.1	NOD3 protein-like	2.8
c76033_g4_i2	XP_007255434.1	Nogo-B receptor	2.14
c81648_g1_i10	AGS07433.1	Non-receptor protein tyrosine kinase 2-1	2.32

c81648_g1_i7	AGS07435.1	Non-receptor protein tyrosine kinase 2-3	7.89
c75517_g1_i1	XP_007233439.1	Non-syndromic hearing impairment protein 5	2.65
c82161_g4_i1	NP_001108566.1	Notch homolog 2	2.39
c76844_g2_i2	XP_004074887.1	Notch-regulated ankyrin repeat-containing protein A-like	2.54
c77045_g1_i3	CAK11208.1	Novel protein similar to vertebrate cell adhesion	3.45
c80523_g11_i3	CAX14016.1	Novel protein similar to vertebrate MAP/microtubule	2.24
c75203_g3_i1	XP_696713.3	Nuclear envelope pore membrane protein POM 121	7.75
c82426_g5_i1	XP_005723858.1	Nuclear export mediator factor NEMF-like	2.45
c81644_g3_i1	XP_005281412.1	Nuclear factor 1 X-type isoform X4	6.16
c82203_g9_i2	XP_007260690.1	Nuclear factor 1 X-type-like isoform X3	6.65
c76678_g1_i1	XP_007240713.1	Nuclear factor erythroid 2-related factor 1-like	2.76
c82124_g2_i3	XP_007259219.1	Nuclear factor erythroid 2-related factor 1-like isoform	3.27
c73439_g2_i1	NP_001004120.1	Nuclear factor interleukin-3-regulated protein	2.15
c76987_g2_i6	XP_007244327.1	Nuclear factor of activated T-cells 5-like	4.54
c76991_g4_i1	XP_007246953.1	Nuclear factor of activated T-cells, cytoplasmic 3-like	4.28
c74624_g1_i2	XP_007237238.1	Nuclear fragile X mental retardation-interacting protein	2.76
c81984_g10_i1	AAC64706.1	Nuclear oncoprotein	3.07
c79786_g7_i1	NP_571013.1	Nuclear oncoprotein skib	4.39
c78527_g1_i10	XP_005169201.1	Nuclear pore complex protein Nup155 isoform X1	2.14
c78527_g1_i2	XP_007244856.1	Nuclear pore complex protein Nup155-like isoform X1	3.94
c81449_g4_i1	XP_006640849.1	Nuclear pore complex protein Nup214-like	8.84
c82507_g2_i4	XP_007259635.1	Nuclear pore complex protein Nup98-Nup96	2.73
c81032_g1_i8	XP_002667606.3	Nuclear pore membrane glycoprotein 210	5.3
c84010_g1_i2	ELK02830.1	Nuclear pore membrane glycoprotein 210-like protein	-2.74
c83032_g4_i5	XP_007245506.1	Nuclear receptor coactivator 1-like	6.98
c74925_g17_i1	XP_007260173.1	Nuclear receptor coactivator 2 isoform X1	6.57
c80693_g4_i16	XP_007247838.1	Nuclear receptor coactivator 3-like	2.01
c80680_g19_i3	XP_007243380.1	Nuclear receptor coactivator 6-like isoform X1	4.96
c80139_g3_i7	NP_956570.2	Nuclear receptor corepressor 1	7.58
c80139_g3_i2	XP_007233615.1	Nuclear receptor corepressor 1-like	6.67
c83280_g9_i9	XP_007229425.1	Nuclear receptor corepressor 2 isoform X1	9.64
c82759_g11_i5	XP_007229426.1	Nuclear receptor corepressor 2 isoform X2	5.5
c82759_g11_i12	XP_007229427.1	Nuclear receptor corepressor 2 isoform X3	5.86
c70158_g1_i3	NP_001124064.1	Nuclear receptor subfamily 1, group D, member 2a	2.91
c80952_g2_i1	XP_006634384.1	Nuclear receptor-binding protein 2-like	3.78

c78369_g4_i4	XP_007244808.1	Nuclear receptor-interacting protein 1-like isoform X1	3.36
c83188_g6_i17	XP_007244582.1	Nuclear RNA export factor 1-like	3.11
c79010_g3_i7	XP_007245704.1	Nuclear transcription factor Y subunit gamma isoform X5	2.26
c81471_g6_i2	XP_007253246.1	Nuclear valosin-containing protein-like	2.24
c83394_g9_i4	NP_001038928.1	Nucleobindin-1 precursor	2.12
c74964_g2_i4	XP_005156577.1	Nucleolar and coiled-body phosphoprotein 1 isoform X1	4.9
c75334_g10_i3	XP_007240837.1	Nucleolar and coiled-body phosphoprotein 1-like	3.6
c78454_g5_i1	NP_001133389.1	Nucleolar protein 14	3.62
c78149_g10_i4	XP_007248939.1	Nucleolar protein 58-like	2.23
c80240_g4_i7	XP_002662124.1	Nucleolar protein 9-like isoform X1	2.08
c79515_g3_i4	XP_007233107.1	Nucleolar transcription factor 1-B-like isoform X3	2.19
c81439_g1_i11	XP_005156856.1	Nucleolysin TIAR isoform X3	2.81
c77328_g1_i3	XP_007256635.1	Nucleoporin NUP188 homolog	4.24
c82222_g1_i1	XP_007245485.1	Nucleoprotein TPR-like isoform X2	3.9
c78443_g8_i10	NP_001187287.1	Nucleoside diphosphate kinase 7	-2.2
c81838_g10_i2	XP_007239501.1	Nucleosome assembly protein 1-like 1 isoform X3	2.35
c81689_g1_i1	XP_005171685.1	Nucleosome-remodeling factor subunit BPTF isoform X3	17.91
c81689_g1_i6	XP_005171689.1	Nucleosome-remodeling factor subunit BPTF isoform X7	28.98
c78824_g4_i5	XP_007237839.1	Nucleus accumbens-associated protein 1-like isoform X1	8.62
c78824_g3_i2	XP_003455024.1	Nucleus accumbens-associated protein 2-like isoform X1	8.53
c82803_g7_i1	XP_006626661.1	Occludin-like isoform X2	2.31
c77072_g1_i8	NP_001187099.1	Oct1 transcription factor	4.39
c79448_g4_i4	NP_001038314.1	Olfactomedin-like 2Ba precursor	8.34
c78414_g11_i1	XP_001342693.3	Olfactomedin-like protein 1-like	4.64
c80469_g11_i6	XP_007256471.1	Oligophrenin-1	2.88
c78915_g11_i3	XP_005876761.1	ORM1-like protein 2	2.75
c82495_g10_i1	XP_007239051.1	Ornithine aminotransferase, mitochondrial	3.93
c73944_g1_i1	CBN81273.1	Orphan sodium-and chloride-dependent neurotransmitter transporter	5.47
c83628_g1_i6	XP_004574810.1	Otoancorin-like	66.23
c77080_g2_i2	XP_007242932.1	OTU domain-containing protein 5-A-like, partial	-6
c82632_g1_i7	XP_007242259.1	OTU domain-containing protein 7B	6.74
c82690_g2_i10	XP_006794841.1	Oxidation resistance protein 1-like isoform X3	14.49

c80831_g4_i7	NP_957073.2	Oxoglutarate (alpha-ketoglutarate) dehydrogenase (lipoamide)	5.9
c81077_g5_i2	XP_007232796.1	Oxysterol-binding protein 1-like isoform X3	2.45
c74758_g5_i3	NP_001116220.1	Oxysterol-binding protein 2	3.06
c77560_g7_i3	XP_007260028.1	Oxysterol-binding protein-related protein 11	3.11
c76501_g3_i1	XP_007256395.1	Oxysterol-binding protein-related protein 2	3.47
c79832_g14_i4	XP_007242578.1	Oxysterol-binding protein-related protein 3-like	5.21
c80909_g9_i9	XP_001345022.3	Oxysterol-binding protein-related protein 5 isoform X1	6.63
c77925_g5_i12	NP_001071273.1	Oxysterol-binding protein-related protein 9	4.01
c78936_g1_i3	XP_005170502.1	P66 alpha isoform X2	4.58
c78936_g1_i2	XP_005170505.1	P66 alpha isoform X5	4.53
c80323_g5_i7	XP_007249052.1	PAB-dependent poly(A)-specific ribonuclease subunit 3	2.24
c82819_g6_i1	XP_002662923.1	Paired amphipathic helix protein Sin3a	3.08
c80554_g1_i4	XP_003969856.1	Paired amphipathic helix protein Sin3a-like	-3.49
c83113_g5_i3	XP_006782501.1	Paired amphipathic helix protein Sin3a-like isoform X1	2.46
c76770_g8_i1	AHH83733.1	Paired related homeobox 1a, partial	2.88
c79115_g3_i6	NP_001121854.1	Palmitoyltransferase ZDHHC17	2.06
c78621_g4_i1	XP_005173776.1	Palmitoyltransferase ZDHHC3 isoform X1	2.74
c77260_g4_i3	XP_007242362.1	Palmitoyltransferase ZDHHC5-like	2.34
c80767_g1_i3	XP_007244096.1	Palmitoyltransferase ZDHHC7-like	2.48
c82676_g5_i7	XP_006633086.1	Palmitoyltransferase ZDHHC9-like	2.93
c81156_g5_i4	XP_007238714.1	Partitioning defective 3 homolog isoform X2	6.82
c80929_g4_i1	XP_007228579.1	Partitioning defective 6 homolog gamma-like	4.23
c65003_g2_i1	AAO25757.1	Parvalbumin	-3.72
c73279_g1_i1	XP_007242851.1	Paternally-expressed gene 3 protein-like	5.21
c79660_g8_i4	NP_956490.1	PDZ and LIM domain 5 isoform 2	2.67
c80657_g15_i1	XP_007260206.1	PDZ and LIM domain protein 2	2.07
c74332_g2_i2	XP_007254476.1	PDZ domain-containing protein 11 isoform X1	7.31
c83575_g4_i9	XP_007250534.1	PDZ domain-containing protein 2-like isoform X2	2.65
c77069_g2_i2	XP_689774.4	PDZ domain-containing protein 8	2.26
c79333_g7_i5	XP_007232336.1	Pendrin-like isoform X3	5.06
c78966_g7_i4	XP_007260835.1	Peptidyl-prolyl cis-trans isomerase C	2.26
c79439_g1_i3	XP_001340208.3	Peptidyl-prolyl cis-trans isomerase FKBP10 isoform X1	2.38
c75668_g19_i2	XP_007244105.1	Peptidyl-prolyl cis-trans isomerase FKBP4-like	2.43
c76100_g5_i3	XP_007260574.1	Peregrin-like	3.71
c79124_g1_i6	XP_007251184.1	Perforin-1-like, partial	2.98

c79237_g1_i7	XP_005168389.1	Pericentriolar material 1 protein isoform X7	2.39
c79237_g5_i2	XP_007232658.1	Pericentriolar material 1 protein-like	2.27
c77373_g4_i4	XP_007255257.1	Perilipin-2	2.89
c84014_g5_i7	XP_006642068.1	Period circadian protein homolog 2-like	16
c81405_g3_i2	XP_007253055.1	Period circadian protein homolog 2-like isoform X1	4.03
c76909_g2_i8	AHM24918.1	Periostin	8.1
c81337_g2_i4	NP_001071254.1	Periostin isoform 1 precursor	3.88
c76992_g1_i2	XP_005164723.1	Periphilin-1 isoform X1	-2.28
c83536_g5_i5	XP_007233792.1	Periplakin	4.19
c76652_g21_i2	XP_007236114.1	PERQ amino acid-rich with GYF domain-containing protein	2.65
c80566_g5_i1	XP_007255330.1	PH and SEC7 domain-containing protein 3-like isoform X1	6.22
c80566_g5_i10	XP_007255331.1	PH and SEC7 domain-containing protein 3-like isoform X2	5.07
c80566_g5_i6	XP_007255332.1	PH and SEC7 domain-containing protein 3-like isoform X3	2.61
c82040_g1_i1	XP_005796163.1	PH domain leucine-rich repeat-containing protein	3.93
c83734_g10_i3	XP_007228108.1	PHD and RING finger domain-containing protein 1 isoform X2	5.47
c75281_g1_i2	XP_005157088.1	PHD finger protein 3 isoform X2	3.88
c78872_g1_i2	NP_001007769.1	Phenylalanyl-tRNA synthetase beta chain	2.19
c78462_g10_i5	XP_007257952.1	PH-interacting protein	2.23
c78462_g10_i9	XP_698221.5	PH-interacting protein isoform X2	8.21
c75311_g1_i3	NP_001187986.1	Phosphatase 1 regulatory subunit 7	2.28
c77335_g7_i2	XP_001341899.2	Phosphatidate cytidylyltransferase 1	4.25
c81355_g2_i4	XP_005945187.1	Phosphatidate cytidylyltransferase 2-like	5.06
c78353_g9_i4	XP_007257619.1	Phosphatidylcholine:ceramide cholinephosphotransferase	2.59
c77579_g2_i13	XP_007228599.1	Phosphatidylinositide phosphatase SAC1-B-like	4.13
c76959_g3_i6	XP_001923007.3	Phosphatidylinositol 3,4,5-trisphosphate 5-phosphatase 1	3.38
c82239_g3_i1	XP_699627.3	Phosphatidylinositol 3,4,5-trisphosphate-dependent Rac	6.2
c77736_g4_i6	XP_007236039.1	Phosphatidylinositol 4-kinase beta-like isoform X2	5.25
c78986_g6_i1	XP_007254854.1	Phosphatidylinositol 5-phosphate 4-kinase type-2 alpha	3.22
c79316_g7_i5	NP_001001822.1	Phosphatidylinositol-3,4,5-trisphosphate 3-phosphatase and	3.55
c78986_g1_i3	NP_001122174.1	Phosphatidylinositol-5-phosphate 4-kinase type-2 alpha	4.77
c82919_g10_i12	XP_005172377.1	Phosphatidylinositol-binding clathrin assembly protein	4.91

c81441_g4_i8	XP_003454493.1	Phosphatidylserine synthase 1	3.65
c80473_g1_i10	XP_005453238.1	Phosphofurin acidic cluster sorting protein 1-like isoform	2.97
c75780_g4_i1	XP_003201197.2	Phosphofurin acidic cluster sorting protein 2 isoform X1	4.42
c79246_g5_i4	XP_007245245.1	Phospholipase D1	-2.84
c82816_g3_i2	XP_005165435.1	Phospholipase D2 isoform X1	2.57
c80974_g5_i3	XP_007229879.1	Phosphomannomutase 1	3.74
c83801_g13_i1	XP_007249377.1	Phosphoprotein associated with glycosphingolipid-enriched	2.58
c75854_g14_i1	XP_688220.3	Phosphorylated CTD-interacting factor 1	5.06
c83432_g9_i4	XP_696355.4	Piezo-type mechanosensitive ion channel component 1	9.01
c80578_g8_i2	XP_001338299.2	Plakophilin-1	2.3
c81748_g13_i8	XP_007228299.1	Plakophilin-3 isoform X1	2.89
c81748_g13_i1	XP_002662884.1	Plakophilin-3-like	4.71
c77087_g6_i12	XP_007235565.1	Plastin-2-like	2.26
c83759_g3_i3	XP_007257106.1	Platelet-derived growth factor receptor alpha isoform X1	2.36
c78526_g4_i6	XP_007232268.1	Platelet-derived growth factor receptor beta isoform X1	5.71
c80664_g6_i3	EDL17685.1	Pleckstrin homology domain containing, family A (phosphoinositide	3.58
c81792_g2_i12	XP_007228638.1	Pleckstrin homology domain-containing family A member 6	4.64
c69161_g1_i1	NP_001134210.1	Pleckstrin homology domain-containing family F member 1	2.04
c81879_g10_i4	XP_006008181.1	Pleckstrin homology domain-containing family G member	2.98
c82002_g2_i4	XP_005448451.1	Pleckstrin homology domain-containing family G member 5	8.37
c75010_g9_i4	XP_005732944.1	Pleckstrin homology domain-containing family N member	3.06
c81352_g8_i1	NP_001134998.1	Pleckstrin homology-like domain family A member 2	2.37
c79714_g15_i5	ADO27918.1	Pleckstrin-like proteiny domain-containing family j member 1	4.4
c83937_g9_i3	XP_005170112.1	Plectin a isoform X1	4.72
c83624_g1_i9	XP_007257339.1	Plectin-like isoform X2	14.44
c79876_g6_i7	XP_007230375.1	Plexin domain-containing protein 2-like	2.52
c81059_g7_i3	NP_001103480.1	Plexin-A1	7.3
c81607_g5_i4	XP_007253387.1	Plexin-B1-like isoform X1	4.32
c80882_g5_i1	XP_007229785.1	Plexin-B2-like isoform X1	4.89
c80882_g5_i3	XP_007229787.1	Plexin-B2-like isoform X3	5.02
c83103_g16_i3	XP_694914.4	Plexin-B3 isoform X2	9.47

c81345_g4_i1	XP_005164837.1	Plexin-C1 isoform X1	3.67
c82312_g5_i5	XP_006796494.1	Plexin-D1-like isoform X1	2.78
c84348_g2_i1	CBN81178.1	Pol polyprotein	5.28
c83657_g5_i1	XP_007250915.1	Poliovirus receptor-related protein 2-like isoform X1	4.6
c83657_g5_i3	XP_007250916.1	Poliovirus receptor-related protein 2-like isoform X2	3.89
c79337_g12_i2	XP_007233123.1	Poliovirus receptor-related protein 4-like isoform X1	2.04
c78589_g1_i3	CAQ14531.1	Polo-like kinase 3 (Drosophila)	2.53
c78968_g1_i6	XP_007255485.1	Poly(A) polymerase alpha isoform X2	2.53
c82355_g4_i5	XP_005156848.1	Poly(A) polymerase gamma isoform X1	4.56
c82817_g3_i8	ABD65557.1	Poly(ADP-ribose) glycohydrolase-like	-2.01
c79405_g19_i2	NP_001188110.1	Poly(rC)-binding protein 2	2.19
c79385_g11_i1	XP_005449062.1	Poly(U)-binding-splicing factor PUF60-like isoform X6	5.02
c75554_g2_i2	XP_007239958.1	Polycomb protein suz12-A-like	3.5
c81709_g3_i5	XP_006640853.1	Polymerase delta-interacting protein 2-like isoform X2	2.43
c68108_g1_i1	XP_007256332.1	Polymerase I and transcript release factor	9.4
c78481_g9_i1	XP_007239828.1	Polymerase I and transcript release factor-like	2.53
c77965_g1_i1	XP_007258916.1	Polypeptide N-acetylgalactosaminyltransferase 12-like	3.2
c80219_g3_i4	XP_007253832.1	Polypeptide N-acetylgalactosaminyltransferase 5	2.24
c82494_g7_i6	XP_004070476.1	Polypeptide N-acetylgalactosaminyltransferase 6-like	2.75
c81385_g5_i1	NP_001018313.1	Polypyrimidine tract binding protein 1a	5.15
c81385_g4_i6	XP_007240255.1	Polypyrimidine tract-binding protein 1	2.58
c78699_g10_i2	XP_006803668.1	Polypyrimidine tract-binding protein 1-like isoform X1	4.37
c78699_g1_i2	XP_007245175.1	Polypyrimidine tract-binding protein 1-like isoform X2	2.55
c78044_g6_i3	XP_001335967.2	Polypyrimidine tract-binding protein 3	4.14
c78044_g6_i4	XP_006626634.1	Polypyrimidine tract-binding protein 3-like	4.23
c77040_g5_i1	XP_007235365.1	Polyribonucleotide 5'-hydroxyl-kinase Clp1	2.11
c79504_g2_i2	AAI51886.1	Ppp4r2a protein	3
c80591_g6_i2	XP_005167362.1	PR domain zinc finger protein 16 isoform X7	107.95
c80591_g6_i3	XP_006642023.1	PR domain zinc finger protein 16-like isoform X2	16.29
c80591_g10_i2	XP_007247970.1	PR domain zinc finger protein 16-like isoform X3	7.11
c80591_g10_i1	XP_007247972.1	PR domain zinc finger protein 16-like isoform X5	4.6
c79405_g2_i1	NP_001187580.1	Pra1 family protein 3	2.07
c78047_g14_i1	NP_571522.1	Pre-B-cell leukemia homeobox 4	3.67
c78590_g6_i3	XP_004079906.1	Prefoldin subunit 2-like	4.23
c82617_g7_i3	XP_005813929.1	Pre-mRNA 3' end processing protein WDR33-like	3.1
c75508_g2_i2	XP_007260950.1	Pre-mRNA-processing-splicing factor 8	2.71

c80316_g1_i3	XP_004543175.1	Pre-mRNA-splicing factor ATP-dependent RNA helicase	2.61
c75589_g9_i1	NP_001071037.1	Pre-mRNA-splicing factor CWC22 homolog	2.26
c82997_g2_i2	XP_007260919.1	Pre-mRNA-splicing regulator WTAP isoform X1	2.6
c71280_g3_i1	XP_007246233.1	Pre-rRNA processing protein FTSJ3-like	3.52
c76699_g8_i6	NP_571589.2	Presenilin-2	2.85
c76313_g1_i6	XP_005163609.1	Presequence protease, mitochondrial isoform X1	5.43
c76313_g1_i12	XP_005796640.1	Presequence protease, mitochondrial-like	4.18
c53922_g1_i1	AFN73056.1	Prion protein 1	2.82
c82987_g7_i10	XP_007252195.1	Probable ATP-dependent RNA helicase DDX5	2.03
c78697_g3_i4	XP_007239643.1	Probable ATP-dependent RNA helicase DDX5-like isoform X2	3.4
c79057_g10_i3	XP_007259595.1	Probable ATP-dependent RNA helicase ddx6	2.96
c83095_g5_i3	XP_007246416.1	Probable cation-transporting ATPase 13A2-like	19.81
c80536_g3_i10	XP_006637789.1	Probable cation-transporting ATPase 13A3-like	3.37
c77286_g1_i2	XP_007239229.1	Probable E3 ubiquitin-protein ligase HECTD4-like isoform X1	5.95
c84163_g4_i2	XP_005168975.1	Probable E3 ubiquitin-protein ligase HERC1-like isoform X1	35.37
c74188_g2_i2	NP_001138254.1	Probable E3 ubiquitin-protein ligase MGRN1	3.29
c83167_g2_i4	XP_004568069.1	Probable E3 ubiquitin-protein ligase MYCBP2-like isoform X12	12.96
c79737_g1_i2	XP_007255462.1	Probable E3 ubiquitin-protein ligase RNF217 isoform X2	4.33
c83508_g10_i2	XP_007240087.1	Probable G-protein coupled receptor 146-like	2.48
c77914_g1_i3	XP_007256617.1	Probable helicase senataxin isoform X1	11.16
c77933_g8_i2	NP_998431.1	Probable helicase with zinc finger domain	2.41
c79139_g5_i2	XP_684212.4	Probable inactive glycosyltransferase 25 family member 3	2.82
c83902_g11_i6	XP_007248516.1	Probable palmitoyltransferase ZDHHC14-like isoform X2	3.27
c80662_g6_i13	XP_007252831.1	Probable phospholipid-transporting ATPase IC-like isoform	6.7
c74622_g6_i1	XP_002664465.3	Probable phospholipid-transporting ATPase IG isoform X1	8.99
c74622_g10_i3	XP_005173286.1	Probable phospholipid-transporting ATPase IG isoform X4	4.05
c78840_g9_i2	XP_003438982.1	Probable phospholipid-transporting ATPase IIA	4.39
c77470_g1_i1	XP_695556.2	Probable phospholipid-transporting ATPase VA	3.96
c81489_g1_i5	XP_004562126.1	Probable serine/threonine-protein kinase fhkB-like	25.56
c83523_g4_i14	XP_007227911.1	Probable ubiquitin carboxyl-terminal hydrolase FAF-X	5.61
c83523_g4_i8	XP_007244285.1	Probable ubiquitin carboxyl-terminal hydrolase FAF-X-like	4.7

c82986_g1_i1	NP_001007378.2	Procollagen-lysine,2-oxoglutarate 5-dioxygenase 2 isoform 1 precursor	3.32
c77310_g10_i2	XP_007256389.1	Procollagen-lysine,2-oxoglutarate 5-dioxygenase 3-like	2.52
c83049_g2_i3	XP_007229232.1	Profilin-2-like isoform X2	2.94
c81043_g12_i3	XP_005159974.1	Progesterone-induced-blocking factor 1 isoform X1	2.61
c76437_g21_i1	XP_007251087.1	Progestin and adipoQ receptor family member 4-like	4.1
c81096_g7_i6	XP_005158451.1	Progestin and adipoQ receptor family member 6 isoform X2	2.68
c82861_g6_i2	XP_007245726.1	Programmed cell death 6-interacting protein isoform X2	5.55
c77320_g10_i4	XP_007257668.1	Programmed cell death protein 4	2.79
c75395_g4_i2	XP_005160907.1	Programmed cell death protein 6 isoform X1	-3.81
c83596_g5_i9	AAK95833.1	Prolactin receptor	2.3
c83191_g8_i1	XP_007247803.1	Prolargin	2.63
c79909_g5_i1	AEL21374.1	Proliferator-activated receptor gamma coactivator 1 alpha	5.41
c78808_g2_i5	XP_007252552.1	Proline and serine-rich protein 1-like	2.67
c83028_g1_i2	XP_001339018.3	Proline-, glutamic acid- and leucine-rich protein 1-like	4.04
c83705_g3_i1	XP_007248028.1	Proline-rich transmembrane protein 3-like isoform X1	4.03
c74698_g1_i1	XP_007233306.1	Prolyl 3-hydroxylase 2-like	2.11
c77209_g8_i6	XP_005173950.1	Prolyl 4-hydroxylase subunit alpha-2 isoform X2	2.44
c76245_g2_i4	XP_005156134.1	Prolyl 4-hydroxylase, alpha polypeptide I a isoform X1	2.66
c79002_g9_i1	XP_005158713.1	Prolyl 4-hydroxylase, alpha polypeptide I b isoform X1	2.94
c77440_g2_i1	NP_001167336.1	Prolyl endopeptidase	2.1
c77440_g1_i1	XP_007260527.1	Prolyl endopeptidase-like	3.49
c80345_g5_i10	XP_007255325.1	Pro-neuregulin-1, membrane-bound isoform isoform X10	7.28
c80345_g5_i3	XP_007255326.1	Pro-neuregulin-1, membrane-bound isoform isoform X11	9.36
c80345_g5_i5	XP_007255328.1	Pro-neuregulin-1, membrane-bound isoform isoform X13	7.44
c80345_g5_i6	XP_007255320.1	Pro-neuregulin-1, membrane-bound isoform isoform X5	10.16
c75117_g6_i5	XP_007253436.1	Prostacyclin synthase-like	2.13
c83270_g6_i2	XP_007252992.1	Prostaglandin E2 receptor EP2 subtype-like	3.56
c76387_g2_i1	XP_007251722.1	Prostaglandin F2 receptor negative regulator-like	2.58
c82978_g2_i2	XP_007245479.1	Prostaglandin G/H synthase 2-like	3.9
c77418_g12_i2	XP_006638186.1	Proteasome activator complex subunit 3-like isoform X2	-4.22
c77030_g1_i3	XP_005159530.1	Proteasome subunit beta type-8 isoform X2	-2.35
c77632_g3_i3	XP_007254842.1	Protein AF-10 isoform X5	5.79

c81254_g4_i1	NP_001244040.1	Protein arginine N-methyltransferase 1	3.38
c81254_g4_i2	XP_007251132.1	Protein arginine N-methyltransferase 1-like	2.92
c82145_g5_i2	XP_696015.4	Protein argonaute-3	13.79
c82145_g1_i1	XP_005806537.1	Protein argonaute-3-like	5.2
c81295_g21_i1	XP_007258334.1	Protein argonaute-3-like isoform X2	7.86
c81295_g16_i3	XP_005813422.1	Protein argonaute-4-like isoform X2	3
c76813_g11_i2	XP_007235447.1	Protein bicaudal C homolog 1	4.5
c78560_g4_i2	XP_007244682.1	Protein bicaudal C homolog 1-B-like isoform X5	-5.89
c79312_g5_i1	XP_007234703.1	Protein bicaudal D homolog 2-like	5.05
c80455_g11_i1	XP_007237106.1	Protein bicaudal D homolog 2-like isoform X1	3.48
c74564_g4_i2	XP_007256780.1	Protein BTG1-like isoform X1	2.13
c83303_g1_i1	XP_007253159.1	Protein capicua homolog isoform X1	12.69
c79612_g11_i5	XP_005173570.1	Protein capicua homolog isoform X3	2.79
c83187_g3_i1	XP_007232313.1	Protein CASC3, partial	2.88
c75556_g6_i2	XP_005808955.1	Protein C-ets-1-like	2.75
c83650_g2_i5	XP_007247339.1	Protein C-ets-2	2.05
c79806_g1_i6	XP_005163974.1	Protein CLEC16A isoform X3	10.21
c79526_g1_i6	XP_007251870.1	Protein cornichon homolog 4	2.27
c75611_g3_i1	XP_007229862.1	Protein CYR61-like isoform X2	2.69
c81473_g4_i5	XP_007252607.1	Protein Daple	6.35
c80335_g2_i6	XP_007254344.1	Protein DDI1 homolog 2-like isoform X1	2.86
c78733_g1_i3	XP_007251535.1	Protein DENND6A	3.34
c76420_g6_i2	XP_005467700.1	Protein diaphanous homolog 1-like isoform X2	4.51
c77790_g7_i6	XP_006803314.1	Protein diaphanous homolog 2-like	5.4
c82534_g7_i8	XP_005922642.1	Protein disulfide-isomerase TMX3-like	2.25
c75105_g1_i3	XP_004077731.1	Protein dopey-1-like	7.55
c84081_g1_i14	XP_007253059.1	Protein dopey-1-like isoform X2	4.98
c80138_g4_i2	XP_004569518.1	Protein EFR3 homolog A-like isoform X2	5.07
c77623_g2_i2	XP_697727.4	Protein ELYS	3.79
c79617_g11_i3	XP_007247333.1	Protein EMSY-like isoform X1	4.24
c78615_g7_i3	XP_007245471.1	Protein enabled homolog isoform X2	3.57
c73918_g6_i1	XP_007245856.1	Protein ENL isoform X2	3.9
c80568_g4_i1	XP_007249691.1	Protein eva-1 homolog B-like isoform X1	2.19
c76813_g9_i4	XP_007255862.1	Protein FAM102A	4.73
c77771_g16_i8	XP_007256913.1	Protein FAM107A	5.62
c76535_g7_i1	XP_005162459.1	Protein FAM110C-like	4.52

c79700_g18_i5	XP_007230510.1	Protein FAM126B-like isoform X2	8.47
c78432_g12_i3	XP_007230014.1	Protein FAM134C	3.98
c83975_g16_i3	XP_007243541.1	Protein FAM135A-like	2.31
c76478_g2_i7	XP_005915543.1	Protein FAM135A-like isoform X4	9.08
c78871_g1_i2	XP_007253770.1	Protein FAM13A isoform X1	5.58
c83272_g7_i9	XP_007230299.1	Protein FAM160A1 isoform X1	6.43
c78781_g13_i1	XP_007244832.1	Protein FAM168A isoform X2	2.72
c76066_g2_i3	XP_006627867.1	Protein FAM168A-like isoform X4	13.39
c79650_g1_i3	XP_007236465.1	Protein FAM178A isoform X2	7.12
c81138_g4_i2	XP_007245657.1	Protein FAM193B isoform X1	2.45
c82148_g15_i1	XP_007251897.1	Protein FAM219B-like	4.28
c82576_g12_i2	XP_007245066.1	Protein FAM3C-like	2.07
c81937_g3_i3	XP_007230861.1	Protein FAM63A-like	2.22
c81937_g3_i9	XP_698926.5	Protein FAM63B	8.63
c81620_g5_i1	XP_007249360.1	Protein FAM65B isoform X1	13.33
c81620_g5_i5	XP_007249363.1	Protein FAM65B isoform X4	2.37
c79523_g10_i4	XP_007233670.1	Protein FAM69A-like	2.39
c83687_g7_i1	XP_002665697.3	Protein FAM89A	3.21
c75861_g2_i3	XP_007247898.1	Protein flightless-1 homolog	3.46
c69396_g2_i2	XP_005463310.1	Protein furry homolog	28.63
c84197_g8_i2	XP_005157427.1	Protein furry homolog isoform X6	6.48
c84197_g8_i10	XP_001332249.2	Protein furry homolog isoformX1	5.32
c77223_g6_i4	NP_001153139.1	Protein furry homolog-like	2.88
c83105_g16_i2	XP_006790274.1	Protein furry homolog-like isoform X5	44.19
c80353_g5_i4	NP_998133.1	Protein HEG precursor	4.68
c82204_g4_i7	XP_006626706.1	Protein Hook homolog 3-like	3.33
c80988_g6_i2	XP_005935625.1	Protein inscuteable homolog	2.59
c82047_g5_i2	XP_007230998.1	Protein jagged-2-like isoform X2	3.71
c80749_g6_i6	XP_007250964.1	Protein Jumonji-like	2.3
c79203_g8_i5	XP_007230331.1	Protein KHNYN-like	2.91
c81334_g12_i1	XP_004084041.1	Protein KIAA0284 homolog	24.09
c80489_g4_i16	XP_007258212.1	Protein KIAA1199 homolog isoform X1	9.89
c73802_g4_i3	XP_005161962.1	Protein kinase C and casein kinase substrate in neurons 1a	4.66
c75593_g1_i2	XP_005162000.1	Protein kinase C binding protein 1, like isoform X1	4.77
c79655_g5_i5	XP_004068532.1	Protein kinase C delta type-like isoform 2	-2.59
c78364_g1_i2	XP_005156660.1	Protein kinase C epsilon type isoform X2	2.55

c79310_g7_i1	XP_007235706.1	Protein kinase C epsilon type-like	3.31
c79310_g8_i2	NP_001116528.1	Protein kinase C eta type	3.34
c80513_g4_i2	XP_005155635.1	Protein LAP2 isoform X3	2.79
c81907_g6_i4	XP_004080646.1	Protein LSM12 homolog A-like	2.19
c81016_g12_i3	XP_007251915.1	Protein LSM14 homolog A isoform X1	2.32
c82037_g1_i1	XP_007228251.1	Protein LSM14 homolog A-like isoform X2	2.82
c82461_g1_i2	XP_007260707.1	Protein LTV1 homolog	2.52
c83785_g13_i1	XP_007248899.1	Protein lunapark-B-like isoform X1	2.76
c83840_g4_i2	XP_004559818.1	Protein MEMO1-like isoform X1	2.9
c77256_g5_i2	NP_001268979.1	Protein MGARP-like	2.74
c81490_g9_i4	XP_003967530.1	Protein MON2 homolog	2.19
c77838_g2_i3	XP_007245218.1	Protein Niban-like	2.5
c78545_g4_i3	XP_007238413.1	Protein NLRC3-like isoform X1	16.72
c78312_g1_i1	NP_001186995.1	Protein NLRC5	4.33
c82299_g2_i1	XP_007241385.1	Protein NLRC5-like	2.88
c84107_g2_i5	XP_007241238.1	Protein NLRC5-like, partial	2.13
c83420_g6_i5	XP_007253868.1	Protein numb homolog isoform X1	4.39
c83420_g6_i2	XP_007253872.1	Protein numb homolog isoform X5	8.05
c83811_g9_i5	XP_007257313.1	Protein outspread-like	4.75
c75571_g2_i2	XP_005163536.1	Protein patched homolog 1 isoform X1	5.97
c79864_g4_i3	XP_007231660.1	Protein patched homolog 1 isoform X2	6.2
c79738_g7_i6	NP_001003870.1	Protein phosphatase 1 regulatory subunit 12A	4.96
c75340_g1_i5	XP_007235189.1	Protein phosphatase 1 regulatory subunit 12A-like isoform	2.02
c75937_g8_i7	XP_007231418.1	Protein phosphatase 1 regulatory subunit 12C-like isoform	6.28
c79740_g1_i1	XP_007228633.1	Protein phosphatase 1 regulatory subunit 15B	2.36
c83946_g6_i3	CBN81872.1	Protein phosphatase 1 regulatory subunit 16A	5.61
c82904_g3_i1	XP_005167945.1	Protein phosphatase 1 regulatory subunit 1C isoform X4	2.85
c77516_g3_i1	XP_007235688.1	Protein phosphatase 1 regulatory subunit 37	3.49
c75487_g6_i1	XP_005159256.1	Protein phosphatase 1 regulatory subunit 3E-like	7.46
c69938_g3_i2	XP_007255830.1	Protein phosphatase 1B isoform X1	2.25
c83550_g6_i9	XP_007258938.1	Protein phosphatase 1D-like	2.06
c76900_g5_i4	XP_005169569.1	Protein phosphatase 1G isoform X1	-2.04
c67684_g3_i1	XP_007232452.1	Protein phosphatase 1H-like	3.5
c80283_g4_i2	XP_007234372.1	Protein phosphatase 1K, mitochondrial isoform X1	12.1
c82556_g9_i3	NP_955978.2	Protein phosphatase 6, regulatory subunit 3	2.77

c83432_g10_i1	XP_007236600.1	Protein phosphatase inhibitor 2-like isoform X2	3.93
c82889_g9_i2	XP_007228885.1	Protein phosphatase PTC7 homolog	4.6
c78200_g21_i5	XP_007238242.1	Protein phosphatase Slingshot homolog 1-like	16.25
c79667_g5_i3	XP_003201761.2	Protein phosphatase Slingshot homolog 2-like	2.81
c77735_g1_i2	XP_007236877.1	Protein phosphatase Slingshot homolog 2-like isoform X1	2.62
c84355_g2_i2	XP_007245605.1	Protein phosphatase Slingshot homolog 3-like	3.13
c79667_g5_i8	XP_005157381.1	Protein phosphatase Slingshot homolog 3-like isoform X1	3.12
c80603_g11_i3	NP_001154804.1	Protein phosphatase, Mg2+/Mn2+ dependent, 1Ab	4.27
c77322_g2_i3	XP_007244024.1	Protein prenyltransferase alpha subunit repeat-containing	4.84
c77620_g1_i3	XP_007228593.1	Protein PRRC2A-like isoform X3	2.56
c83769_g21_i4	XP_007236403.1	Protein PRRC2B	2.23
c78820_g10_i4	XP_001919460.4	Protein PRRC2C	3.35
c78000_g16_i2	XP_007259000.1	Protein quaking-A-like isoform X1	4.02
c81346_g16_i2	XP_007230663.1	Protein RIC1 homolog	15.6
c78610_g4_i4	XP_007257799.1	Protein RMD5 homolog B-like	2.5
c76591_g1_i1	XP_007248556.1	Protein SCAF8	3.64
c83334_g6_i3	XP_005166472.1	Protein scribble homolog isoform X9	14.32
c78008_g10_i2	XP_007247089.1	Protein Shroom1 isoform X1	3.21
c78862_g2_i1	XP_007248342.1	Protein Shroom2-like isoform X4	3.25
c81679_g2_i4	XP_007234025.1	Protein Shroom3 isoform X2	12
c79927_g7_i3	XP_005172390.1	Protein Shroom4 isoform X1	5.88
c81292_g6_i4	XP_001920698.3	Protein Smaug homolog 1-like isoform X1	14.86
c82438_g7_i2	XP_007242208.1	Protein SMG5	3.28
c77270_g15_i1	XP_007258093.1	Protein SMG7 isoform X4	5.97
c82920_g3_i1	XP_001338362.3	Protein SOGA1 isoform X1	3.9
c82812_g20_i1	XP_003970742.1	Protein spinster homolog 2-like	2.24
c81989_g6_i7	XP_007249414.1	Protein spire homolog 1-like isoform X6	8.66
c80292_g10_i1	XP_007247081.1	Protein sprouty homolog 4	3.1
c83194_g1_i4	XP_007254674.1	Protein SSXT isoform X2	3.94
c81018_g1_i8	XP_007236009.1	Protein strawberry notch homolog 2-like isoform X1	8.9
c78515_g14_i1	XP_007252704.1	Protein strawberry notch homolog 2-like isoform X2	7.08
c83379_g4_i2	XP_007244442.1	Protein SZT2	14.94
c84059_g3_i1	XP_005171661.1	Protein TANC2 isoform X1	22.55
c75524_g2_i2	XP_690863.4	Protein TBRG4	2.25
c79372_g2_i10	XP_007256662.1	Protein transport protein Sec16A-like isoform X1	3.51

c79372_g2_i8	XP_007256663.1	Protein transport protein Sec16A-like isoform X2	11.98
c79402_g3_i1	XP_005169625.1	Protein transport protein Sec24B isoform X2	2.11
c82260_g1_i4	XP_007259391.1	Protein transport protein Sec24C-like isoform X3	3.74
c82586_g10_i10	XP_007241130.1	Protein transport protein Sec31A isoform X7	7.42
c77301_g4_i1	XP_006791014.1	Protein tweety homolog 2-like isoform X2	4.75
c81023_g7_i3	XP_005158252.1	Protein tyrosine phosphatase, non-receptor type 23, a	34.84
c75132_g17_i2	NP_997952.1	Protein unc-119 homolog B	3.06
c81774_g3_i9	XP_005156451.1	Protein unc-13 homolog D-like	8.26
c80164_g4_i8	XP_007237050.1	Protein VPRBP isoform X1	5.31
c77108_g17_i1	XP_007232516.1	Protein Wnt-9a	3.53
c77064_g4_i8	XP_007248345.1	Protein WWC3-like isoform X1	3.23
c83940_g9_i1	XP_007249158.1	Protein XRP2	2.69
c77588_g5_i4	NP_494654.2	Protein Y8A9A.2	5.1
c82871_g2_i3	XP_007247445.1	Protein YIPF3 isoform X1	2.07
c81905_g8_i2	XP_007229477.1	Protein yippee-like 1 isoform X2	4.21
c76153_g3_i3	NP_998066.1	Protein zer-1 homolog	2.34
c82008_g1_i9	XP_007253486.1	Protein-arginine deiminase type-2-like	2.14
c77875_g3_i1	XP_007247054.1	Proteinase-activated receptor 2-like	2.1
c82702_g4_i6	XP_003201274.1	Protein-methionine sulfoxide oxidase mical1	3.38
c81035_g8_i13	XP_007254721.1	Protein-methionine sulfoxide oxidase MICAL2-like isoform	4.4
c83740_g5_i3	XP_005168402.1	Protocadherin Fat 1 isoform X5	4.88
c81427_g5_i6	XP_007246503.1	Protocadherin Fat 2-like isoform X2	23.74
c72789_g1_i1	XP_006632080.1	Protocadherin gamma-C5-like	6.04
c79077_g8_i1	XP_007240588.1	Protocadherin-12-like	8.4
c77153_g15_i1	XP_007252639.1	Protocadherin-17-like	3.67
c83110_g11_i2	XP_007252964.1	Protocadherin-1-like isoform X1	4.46
c83110_g1_i2	XP_007252965.1	Protocadherin-1-like isoform X2	4.68
c70011_g1_i2	XP_007259928.1	Proto-oncogene c-Fos-like	6.48
c77212_g1_i9	XP_007252300.1	Proto-oncogene c-Rel	2.59
c79548_g3_i1	NP_001070859.1	Proto-oncogene serine/threonine-protein kinase pim-1	4.94
c76783_g2_i6	XP_006639478.1	Proto-oncogene tyrosine-protein kinase Src-like isoform X3	2.82
c76169_g2_i7	XP_007245745.1	Proto-oncogene tyrosine-protein kinase Yrk-like isoform X1	2.6
c76169_g2_i3	XP_007245747.1	Proto-oncogene tyrosine-protein kinase Yrk-like isoform X3	3.16
c79902_g10_i1	XP_007229586.1	Protrudin isoform X5	2.11

c80954_g20_i2	ACI33987.1	P-selectin precursor	3.4
c81023_g4_i3	XP_001921602.2	Pseudopodium-enriched atypical kinase 1-like	6.97
c77925_g1_i1	XP_007251655.1	PTB-containing, cubilin and LRP1-interacting protein	5.01
c75644_g1_i18	AAH28733.1	PTK2 protein	3.33
c77515_g3_i3	AAH49294.1	Ptp1b protein, partial	5.4
c81161_g1_i2	AAI62720.1	Ptpn4 protein	3.52
c81879_g10_i8	XP_007068550.1	Puratrophin-1	7.86
c72002_g1_i1	XP_007259956.1	Puratrophin-1-like	6.05
c79783_g6_i6	XP_007227914.1	Putative ATP-dependent RNA helicase an3-like isoform X2	4.42
c82905_g11_i1	ERE76422.1	Putative disks large isoform 1	3.44
c80708_g17_i5	NP_001071271.3	Putative glycerol kinase 5	2.91
c80708_g17_i7	XP_007257899.1	Putative glycerol kinase 5-like	13.09
c72951_g1_i1	NP_001187225.1	Putative membrane progestin receptor alpha	3.49
c80659_g3_i6	XP_007233793.1	Putative oxidoreductase GLYR1 isoform X1	3.53
c83730_g3_i3	WP_020846978.1	Putative peptidoglycan bound protein	3.58
c82146_g2_i6	XP_007252246.1	Putative Polycomb group protein ASXL2 isoform X1	3.48
c82146_g2_i9	XP_007252247.1	Putative Polycomb group protein ASXL2 isoform X2	7.22
c81201_g3_i1	XP_007259363.1	Putative sodium-coupled neutral amino acid transporter 10	5.52
c74893_g3_i1	XP_003873176.1	Putative surface antigen, partial	2.99
c79974_g3_i1	XP_007248565.1	PWWP domain-containing protein 2B	2.41
c81729_g4_i1	XP_007229647.1	PX domain-containing protein kinase-like protein isoform	6.61
c78122_g1_i1	XP_007251926.1	Pygopus homolog 1 isoform X1	2.49
c79648_g9_i6	XP_007235398.1	Pyridoxal-dependent decarboxylase domain-containing	2.67
c80844_g4_i1	XP_007247208.1	Pyrin-like isoform X1	2.29
c82086_g8_i3	XP_007244570.1	Pyruvate carboxylase, mitochondrial-like	3.07
c75356_g5_i2	XP_007244093.1	Pyruvate dehydrogenase phosphatase regulatory subunit,	2.33
c80889_g6_i4	XP_007239705.1	Pyruvate kinase PKM-like isoform X2	2.49
c83204_g5_i2	XP_007257135.1	R3H domain-containing protein 1-like isoform X7	3.16
c82769_g11_i2	XP_007250661.1	R3H domain-containing protein 2-like isoform X4	10.71
c82325_g7_i1	XP_003438868.1	Rab GDP dissociation inhibitor alpha-like isoform X1	6.77
c79610_g3_i4	XP_007252464.1	Rab GDP dissociation inhibitor beta-like	2
c83303_g10_i4	XP_007252717.1	Rab GTPase-activating protein 1-like, isoform 10-like	7.45
c76522_g3_i1	NP_001116759.1	Rab GTPase-binding effector protein 1	2.64
c76435_g1_i6	NP_001074094.1	Rab GTPase-binding effector protein 2	2.67

c81952_g1_i8	XP_007260224.1	Rab11 family-interacting protein 1-like	3.32
c83431_g1_i5	XP_007246427.1	Rab11 family-interacting protein 1-like isoform X1	3
c79209_g9_i5	XP_007234458.1	Rab11 family-interacting protein 4B-like isoform X2	3.28
c79334_g2_i6	XP_007257654.1	Rab3 GTPase-activating protein non-catalytic subunit	5.21
c76992_g6_i1	XP_007251664.1	RAC-beta serine/threonine-protein kinase isoform X1	2.44
c75411_g3_i2	XP_007259131.1	Radixin	5.73
c82547_g6_i1	XP_007248646.1	Ragulator complex protein LAMTOR1	3.19
c79539_g2_i7	XP_005158700.1	Ral GTPase-activating protein subunit alpha-1 isoform X4	9.86
c84057_g3_i1	XP_005158963.1	Ral GTPase-activating protein subunit alpha-2 isoform X5	10.77
c82657_g5_i5	XP_007252760.1	Ral GTPase-activating protein subunit beta-like	2.45
c83292_g2_i7	XP_007242257.1	Ral guanine nucleotide dissociation stimulator-like	2.07
c81244_g4_i1	NP_001092249.1	Rap guanine nucleotide exchange factor (GEF) 5b	2.82
c84043_g2_i5	XP_005170987.1	Rap guanine nucleotide exchange factor 2 isoform X2	4.97
c84043_g2_i4	XP_006629534.1	Rap guanine nucleotide exchange factor 2-like	5.71
c77788_g5_i8	XP_007240936.1	Rap guanine nucleotide exchange factor 6-like isoform X2	4.76
c83471_g8_i12	XP_005464654.1	Rap1 GTPase-activating protein 2-like isoform X5	11.66
c80881_g3_i2	XP_007239851.1	Rap1 GTPase-GDP dissociation stimulator 1-like isoform X2	3.23
c80723_g8_i6	XP_005161298.1	Rapamycin-insensitive companion of mTOR isoform X2	6.04
c82162_g3_i2	NP_001138710.1	Rapunzel	2.66
c76680_g4_i6	XP_007244731.1	Ras and Rab interactor 3-like	4.56
c75141_g4_i2	XP_007247809.1	Ras association domain-containing protein 5	2.72
c80491_g4_i2	XP_007253934.1	Ras GTPase-activating protein 1 isoform X1	4.46
c78659_g14_i7	XP_005933216.1	Ras GTPase-activating protein 2-like	2.01
c80340_g8_i5	XP_003445822.1	Ras GTPase-activating protein 3	2.19
c84179_g3_i1	XP_006780404.1	Ras GTPase-activating protein 3-like	6.44
c75666_g19_i1	XP_001332688.5	Ras GTPase-activating protein nGAP isoform X1	8.06
c75666_g19_i3	XP_005171378.1	Ras GTPase-activating protein nGAP isoform X2	10.98
c73706_g2_i2	XP_007239195.1	Ras GTPase-activating protein-binding protein 2	2.39
c81088_g4_i3	NP_001121812.1	Ras GTPase-activating-like protein IQGAP1	11.28
c83019_g3_i5	XP_006628835.1	Ras GTPase-activating-like protein IQGAP1-like	17.93
c78987_g10_i4	XP_007238799.1	Ras guanyl-releasing protein 3	3.08
c74189_g1_i1	XP_007250433.1	Ras suppressor protein 1 isoform X2	2.95
c75639_g13_i13	XP_007234203.1	Ras-associated and pleckstrin homology domains-containing	12.8

c78100_g1_i1	XP_005311700.1	Ras-related GTP-binding protein C isoform X1	3.65
c78100_g15_i3	XP_005806529.1	Ras-related GTP-binding protein C-like	2.78
c83577_g6_i3	XP_007242229.1	Ras-related protein Rab-11A-like isoform X1	2.32
c74373_g3_i4	XP_005810327.1	Ras-related protein Rab-13-like	4.82
c75471_g12_i5	XP_003459795.1	Ras-related protein Rab-1A-like isoformX1	3.49
c82507_g5_i3	XP_007237417.1	Ras-related protein Rab-21-like	2.53
c81264_g14_i2	XP_007247390.1	Ras-related protein Rab-23 isoform X1	3.91
c77293_g3_i1	XP_004560590.1	Ras-related protein Rab-30-like isoform X2	5.56
c82392_g17_i1	XP_007258515.1	Ras-related protein Rab-31, partial	3.95
c82392_g13_i1	XP_005924659.1	Ras-related protein Rab-31-like isoform X2	4.49
c81498_g10_i1	XP_005803252.1	Ras-related protein Rab-40C-like isoform X1	5.04
c78802_g3_i3	NP_001188141.1	Ras-related protein Rab-4B	2.82
c83502_g6_i1	NP_001187853.1	Ras-related protein Rab-6B	2.57
c82494_g18_i1	AHL29952.1	Ras-related protein Rab-8A	2.73
c78317_g1_i1	XP_007236624.1	Ras-related protein Ral-A-like isoform X1	2.68
c80519_g2_i1	XP_002824419.1	Ras-related protein Rap-2a	2.16
c83200_g2_i2	NP_001005931.2	Ras-related protein R-Ras	3.23
c76284_g9_i2	XP_004543243.1	Ras-related protein R-Ras2-like isoform X2	3
c81402_g8_i3	XP_007238700.1	Ras-responsive element-binding protein 1 isoform X3	4.07
c75363_g1_i1	XP_007244664.1	Receptor expression-enhancing protein 3-like	6.2
c78979_g6_i4	NP_956413.2	Receptor tyrosine-protein kinase erbB-2 precursor	5.83
c83177_g13_i9	XP_005451978.1	Receptor tyrosine-protein kinase erbB-4-like	5.37
c81852_g15_i5	NP_919392.2	Receptor-interacting serine/threonine-protein kinase 2	4.33
c82492_g2_i5	XP_007237425.1	Receptor-type tyrosine-protein phosphatase beta-like	8.04
c73947_g1_i2	XP_002667259.3	Receptor-type tyrosine-protein phosphatase beta-like,	33.53
c76118_g2_i1	XP_003199700.1	Receptor-type tyrosine-protein phosphatase epsilon	6.67
c76118_g8_i1	XP_005471474.1	Receptor-type tyrosine-protein phosphatase epsilon-like	2.35
c84260_g1_i6	XP_007228142.1	Receptor-type tyrosine-protein phosphatase eta-like	3.14
c82492_g1_i4	XP_007244440.1	Receptor-type tyrosine-protein phosphatase F	3.71
c82562_g1_i2	XP_005165742.1	Receptor-type tyrosine-protein phosphatase F isoform X1	11.13
c82492_g1_i1	XP_005165744.1	Receptor-type tyrosine-protein phosphatase F isoform X3	3.52
c77642_g4_i2	NP_001077045.1	Receptor-type tyrosine-protein phosphatase F precursor	9.5
c79279_g4_i3	XP_001920779.4	Receptor-type tyrosine-protein phosphatase gamma	7.3
c79861_g1_i4	XP_007253445.1	Receptor-type tyrosine-protein phosphatase gamma-like	3.39

c79279_g4_i1	ERE88887.1	Receptor-type tyrosine-protein phosphatase gamma-like protein	6.4
c79211_g1_i4	XP_007246693.1	Receptor-type tyrosine-protein phosphatase zeta	-3.64
c72896_g1_i2	XP_005159884.1	Recombination signal binding protein for immunoglobulin	8.33
c84040_g2_i1	XP_007251830.1	Regulator of chromosome condensation-like	2.27
c83630_g4_i4	XP_005162225.1	Regulator of complement activation group 2 gene 1 isoform	2.48
c71296_g1_i3	NP_001082981.1	Regulator of G-protein signalling 1	2.18
c81036_g4_i2	NP_998639.1	Regulator of nonsense transcripts 1	3.95
c81036_g4_i3	XP_005163697.1	Regulator of nonsense transcripts 1 isoform X1	2.45
c77654_g1_i6	XP_007235122.1	Regulator of nonsense transcripts 2-like isoform X1	4.53
c80699_g1_i7	XP_001919288.2	Regulatory-associated protein of mTOR isoformX1	5.86
c81493_g2_i2	XP_007242114.1	RELT-like protein 1 isoform X2	2.5
c81704_g9_i3	XP_001921675.3	Remodeling and spacing factor 1-like	4.62
c75840_g15_i3	ACI33326.1	Repressor of RNA polymerase III transcription MAF1 homolog	2.32
c66890_g2_i2	NP_957366.1	Reticulon-3	2.6
c66890_g2_i1	XP_003198973.1	Reticulon-3-like isoformX2	2.12
c79536_g13_i1	XP_007230523.1	Retinal dehydrogenase 2	2.64
c77558_g6_i2	ERE68305.1	Retinoic acid receptor alpha isoform 2	-2.9
c78386_g8_i14	NP_571414.1	Retinoic acid receptor gamma-A	2.24
c70458_g2_i1	XP_007248416.1	Retinoic acid receptor gamma-A-like isoform X2	60.23
c78276_g7_i2	XP_005159468.1	Retinoic acid receptor RXR-beta-A isoform X3	3.45
c81432_g1_i1	XP_005162076.1	Retrotransposon-derived protein PEG10-like	7.02
c80913_g5_i5	XP_007233449.1	Reversion-inducing cysteine-rich protein with Kazal	7.64
c83271_g2_i2	AAI59237.1	Rhesus blood group-associated glycoprotein	2.56
c73761_g1_i1	XP_007244973.1	Rho GTPase-activating protein 1	3.5
c81352_g11_i5	NP_001038715.1	Rho GTPase-activating protein 10	2.68
c80282_g1_i7	XP_007253460.1	Rho GTPase-activating protein 12-like isoform X2	3.08
c80594_g2_i3	XP_007251283.1	Rho GTPase-activating protein 17-like isoform X1	7.11
c75779_g9_i2	XP_005163951.1	Rho GTPase-activating protein 17-like isoform X2	3.21
c81025_g3_i1	XP_005163349.1	Rho GTPase-activating protein 21 isoform X2	3.85
c80289_g2_i8	XP_001921859.4	Rho GTPase-activating protein 21-like	3.67
c81025_g8_i1	XP_007250678.1	Rho GTPase-activating protein 21-like isoform X1	2.51
c81025_g4_i2	XP_007250679.1	Rho GTPase-activating protein 21-like isoform X2	8.6
c80289_g2_i14	XP_005162594.1	Rho GTPase-activating protein 21-like isoform X3	6.06
c81221_g9_i15	XP_005164231.1	Rho GTPase-activating protein 23-like isoform X2	5.1

c81221_g9_i19	XP_005164233.1	Rho GTPase-activating protein 23-like isoform X4	3.18
c83646_g2_i1	XP_007248841.1	Rho GTPase-activating protein 27-like	2.22
c81197_g2_i4	XP_005171660.1	Rho GTPase-activating protein 27-like isoform X2	3.21
c81197_g2_i8	XP_694888.4	Rho GTPase-activating protein 27-like isoform X3	3.58
c83570_g7_i7	XP_005163369.1	Rho GTPase-activating protein 29 isoform X1	5.16
c78977_g2_i1	XP_007241093.1	Rho GTPase-activating protein 31-like	2.81
c79499_g2_i1	XP_007235698.1	Rho GTPase-activating protein 32-like isoform X3	4.33
c76749_g5_i5	XP_007260959.1	Rho GTPase-activating protein 35 isoform X1	2.91
c76749_g5_i2	XP_007261046.1	Rho GTPase-activating protein 35-like isoform X1	2.62
c78474_g1_i2	XP_007250816.1	Rho GTPase-activating protein 39-like isoform X1	4.57
c75656_g2_i1	XP_007250156.1	Rho GTPase-activating protein 42-like	3.24
c83128_g5_i2	XP_003966500.1	Rho GTPase-activating protein 6-like	5.19
c79061_g2_i2	XP_007242084.1	Rho GTPase-activating protein 6-like isoform X1	3.68
c82431_g9_i2	XP_007231767.1	Rho GTPase-activating protein 7-like isoform X1	6.35
c80352_g6_i6	XP_005159917.1	Rho GTPase-activating protein 7-like isoform X2	4.75
c82436_g16_i5	ABG46347.1	Rho guanine exchange factor betaPix B	2.88
c83399_g3_i4	NP_001075100.1	Rho guanine nucleotide exchange factor (GEF) 1a	6.98
c80773_g4_i3	XP_005158600.1	Rho guanine nucleotide exchange factor 10 isoform X4	7.45
c83464_g1_i9	XP_007254648.1	Rho guanine nucleotide exchange factor 11-like isoform X1	6.08
c82992_g2_i2	XP_003200092.2	Rho guanine nucleotide exchange factor 12-like	4.56
c83213_g4_i10	XP_683105.3	Rho guanine nucleotide exchange factor 15	2.1
c82419_g3_i7	XP_007232504.1	Rho guanine nucleotide exchange factor 1-like isoform X1	5.85
c82419_g3_i13	XP_007232507.1	Rho guanine nucleotide exchange factor 1-like isoform X4	7.53
c81862_g2_i7	XP_007259692.1	Rho guanine nucleotide exchange factor 28 isoform X1	18.14
c82174_g5_i12	XP_005173279.1	Rho guanine nucleotide exchange factor 6-like isoform X1	3.79
c81472_g3_i5	XP_004542908.1	Rho-associated protein kinase 1-like isoform X1	2.92
c83993_g3_i13	XP_007240795.1	Rho-associated protein kinase 2	2.71
c83993_g3_i9	XP_007247587.1	Rho-associated protein kinase 2-like isoform X3	4
c79304_g13_i5	XP_007244939.1	Rhophilin-2 isoform X1	2.64
c82130_g14_i5	XP_691270.6	Rho-related BTB domain-containing protein 3	6.96
c77450_g5_i4	NP_001188131.1	Rho-related gtp-binding protein rhoe	2.85
c75556_g14_i1	NP_001187734.1	Rho-related GTP-binding protein RhoF	2.4
c82144_g1_i1	XP_007261090.1	Ribonuclease-like 3-like	4.33
c75043_g1_i2	XP_007259098.1	Ribose-phosphate pyrophosphokinase 2-like	2.3

c75552_g2_i5	XP_006631516.1	Ribosomal protein S6 kinase 2 alpha-like isoform X1	2.37
c75552_g2_i1	XP_006631517.1	Ribosomal protein S6 kinase 2 alpha-like isoform X2	2.72
c80782_g11_i6	XP_004080894.1	Ribosomal protein S6 kinase alpha-3-like	2.34
c77081_g9_i6	XP_007254037.1	Ribosomal protein S6 kinase alpha-5-like	2.55
c75511_g2_i1	XP_007230021.1	Ribosomal protein S6 kinase delta-1-like	4.91
c81362_g6_i5	XP_007259417.1	Ribosome biogenesis protein BMS1 homolog	5.07
c78899_g7_i1	NP_001104620.2	Ribosome biogenesis protein BMS1 homolog	2.5
c83572_g13_i5	NP_001071203.1	Ribosome biogenesis protein bop1	2.04
c83893_g6_i1	NP_956356.1	Ribosome biogenesis regulatory protein homolog	3.45
c83095_g2_i5	XP_007239058.1	RING finger and transmembrane domain-containing protein	3.59
c82526_g2_i2	AAH65620.1	Ring finger protein 13	2.29
c82297_g5_i1	NP_001017554.1	RING finger protein 150 precursor	2.64
c78367_g6_i5	XP_695200.4	RING finger protein 38	2.98
c80598_g13_i7	XP_005164288.1	RING finger protein unkempt homolog isoform X1	5.46
c80598_g13_i4	XP_005164289.1	RING finger protein unkempt homolog isoform X2	6.71
c80674_g3_i2	XP_007231394.1	RNA binding protein fox-1 homolog 2-like isoform X3	2.86
c82220_g2_i2	XP_007245848.1	RNA exonuclease 1 homolog	3.13
c80813_g3_i5	XP_007253995.1	RNA polymerase II elongation factor ELL2	3.32
c77729_g4_i3	XP_007253121.1	RNA polymerase II subunit A C-terminal domain phosphatase	2.16
c74172_g3_i2	XP_005169271.1	RNA/RNP complex-1-interacting phosphatase isoform X1	2.11
c77300_g13_i2	XP_007237397.1	RNA-binding motif, single-stranded-interacting protein 1	3.82
c76191_g5_i2	XP_005155719.1	RNA-binding motif, single-stranded-interacting protein 2	2.84
c78445_g8_i8	XP_006625338.1	RNA-binding protein 10-like	2.23
c78445_g8_i10	XP_007243731.1	RNA-binding protein 10-like isoform X1	3.74
c80870_g12_i4	XP_007253344.1	RNA-binding protein 38-like isoform X1	2.12
c81720_g4_i2	XP_007244536.1	RNA-binding protein 4.1-like	3.23
c83339_g3_i2	NP_001108158.1	RNA-binding protein 47	3.86
c83339_g3_i5	XP_005168418.1	RNA-binding protein 47 isoform X3	3.64
c80700_g1_i1	XP_007237372.1	RNA-binding protein 6	11.84
c80700_g1_i2	XP_005166176.1	RNA-binding protein 6 isoform X1	2.58
c81555_g2_i2	XP_007228836.1	RNA-binding protein EWS isoform X1	3.15
c77341_g8_i2	XP_007242231.1	RNA-binding protein MEX3B-like	8.51
c75639_g13_i15	XP_007236681.1	RNA-binding protein MEX3D	6.03

c75431_g11_i4	XP_005813457.1	RNA-binding protein with multiple splicing-like	2.45
c83372_g12_i3	XP_007240175.1	Roquin-1 isoform X1	7.62
c83372_g13_i1	XP_006867122.1	Roquin-1 isoform X2	9.36
c77466_g6_i1	XP_007231520.1	Roquin-2-like	6.94
c80640_g1_i2	XP_004558300.1	Roundabout homolog 1-like isoform X4	6.39
c82682_g2_i3	AAI65359.1	Rrm1 protein	5.89
c75823_g5_i13	NP_001025447.1	RRP12-like protein	6.84
c82086_g9_i1	XP_005169860.1	Runt-related transcription factor 2 isoform X1	4.85
c81220_g6_i5	NP_571679.2	Runt-related transcription factor 3	2.66
c69354_g1_i4	Q1JQ66.1	S35E3_DANRE RecName: Full=Solute carrier family 35 member E3	2.12
c82420_g5_i13	CAQ14845.1	S-adenosylhomocysteine hydrolase-like 1	2.95
c81809_g8_i13	XP_007230536.1	SAFB-like transcription modulator	5.28
c84034_g1_i2	XP_003980000.1	SAM domain and HD domain-containing protein 1-like,	3.39
c80908_g7_i7	XP_007251530.1	Sarcolemmal membrane-associated protein isoform X1	3.68
c80908_g7_i1	XP_007251534.1	Sarcolemmal membrane-associated protein isoform X5	4.84
c62486_g1_i1	XP_003228550.1	Sarcolipin-like	-2.04
c77260_g5_i1	XP_697108.5	Sarcoplasmic/endoplasmic reticulum calcium ATPase 1	2.34
c76514_g15_i1	XP_007499523.1	Sarcoplasmic/endoplasmic reticulum calcium ATPase 1	2.21
c83519_g9_i10	XP_007252855.1	Sarcoplasmic/endoplasmic reticulum calcium ATPase 2-like	2.28
c78743_g2_i1	AAH67619.1	Sb:cb283 protein, partial	-3.37
c78515_g2_i8	XP_007255477.1	Scavenger receptor class A member 3	4.84
c81267_g16_i4	XP_007254951.1	Scavenger receptor class A member 5-like	4.3
c81971_g11_i7	XP_007259021.1	Scavenger receptor class F member 2-like, partial	5.12
c76774_g3_i1	XP_005164891.1	Scm-like with four mbt domains 2 isoform X1	4
c81523_g2_i5	XP_007235023.1	SCY1-like protein 2-like isoform X2	9.81
c79282_g4_i10	XP_006635264.1	SEC14-like protein 1-like	10.77
c79282_g4_i5	XP_007252219.1	SEC14-like protein 1-like isoform X2	6.02
c79282_g4_i9	XP_007252221.1	SEC14-like protein 1-like isoform X4	6.57
c78089_g2_i2	XP_007256889.1	Secretagogin	2.62
c75717_g8_i1	XP_006625426.1	Secreted frizzled-related protein 1-like	2.84
c83372_g4_i4	XP_007230631.1	Secretory carrier-associated membrane protein 3-like	2.2
c79169_g6_i2	XP_007237401.1	Secretory phospholipase A2 receptor	8.82
c83369_g7_i4	XP_001920242.3	Segment polarity protein dishevelled homolog DVL-3 isoform	5.44

c83369_g5_i2	XP_006637903.1	Segment polarity protein dishevelled homolog DVL-3-like	2.77
c78023_g2_i3	XP_007244576.1	Seipin-like isoform X1	3.48
c81519_g3_i4	XP_005950774.1	Seizure protein 6 homolog	4.56
c76052_g1_i2	NP_840075.2	Selenoprotein T1a precursor	3.26
c81988_g4_i6	NP_571125.1	Semaphorin 3h precursor	3.56
c83023_g2_i4	XP_007232781.1	Semaphorin-3C	13.65
c78475_g10_i1	XP_007251003.1	Semaphorin-3D	2.07
c78917_g5_i4	NP_001116184.1	Semaphorin-3G precursor	7.92
c76420_g11_i2	XP_005168672.1	Semaphorin-4C isoform X1	4.37
c76420_g13_i3	XP_007237178.1	Semaphorin-4C-like	3.15
c76740_g2_i6	XP_007227982.1	Semaphorin-5B	2.26
c80763_g3_i7	XP_005173706.1	Semaphorin-6D isoform X2	2.78
c81375_g2_i3	XP_001343517.1	Sentrin-specific protease 1	2.26
c82648_g7_i1	XP_007247257.1	Septin-2-like isoform X2	2.19
c82867_g3_i1	NP_001071211.1	Septin-7 isoform 1	5.61
c82867_g3_i3	NP_001119922.1	Septin-7 isoform 2	2.23
c75896_g2_i3	XP_007254789.1	Septin-7 isoform X1	2.02
c83409_g11_i4	NP_001135163.1	Serine (or cysteine) proteinase inhibitor clade E, nexin,	-2.7
c75590_g2_i4	XP_007253455.1	Serine hydroxymethyltransferase, mitochondrial	2.43
c77747_g7_i3	XP_007248546.1	Serine palmitoyltransferase 2	2.46
c79435_g4_i2	XP_004564407.1	Serine/arginine repetitive matrix protein 1-like isoform	2.86
c77575_g4_i6	NP_001008627.1	Serine/threonine kinase 35, like	3.17
c82563_g8_i8	XP_006631941.1	Serine/threonine-protein kinase 10-like	4.64
c76309_g1_i2	NP_956829.1	Serine/threonine-protein kinase 17B	2.08
c76309_g1_i8	XP_007238918.1	Serine/threonine-protein kinase 17B-like	2.08
c78741_g3_i1	XP_003451900.1	Serine/threonine-protein kinase 3/4-like isoform X1	3.29
c78759_g10_i1	XP_007233490.1	Serine/threonine-protein kinase 35-like	3.03
c77655_g3_i3	NP_998621.1	Serine/threonine-protein kinase 38	3.33
c78526_g11_i1	XP_003200963.1	Serine/threonine-protein kinase 38	2.18
c76207_g10_i4	XP_007249398.1	Serine/threonine-protein kinase 3-like isoform X2	3.38
c82590_g16_i1	XP_007249689.1	Serine/threonine-protein kinase 40	5.19
c78053_g2_i14	XP_004072970.1	Serine/threonine-protein kinase A-Raf-like	10.63
c78600_g14_i2	XP_007255655.1	Serine/threonine-protein kinase LATS2	4.56
c78600_g8_i1	NP_001121728.1	Serine/threonine-protein kinase LATS2 isoform 2	2.2
c81307_g6_i1	XP_007239017.1	Serine/threonine-protein kinase LMTK2-like	8.86
c81566_g13_i1	XP_005998475.1	Serine/threonine-protein kinase MARK1	8.09

c79700_g17_i1	XP_005161432.1	Serine/threonine-protein kinase MARK2 isoform X10	6.08
c80523_g11_i6	XP_007244545.1	Serine/threonine-protein kinase MARK2-like isoform X2	3.27
c80523_g11_i5	XP_007244549.1	Serine/threonine-protein kinase MARK2-like isoform X6	2.49
c82888_g8_i3	XP_007256678.1	Serine/threonine-protein kinase MRCK beta isoform X2	3.8
c76111_g3_i1	XP_005160107.1	Serine/threonine-protein kinase N1 isoform X1	2.36
c78702_g12_i5	XP_007229857.1	Serine/threonine-protein kinase N1-like isoform X1	2.55
c76111_g4_i6	XP_007253180.1	Serine/threonine-protein kinase N1-like isoform X3	4.78
c75665_g2_i5	XP_700704.3	Serine/threonine-protein kinase N2	2.52
c76405_g15_i3	XP_007255867.1	Serine/threonine-protein kinase N2-like isoform X1	4.85
c75520_g2_i1	XP_004553828.1	Serine/threonine-protein kinase Nek7-like isoform X1	2.56
c81809_g13_i3	XP_006640990.1	Serine/threonine-protein kinase NLK-like, partial	3.31
c83306_g5_i1	NP_957469.2	Serine/threonine-protein kinase OSR1	2.44
c83062_g4_i4	XP_007246220.1	Serine/threonine-protein kinase PAK 2 isoform X2	-2.72
c83547_g7_i13	XP_007238430.1	Serine/threonine-protein kinase PAK 6-like isoform X1	4.22
c83943_g2_i1	ABD65548.1	Serine/threonine-protein kinase Pim-3-like	-3.69
c82130_g9_i1	XP_007229172.1	Serine/threonine-protein kinase PLK2-like	4.2
c81717_g9_i7	NP_998614.1	Serine/threonine-protein kinase PRP4 homolog	7.04
c77763_g2_i3	XP_007257905.1	Serine/threonine-protein kinase Sgk1 isoform X2	2.84
c82688_g3_i2	XP_007253283.1	Serine/threonine-protein kinase SIK2-like isoform X1	14.46
c78594_g5_i6	XP_005454385.1	Serine/threonine-protein kinase SIK3 homolog	3.67
c81142_g16_i5	XP_006640982.1	Serine/threonine-protein kinase TAO1-like	2.91
c81142_g12_i1	CBN81378.1	Serine/threonine-protein kinase TAO2	7.62
c80250_g2_i1	XP_007248751.1	Serine/threonine-protein kinase TAO2-like	5.21
c82317_g7_i8	XP_007246109.1	Serine/threonine-protein kinase ULK1 isoform X4	4.25
c78620_g6_i4	XP_007246057.1	Serine/threonine-protein kinase ULK2-like isoform X1	3.56
c80680_g15_i1	XP_005164609.1	Serine/threonine-protein kinase WNK1 isoform X5	49.7
c78834_g5_i2	XP_007233936.1	Serine/threonine-protein kinase WNK1-like	23.03
c83458_g11_i7	XP_007252935.1	Serine/threonine-protein kinase WNK1-like isoform X1	21
c83458_g11_i10	XP_007252937.1	Serine/threonine-protein kinase WNK1-like isoform X3	2.75
c71668_g4_i1	XP_007229440.1	Serine/threonine-protein phosphatase 2A 65 kDa regulatory	2.49
c78098_g3_i1	XP_005163462.1	Serine/threonine-protein phosphatase 2A regulatory subunit	5.03
c81904_g3_i1	XP_007236052.1	Serine/threonine-protein phosphatase 4 regulatory subunit	3.37

c78537_g12_i1	XP_005157433.1	Serine/threonine-protein phosphatase 5 isoform X1	2.47
c81512_g17_i2	NP_001018164.1	Serine/threonine-protein phosphatase 6 regulatory ankyrin repeat	11.31
c81130_g1_i1	XP_004071219.1	Serine/threonine-protein phosphatase PP1-beta-like	2.02
c74414_g11_i6	NP_775345.2	Serrate RNA effector molecule homolog	2.79
c79317_g5_i1	XP_002942523.2	Serum response factor	2.62
c79317_g5_i6	XP_005174111.1	Serum response factor a isoform X1	2.22
c75222_g1_i2	XP_007249475.1	Serum response factor-binding protein 1-like isoform X1	2.57
c75021_g3_i1	XP_005473952.1	Serum response factor-like isoform X1	3.48
c79069_g3_i4	NP_991103.1	SET and MYND domain containing 1	-2.32
c80443_g5_i3	XP_007253385.1	SET domain-containing protein 5	3.33
c78536_g2_i2	XP_007244010.1	SET-binding protein	3.55
c80148_g1_i3	AAI63938.1	Sf1 protein	3.4
c81370_g5_i1	XP_007237210.1	SH2 domain-containing adapter protein F-like isoform X3	2.4
c76276_g3_i2	XP_005155665.1	SH2 domain-containing protein 3C isoform X2	3.93
c71289_g1_i2	XP_007234760.1	SH2B adapter protein 1-like isoform X1	3.6
c77174_g4_i1	XP_003198643.1	SH2B adapter protein 3	6.09
c79535_g4_i3	XP_007251422.1	SH3 and PX domain-containing protein 2A isoform X2	4.29
c78577_g2_i3	XP_005452607.1	SH3 and PX domain-containing protein 2B-like isoform X3	7
c77431_g15_i1	XP_007238356.1	SH3 domain-binding protein 4-A-like	3.35
c76281_g7_i1	XP_007232483.1	SH3 domain-binding protein 4-like	5.06
c79775_g13_i4	XP_007227923.1	Short stature homeobox protein isoform X2	2.14
c80555_g5_i18	AAI24137.1	Si:ch211-114c12.2	4.07
c83115_g6_i9	AAI52517.1	Si:ch211-13c6.2 protein	3.62
c78477_g6_i2	AAI54248.1	Si:ch211-215a10.4 protein	2.63
c78607_g12_i3	XP_005160903.1	Si:ch211-243j20.2 isoform X3	6.58
c73912_g3_i4	NP_001264375.1	Si:ch211-250b22.7	9.72
c74831_g1_i1	AAI55834.1	Si:dkey-10p5.7	2.26
c75049_g4_i8	AAI29043.1	Si:dkey-11e23.5 protein	4.08
c77067_g6_i5	XP_005162817.1	Si:dkey-11p10.8 isoform X2	5.79
c76292_g5_i5	AAH44565.1	Si:dkey-11p23.2 protein	2.21
c79702_g1_i2	XP_697494.6	Si:dkey-266m15.6	20.16
c80651_g12_i1	XP_005167423.1	Si:dkey-32e23.4 isoform X2	5.82
c81571_g4_i4	XP_006626396.1	Sialomucin core protein 24-like	2.55
c83488_g7_i16	XP_005163498.1	Sickle tail protein homolog isoform X1	6.57

c83488_g7_i3	XP_005163499.1	Sickle tail protein homolog isoform X2	7.96
c80267_g1_i5	XP_005162646.1	Sickle tail protein homolog isoform X5	4.29
c73634_g2_i8	ADO27796.1	Sideroflexin-1	2.48
c76957_g1_i4	NP_001167297.1	Signal peptide peptidase-like 2A precursor	2.34
c83947_g4_i1	XP_007233518.1	Signal peptide, CUB and EGF-like domain-containing protein	6.13
c82006_g5_i5	XP_005166450.1	Signal peptide, CUB domain, EGF-like 2 isoform X4	7.64
c74516_g1_i4	XP_007242626.1	Signal recognition particle receptor subunit alpha-like	3.01
c75576_g5_i3	XP_007252198.1	Signal recognition particle subunit SRP68	4.55
c83777_g2_i5	XP_007249195.1	Signal transducer and activator of transcription 2	4.23
c78505_g14_i6	XP_005163853.1	Signal transducer and activator of transcription 3 isoform	2.76
c78505_g14_i10	XP_003964845.1	Signal transducer and activator of transcription 3-like	6.04
c82916_g2_i3	ACU12487.1	Signal transducer and activator of transcription 5	3.36
c82916_g2_i6	ACK75717.1	Signal transducer and activator of transcription 5b	3.67
c79892_g8_i11	XP_005162290.1	Signal transducer and activator of transcription 6,	5.13
c78465_g3_i5	AAH60933.1	Signal transduction and activation of transcription 1a	3.23
c77991_g6_i1	NP_998615.1	Single stranded DNA binding protein 3b	2.12
c80817_g1_i10	ACX54276.1	Single-stranded DNA-binding protein 1b	2.56
c78028_g17_i9	XP_004552784.1	Single-stranded DNA-binding protein 3-like	2.07
c77515_g8_i1	AAX30332.1	SJCHGC03023 protein	2.92
c76906_g3_i1	XP_007234425.1	Ski-like protein	3.39
c78892_g2_i2	XP_007257083.1	SLAIN motif-containing protein 2 isoform X4	2.39
c80370_g2_i3	XP_007242724.1	SLAM family member 9-like, partial	2.89
c80565_g6_i3	AAH64290.1	Slc9a3r2 protein	3.78
c75299_g2_i4	XP_005743906.1	Slit homolog 1 protein-like isoform X1	10.01
c77019_g4_i1	NP_571810.1	Slit homolog 2 protein precursor	5.01
c77052_g5_i6	NP_571811.2	Slit homolog 3 protein precursor	3.16
c78531_g4_i6	XP_006633879.1	SLIT-ROBO Rho GTPase-activating protein 1-like	2.9
c84057_g6_i1	XP_007247811.1	SLIT-ROBO Rho GTPase-activating protein 2 isoform X2	9.92
c81150_g13_i1	XP_004544883.1	SLIT-ROBO Rho GTPase-activating protein 3-like isoform X1	11.64
c69530_g1_i1	XP_005162977.1	Slow myosin heavy chain 1 isoform X1	2.14
c84322_g1_i1	NP_001129995.1	Slow myosin heavy chain 3	2.37
c71587_g2_i1	Q9I8V2.1	SMAD1_DANRE RecName: Full=Mothers against decapentaplegic homolog 1; Short=MAD	6.92
c78985_g3_i3	AAH44407.1	Smarca4 protein, partial	3.79

c82319_g2_i9	XP_007236254.1	Smoothelin-like	5.42
c82319_g2_i16	XP_006789742.1	Smoothelin-like isoform X3	2.98
c82319_g2_i1	XP_004544698.1	Smoothelin-like isoform X8	5.66
c77292_g4_i4	XP_007260300.1	Sn1-specific diacylglycerol lipase alpha-like	3.2
c82700_g3_i1	NP_957127.1	SNF-related serine/threonine-protein kinase	6.61
c80630_g3_i2	XP_007250479.1	SNF-related serine/threonine-protein kinase	4.78
c79158_g2_i1	XP_007229363.1	Sodium- and chloride-dependent glycine transporter 1	3.88
c79524_g3_i2	BAB83084.1	Sodium bicarbonate cotransporter	6.39
c83627_g18_i4	XP_007239140.1	Sodium channel subunit beta-2	9.38
c78298_g1_i9	ABU68838.1	Sodium hydrogen exchanger 8	3.6
c84209_g5_i4	AAT48993.1	Sodium potassium ATPase alpha subunit	6.49
c81409_g2_i2	NP_001034233.1	Sodium/calcium exchanger 1 precursor	3.78
c81409_g2_i6	XP_007230105.1	Sodium/calcium exchanger 1-like isoform X1	8.13
c76249_g2_i1	XP_007258331.1	Sodium/hydrogen exchanger 3-like isoform X1	5.42
c76249_g1_i3	XP_007258332.1	Sodium/hydrogen exchanger 3-like isoform X2	2.13
c75616_g1_i1	XP_007252289.1	Sodium/potassium/calcium exchanger 3-like	14.44
c84209_g4_i1	ABF58911.1	Sodium/potassium-transporting ATPase alpha-1 subunit	4.38
c72975_g1_i4	XP_007242934.1	Sodium/potassium-transporting ATPase subunit alpha-1-like,	12.34
c79862_g11_i1	XP_007253156.1	Sodium/potassium-transporting ATPase subunit alpha-3-like	4.71
c82928_g6_i3	NP_001158777.1	Sodium-coupled neutral amino acid transporter 2	2.88
c82928_g6_i2	XP_007238009.1	Sodium-coupled neutral amino acid transporter 2 isoform X2	3.63
c82928_g6_i1	XP_006633683.1	Sodium-coupled neutral amino acid transporter 2-like	2.65
c81174_g1_i5	XP_003976732.1	Sodium-coupled neutral amino acid transporter 4-like	4.8
c79287_g12_i4	NP_001082989.1	Sodium-dependent glucose transporter 1	3.61
c79858_g1_i2	XP_007257867.1	Sodium-dependent phosphate transporter 1-B-like	6.57
c81422_g1_i5	XP_007231665.1	Sodium-dependent phosphate transporter 2-like isoform X1	3.43
c81153_g11_i7	XP_007252502.1	Solute carrier family 12 member 2 isoform X1	2.84
c82730_g1_i9	XP_691291.2	Solute carrier family 12 member 4 isoform X2	2.82
c81786_g8_i6	XP_007256975.1	Solute carrier family 12 member 7-like isoform X2	15.51
c79363_g4_i3	XP_007256978.1	Solute carrier family 12 member 7-like isoform X5	5.01
c83202_g3_i4	XP_007258151.1	Solute carrier family 12 member 9-like isoform X1	2.39
c78238_g1_i1	XP_005173495.1	Solute carrier family 12 member 9-like, partial	3.97
c81597_g8_i3	XP_007229414.1	Solute carrier family 23 member 2-like isoform X1	3.53
c75520_g1_i3	NP_001002559.1	Solute carrier family 35, member F6	2.44

c77401_g12_i1	NP_001002648.1	Solute carrier family 38, member 5b	6.48
c80251_g6_i5	XP_005156133.1	Solute carrier family 4, anion exchanger, member 1b	2.17
c83845_g10_i3	NP_001107912.1	Solute carrier family 4, anion exchanger, member 2b	6.78
c78638_g5_i5	XP_005173158.1	Solute carrier family 43, member 1a isoform X1	3.25
c82571_g11_i12	NP_001032750.1	Solute carrier family 6, member 6	6.23
c79805_g5_i3	ADD17065.1	Solute carrier family 7 member 8-like protein	4.85
c75606_g2_i3	NP_001091726.2	Solute carrier family 9 (sodium/hydrogen exchanger), member 6a	3.76
c78972_g1_i5	NP_001106947.1	Solute carrier family 9 (sodium/hydrogen exchanger), member 6b	3.28
c82956_g11_i6	XP_006638599.1	Son of sevenless homolog 1-like isoform X1	7.83
c77071_g1_i1	XP_007245065.1	Sortilin-like	2.18
c81009_g6_i1	XP_003200086.2	Sortilin-related receptor isoform X1	10.57
c81009_g5_i2	XP_007229453.1	Sortilin-related receptor-like	4.49
c76756_g12_i2	ACN10877.1	Sorting and assembly machinery component 50 homolog	2.76
c81227_g5_i6	XP_007235153.1	Sorting nexin-1	2.38
c77264_g3_i1	XP_007256713.1	Sorting nexin-17 isoform X3	2.45
c79963_g10_i9	ADO27741.1	Sorting nexin-24	2.42
c80211_g2_i1	XP_007230646.1	Sorting nexin-27-like	3.5
c75664_g6_i3	XP_007228608.1	Sorting nexin-33	2.3
c80192_g11_i2	XP_007260027.1	Sorting nexin-4	2.02
c79618_g3_i6	XP_007253984.1	Sorting nexin-9-like isoform X2	3.78
c83330_g9_i3	ADB45218.1	SOX4 HMG-box protein	2.86
c77594_g2_i1	XP_007258595.1	Spartin-like isoform X3	3.51
c81297_g6_i1	XP_005810101.1	Speckle-type POZ protein-like A-like isoform X1	2.32
c79859_g10_i3	XP_007233972.1	Spectrin alpha chain, non-erythrocytic 1 isoform X1	5.4
c79859_g10_i8	XP_007233978.1	Spectrin alpha chain, non-erythrocytic 1 isoform X7	2.19
c80385_g19_i1	NP_571600.1	Spectrin beta chain, erythrocyte	4.77
c83720_g4_i6	XP_007231836.1	Spectrin beta chain, non-erythrocytic 1 isoform X1	11.55
c83720_g4_i9	XP_007231837.1	Spectrin beta chain, non-erythrocytic 1 isoform X2	4.01
c83720_g4_i1	XP_007261083.1	Spectrin beta chain, non-erythrocytic 1-like isoform X6	2.63
c81409_g6_i1	XP_007230878.1	Sperm-associated antigen 1-like	3.36
c83552_g6_i11	XP_005162798.1	Spermatogenesis-associated protein 13 isoform X1	4.11
c76983_g3_i2	XP_007253250.1	Sphingolipid delta(4)-desaturase DES1	3.35
c79808_g1_i2	XP_007241097.1	Sphingosine 1-phosphate receptor 2	2.34
c80841_g1_i1	XP_007254565.1	Sphingosine kinase 2-like	4.82

c84005_g4_i2	XP_007229050.1	Sphingosine-1-phosphate phosphatase 1	3.51
c80592_g4_i3	XP_007256723.1	Sphingosine-1-phosphate phosphatase 1-like	2.96
c83367_g16_i3	XP_006639926.1	Spindlin-1-like	4.74
c80148_g1_i9	XP_006911198.1	Splicing factor 1-like	12.37
c81640_g6_i5	XP_007227831.1	Splicing factor 3B subunit 1 isoform X4	2.72
c77626_g11_i1	XP_007249238.1	Splicing factor 3B subunit 3	4.11
c83916_g1_i10	AAI62653.1	Spon1b protein	2.61
c75163_g1_i3	XP_007257446.1	Sprouty-related, EVH1 domain-containing protein 1	5.39
c73967_g4_i1	NP_001099164.1	SPRY domain-containing protein 3	2.8
c80710_g13_i8	XP_007238236.1	Squamous cell carcinoma antigen recognized by T-cells 3	2.24
c81176_g1_i2	XP_005170707.1	SRSF protein kinase 2-like isoform X4	3.63
c68313_g1_i1	NP_001158341.1	SRY-box containing gene 7	3.2
c77071_g8_i3	AAH77133.1	Staphylococcal nuclease domain containing 1	2.09
c72612_g1_i2	XP_692994.3	StAR-related lipid transfer protein 7, mitochondrial	5.12
c82585_g2_i1	XP_005171942.1	StAR-related lipid transfer protein 8 isoform X1	4.81
c82916_g2_i9	AAI39518.1	Stat5.2 protein	3.41
c80865_g2_i2	XP_005156902.1	Stearoyl-CoA desaturase b isoform X1	5.28
c77124_g2_i8	XP_007246341.1	Sterile alpha motif domain-containing protein 11 isoform	2.42
c83289_g6_i10	XP_007255720.1	Sterile alpha motif domain-containing protein 5-like	2.94
c81440_g7_i2	XP_005158307.1	Sterol regulatory element-binding protein	4.89
c79743_g1_i4	AFH35105.1	Sterol regulatory element-binding protein 1	2.47
c76837_g1_i4	XP_007236222.1	Sterol regulatory element-binding protein 2-like isoform	2.06
c81360_g2_i2	XP_005924590.1	Stress response protein NST1-like isoform X1	-2.9
c83448_g7_i10	XP_007254034.1	Stress-induced-phosphoprotein 1	2.93
c78707_g11_i9	XP_007240441.1	Stress-induced-phosphoprotein 1-like	2.36
c81634_g15_i3	XP_005169761.1	Striatin-4 isoform X1	4.75
c82224_g6_i8	XP_007429955.1	Striatin-interacting protein 1	-2.03
c77767_g3_i2	XP_007246179.1	Striatin-like isoform X1	4.74
c75549_g8_i1	XP_007254230.1	Stromal cell-derived factor 2	2.27
c80295_g3_i1	XP_007258067.1	Stromal interaction molecule 1-like isoform X1	2.95
c80816_g17_i3	XP_007249440.1	Stromal membrane-associated protein 2	16.74
c82305_g6_i1	XP_004070486.1	Structural maintenance of chromosomes protein 1A	3.47
c81648_g3_i6	XP_007252050.1	Structural maintenance of chromosomes protein 6 isoform X2	2.11
c79063_g7_i5	XP_007253128.1	Succinate dehydrogenase	3.06

c78358_g1_i4	AAH56551.1	Suclg2 protein, partial	2.01
c75059_g18_i1	XP_007229905.1	Sugar phosphate exchanger 3-like	3.46
c80415_g10_i6	XP_007238038.1	SUMO-activating enzyme subunit 2-like	2.14
c73091_g1_i2	ACI33971.1	SUMO-conjugating enzyme UBC9	2.58
c76402_g8_i3	XP_007228891.1	Superkiller viralicidic activity 2-like 2 isoform X1	2.86
c82272_g3_i5	XP_007241941.1	Suppression of tumorigenicity 5 protein-like, partial	2.81
c81950_g8_i1	XP_007255839.1	Suppressor of cytokine signaling 5	3.3
c81973_g3_i1	XP_007231032.1	Suppressor of cytokine signaling 5-like	6.85
c78887_g8_i1	XP_007253046.1	Suppressor of cytokine signaling 6-like	4.3
c80792_g3_i26	XP_007259608.1	Suppressor of tumorigenicity 14 protein homolog	2.89
c79946_g3_i2	AAH63248.1	Suppressor of Ty 6 homolog (S. cerevisiae)	2.16
c82760_g3_i4	XP_005476229.1	SURP and G-patch domain-containing protein 1-like	2.37
c83999_g2_i5	NP_997766.1	Survival of motor neuron-related-splicing factor 30	-2.09
c78434_g6_i7	XP_007227782.1	Sushi repeat-containing protein SRPX isoform X1	8.42
c83753_g6_i1	XP_007233872.1	Sushi, von Willebrand factor type A, EGF and pentraxin	13.51
c68665_g1_i1	A8YPR9.1	SVMI1_CERCE RecName: Full=Snake venom metalloprotease inhibitor 02A10; AltName:	2.54
c78528_g3_i3	XP_006635727.1	SWI/SNF complex subunit SMARCC1-like	3.88
c79002_g1_i1	XP_695864.3	SWI/SNF complex subunit SMARCC2	5.38
c79002_g14_i1	XP_005991496.1	SWI/SNF complex subunit SMARCC2 isoform X5	2.23
c75480_g6_i10	XP_004549395.1	SWI/SNF-related matrix-associated actin-dependent	2.09
c82693_g1_i1	XP_007236281.1	Synaptotagmin-like protein 2 isoform X3	4.71
c79924_g11_i1	NP_001187727.1	Syndecan-2-b precursor	2.88
c73551_g1_i1	XP_007250505.1	Syndecan-2-like	3.03
c83753_g16_i1	XP_007245738.1	Syndecan-3	5.27
c80148_g5_i2	XP_007250597.1	Synembryn-B	2.73
c83650_g4_i2	XP_007243207.1	Synemin-like	5.06
c79687_g1_i6	XP_007248680.1	Synergin gamma isoform X1	2.62
c78025_g4_i7	XP_005173167.1	Syntaxin-3 isoform X5	3.2
c81015_g2_i4	XP_007240149.1	Syntaxin-6	11.22
c79632_g3_i2	XP_007233479.1	Syntaxin-binding protein 3-like	2.35
c80693_g2_i3	NP_001187914.1	Tafazzin	-2.33
c83162_g1_i4	XP_007255352.1	Talin-1-like isoform X4	12.17
c80828_g23_i2	XP_004553206.1	Talin-2-like isoform X4	47.95
c77213_g7_i5	XP_687410.3	Tankyrase-1 isoform X2	10.27
c83760_g2_i1	XP_005473081.1	Tankyrase-1-like isoform X2	3.63

c74973_g1_i1	XP_003449482.2	Tankyrase-2-like isoform X1	9.57
c82535_g4_i9	XP_007257683.1	Target of Nesh-SH3-like isoform X2	4.05
c82535_g4_i7	XP_007257685.1	Target of Nesh-SH3-like isoform X4	9.16
c80324_g3_i1	ADD83026.1	TATA box binding protein	2.03
c80577_g6_i2	XP_007256489.1	TATA element modulatory factor	2.58
c77446_g6_i3	XP_007253966.1	Tau-tubulin kinase 2-like isoform X1	11.01
c77712_g12_i5	XP_689617.6	TBC1 domain family member 1 isoform X4	2.87
c84286_g3_i10	XP_007237455.1	TBC1 domain family member 10A-like	3.71
c77897_g1_i13	XP_007238168.1	TBC1 domain family member 12-like	8.11
c81996_g2_i2	XP_005164004.1	TBC1 domain family member 17 isoform X1	2.76
c83049_g3_i10	XP_007234986.1	TBC1 domain family member 22B isoform X1	4.68
c76401_g10_i1	XP_004573516.1	TBC1 domain family member 22B-like isoform X3	3.79
c77011_g6_i8	XP_007233684.1	TBC1 domain family member 23-like isoform X1	2.95
c76498_g3_i1	XP_007228323.1	TBC1 domain family member 2B	5.09
c76539_g11_i8	XP_007240029.1	TBC1 domain family member 8B isoform X2	2.43
c80989_g15_i4	XP_692034.2	TBC1 domain family member 9 isoform 2	2.35
c78033_g5_i2	XP_005463856.1	TBC1 domain family member 9B-like isoform X3	7.77
c77942_g5_i13	XP_007257999.1	Tectonin beta-propeller repeat-containing protein 2	5.03
c83941_g9_i7	XP_002660903.3	Telomerase protein component 1	7.12
c79299_g1_i1	CAM13370.1	Tenascin C	34.64
c79299_g1_i3	XP_005171847.1	Tenascin isoform X3	10.1
c79299_g1_i9	NP_570982.1	Tenascin precursor	25.02
c81598_g3_i2	XP_005171321.1	Tenascin W isoform X1	4.99
c81826_g5_i1	XP_003199292.2	Tensin-1 isoform X1	3.98
c81826_g5_i2	XP_005464106.1	Tensin-1-like isoform X11	19.58
c83448_g7_i7	NP_001232024.1	Testis derived transcript	2.59
c83551_g6_i1	XP_692960.1	Testis development-related protein	4.03
c82955_g17_i4	XP_005164709.1	Tetraspanin-11 isoform X1	2.14
c83908_g6_i2	XP_007240897.1	Tetraspanin-15-like	3.14
c76841_g1_i1	NP_001187896.1	Tetraspanin-17	2.13
c82311_g12_i1	XP_007253406.1	Tetraspanin-2	3.22
c79248_g1_i2	XP_003448327.1	Tetraspanin-2-like	6.81
c77520_g1_i2	NP_001187507.1	Tetraspanin-31	2.3
c77447_g2_i5	XP_698025.5	Tetratricopeptide repeat protein 17	5.36
c75582_g1_i2	XP_007258521.1	Thiamine transporter 1-like	5.48
c81850_g2_i11	XP_007260154.1	Thiamine-triphosphatase-like	3.03

c79163_g7_i3	XP_005157191.1	THO complex subunit 2 isoform X1	5.55
c77308_g8_i1	XP_007258392.1	Threonine--tRNA ligase, cytoplasmic-like	4.35
c73491_g1_i3	XP_007230403.1	Thrombospondin-1-like	4.43
c79089_g2_i2	XP_007258230.1	Thrombospondin-1-like isoform X1	7.39
c83171_g4_i5	XP_007256649.1	Thrombospondin-4-B-like	2.46
c77777_g4_i5	XP_007235980.1	Thymidine kinase 2, mitochondrial isoform X1	2.63
c78405_g5_i1	NP_001124169.1	Thymosin, beta 4 x	-2.2
c73933_g1_i2	NP_001071043.2	Thyroid hormone receptor interactor 4	-4.82
c78824_g5_i1	XP_007249722.1	Thyroid hormone receptor-associated protein 3-like	9.53
c70328_g3_i3	XP_007229873.1	Thyrotroph embryonic factor	4.31
c76166_g6_i2	XP_007244918.1	Tight junction protein ZO-1-like isoform X10	4.38
c81503_g3_i9	XP_007244919.1	Tight junction protein ZO-1-like isoform X11	8.82
c81503_g3_i5	XP_007244910.1	Tight junction protein ZO-1-like isoform X2	10.08
c81503_g3_i6	XP_005450929.1	Tight junction protein ZO-1-like isoform X8	9.11
c76166_g11_i6	XP_007244917.1	Tight junction protein ZO-1-like isoform X9	9.09
c82122_g3_i1	XP_005155631.1	Tight junction protein ZO-2 isoform X1	4.52
c81835_g1_i2	XP_007255077.1	Tight junction protein ZO-2-like isoform X1	2.74
c83258_g4_i4	XP_007252708.1	Tight junction protein ZO-3-like isoform X2	4.68
c82804_g7_i22	XP_007244481.1	Titin-like	32.84
c82710_g3_i4	ABE99696.1	TNF receptor associated factor 2	3.55
c82905_g9_i12	ADF56651.2	TNF receptor-associated factor 6 a	3.52
c76936_g6_i8	XP_007257814.1	TNFAIP3-interacting protein 1-like	3.54
c81097_g5_i3	XP_005171721.1	TOM1-like protein 2-like isoform X4	3.48
c77488_g10_i6	XP_007256608.1	Torsin-1B-like isoform X1	-2.29
c83579_g6_i3	CAI96518.1	TPA: leukemia inhibitory factor receptor.a	7.1
c75032_g3_i4	CBX19678.1	TPA: protein tyrosine phosphatase, non-receptor type 11	3.78
c79270_g10_i5	XP_007256436.1	TRAF3-interacting protein 1 isoform X1	5.71
c83496_g7_i4	XP_007244190.1	Trafficking kinesin-binding protein 2 isoform X3	3.25
c83496_g7_i1	XP_007244193.1	Trafficking kinesin-binding protein 2 isoform X6	3.62
c78985_g2_i1	NP_853634.1	Transcription activator BRG1	2.53
c80851_g13_i4	NP_998440.1	Transcription cofactor vestigial-like protein 4	6.59
c81312_g1_i1	XP_007236371.1	Transcription cofactor vestigial-like protein 4-like	6.17
c80619_g3_i1	XP_007239265.1	Transcription factor 20-like	2.74
c77795_g5_i2	XP_005447997.1	Transcription factor 20-like isoform X3	3.19
c81759_g6_i1	XP_001336482.2	Transcription factor CP2 isoform X1	3.27
c80881_g11_i1	XP_002710633.1	Transcription factor CP2-like 3	2.83

c80263_g4_i1	NP_998597.1	Transcription factor E2F4	6.2
c77867_g5_i13	XP_007245893.1	Transcription factor E3-like isoform X3	3.01
c80680_g6_i2	XP_005455658.1	Transcription factor EC-like isoform X2	9.53
c79803_g15_i1	XP_006633709.1	Transcription factor ETV6-like	-2.06
c78899_g10_i1	XP_007251820.1	Transcription factor HIVEP3-like	2.9
c81356_g4_i1	XP_004071881.1	Transcription factor jun-B-like	2.72
c71476_g1_i1	NP_001076409.1	Transcription factor MafA	5.29
c76835_g19_i1	XP_006639587.1	Transcription factor MafB-like	2.68
c81051_g17_i4	AHB37083.1	Transcription factor NfKB p65 subunit	3.55
c79950_g9_i5	XP_007250381.1	Transcription factor RFX3	3.64
c82127_g9_i7	XP_005450158.1	Transcription factor SOX-13-like isoform X3	3.35
c81073_g3_i1	XP_007256839.1	Transcription factor Sox-2	2.22
c77925_g7_i4	XP_007234923.1	Transcription factor Sp3 isoform X2	2.81
c79254_g4_i19	XP_007253014.1	Transcription initiation factor IIA subunit 1-like isoform	2.47
c82841_g3_i4	XP_007235910.1	Transcription initiation factor TFIID subunit 1-like	2.01
c81312_g8_i2	XP_007234563.1	Transcription regulator protein BACH1-like isoform X1	3.64
c81912_g3_i1	XP_005157218.1	Transcriptional activator protein Pur-alpha-like	3.17
c78967_g9_i3	XP_006978666.1	Transcriptional enhancer factor TEF-1 isoform X1	3.84
c78967_g9_i9	XP_006070974.1	Transcriptional enhancer factor TEF-1 isoform X4	7.69
c83257_g13_i2	XP_007228484.1	Transcriptional regulator ATRX-like isoform X1	6.49
c80812_g2_i14	XP_007247341.1	Transcriptional regulator Erg isoform X1	3.72
c80812_g7_i4	XP_007247342.1	Transcriptional regulator Erg isoform X2	4.57
c75139_g5_i1	XP_007254494.1	Transcriptional regulator Kaiso isoform X1	5.73
c81829_g10_i3	NP_001007403.1	Transducin beta-like protein 3	2.15
c78968_g3_i1	XP_007246991.1	Transducin-like enhancer protein 3 isoform X1	2.86
c82766_g5_i3	XP_007252395.1	Transferrin receptor protein 1-like	4.08
c79056_g5_i4	XP_007255013.1	Transforming acidic coiled-coil-containing protein 1-like	2.28
c81898_g10_i5	XP_698488.6	Transforming acidic coiled-coil-containing protein 2-like	8.97
c82216_g3_i8	XP_007235944.1	Transforming growth factor beta-1-induced transcript 1	2.53
c81254_g6_i2	NP_878293.1	Transforming growth factor, beta 1a precursor	3.32
c75556_g6_i3	XP_003441729.2	Transforming protein p68/c-ets-1-like isoform X1	5.74
c82314_g13_i7	XP_006628750.1	Transient receptor potential cation channel subfamily M	4.43
c80293_g6_i2	XP_003439025.1	Translocating chain-associated membrane protein 1-like	3.99

c74414_g4_i2	XP_007234420.1	Translocation protein SEC62 isoform X1	2.01
c83004_g5_i1	NP_001002588.1	Translocation protein SEC63 homolog	2.49
c83654_g9_i4	XP_007255923.1	Transmembrane 9 superfamily member 1	2.05
c76329_g2_i4	NP_001135200.1	Transmembrane 9 superfamily member 3 precursor	2.47
c81840_g2_i7	XP_007250838.1	Transmembrane 9 superfamily member 4	2.04
c82312_g1_i4	XP_007238341.1	Transmembrane and coiled-coil domains protein 1 isoform X2	3.95
c83166_g6_i1	XP_005734853.1	Transmembrane and TPR repeat-containing protein 2-like	4.8
c76007_g2_i4	XP_001922486.4	Transmembrane and TPR repeat-containing protein 3	3.78
c76332_g1_i4	NP_001187457.1	Transmembrane bax inhibitor motif-containing protein 4	2.09
c72664_g1_i1	XP_004072289.1	Transmembrane emp24 domain-containing protein 7-like	2.06
c73609_g3_i2	XP_007244518.1	Transmembrane gamma-carboxyglutamic acid protein 3-like	4.33
c79016_g1_i5	XP_007261049.1	Transmembrane protease serine 13-like isoform X1	3.78
c79016_g1_i11	XP_007261050.1	Transmembrane protease serine 13-like isoform X2	2.03
c80489_g10_i1	NP_001187767.1	Transmembrane protein 106b	2.37
c72413_g1_i4	XP_007236716.1	Transmembrane protein 131-like	2.02
c75724_g1_i7	XP_007242196.1	Transmembrane protein 147-like isoform X1	-2.11
c76431_g7_i10	XP_007247122.1	Transmembrane protein 164	2.34
c82639_g6_i1	XP_007252946.1	Transmembrane protein 168	2.04
c75929_g5_i1	ABC94630.1	Transmembrane protein 16E	8.09
c71797_g2_i2	NP_001018325.1	Transmembrane protein 179B	2.61
c77306_g10_i2	XP_007259793.1	Transmembrane protein 184A, partial	-3.93
c79829_g6_i3	XP_007251312.1	Transmembrane protein 184B-like isoform X1	3.83
c77634_g7_i5	NP_001139068.1	Transmembrane protein 184C	2.39
c79173_g7_i1	XP_007249253.1	Transmembrane protein 189-like	2.34
c76078_g10_i1	XP_007246890.1	Transmembrane protein 201	7.06
c77003_g1_i1	XP_007241833.1	Transmembrane protein 204-like	2.28
c82392_g19_i1	XP_005800865.1	Transmembrane protein 211-like	3.71
c74590_g1_i4	NP_001080854.1	Transmembrane protein 30A	-2.15
c76023_g11_i5	XP_007254701.1	Transmembrane protein 41B	3.08
c76623_g1_i2	ETE58935.1	Transmembrane protein 50B	2.64
c79756_g2_i4	XP_007250453.1	Transmembrane protein 56-B-like	7.64
c78876_g2_i4	XP_007228820.1	Transmembrane protein 63B-like isoform X3	3.55
c78684_g1_i1	XP_007257794.1	Transmembrane protein 65-like	4.36

c80323_g10_i4	XP_007253366.1	Transmembrane protein adipocyte-associated 1 homolog	2.16
c83973_g14_i1	NP_001188089.1	Transmembrane protein c9orf46	3.86
c73916_g1_i6	XP_007249275.1	Transport and Golgi organization protein 6 homolog	6.55
c77224_g6_i7	XP_003452860.1	Transportin-2-like isoform 1	10.02
c81718_g10_i9	CDJ82928.1	Transposase domain containing protein	5.51
c80778_g2_i3	XP_007251326.1	Trinucleotide repeat-containing gene 6B protein-like	2.83
c77629_g1_i3	XP_007236217.1	TRIO and F-actin-binding protein-like isoform X1	3.04
c82505_g2_i11	XP_005745550.1	Triple functional domain protein-like isoform X13	7.98
c77669_g4_i2	XP_007247605.1	TRNA (guanine(37)-N1)-methyltransferase	2.23
c77292_g5_i1	XP_005174433.1	Tropomyosin alpha-1 chain isoform X7	2.39
c79815_g5_i8	NP_958900.1	Tropomyosin alpha-3 chain isoform 2	2.1
c79815_g5_i17	XP_004075094.1	Tropomyosin beta chain-like isoform 3	-3.22
c72466_g2_i1	XP_007249917.1	Troponin C, skeletal muscle-like isoform X1	-2.22
c77919_g2_i3	ADO28072.1	Troponin I fast skeletal muscle	-2.02
c75097_g1_i5	XP_007228170.1	Troponin I, fast skeletal muscle-like	-4.26
c73326_g3_i2	XP_007251785.1	TSC22 domain family protein 1 isoform X1	2.88
c81496_g11_i2	XP_007229242.1	TSC22 domain family protein 2-like	5.76
c76122_g2_i4	XP_003454643.2	Tubulin beta chain-like	3.6
c77959_g7_i1	XP_006634483.1	Tubulin beta-5 chain-like	3.71
c75595_g8_i3	XP_007234837.1	Tubulin polymerization-promoting protein	3.11
c80426_g4_i4	XP_007240379.1	Tubulin--tyrosine ligase-like	3.06
c79592_g1_i1	XP_007250247.1	Tumor necrosis factor ligand superfamily member 10-like	5.99
c80870_g4_i1	XP_007251777.1	Tumor necrosis factor ligand superfamily member 11	2.92
c78026_g12_i4	XP_007237285.1	Tumor necrosis factor receptor superfamily member 10B-like	3.29
c81838_g9_i5	XP_005469792.1	Tumor necrosis factor receptor superfamily member 1B-like	2.97
c78062_g5_i2	XP_007245461.1	Tumor necrosis factor receptor superfamily member 21	2.95
c82876_g1_i3	XP_007249848.1	Tumor necrosis factor receptor superfamily member 5-like	2.17
c79627_g9_i2	AGW47747.1	Tumor necrosis factor superfamily member 12	3
c77621_g2_i7	NP_694519.1	Tumor protein 63 isoform gamma	2.6
c81787_g6_i7	NP_001188174.1	Tumor protein D52	3.21
c79730_g2_i1	XP_007228926.1	Tumor protein p53-inducible nuclear protein 1 isoform X1	2.09
c83501_g2_i2	XP_006796369.1	Tumor protein p53-inducible nuclear protein 2-like isoform	5

c78370_g12_i1	XP_007232965.1	Tumor protein p53-inducible protein 11-like isoform X1	7.07
c77796_g4_i5	XP_007257587.1	Two pore calcium channel protein 1-like isoform X2	5.32
c77145_g4_i3	XP_007254055.1	Tyrosine-protein kinase ABL1 isoform X1	2.9
c77145_g2_i1	XP_006640804.1	Tyrosine-protein kinase ABL1-like	6.21
c81543_g2_i6	XP_003453034.1	Tyrosine-protein kinase Fyn-like isoformX2	2.62
c83517_g5_i5	NP_571148.1	Tyrosine-protein kinase JAK1	3.43
c80861_g4_i1	XP_006634985.1	Tyrosine-protein kinase JAK1-like	2.2
c79217_g1_i6	XP_007252861.1	Tyrosine-protein kinase JAK2-like isoform X1	2.05
c81978_g1_i1	XP_007229758.1	Tyrosine-protein kinase receptor Tie-2-like	7.41
c81343_g12_i4	XP_005474876.1	Tyrosine-protein kinase receptor UFO-like isoform X1	3.74
c75796_g8_i3	XP_007253725.1	Tyrosine-protein kinase RYK isoform X1	3.03
c81543_g3_i3	XP_007235354.1	Tyrosine-protein kinase yes-like isoform X1	2.78
c76851_g4_i1	XP_007246331.1	Tyrosine-protein phosphatase non-receptor type 11-like	12.89
c82499_g10_i2	NP_001167187.1	Tyrosine-protein phosphatase non-receptor type 12	4.71
c80375_g6_i2	XP_007245057.1	Tyrosine-protein phosphatase non-receptor type 12 isoform	4.65
c82371_g13_i4	XP_007237278.1	Tyrosine-protein phosphatase non-receptor type 14	12.72
c77515_g3_i5	XP_003439149.1	Tyrosine-protein phosphatase non-receptor type 1-like	3.84
c79622_g11_i1	XP_007257489.1	Tyrosine-protein phosphatase non-receptor type 21-like	3.85
c80134_g12_i3	XP_005162238.1	Tyrosine-protein phosphatase non-receptor type 22 isoform	2.83
c77760_g2_i4	XP_690659.5	Tyrosine-protein phosphatase non-receptor type 9	4.85
c82956_g3_i2	XP_007251166.1	U1 small nuclear ribonucleoprotein 70 kDa-like	2.19
c81285_g2_i5	XP_005165685.1	U3 small nucleolar RNA-associated protein 14 homolog A	2.45
c79321_g9_i1	NP_001133382.1	U3 small nucleolar RNA-associated protein 18 homolog	2.02
c83622_g17_i3	XP_007244543.1	U4/U6.U5 tri-snRNP-associated protein 1-like	2.02
c77219_g7_i5	NP_001116729.1	U5 small nuclear ribonucleoprotein 200 kDa helicase	3.08
c74617_g1_i4	NP_001073638.1	Ubinuclein 2	13.72
c80816_g12_i6	XP_007242226.1	Ubiquilin-4-like	3.06
c82438_g5_i6	XP_007237677.1	Ubiquitin carboxyl-terminal hydrolase 10 isoform X1	4.04
c81466_g5_i3	XP_002663119.3	Ubiquitin carboxyl-terminal hydrolase 11	3.33
c76265_g2_i1	XP_688359.3	Ubiquitin carboxyl-terminal hydrolase 12-like isoformX2	2.25
c81126_g5_i5	XP_005451787.1	Ubiquitin carboxyl-terminal hydrolase 15 isoform X2	4.89
c81126_g5_i9	XP_007237153.1	Ubiquitin carboxyl-terminal hydrolase 15-like isoform X5	9.35
c81011_g5_i4	XP_007260731.1	Ubiquitin carboxyl-terminal hydrolase 24	14.78

c81011_g5_i1	XP_002665714.3	Ubiquitin carboxyl-terminal hydrolase 24 isoform X1	6.16
c81011_g5_i2	XP_005170208.1	Ubiquitin carboxyl-terminal hydrolase 24 isoform X2	14.23
c83411_g7_i3	XP_005454651.1	Ubiquitin carboxyl-terminal hydrolase 25 isoform X6	4.75
c78757_g2_i5	XP_007246013.1	Ubiquitin carboxyl-terminal hydrolase 32-like isoform X1	2.59
c77595_g13_i1	XP_007260704.1	Ubiquitin carboxyl-terminal hydrolase 34-like	15.83
c79601_g8_i4	XP_688241.3	Ubiquitin carboxyl-terminal hydrolase 36	12.99
c81177_g2_i1	XP_001920291.2	Ubiquitin carboxyl-terminal hydrolase 43-like isoform X1	9.55
c75770_g4_i7	XP_005158432.1	Ubiquitin carboxyl-terminal hydrolase 45-like isoform X1	3.06
c80421_g4_i12	XP_007254707.1	Ubiquitin carboxyl-terminal hydrolase 47 isoform X2	5.3
c80711_g7_i5	XP_007245618.1	Ubiquitin carboxyl-terminal hydrolase 7 isoform X1	5.18
c80711_g7_i6	XP_007245620.1	Ubiquitin carboxyl-terminal hydrolase 7 isoform X3	2.64
c76823_g10_i1	XP_003969893.1	Ubiquitin carboxyl-terminal hydrolase 8-like	2.46
c78664_g2_i10	XP_007248357.1	Ubiquitin carboxyl-terminal hydrolase CYLD-like	-3.95
c79826_g3_i2	XP_001922961.2	Ubiquitin conjugation factor E4 A isoform 1	2.59
c76856_g3_i6	NP_919343.1	Ubiquitin conjugation factor E4 B	2.8
c81100_g2_i1	XP_004616705.1	Ubiquitin-60S ribosomal protein L40	-2.08
c73767_g1_i1	XP_007257006.1	Ubiquitin-associated and SH3 domain-containing protein	4.54
c69407_g2_i2	XP_007243992.1	Ubiquitin-associated domain-containing protein 1-like	5.38
c81092_g2_i8	XP_007260218.1	Ubiquitin-associated protein 2-like isoform X1	6.53
c80887_g7_i3	XP_006788034.1	Ubiquitin-associated protein 2-like isoform X3	5.69
c80887_g14_i1	XP_007230585.1	Ubiquitin-associated protein 2-like isoform X6	6.23
c83897_g3_i2	XP_007120122.1	Ubiquitin-conjugating enzyme E2 A	2.09
c81983_g2_i3	NP_001082922.1	Ubiquitin-conjugating enzyme E2 D4	5.39
c83303_g7_i7	NP_958897.1	Ubiquitin-conjugating enzyme E2 H	3.44
c77457_g1_i6	XP_004567748.1	Ubiquitin-conjugating enzyme E2 Q2-like	3.21
c81870_g2_i2	XP_007239218.1	Ubiquitin-like modifier-activating enzyme 1-like isoform	2.01
c82205_g2_i7	XP_695755.4	Ubiquitin-like modifier-activating enzyme 6-like	2.7
c76651_g8_i4	XP_005166483.1	Ubiquitin-protein ligase E3C isoform X1	2.08
c83424_g8_i2	NP_001103872.1	UDP-glucose 6-dehydrogenase	2.27
c81752_g3_i1	XP_007229726.1	UDP-glucuronosyltransferase 2B15-like isoform X7	2.91
c75103_g1_i4	XP_005166312.1	UDP-N-acetylhexosamine pyrophosphorylase isoform X1	2.86
c79713_g6_i3	XP_007245045.1	UHRF1-binding protein 1-like isoform X2	4.49
c81534_g3_i4	XP_007253247.1	Uncharacterized protein C10orf12-like	6.96

c77743_g6_i4	XP_007254217.1	Uncharacterized protein C17orf85 homolog	3.1
c81629_g1_i11	XP_007249025.1	Uncharacterized protein CXorf23 homolog isoform X1	5.56
c84196_g1_i4	XP_003979573.1	Uncharacterized protein K02A2.6-like, partial	4.89
c75682_g3_i2	XP_007240644.1	Uncharacterized protein KIAA0232 homolog isoform X3	4.58
c75049_g4_i5	XP_007232985.1	Uncharacterized protein KIAA0247 homolog	2.42
c78505_g11_i1	XP_007230433.1	Uncharacterized protein KIAA0247-like	2.34
c77150_g3_i2	XP_007251918.1	Uncharacterized protein KIAA0355 homolog isoform X1	8.17
c78806_g6_i3	XP_007249269.1	Uncharacterized protein KIAA0513 homolog isoform X2	2.8
c78487_g2_i4	XP_004564930.1	Uncharacterized protein KIAA0930 homolog isoform X2	2.59
c82337_g4_i2	XP_007236214.1	Uncharacterized protein KIAA1467 homolog	2.53
c80581_g2_i4	XP_007255063.1	Uncharacterized protein KIAA1958 homolog isoform X2	2.2
c77615_g5_i2	XP_001344050.1	Uncharacterized protein LOC100004848	4.87
c79835_g8_i1	XP_005162724.1	Uncharacterized protein LOC100126011 isoform X2	5.28
c74541_g4_i1	NP_001108374.1	Uncharacterized protein LOC100141337	3.31
c79509_g4_i4	NP_001108400.1	Uncharacterized protein LOC100141364	3.37
c79333_g7_i10	XP_003704380.1	Uncharacterized protein LOC100882671	2.04
c79902_g1_i4	XP_003964916.1	Uncharacterized protein LOC101068595	2.25
c82426_g7_i5	XP_004074928.1	Uncharacterized protein LOC101171598	3.1
c83807_g2_i13	XP_004557214.1	Uncharacterized protein LOC101476340	-2.63
c80740_g10_i1	XP_005162590.1	Uncharacterized protein LOC101886867	3.59
c78082_g1_i2	XP_005158483.1	Uncharacterized protein LOC101887158	-3.52
c83191_g5_i1	XP_005946647.1	Uncharacterized protein LOC102307834	7.08
c80302_g4_i4	XP_005937488.1	Uncharacterized protein LOC102311409	-3.97
c84215_g4_i7	XP_006808885.1	Uncharacterized protein LOC102782322	2.07
c85669_g1_i1	XP_006815882.1	Uncharacterized protein LOC102807728	8.89
c78080_g3_i4	XP_007246039.1	Uncharacterized protein LOC103021609 isoform X1	3.25
c82242_g2_i9	XP_007254932.1	Uncharacterized protein LOC103024880	3.4
c80362_g6_i2	XP_007258478.1	Uncharacterized protein LOC103026154	5.43
c81118_g4_i7	XP_007228917.1	Uncharacterized protein LOC103027094	2.64
c84341_g1_i1	XP_007255292.1	Uncharacterized protein LOC103027733 isoform X1	2.35
c78050_g1_i19	XP_007245554.1	Uncharacterized protein LOC103029909	7.55
c82875_g3_i1	XP_007233519.1	Uncharacterized protein LOC103030801	2.37
c83704_g6_i1	XP_007256902.1	Uncharacterized protein LOC103034725	4.75
c75654_g1_i5	XP_007231427.1	Uncharacterized protein LOC103034921	2.79

c76364_g1_i1	XP_007258854.1	Uncharacterized protein LOC103036525	2.39
c80419_g1_i16	XP_007229034.1	Uncharacterized protein LOC103038476	4.15
c83981_g1_i1	XP_007241388.1	Uncharacterized protein LOC103040198	2.09
c81034_g2_i1	XP_007259509.1	Uncharacterized protein LOC103045094	3.13
c82801_g2_i1	XP_687113.2	Uncharacterized protein LOC558761	2.01
c80974_g12_i4	XP_005169142.1	Uncharacterized protein LOC560966 isoform X1	2.05
c80783_g8_i2	NP_001073474.1	Uncharacterized protein LOC563192	2.37
c83975_g16_i1	XP_005157065.1	Uncharacterized protein LOC566435 isoform X6	6.76
c76140_g1_i1	XP_005174040.1	Uncharacterized protein LOC566957	12.53
c78285_g2_i3	XP_005173756.1	Uncharacterized protein LOC567193 isoform X2	37.36
c79716_g4_i2	XP_005173757.1	Uncharacterized protein LOC567193 isoform X3	5.85
c73944_g1_i3	NP_001103944.1	Uncharacterized protein LOC567809	3.3
c77672_g1_i2	XP_005173185.1	Uncharacterized protein LOC568603 isoform X2	2.08
c82242_g2_i2	XP_005163188.1	Uncharacterized protein LOC777611 isoform X1	5.5
c84232_g1_i11	NP_001119932.1	Uncharacterized protein LOC796658	2.57
c82797_g6_i10	NP_001122275.1	Uncharacterized protein LOC798684	-2.11
c81417_g3_i11	XP_007251732.1	Unconventional myosin-Ib-like isoform X3	4.34
c81417_g3_i12	XP_007251733.1	Unconventional myosin-Ib-like isoform X4	5.8
c81861_g1_i1	NP_001093501.1	Unconventional myosin-Ic	4.27
c80298_g7_i7	XP_694821.5	Unconventional myosin-Ic isoform X3	2.02
c75795_g5_i1	XP_007259235.1	Unconventional myosin-Id isoform X1	3.15
c82380_g4_i5	XP_007231910.1	Unconventional myosin-IXa isoform X6	5.74
c82380_g4_i8	XP_007231911.1	Unconventional myosin-IXa isoform X7	3.45
c84065_g2_i1	XP_007244417.1	Unconventional myosin-IXa-like isoform X1	23.55
c83912_g5_i7	XP_005171392.1	Unconventional myosin-IXb isoform X2	3.42
c84065_g3_i9	XP_007236613.1	Unconventional myosin-IXb-like isoform X2	4.83
c84065_g3_i14	XP_007236614.1	Unconventional myosin-IXb-like isoform X3	7.4
c84065_g3_i12	XP_007236616.1	Unconventional myosin-IXb-like isoform X5	4
c80982_g10_i12	XP_005173731.1	Unconventional myosin-Va isoform X1	10.06
c77054_g3_i17	XP_006793536.1	Unconventional myosin-VI-like isoform X2	5.03
c83212_g7_i2	XP_700015.5	Unconventional myosin-X	2.92
c75939_g5_i1	XP_005171459.1	Unconventional myosin-X isoform X2	6.77
c83874_g2_i5	XP_005157672.1	Unconventional myosin-XVIIIa isoform X8	10.81
c83875_g11_i2	XP_007248612.1	Unhealthy ribosome biogenesis protein 2 homolog	2.93
c78957_g3_i4	AAI68513.1	Unknown (protein for IMAGE:6962011)	2.57
c80159_g3_i1	XP_007248699.1	UPF0378 protein KIAA0100 homolog isoform X1	14.8

c80159_g3_i2	XP_007248702.1	UPF0378 protein KIAA0100 homolog isoform X4	5.61
c82797_g6_i14	XP_007245622.1	UPF0472 protein C16orf72 homolog	2.59
c82187_g3_i9	XP_006633828.1	UPF0577 protein KIAA1324-like	4.24
c81166_g4_i1	NP_956913.2	UPF0668 protein C10orf76 homolog	2.18
c83476_g14_i1	XP_005805191.1	UPF0690 protein C1orf52 homolog	-2.13
c64539_g1_i2	XP_007249518.1	UPF0693 protein C10orf32 homolog isoform X2	2.65
c79525_g6_i6	NP_001004666.1	Uridine-cytidine kinase 1	4.07
c79601_g8_i1	AAH57470.1	Usp36 protein	9.11
c81426_g7_i7	XP_005164936.1	USP6 N-terminal like isoform X3	2.12
c83762_g12_i1	XP_007233516.1	Utrophin-like	9.43
c81328_g5_i2	XP_007260196.1	Vacuolar protein sorting-associated protein 13A isoform X2	5.08
c81328_g5_i3	XP_007260197.1	Vacuolar protein sorting-associated protein 13A isoform X3	13.09
c81562_g6_i9	XP_005456824.1	Vacuolar protein sorting-associated protein 13B isoform X5	7.56
c82993_g3_i5	XP_001922767.3	Vacuolar protein sorting-associated protein 13C	28.08
c77519_g10_i6	XP_007229545.1	Vacuolar protein sorting-associated protein 37C-like	4.48
c83460_g2_i6	XP_682807.5	Valine--tRNA ligase	2.18
c84015_g8_i1	XP_007259108.1	Vang-like protein 1-like isoform X1	5.67
c82664_g1_i1	XP_005164393.1	Vascular cell adhesion protein 1 isoform X2	2.42
c78071_g15_i4	XP_007236910.1	Vascular endothelial zinc finger 1-like	5.1
c83863_g7_i12	XP_007248224.1	Vasculin-like protein 1 isoform X1	2.26
c79261_g11_i1	XP_007232243.1	Vasorin	2.3
c80866_g11_i1	XP_007241278.1	Vasorin-like isoform X1	3.98
c77013_g2_i1	AAH66463.1	Vat1 protein, partial	3.31
c77756_g11_i1	AAB47406.1	Ventral neural cadherin, partial	2.06
c81417_g3_i2	NP_001106204.1	Ventricular myosin heavy chain	8.2
c81741_g1_i1	XP_007242066.1	Very long-chain specific acyl-CoA dehydrogenase,	2.64
c83154_g5_i2	XP_007227976.1	Very-long-chain (3R)-3-hydroxyacyl-	2.31
c78654_g10_i3	XP_005156393.1	Vesicle transport through interaction with t-SNAREs	7.63
c78541_g3_i3	ADO28099.1	Vesicle-associated membrane protein-associated protein b	3
c78982_g2_i8	XP_683005.3	Vigilin isoform 2	4.53
c75415_g2_i2	XP_003438114.1	Vimentin-like	3.35
c78728_g11_i3	XP_003961231.1	Vinculin-like isoform 1	2.31
c79030_g3_i5	XP_005162526.1	Vinexin isoform X5	2.64
c79665_g2_i3	XP_007233535.1	VIP36-like protein-like	2.01

c77802_g3_i11	XP_007249184.1	Vitamin D3 receptor B-like isoform X1	3.25
c79480_g1_i7	NP_001117847.1	Vitellogenin receptor precursor	2.68
c81115_g9_i6	XP_006124784.1	Voltage-gated potassium channel subunit beta-2	16.93
c83313_g6_i2	NP_001268918.1	Von Willebrand factor precursor	2.32
c78492_g10_i4	XP_007256338.1	V-type proton ATPase 116 kDa subunit a isoform 1-like	4.27
c72236_g2_i6	XP_007234916.1	WAS/WASL-interacting protein family member 1-like	2.55
c81095_g4_i1	XP_007240199.1	WAS/WASL-interacting protein family member 2-like	2.5
c82959_g2_i4	XP_694117.3	WASH complex subunit 7-like	2.6
c83203_g5_i2	XP_007250553.1	WD repeat and FYVE domain-containing protein 3	2.46
c83203_g2_i1	XP_005165449.1	WD repeat and FYVE domain-containing protein 3 isoform X5	44.72
c76669_g4_i6	AAI55127.1	WD repeat domain 43	2.81
c82658_g2_i18	XP_005164183.1	WD repeat domain, phosphoinositide interacting 2 isoform	4.27
c75109_g7_i3	XP_687231.3	WD repeat-containing protein 11	4.61
c76428_g6_i3	XP_007259932.1	WD repeat-containing protein 26-like	3.6
c77021_g4_i2	XP_007251868.1	WD repeat-containing protein 26-like isoform X2	6.47
c81124_g10_i3	NP_942574.1	WD repeat-containing protein 3	2.71
c77487_g3_i4	XP_007231456.1	WD repeat-containing protein 36 isoform X1	2.14
c83454_g2_i6	XP_007253300.1	WD repeat-containing protein 75	5.79
c80179_g1_i5	XP_005725559.1	WD repeat-containing protein 7-like isoform X3	4.31
c75430_g1_i4	Q6NX08.1	WDR12_DANRE RecName: Full=Ribosome biogenesis protein wdr12; AltName: Full=WD	2.11
c74508_g1_i2	NP_001186030.1	WNT1 inducible signaling pathway protein 2 precursor	2.67
c83093_g4_i2	XP_005165215.1	WSC domain-containing protein 2 isoform X1	4.25
c83128_g7_i3	XP_701004.4	Wu:fc51b03	4.12
c79441_g25_i1	XP_007254066.1	WW domain binding protein 1-like	6.06
c76577_g1_i4	XP_006797027.1	WW domain-binding protein 2-like	2.22
c76825_g2_i3	XP_007234341.1	WW domain-containing transcription regulator protein 1	4.37
c80808_g1_i2	XP_003309339.1	Xin actin-binding repeat-containing protein 2 isoform 3	3.24
c83251_g2_i12	XP_005924594.1	Y' element ATP-dependent helicase YEL077C-like	2.48
c70355_g2_i1	XP_007236435.1	YEATS domain-containing protein 2 isoform X1	14.41
c80610_g3_i2	NP_001002752.1	YEATS domain-containing protein 4	-3.56
c80626_g4_i1	AAI29217.1	Yes-associated protein 1	3.3
c83673_g2_i1	XP_007231949.1	YTH domain-containing family protein 1-like	2.87
c80498_g2_i1	XP_007249012.1	YTH domain-containing family protein 3 isoform X2	4.22
c75857_g3_i9	XP_005166890.1	Zgc:103670 isoform X4	2.8

c78620_g9_i7	AAH93324.1	Zgc:136652 protein	5.78
c76573_g6_i2	AAI24298.1	Zgc:153274	2.25
c81846_g2_i2	AAI24814.1	Zgc:154116	2.7
c80938_g6_i7	AAI29182.1	Zgc:158263	2.19
c81455_g1_i1	AAI33083.1	Zgc:158327 protein	9.12
c78530_g10_i2	AAI00038.1	Zgc:165381 protein	8.56
c75688_g10_i1	AAI55307.1	Zgc:175013 protein	2.24
c77743_g1_i1	XP_007249372.1	Zinc finger and BTB domain-containing protein 10	2.22
c78782_g2_i1	NP_997815.2	Zinc finger and BTB domain-containing protein 11	2.58
c83828_g10_i1	XP_007230416.1	Zinc finger and BTB domain-containing protein 18.2-like	3.46
c79066_g14_i2	XP_001339146.1	Zinc finger and BTB domain-containing protein 38	4.81
c79013_g4_i3	XP_005940038.1	Zinc finger and BTB domain-containing protein 45-like	5.51
c78823_g18_i1	XP_007233361.1	Zinc finger and BTB domain-containing protein 7A	4.77
c77105_g11_i1	XP_007256963.1	Zinc finger and BTB domain-containing protein 7B-like	2.16
c82235_g2_i5	NP_956816.2	Zinc finger CCCH domain-containing protein 13	3.86
c81675_g16_i2	NP_956182.1	Zinc finger CCCH domain-containing protein 15	2.02
c78668_g2_i3	XP_007249272.1	Zinc finger CCCH domain-containing protein 18 isoform X1	3.01
c80906_g7_i2	XP_001343417.2	Zinc finger CCCH domain-containing protein 7B-like	3.79
c83472_g1_i14	XP_007251331.1	Zinc finger CCCH domain-containing protein 7B-like isoform	6.99
c78559_g9_i2	NP_001091858.1	Zinc finger CCHC domain-containing protein 24	4.23
c77972_g6_i1	AGS58238.1	Zinc finger E-box binding homeobox 1	4.81
c81067_g7_i2	XP_007234581.1	Zinc finger FYVE domain-containing protein 1-like	2.45
c80847_g19_i1	XP_007244102.1	Zinc finger homeobox protein 3-like	3.73
c81587_g5_i2	XP_007260153.1	Zinc finger homeobox protein 4-like isoform X3	2.48
c81830_g8_i6	XP_007250331.1	Zinc finger MIZ domain-containing protein 2 isoform X1	2.22
c77529_g24_i2	ADO27742.1	Zinc finger mynd domain-containing protein 19	2.52
c75712_g9_i1	XP_689880.2	Zinc finger protein 135-like isoform X5	2.92
c81290_g4_i2	XP_007242359.1	Zinc finger protein 217-like	6.19
c79200_g5_i3	XP_006635730.1	Zinc finger protein 236-like	15.09
c76372_g4_i2	XP_007234127.1	Zinc finger protein 281-like	4.54
c83881_g8_i5	XP_007259953.1	Zinc finger protein 292 isoform X3	10.77
c76315_g3_i1	XP_007257487.1	Zinc finger protein 292-like	3.47
c79982_g6_i5	XP_007237607.1	Zinc finger protein 341 isoform X3	4.05

c82093_g3_i2	XP_007244497.1	Zinc finger protein 346	2.11
c79519_g6_i8	XP_007256009.1	Zinc finger protein 362-like	4.93
c80994_g6_i3	XP_005160701.1	Zinc finger protein 395 isoform X1	2.27
c76405_g11_i2	XP_007231360.1	Zinc finger protein 418-like	2.75
c82421_g11_i4	XP_005166517.1	Zinc finger protein 507	4.08
c82134_g2_i1	XP_005173109.1	Zinc finger protein 518B-like	5.78
c81375_g9_i7	XP_007247004.1	Zinc finger protein 536 isoform X7	4.43
c82464_g15_i1	XP_007247849.1	Zinc finger protein 572-like	2.16
c76970_g1_i3	XP_007247901.1	Zinc finger protein 598	4.68
c83099_g7_i2	XP_005174270.1	Zinc finger protein 609 isoform X1	5.54
c75903_g2_i2	XP_007241276.1	Zinc finger protein 628-like	7.9
c77553_g1_i1	XP_005168813.1	Zinc finger protein 644-like isoform X2	8.04
c80890_g1_i1	XP_007230573.1	Zinc finger protein 687-like isoform X3	8.76
c79012_g4_i3	XP_002666496.3	Zinc finger protein 704 isoform X1	5.98
c79012_g4_i2	XP_005162071.1	Zinc finger protein 704 isoform X2	6.54
c82057_g1_i1	XP_007249374.1	Zinc finger protein 704-like isoform X2	4.45
c77935_g10_i2	XP_007246608.1	Zinc finger protein 800-like isoform X1	6.66
c82501_g2_i3	XP_004560049.1	Zinc finger protein 91-like	5.33
c81413_g4_i1	XP_005159955.1	Zinc finger protein basonuclin-2 isoform X4	5.01
c81413_g12_i1	XP_005797706.1	Zinc finger protein basonuclin-2-like	4.34
c79767_g6_i5	XP_007230435.1	Zinc finger protein DPF3-like	4.4
c83955_g1_i3	XP_002666356.3	Zinc finger protein GLIS2-like	7.4
c79622_g3_i4	XP_007230686.1	Zinc finger protein Pegasus-like	5.26
c77203_g1_i2	XP_690924.6	Zinc finger protein Rlf	9.36
c75876_g1_i1	XP_005754656.1	Zinc finger protein Xfin-like	3.22
c79854_g2_i4	XP_007250529.1	Zinc finger RNA-binding protein isoform X2	2.21
c81314_g11_i2	NP_001138291.1	Zinc finger SWIM domain-containing protein 5	5.38
c81314_g11_i7	XP_006626879.1	Zinc finger SWIM domain-containing protein 6-like isoform	4.02
c79307_g5_i4	XP_007258777.1	Zinc finger SWIM domain-containing protein 8 isoform X1	3.5
c79244_g3_i1	XP_007254832.1	Zinc finger X-chromosomal protein	2.39
c74749_g6_i1	XP_691749.6	Zinc finger Y-chromosomal protein 1-like isoform X3	2.19
c83540_g6_i1	XP_001922332.3	Zinc finger ZZ-type and EF-hand domain-containing protein	5.02
c81533_g3_i1	XP_007242157.1	Zinc fingers and homeoboxes protein 1-like isoform X4	2.34
c80999_g5_i1	XP_007255563.1	Zinc transporter 1	3.83

c80462_g10_i4	NP_001133377.1	Zinc transporter 4	2.53
c79065_g16_i1	XP_001340102.4	Zinc transporter ZIP14-like isoform X1	4.56
c75146_g1_i4	XP_007236586.1	Zinc-binding protein A33-like	2.14
c81719_g2_i4	XP_007249864.1	Zyxin isoform X1	2.28