Proteomic analysis of multiple primary cilia reveals a novel mode of ciliary development in mammals

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Summary

Cilia are structurally and functionally diverse organelles, whose malfunction leads to ciliopathies. While recent studies have uncovered common ciliary transport mechanisms, limited information is available on the proteome of cilia, particularly that of sensory subtypes, which could provide insight into their functional and developmental diversities. In the present study, we performed proteomic analysis of unique, multiple 9+0 cilia in choroid plexus epithelial cells (CPECs). The analysis of juvenile swine CPEC cilia identified 868 proteins. Among them, 396 were shared with the proteome of 9+0 photoreceptor cilia (outer segment), whereas only 152 were shared with the proteome of 9+2 cilia and flagella. Various signaling molecules were enriched in a CPEC-specific ciliome subset, implicating multiplicity of sensory functions. The ciliome also included molecules for ciliary motility such as Rsph9. In CPECs from juvenile swine or adult mouse, Rsph9 was localized to a subpopulation of cilia, whereas they were non-motile. Live imaging of mouse choroid plexus revealed that neonatal CPEC cilia could beat vigorously, and the motility waned and was lost within 1–2 weeks. The beating characteristics of neonatal CPEC cilia were variable and different from those of typical 9+2 cilia of ependyma, yet an Efhc1-mediated mechanism to regulate the beating frequency was shared in both types of cilia. Notably, ultrastructural analysis revealed the presence of not only 9+0 but also 9+2 and atypical ciliary subtypes in neonatal CPEC. Overall, these results identified both conserved and variable components of sensory cilia, and demonstrated a novel mode of ciliary development in mammals.

Key words: Proteomics, Cilia, Development

Introduction

Cilia are projections from the cell surface bearing microtubule-based cytoskeleton, and are involved in various developmental and physiological events (Gerdes et al., 2009). Being present in most cell types in vertebrate, they are highly diverse in their structure and function (Satir and Christensen, 2007; Takeda and Narita, 2012). Regarding the structural aspects, variations exist in the axonemal structure and the ciliary number among different ciliary subtypes. It is well described that the solitary 9+0 primary cilia and multiple 9+2 cilia are generated by distinct cellular mechanisms from each other. Whereas primary cilia are generated in the G_1/G_0 phase by diverting the centriole to the basal body, 9+2 multiciliogenesis involves the explosive neogenesis of basal bodies around the deuterosome deep inside the cytosol (Beisson and Wright, 2003; Dawe et al., 2007; Guirao et al., 2010; Vladar and Stearns, 2007).

Ciliary functions can be generalized as motile propeller and/or sensory antenna, but they are in fact highly variable. Although studies have uncovered intracellular ciliary transport and targeting mechanisms (Nachury et al., 2010), the whole picture is far from being understood. Proteomic analysis of ciliary proteins could provide versatile information to understand ciliary functions as well as ciliary targeting mechanisms. However, cilia proteome, particularly that of 9+0 cilia, is not easily available, largely due to the technical difficulties in isolation of the minute organelle. Among several proteomic analyses of cilia reported so far, most of the datasets were derived from motile 9+2 cilia and flagella (Broadhead et al., 2006; Mayer et al., 2009; Ostrowski et al., 2002; Pazour et al., 2005), while those from mouse photoreceptor outer segments (Liu et al., 2007) solely represent the 9+0 cilia proteome dataset.

In the present study, we analyze the proteome of multiple 9+0 cilia in choroid plexus epithelial cells (CPECs) (Narita et al., 2010; Takeda and Narita, 2012). Our analysis of CPEC cilia from juvenile swine identifies 868 proteins. Comparison to other reported ciliome datasets revealed that nearly a half of the CPEC cilia proteins are also present in photoreceptor outer segment. The juvenile swine CPEC ciliome also includes various signaling molecules, and molecules for ciliary motility such as Rsph9, though they are non-motile. Subsequent live cell imaging and

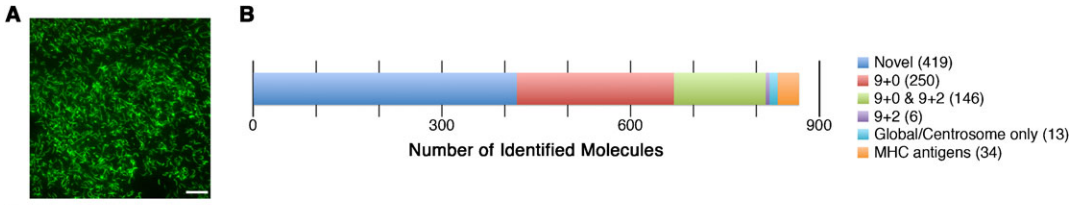
ultrastructural analyses lead to the discovery of transient motile properties of perinatal CPEC cilia, which are associated with the appearance of 9+2 and atypical ciliary subtypes. Altogether, these results provide valuable information for more comprehensive understanding of 9+0 ciliome, and demonstrate structural and functional transitions of CPEC cilia, which represent a novel mode of ciliary development in mammals.

Results

Proteomic analysis of multiple 9+0 cilia from choroid plexus epithelial cells

To determine the proteome of CPEC cilia, they were purified from swine choroid plexus tissue. The swine used for this work were approximately 6 months of age, which is a juvenile stage (weaned but sexually immature), and corresponds to approximately 1–2 month old mice. Treatment of fresh choroid plexi with dibucaine hydrochloride resulted in acute shedding of cilia, as a massive amount of cilia could be pelleted from the supernatant immediately after the treatment (Fig. 1A). The detached cilia were then enriched by differential centrifugation and equilibrium sedimentation, with more stringent sucrose gradients than previously described (Narita et al., 2010). The enriched fractions of CPEC cilia proteins (~13 µg) were resolved on 5–20% (w/v) polyacrylamide gradient gels, which were cut into four slices and treated with trypsin. The resulting trypsin digests extracted from each gel slice were separated and identified by nano liquid chromatography-mass spectrometry (LC-MS). By using LTQ Orbitrap Velos, 1,115 proteins were identified by 22,431 unique peptides under highly stringent conditions; the precursor mass tolerance, fragment mass tolerance, and false discovery rate were set to 7 ppm, 0.5 Da, and 1%, respectively. However, the protein identities were provisional in most cases because the annotation of swine proteins used for the identification was not as thorough as those of common organisms such as human or mouse. Therefore, we analyzed the identified swine proteins, first by the HomoloGene and second by the Blastp, and the information on human proteins of the highest similarities, including their GO terms, were added to the swine proteome dataset for approximate analyses (supplementary material Table S1).

In the proteome, alpha and beta tubulins were identified with the top 5% probability scores. The dataset also included some intraflagellar transport components (IFT81, IFT122), basal body/transition zone components (ODF2, CEP290, CEP110), septin and importins (SEPT3, IPO4, IPO5), as well as annexins (ANXAs 1, 2, 4, 7, 11), which have been detected in cilia of various mammalian tissues (Ignotz et al., 2007; Ostrowski et al., 2002; Rodrigo et al., 2004) (supplementary material Table S1).



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Biological Process

GO ID	GO term	Count	P-value	Fold Enrichment
0008104	Protein localization	98	6.99E-14	2.2
0046907	Intracellular transport	77	4.05E-12	2.3
0007010	Cytoskeleton organization	45	6.92E-06	2.1
0016044	Membrane organization	41	7.01E-06	2.2
0032989	Cellular component morphogenesis	42	8.09E-06	2.1

Molecular Function

GO ID	GO term	Count	P-value	Fold Enrichment
0008092	Cytoskeletal protein binding	60	7.52E-10	2.4
0005525	GTP binding	41	3.94E-06	2.2

Cellular Component

GO ID	GO term	Count	P-value	Fold Enrichment
0000267	Cell fraction	131	9.03E-22	2.4
0005783	Endoplasmic reticulum	112	2.43E-17	2.3
0031982	Vesicle	87	4.47E-16	2.6
0012505	Endomembrane system	89	5.43E-13	2.2

Fig. 1. Proteomic analysis of swine choroid plexus epithelial cilia. (**A**) Swine CPEC cilia detached by dibucaine hydrochloride. Crude cilia in suspension were ultracentrifuged, and the resulting pellet was fixed and immunostained for acetylated alpha tubulin (Green). Bar, 20 µm. For proteomic analysis, detached cilia were enriched further by differential centrifugation followed by equilibrium sedimentation. (**B**) Analysis of CPEC cilia proteomics data using the Ciliome database. A database search of molecules identified in the present study was performed. If molecules were already listed, the types of cilia the data were derived from were determined; *9+0*, proteome of mouse photoreceptor sensory cilia (Liu et al., 2007); *9+2*, proteome of motile cilia and flagella from human bronchial epithelium (Ostrowski et al., 2002), Chlamydomonas (Pazour et al., 2005), and trypanosome (Broadhead et al., 2006); *Global*, datasets were obtained by comparative genomics (Avidor-Reiss et al., 2004; Li et al., 2004), transcriptional profiling of Chlamydomonas (Stolc et al., 2005), and analysis of genes containing an x-box in *C. elegans* (Blacque et al., 2005; Efimenko et al., 2005); *Centrosome*, proteome of centrosome from human lymphoblastoma (Andersen et al., 2003) and Chlamydomonas (Keller et al., 2005). The actual counts of molecules in each category are shown in the key. (**C**) Gene ontology terms enriched in the CPEC ciliome. The dataset of 868 CPEC ciliome was analyzed using the DAVID server. Shown in this panel are those with more than 40 gene counts, $P<0.01$, and more than 2-fold enrichment values.

These data indicated that cilia were enriched successfully. However, analysis of the dataset using a mitochondrial proteome database suggested that 15% of identified proteins (185 proteins) might be derived from mitochondria, which have similar physical properties of size and density to cilia and could not be separated completely (supplementary material Table S1). We also checked obvious contaminants such as ribosomal proteins and serum proteins manually (Liu et al., 2007), which altogether added up to an additional 5.6% of total proteins (62 proteins) (supplementary material Table S1). Therefore, we considered the remaining 868 proteins to be the "true" CPEC ciliome.

We next analyzed the CPEC ciliome using the Ciliaproteome database to compare the similarities and differences between previously reported cilia proteomes (Fig. 1B; supplementary material Table S1). This result indicated that approximately half (415 out of 868 proteins) of the CPEC ciliome were shared with other ciliome datasets. Most of the shared proteins (396 proteins) were found in the dataset for the mouse photoreceptor sensory (9+0) cilium complex (Liu et al., 2007). Among the 396 proteins, 250 were those found only in the photoreceptor sensory cilium complex and the remaining 146 were those found in both 9+0 and 9+2 cilia proteome datasets. A small fraction of the CPEC ciliome was shared exclusively with 9+2 cilia and flagella proteome datasets (6 proteins) or other omics datasets (13 proteins) (Fig. 1B). The remaining proteins (34 MHC antigens and 419 other proteins) were not shared with other ciliome datasets (Fig. 1B), suggesting functional diversities among different cilia.

We also performed an approximate GO analysis of the swine CPEC ciliome. Among the total 1,115 proteins identified by LC-MS, 1,068 proteins (96%) were assigned homologous human proteins and 1,060 proteins (95%) were annotated with at least one GO term. The GO terms were then analyzed by using the functional annotation clustering tools of DAVID application server (Huang et al., 2008) (Fig. 1C). In the GO domain of "biological process", enriched GO terms with more than 40 gene counts were "protein localization", "intracellular transport", "cytoskeleton organization", "membrane organization" and "cellular component morphogenesis". In the GO domain of "molecular function", enriched GO terms were "cytoskeletal protein binding" and "GTP binding". In the GO domain of "cellular component", enriched GO terms were "cell fraction", "endoplasmic reticulum", "vesicle" and "endomembrane system". Overall, these data suggested that the molecules involved in ciliogenesis and ciliary transport were enriched in this CPEC ciliome dataset.

Furthermore, to gain insight into the functions of CPEC cilia, enriched GO terms in the subsets of CPEC ciliome were analyzed by DAVID application server. In the 419 CPEC-specific ciliome dataset (*Novel* subset, Fig. 1B), components of various extracellular signaling pathways and small molecule transporters were enriched (Table 1). In the dataset of 250 proteins found only in 9+0 cilia (*9+0* subset, Fig. 1B), enriched GO terms included "vesicle-mediated transport" ($P=4.68\times10^{-5}$), "cofactor binding" ($P=2.37\times10^{-4}$), "enzyme binding" ($P=4.87\times10^{-4}$), "oxidation reduction" ($P=5.45\times10^{-4}$), and "regulation of cellular protein metabolic process" ($P=7.18\times10^{-4}$). Of particular interest was "vesicle-mediated transport", in which several molecules known to localize to cilia or be involved in cilia-mediated processes, such as FLNA (Adams et al., 2012), GSN (Kim et al., 2010), and TXNDC5 (Liu et al., 2007), were found. Collectively, these data demonstrated that a notable molecular similarity between CPEC cilia and photoreceptor outer segment, and provided insight into the common and variable functional aspects of 9+0 cilia.

Identification of motile cilium components in the CPEC ciliome

Interestingly, we identified several molecules in the CPEC ciliome that have been implicated in the motility of 9+2 cilia,

Table 1. Gene ontology terms enriched in the CPEC-specific ciliome. The datasets of the 419 CPEC-specific ciliome and the 868 whole CPEC ciliome were analyzed using the DAVID server. The results were compared to each other, and those GO terms showing higher enrichment scores and greater significance in the CPEC-specific dataset were extracted. Shown below are those with more than 6 gene counts, $P<0.01$, and more than 2-fold enrichment values.

Biological process				
GO ID	GO term	Count	P-value	Fold enrichment
0032868	Response to insulin stimulus	10	6.97E–04	4.1
0051056	Regulation of small GTPase mediated signal transduction	16	1.23E–03	2.6
0007219	Notch signaling pathway	7	1.52E–03	5.6
0015837	Amine transport	10	2.25E–03	3.5
0009991	Response to extracellular stimulus	14	2.72E–03	2.6
0007243	Protein kinase cascade	19	3.93E–03	2.1
0007167	Enzyme linked receptor protein signaling pathway	18	4.04E–03	2.2
0018108	Peptidyl-tyrosine phosphorylation	6	4.87E–03	5.4
0006820	Anion transport	10	7.95E–03	2.9
0051272	Positive regulation of cell motion	8	9.58E–03	3.4
Molecular function				
GO ID	GO term	Count	P-value	Fold enrichment
0004672	Protein kinase activity	31	2.74E–04	2.0
0005158	Insulin receptor binding	6	5.75E–04	8.6
0005178	Integrin binding	7	3.42E–03	4.7
Cellular component				
GO ID	GO term	Count	P-value	Fold enrichment
0043235	Receptor complex	11	3.48E–04	4.1

namely, deleted in primary ciliary dyskinesia (Zariwala et al., 2004) and radial spoke head homologs 4a and 9 (Castleman et al., 2009) (supplementary material Table S1). To validate the proteome data, the mRNA levels of the aforementioned motile cilium components in mouse CPECs were compared by the comparative C_T method to those in ependyma (expressing motile 9+2 cilia and therefore served as a positive control) and in serum-starved NIH3T3 cells (expressing non-motile 9+0 primary cilium and therefore served as a negative control). The quality of primary cultures was validated based on the presence of characteristic cilia (Fig. 2A), as well as real-time PCR for well-known molecular markers of ependymal cells (CD24a) and CPECs (transthyretin; TTR) (Fig. 2B). The motility of ependymal cilia was also confirmed by light microscopy. The expression of Foxj1, the master regulator of motile cilia specification known to be expressed in choroid plexus (Lim et al., 1997), was also confirmed in CPECs, although the levels were somewhat lower than those in ependymal cultures (Fig. 2B). These data demonstrated that the mRNAs of motile cilium components were expressed in CPECs, and that the levels were either comparative to ependyma or intermediate between ependyma and NIH3T3 cells.

Next, we focused on one of the motile cilium components, Rsph9, and assessed its ciliary localization in CPECs. The specificity of the antibody was validated by western blotting for Rsph9 using whole cell lysates of mouse sperm, ependymal cells and HEK293 cells transiently overexpressing Rsph9-FLAG (Fig. 3A; data not shown). Consistent with real-time PCR data, Rsph9 protein was also detected in mouse CPECs by western blotting, but levels were as low as 3% of those in ependymal cells (Fig. 3B). In adult mouse brain sections, both the ependymal cilia and some choroid plexus epithelial cilia were immunostained for Rsph9 (Fig. 3C). In the ependymal layer, the cytoplasm was also stained to some extent, which may be a reservoir of Rsph9 and suggest its rapid turnover in this cell type. Ciliary localization of Rsph9 protein was also observed in juvenile swine choroid plexus tissue (Fig. 3D, top panel); the swine CPEC cilia were longer than mouse counterparts and therefore easier to observe. Interestingly, both mouse and swine CPEC cilia always showed some heterogeneity with respect to Rsph9 immunoreactivity, even in single cells (Fig. 3D, top panel; data not shown). In purified swine CPEC cilia, Rsph9-positive cilia accounted for ~40% of the total population (Fig. 3D, bottom panel; Fig. 3E). These results demonstrated that Rsph9 protein was expressed and localized in a subset of CPEC cilia in juvenile swine and adult mouse, consolidating the proteome data.

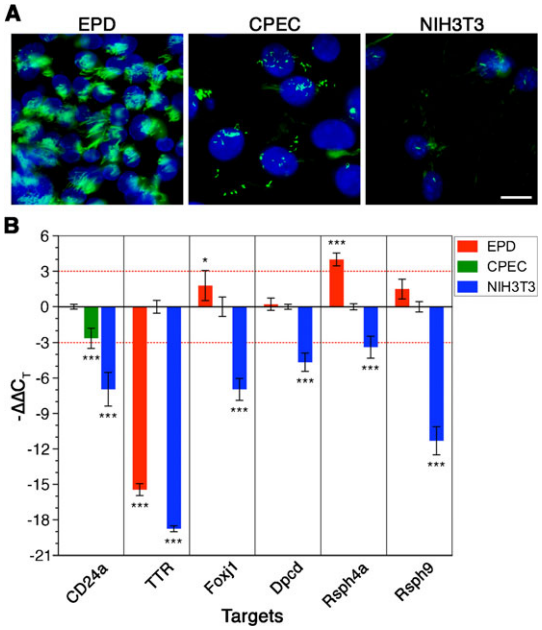

Fig. 2. Validation of motile cilium component gene expression in choroid plexus epithelium. (**A**) Primary cultures of mouse ependyma (EPD; left), choroid plexus epithelium (CPEC, middle) and serum-starved NIH3T3 cells (right). Cells were immunostained for acetylated alpha tubulin (Green). Cell nuclei were counter-stained with DAPI (Blue). Bar, 16 µm. (**B**) Real-time PCR analysis. The gene expression levels of motile cilium components (Dpcd, Rsph4a and Rsph9) identified by the CPEC ciliome were assessed by the comparative C_T method. RNA samples from EPD and CPEC were prepared from mouse primary cultures, and their qualities were validated by the expression levels of CD24a (EPD marker) and transthyretin (TTR; CPEC marker). The $-\Delta\Delta C_T$ values were calculated using B2m as an endogenous reference and CPEC as a calibrator. For CD24a, EPD was used as a calibrator. Values were expressed as the mean ± s.d. *, $P<0.5$; **, $P<0.01$; ***, $P<0.001$ versus calibrator.

CPEC cilia are motile at birth and become non-motile during aging

Previously, we observed CPEC ciliary motility using swine primary cultures in a preliminary setup and found that they were non-motile under normal culture conditions (Narita et al., 2010). However, this observation was contradictory to an earlier report briefly describing a very slow beating of choroid plexus cilia in rodents (Roth et al., 1985). This report was based on a measurement of oscillatory changes in the light intensity transmitted through moving cilia in the brain ventricles detected by a fine optic fiber, and provided no information on detailed beating characteristics, such as beating form and orientation. Having identified the motile cilium components in the ciliome, as well as to resolve the apparent contradiction, we examined CPEC ciliary motility again. Live microscopy of swine CPEC primary cultures, as well as swine choroid plexus tissue all indicated that most, if not all, CPEC cilia were standing still, consistent with our previous observation (supplementary material Movie 1). We also drew the same conclusion from the examination of juvenile (P28) and adult mouse choroid plexus tissue (Table 2). These data indicated that the Rsph9 in swine and mouse CPEC cilia at juvenile and adult stages were non-functional or vestigial, from the viewpoint of ciliary motility.

We next sought to examine the CPEC ciliary motility in younger animals. For this analysis, we focused on mouse, due to the difficulty in obtaining varying ages of swine as well as to the good phenotypic matches between swine and mouse samples as described above. When newborn choroid plexus tissue was examined, active beating of many, but not all, CPEC cilia was found (supplementary material Movie 1). Interestingly, the motility of CPEC cilia waned as mice grew, and approximately two weeks after birth, finding motile CPEC cilia became difficult and the beating appeared to be feeble (supplementary material Movie 1). These data demonstrated that newborn CPEC cilia were able to beat, and within 1–2 weeks, lost motility and eventually became non-motile (Table 2).

The beating characteristics of neonatal mouse choroid plexus cilia

We analyzed the ciliary motilities of mouse CPECs and ependymal cells in more detail using high-speed video

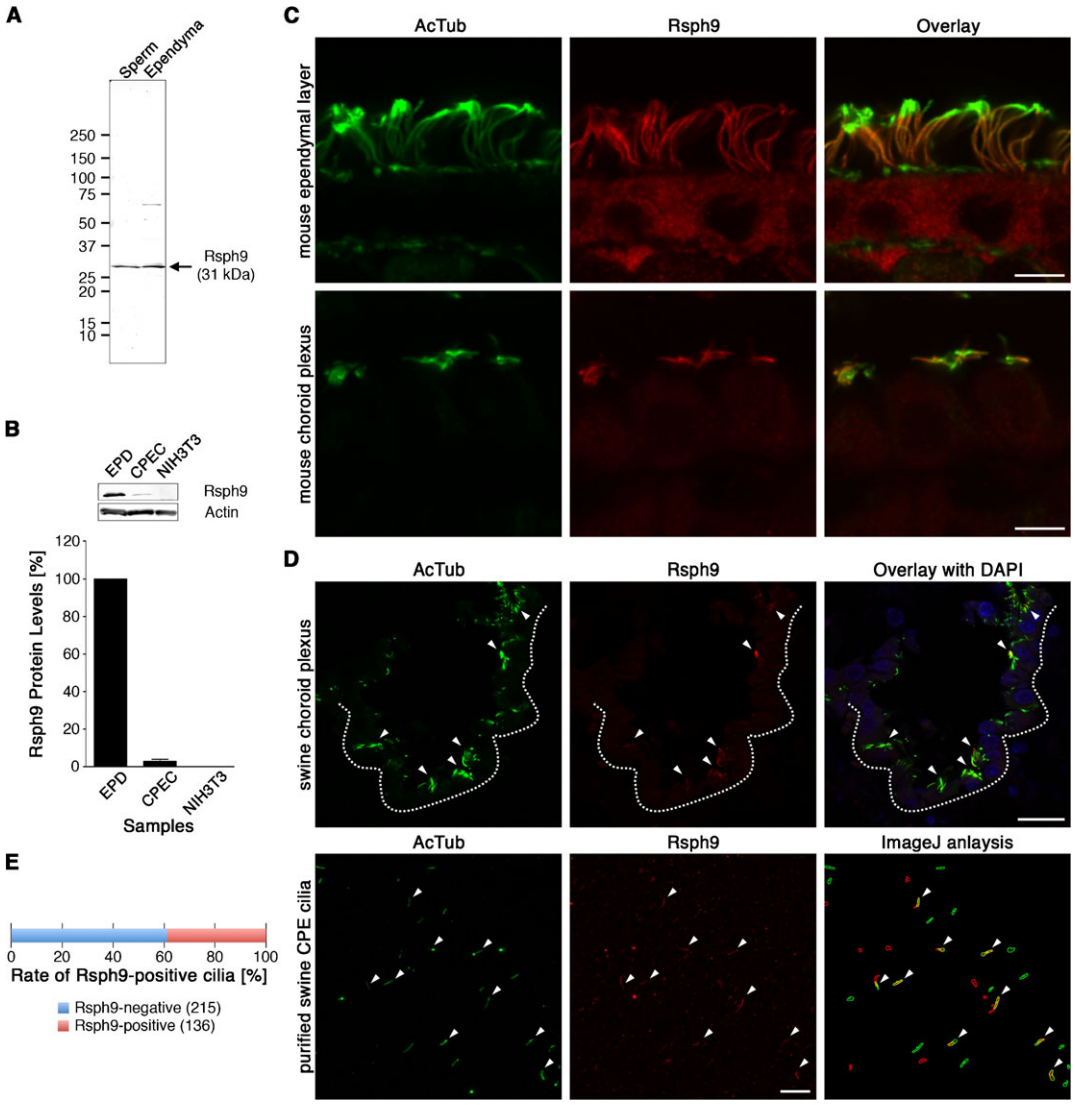

Fig. 3. Immunological analysis of Rsph9. (**A**) Western blot analysis for Rsph9. Whole cell lysates from mouse sperm and ependymal cell cultures (10 µg of total protein each) were used for the analysis, yielding an immunoreactive band of ~31 kDa. The positions and sizes (kDa) of the molecular weight standard are indicated on the left. (**B**) Top, comparison of Rsph9 protein levels between ependyma (EPD), choroid plexus epithelium (CPEC), and NIH3T3 cells. The immunoblot for actin shows equal loading. Bottom, quantification of Rsph9 protein levels by image analysis (n=4). (**C**) Immunostaining of adult mouse brain sections for acetylated alpha tubulin (Green) and Rsph9 (Red). The panels shown are the ependymal layer (top) and choroid plexus (bottom). Bars, 5 µm. (**D**) Immunostaining of swine choroid plexus tissue (top) and purified swine choroid plexus cilia (bottom) for acetylated alpha tubulin (Green) and Rsph9 (Red). For the top panel, cell nuclei were counter-stained with DAPI (Blue). Arrowheads indicate Rsph9-positive cilia. Note the uneven distribution of Rsph9, suggesting the heterogeneity of CPEC primary cilia in terms of motility. Bars, 20 µm. (**E**) Quantification of Rsph9-positive cilia by image analysis of purified swine choroid plexus cilia shown in D.

microscopy and compared the beating characteristics. Contrary to our expectation that CPEC cilia have 9+0 axoneme and should therefore rotate rather than beat as in the case of nodal cilia (Takeda et al., 1999), most of the motile CPEC cilia showed a planar back-and-forth motion, whereas a few of them exhibited rotational movements (Fig. 4A; supplementary material Movie 2). The characteristics of CPEC ciliary movement were nevertheless distinct from those of ependymal cilia. First, while cultured ependyma exhibited uniform ciliary beating forms (Fig. 4A; supplementary material Movie 2), those of neonatal CPECs were variable. Based on the motility characteristics, CPEC cilia appeared to be classified into four subgroups (Fig. 4B): (1) fast beat (average-high ciliary beat frequency (CBF)); (2) slow beat (low CBF); (3) rotation; (4) non-motile. The beating amplitude of CPEC cilia (2.0±0.7 µm, n=20 from 3 cells) was also smaller than that of ependymal cells (7.0±1.9 µm, n=11 from 2 cells) (Fig. 4A,B). Second, the CBF was lower in neonatal CPEC (8.1±2.5 Hz; excluding non-motile cilia) in comparison with ependymal cells (19.1±4.5 Hz) (Fig. 4C,D). Moreover, ependymal CBF followed normal

Table 2. Changes in ciliary motility scores in mouse CPECs following postnatal development.

Postnatal days	Ciliary motility scores
P1	++
P7	+
P14	+/−
P28-adult	−

++: high, +: moderate, +/−: low, −: absent

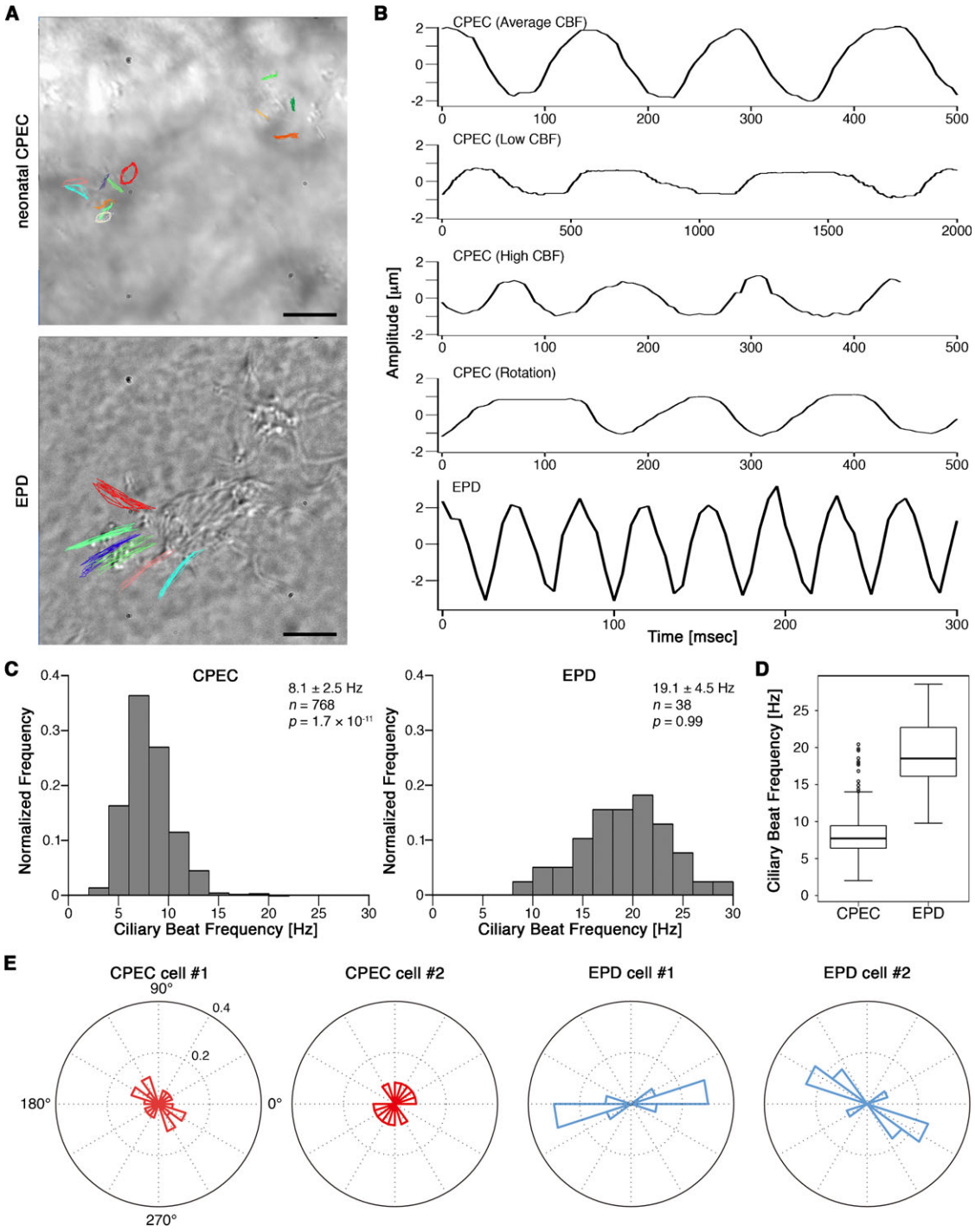

Fig. 4. Characterization of newborn CPEC ciliary motility. (**A**) Top view snapshots of neonatal mouse CPEC (top) and differentiated ependymal cultures (bottom) observed by high-speed video microscopy. The tips of individual cilia were traced manually. Note the presence of both beating and rotating cilia, small beating amplitude and random beating orientation in CPECs. The original live imaging data are available in supplementary material Movie 2. Bars, 5 µm. (**B**) Representative plots of CPECs and ependymal ciliary tip movements. For each ciliary tip tracing, the long axis was determined and defined as the Y-axis of the plot. (**C**,**D**) Summary histograms (C) and box-and-whisker plots (D) of ciliary beating frequency showing differences between neonatal CPECs and differentiated ependymal cultures. (**E**) Circular histograms showing the angular distribution of ciliary beating axes in single cells. The data were normalized to the number of tracked cilia, and each element of the histogram was drawn in point symmetry to the center of the graph.

distribution (P=0.99, chi-square test), while CPECs did not (P=1.7×10^{-11}), likely reflecting the aforementioned heterogeneity. Third, unlike mature ependymal cilia that all beat in the same direction at the cellular and tissue level (Guirao et al., 2010), the beating of neonatal CPEC cilia appeared to be in random orientations (Fig. 4E).

To gain insight into the molecular basis of CPEC ciliary motility, we analyzed the neonatal CPEC cilia from *Efhc1*

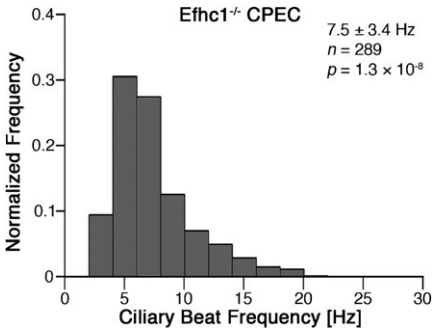

Fig. 5. Measurement of newborn Efhc1$^{-/-}$ CPEC ciliary beating frequency. A summary histogram of ciliary beating frequency in CPECs from neonatal Efhc1 knockout mice, showing significantly lower beating frequency than wild-type ($P=1.3\times10^{-8}$, Mann-Whitney test).

knockout mice. Efhc1 is a microtubule-associated protein localized to mature ependymal cilia and regulates their beating frequency (Suzuki et al., 2009). Interestingly, Efhc1 is expressed transiently in the fetal choroid plexus (Suzuki et al., 2008), which appeared to correlate with the change of ciliary motility in these cells after perinatal period. High-speed video microscopy indicated that the CBF of CPEC from *Efhc1* null mice (7.5±3.4 Hz) was significantly lower than that of wild type (8.1±2.5 Hz; $P=1.3\times10^{-8}$, Mann-Whitney test) (Fig. 4C, Fig. 5), which was similar to the previous report demonstrating the effect of *Efhc1* knockout on CBF of mature ependymal cilia (Suzuki et al., 2009). Collectively, these data demonstrated that, although the characteristics of ciliary motility in CPEC and ependyma were distinct from each other, they share a common, Efhc1-mediated molecular mechanism to regulate the motility.

The axonemal structure of neonatal mouse choroid plexus epithelial cilia was a mixture of 9+0, 9+2 and atypical variants

We and others have previously demonstrated that juvenile and adult CPECs possess clusters of 9+0 cilia (Madhavi and Jacob, 1989; Peters et al., 1991; Narita et al., 2010). However, the observed planar beating strongly suggested that they were 9+2 cilia; indeed, the central pair is believed to define the beating form, as well as the beating plane (Hirokawa et al., 2009; Yagi and Kamiya, 2000). Therefore, we investigated the axonemal structure of neonatal CPEC cilia. For this, the choroid plexus epithelial cilia of the lateral ventricles from P1 mouse pups were fixed and investigated by transmission electron microscopy (TEM) (Fig. 6A,B). Surprisingly, but consistent with the motility profile, ciliary axonemal structure of neonatal CPECs were found out to be heterogeneous. While the majority of cilia possessed the 9+0 axoneme and its variants (Fig. 6B,C), the others clearly had an electron-dense, microtubule-like structure at the center, surrounded by nine outer doublets. Detailed ultrastructural inspection revealed that they took not only the 9+2 but also atypical 9+1 configurations, in which one central doublet microtubule was surrounded by nine outer doublets (Fig. 6C). Of note was the hybrid nature of CPEC cilia; namely, 9+0, 9+2 and

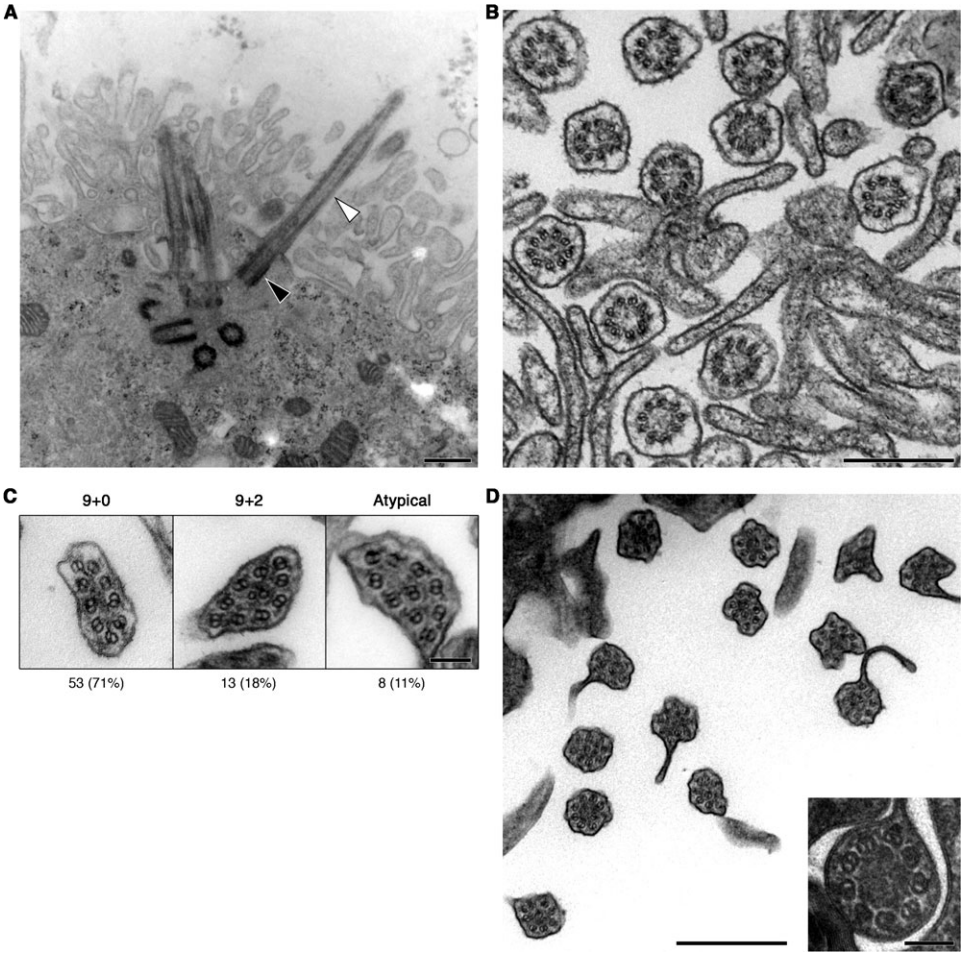

Fig. 6. Ultrastructural analysis of neonatal mouse CPEC cilia. Representative longitudinal (**A**) and transverse (**B**) sections of neonatal mouse CPEC cilia. In (A), the basal body and ciliary axoneme were highlighted with black and white arrowheads, respectively. The ciliary axonemes shown in (B) all took 9+0 configuration. Bars, 500 nm.
(**C**) Summary of the ultrastructural analysis of neonatal mouse CPEC cilia. The axonemal structures of 74 cilia were investigated and classified into three categories. Bar, 100 nm.
(**D**) A representative transverse section of juvenile swine CPEC cilia, which all took 9+0 and the derived configurations. Due to an unavoidable delay in fixing the swine tissue at slaughterhouse, the membrane structure was damaged. Bar, 500 nm. Inlay, magnified view. Bar, 100 nm.

atypical 9+1 variants were found on the same cell (supplementary material Fig. S1). We also noted that neonatal CPEC cilia were flattened in many cases. By contrast, in juvenile swine CPECs in tissue, we observed only 9+0 cilia and its variants (Fig. 6D), consistent with our previous data using juvenile swine CPEC primary culture (Narita et al., 2010). These data suggested that the transient ciliary motility in perinatal CPEC were coincident with the generation of 9+2 and atypical 9+1 cilia.

Discussion

To gain insight into the functional and developmental diversities of cilia, the proteome of multiple 9+0 cilia from juvenile swine CPECs were analyzed. Largely due to the incomplete swine protein annotation, full identification of known cilia proteins, such as IFT proteins and Kif3A/B, was not achieved. There were in fact many MS spectra that were left unidentified. Future enrichment of swine protein database will resolve this issue. Nevertheless, we identified 868 proteins including many membrane channels and receptors as CPEC ciliome, which is comparative to the number of proteins in photoreceptor outer segment (1,185 proteins) (Liu et al., 2007). As proposed by the authors, the large number of proteins in CPEC cilia may reflects the complexities in the ciliary function and the swine genome. Notably, though the photoreceptor outer segment and CPEC cilia are specialized and multiple 9+0 cilia, respectively, nearly 50% of protein components are conserved (Fig. 1).

During preparation of this manuscript, proteome of "generic" primary cilia from mouse inner medullary collecting duct 3 (IMCD3) cells was reported by Ishikawa and colleagues, identifying shared and variable components among different cilia proteome datasets (Ishikawa et al., 2012). Our CPEC cilia proteome dataset in combination with other ciliome datasets provides comprehensive information on what proteins are actually transported to cilia, and will therefore contribute to a better understanding of ciliary targeting mechanisms as well as the functional diversity.

The present study goes beyond the proteomic analysis by providing an insight into the development of CPEC cilia. While the cellular events associated with ciliogenesis of solitary 9+0 primary cilia and multiple 9+2 cilia are well described, that of multiple 9+0 cilia in CPECs was totally unknown. Our analysis of the CPEC cilia proteome also led to the discovery that CPEC ciliary motility is lost progressively after birth (Table 2). This is in clear contrast to the typical multiciliogenesis in bronchial epithelium or the ependyma, wherein fetal 9+0 cilia are replaced by 9+2 cilia, leading to full-fledged motile cilia (Sorokin, 1968; Spassky et al., 2005; Vladar and Stearns, 2007). Subsequent analyses of ciliary beating characterization and axonemal structure strongly suggested that CPEC cilia are derived originally as motile cilia that take 9+2 or atypical 9+1 axonemal configurations, and then shifted to non-motile 9+0 cilia (Figs 4–6), representing a novel mode of ciliary development in mammals.

Interestingly, Mair and colleagues reported that frog olfactory epithelium bore different types of cilia; one was short, motile and newly generating cilia, whereas the other was long, immotile and mature cilia (Mair et al., 1982). These observations appear to be reminiscent of the developmental changes in CPEC ciliary motility described in the present study. In this sense, the loss of motility in CPEC cilia may correlate with the degree of ciliary and/or cellular maturations, and a similar mode of ciliary development might be facilitated in other cell type to generate multiple, specialized cilia. These reports and our findings may pave the way into the evolutionary changes of ciliary types in light of the phylogeny of cilia.

We initially expected that the perinatal CPEC ciliary beating might contribute to the circulation of CSF, because most ependyma have unestablished motile cilia by this time, and it would take approximately three weeks after birth for full maturation (Spassky et al., 2005). However, detailed analyses of neonatal CPEC ciliary motility demonstrated that beating was of low frequency as described previously (Roth et al., 1985), of small amplitude and random orientation (Fig. 4). Since Tissir et al. also reported that mutations in the planar cell polarity genes, *Celsr2* and *Celsr3*, impaired ciliogenesis in ependymal cells while CPEC ciliogenesis was unaffected (Tissir et al., 2010), it is likely that the ciliary motility of perinatal CPECs have different functions from that of the ependyma. Although the transient ciliary motility might simply happen without functional significance during this mode of multiciliogenesis, one of our current speculations is that CPEC ciliary beating may be assisting radial diffusion of molecules that are secreted from CPECs into the CSF. Such assistance may be crucial, for example, in volume transmission of CPEC-derived signaling molecules that would affect the development of cells around brain ventricles (Guirao et al., 2010).

Our gene ontology analysis demonstrated that various signaling molecules were enriched in the CPEC-specific ciliome components (Table 1). This result was consistent with the fact that CPECs express a wide array of cell signaling receptors and ligands (Chodobski and Szmydynger-Chodobska, 2001; Narita et al., 2010), and have multiple functions to maintain brain homeostasis, such as the production of CSF (Narita et al., 2010), receptor-mediated material transport across the blood-CSF barrier (Mitchell et al., 2009), and recruit of lymphocytes for immunosurveillance of the central nervous system (Reboldi et al., 2009). Our data support the idea that mature, non-motile CPEC cilia may be involved in such multiple, tissue-specific signaling events. The present study will be a toehold for getting a deep insight in the brain function through a showcase of ventricular system, and for better understanding of the functional and developmental diversities of vertebrate cilia.

Materials and Methods

Isolation of swine choroid plexus cilia

Isolation of swine CPEC cilia was performed as described previously (Narita et al., 2010) with modifications. In brief, fresh choroid plexus tissue, dissected from swine brains at the local slaughterhouse (Yamanashi Meat Logistics Center, Yamanashi, Japan), was treated with 1 mM dibucaine hydrochloride (Wako Pure Chemical Industries, Osaka, Japan) in ice-cold Dulbecco's modified Eagle medium (DMEM)/HAM's F12 (1:1) (Invitrogen Japan, Tokyo, Japan) containing 0.25 M sucrose for 1 min with gentle agitation at 4℃. After centrifugation at 1,000 × g for 10 min at 4℃, the detached cilia in the resulting supernatant were sedimented on a 50% (w/v) sucrose cushion at 6,000 × g for 10 min at 4℃. The enriched materials on the cushion were collected, overlaid on 9 ml of a 42.5%/40% (w/v) discontinuous sucrose gradient in a 13-ml ultracentrifuge tube, and subjected to equilibrium sedimentation at 150,000 × g for 2 h at 4℃. The cilia enriched at the interface were collected by punching a hole on the side of the tube using a syringe fitted with a 23-G needle, pelleted at 20,000 × g for 5 min at 4℃, and stored at −80℃ until ready for use. The presence of intact cilia in the final pellet was validated routinely by immunostaining for acetylated alpha tubulin. Total protein concentration was determined using Protein Assay Bicinchoninate Kit (Nakalai Tesque, Kyoto, Japan).

Protein identification by mass spectrometry and data analysis

For proteomic analysis, 13 μg of total protein in the isolated CPEC cilia fraction was dissolved in 4× SDS sample buffer and electrophoresed on a precast 5–20% (w/v) e-PAGEL (ATTO. Tokyo, Japan). The gel area containing 20–250 kDa

proteins was cut into four slices using a clean razor blade, and each slice was transferred into a new tube. After reduction and alkylation, the samples in the gel were digested with trypsin overnight at 37℃. The resulting digests were extracted from the gel, concentrated to ~20 µl, and separated on a reversed-phase column using a DiNa-2A nano-LC system (KYA Technologies, Tokyo, Japan). The mobile phases consisted of solvent A (2% (v/v) acetonitrile and 0.1% (v/v) formic acid in H_2O) and solvent B (80% (v/v) acetonitrile and 0.1% (v/v) formic acid in H_2O). The peptides were eluted from the column with a three-step linear gradient of solvent B: 0 to 15% in 20 min, 15 to 50% in 105 min and 50 to 100% in 5 min at a flow rate of 300 nl/min, and sprayed into a LTQ-Orbitrap Velos (Thermo Fisher Scientific, Waltham, MA, USA), which was operated in data-dependent mode, automatically switching between MS and MS/MS acquisition. Full-scan MS spectra (from m/z 380 to 2,000) were acquired in the orbitrap with a resolution of 100,000 at m/z 400. The 20 most intense ions at a threshold above 1,000 were fragmented for collision-induced dissociation in the linear ion trap with normalized collision energy of 35%. All MS spectra were recalibrated in real time with the lock mass option (Olsen et al., 2005) to improve the mass accuracy.

The acquired MS/MS spectra were searched against a non-redundant protein database (Other mammalia; May 15, 2010) from the National Center for Biotechnology Information (NCBI) using the Mascot (v.2.2.04) algorithm (Matrix Science, Boston, MA, USA) with the following parameters: fixed modifications, carbamidomethylation of cysteines; variable modifications, methionine oxidation, pyro-glutamination for *N*-terminal glutamine, *N*-terminal acetylation; maximum missed cleavages, 2; peptide mass tolerance, 7 ppm; MS/MS tolerance, 0.5 Da; false discovery rate, 1%. Finally, 1,115 Sus scrofa proteins were extracted by 5,525 unique peptides.

Because swine protein annotation was not as thorough as those of humans, each protein in the dataset was first assigned a homologous human protein using the HomoloGene database (http://www.ncbi.nlm.nih.gov/homologene) and Blastp (http://blast.ncbi.nlm.nih.gov) for approximate analyses. When multiple swine protein entries yielded the same human protein, the redundancy was maintained. To check if the proteins were derived from contaminants such as mitochondria, serum, or ribosomes, the dataset was analyzed using the MitoProtein database (http://www.mitoproteome.org) and manual investigation. Following these analyses, 247 proteins were marked as probable contaminants, and the remaining 868 proteins were treated as the "true" CPEC ciliome. For comparison of the CPEC cilia proteome with other ciliome datasets, the dataset was analyzed using the Ciliaproteome database (http://www.ciliaproteome.org). For gene ontology (GO) analysis, the GO terms assigned to human homologs were analyzed using the Entrez Gene database (ftp://ftp.ncbi.nlm.nih.gov/gene/DATA/gene2go.gz; as of September 7, 2010). The GO terms enriched in the CPEC ciliome were identified using the functional annotation clustering tools of DAVID application server (version 6.7; http://david.abcc.ncifcrf.gov/summary.jsp).

Comparison of gene expression levels among choroid plexus epithelium, ependyma and NIH3T3 fibroblasts

Full details of the mouse study were approved by the Institutional Animal Care and Use Committee at the University of Yamanashi (Approval number: 19-92). All mice were handled according to the Guide for the Care and Use of Laboratory Animals. Primary cultures of mouse choroid plexus epithelial cells were prepared as described for swine CPECs (Narita et al., 2010), except that dissociation was performed with 0.38 mg/ml papain and tissue was triturated into small pieces by repeated pipetting through 200-µl micropipette tips after enzymatic treatment. Cells were grown for one week to confluency for RNA extraction. For primary cultures of mouse ependyma, the lateral walls of the lateral ventricles containing the subventricular zone were dissected from P1 mice, triturated by repeated pipetting through 1000-µl and 200-µl micropipette tips, and plated in Neurobasal-A medium containing B-27 and ITS supplements (Invitrogen Japan, Tokyo, Japan). Cells were maintained for 3 weeks for monolayer formation and ciliogenesis, and medium was changed twice a week. Cell debris and contaminated neurons were washed out by applying a stream of culture medium from a pipette before changing the medium. Total RNA was extracted from primary cultures as well as serum-starved NIH3T3 cells using the RNeasy Mini kit (Qiagen Japan, Tokyo, Japan). Total RNA from mouse choroid plexus tissues was extracted using Trizol Reagent (Invitrogen Japan, Tokyo, Japan). Reverse transcription and real-time PCR were performed using the First Strand cDNA Synthesis Kit (Fermentas, Glen Burnie, MD, USA) and Power SYBR Green PCR Master Mix (Applied Biosystems Japan, Tokyo, Japan), respectively, following the manufacturers' instructions. The sequences of custom oligonucleotide primer (Invitrogen Japan, Tokyo, Japan) used for real-time PCR are as follows: CD24a Fwd, 5′-TGCTCCTACCCACGCAGATT-3′; CD24a Rev, 5′-CGGGAAACGGTGCAACA-3′; TTR Fwd, 5′-TCCCTTCGACTCTTCCTCCTT-3′; TTR Rev, 5′-GGGCCAGCTTCAGACACAAA-3′; Foxj1 Fwd, 5′-GCCACAACCTGTCCTTGAACA-3′; Foxj1 Rev, 5′-GCCGGGCTCATCCTTCTC-3′; Dpcd Fwd, 5′-GGGATCCGAGCTCATCAAAG-3′; Dpcd Rev, 5′-GGTGTCCTTGCGCATGAAG-3′; Rsph4a Fwd, 5′-TTGAAGGCATCCAAGTGATTGA-3′; Rsph4a Rev, 5′-TGCACGTGATGAACCCAATT-3′; Rsph9 Fwd, 5′-CCTCTTCAAGACCCCTTTTGG-3′; Rsph9 Rev, 5′-GGGCAGGCCTTCAAAGGT-3′; B2m Fwd, 5′-CACTGACCGGCCTGTATGC-3′; B2m Rev 5′-GGTGGCGTGAGTATACTTGAATTTG-3′.

Western blotting and immunocytochemistry

For western blotting, appropriate amounts of protein were separated by electrophoresis on 5–20% (w/v) SDS poly-acrylamide gels and transferred to Immobilon-P membranes (Millipore, Billerica, MA, USA). After blocking with Tris buffered saline with Tween 20 (TBST) containing 5% (w/v) non-fat dry milk for 1 h at room temperature (RT), the blots were incubated with the primary antibodies diluted 1:500 in the blocking buffer and incubated overnight at 4℃. The blots were then washed with TBST and incubated with alkaline phosphatase-conjugated secondary antibody diluted 1:500 in the blocking buffer at RT for 1 h. After washing with TBST, the immuno-reactive bands were visualized using nitro blue tetrazolium chloride (NBT) and 5-Bromo-4-chloro-3-indolyl phosphate, toluidine salt (BCIP) substrates (Roche Diagnostics Japan, Tokyo, Japan). The antibodies used for immunostaining were as follows: Rsph9 (HPA031703, Sigma-Aldrich Japan, Tokyo, Japan); FLAG (018-22381, Wako Pure Chemical Industries, Osaka, Japan); pan actin (MS-1295-P0, Thermo Fisher Scientific Japan, Yokohama, Japan); mouse IgG conjugated with alkaline phosphatase (62-6522, Invitrogen Japan, Tokyo, Japan); rabbit IgG conjugated with alkaline phosphatase (G21079, Invitrogen Japan, Tokyo, Japan).

For immunostaining of the choroid plexus and ependymal layer in brain sections, mice were euthanized by cervical dislocation and the brains were dissected out quickly into cold Leibovitz L-15 medium, cut on a coronal plane to open the anterior horn of the lateral ventricles and immersed immediately in fixative solution (4% (w/v) paraformaldehyde, 100 mM HEPES, pH 7.4, 2.5 mM $CaCl_2$, 1.25 mM $MgCl_2$, 2.9% (w/v) glucose). The coronal brain cryosections of 5 µm thickness were mounted on coated glass slides and autoclaved for heat-induced epitope retrieval. On the other hand, cell cultures grown on glass coverslips were fixed with −20℃ methanol. The sections and monolayers were rinsed with PBS, blocked with 5% (w/v) skim milk in PBS for 30 min, and incubated with the primary antibody overnight at 4℃. After washing with PBS, the samples were incubated with the secondary antibody for 30 min at room temperature, washed with PBS and sealed in mounting solution with 4′,6-diamidino-2-phenylindole (DAPI). The stained cells were investigated under an Olympus BX50 microscope equipped with a Keyence VB-7010 cooled CCD color camera and a VB-7000 digital microscope camera control system (Keyence Japan, Osaka, Japan) or Olympus FluoView 1000 confocal microscope. The primary antibodies used for immunostaining and their dilutions were as follows: acetylated alpha tubulin (1:500; clone 6-11B-1, Sigma-Aldrich Japan, Tokyo, Japan) and Rsph9 (1:200). The secondary antibodies used were Alexa Fluor 488-conjugated goat anti-mouse (1:200) and Alexa Fluor 568-conjugated goat anti-rabbit (1:200) (Invitrogen Japan, Tokyo, Japan). As a negative control, normal immunoglobulins were used as the primary antibody.

Live imaging of choroid plexus epithelial cilia

For the observation of mouse CPEC ciliary motility, wild-type (C57Bl/6J, Charles River Laboratories Japan, Yokohama, Japan) and *Efhc1* knockout (Suzuki et al., 2009) mice were used. Animals were euthanized by decapitation and the choroid plexus tissues were dissected out of the brain immediately in cold Leibovitz L-15 medium and transferred to 35-mm glass bottom dishes. Ciliary motility was first investigated using an Olympus ZDC-IMAGE system equipped with differential interference contrast optics, a UPlanSApo 60×/1.35 oil-immersion objective and a Photometrics Coolsnap HQ2 cooled CCD camera. The images were recorded at approximately 11 frames per second with MetaMorph software. For high-speed video microscopy, the tissues were observed with an Olympus IX71 inverted microscope equipped with a 100 W mercury lamp as a light source, differential interference contrast optics, a UPlanSApo 40×/1.15 water-immersion objective, and an Allied GE680 CCD camera, and the images were recorded with typically 1–2 msec exposure time at 200 frames per second and analyzed with TI Workbench software written by Dr. Takafumi Inoue (Fukatsu et al., 2004). Samples were analyzed at room temperature typically within 25–60 min after euthanasia. Primary cultures of mouse ependyma were also observed under video microscopy for comparison. The CBF was calculated using the following formula (Chilvers and O'Callaghan, 2000): [CBF=(number of frames per second)/(average number of frames for single beat)]. To measure the uniformity of the directions of ciliary beating in single cells, tracks of ciliary tips traced from time-lapse images were fitted to eclipses and the angles of long axes were calculated. In each cell, histograms of the angles were calculated, normalized to the number of tracked cilia, and displayed as circular histograms, in which each element of the histogram was drawn in point symmetry to the center of the graph.

Transmission electron microscopy

For TEM of neonatal CPEC cilia, P1 mouse pups were fixed by perfusion with 2% (w/v) paraformaldehyde, 2.5% (w/v) glutaraldehyde and 2% (w/v) tannic acid in 0.1 M cacodylate buffer, pH 7.4. Whole brains were dissected out and fixed in the same fixative overnight at 4℃. In some experiments, fresh P1 choroid plexus

tissue was dissected out and fixed by immersion. The remainder of the procedure was performed as previously described (Narita et al., 2010).

Statistical analysis

All values were expressed as the mean ± s.d. Real-time PCR data were analyzed with two-way ANOVA followed by Bonferroni posttest to compare selected pairs. For ciliary beat frequency data, the chi-square test was applied to test for normal distribution, and Mann-Whitney test to assess differences between wild-type and Efhc1 knockout mice. Results were considered significant at $P<0.05$.

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Competing Interests

The authors declare that there are no competing interests.

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Swine protein data								Human ortholog data		Database analysis	
gi	Coverage	# Peptides	# AAs	MW [kDa]	calc. pI	Score	RefSeq ID	RefSeq ID	Gene symbol	Ciliome	Contamination check
187370717	56.42	1274	553	59.7	9.19	62366.54	ACD02421.1	NP_001001937.1	ATP5A1	-	Mitochondrion
194037554	70.64	800	528	56.3	5.27	38671.07	XP_001929445.1	NP_001677.2	ATP5B	Yes (9+2/9+0)	Mitochondrion
47523756	56.20	563	1178	129.5	6.83	26589.87	NP_999514.1	NP_071504.2	PC	Yes (9+0)	Mitochondrion
194044029	57.07	487	573	60.9	5.87	23555.83	XP_001928634.1	NP_955472.1	HSPD1	Yes (9+2/9+0)	Mitochondrion
47522754	48.62	440	763	83.1	9.20	21314.37	NP_999127.1	NP_000173.2	HADHA	-	Mitochondrion
187370723	48.62	432	763	83.2	9.20	21057.67	ACD02424.1	NP_000173.2	HADHA	-	Mitochondrion
283443670	43.58	437	1021	112.7	5.58	20945.70	ADB19852.1	NP_000692.2	ATP1A1	Yes (9+2/9+0)	
242253868	23.58	636	246	25.9	7.18	17353.28	NP_001156363.1	NP_002762.2	PRSS3	-	Trypsin
112980819	47.70	264	499	54.8	7.59	14597.04	ABI29191.1	NP_004159.2	SDHA	-	Mitochondrion
89574201	49.91	267	541	59.0	6.57	14553.23	ABD77326.1	NP_004159.2	SDHA	-	Mitochondrion
47523888	52.35	275	298	32.9	9.80	13667.26	NP_999583.1	NP_001142.2	SLC25A4	-	Mitochondrion
284009806	42.75	286	1020	112.1	5.66	13461.03	NP_001165012.1	NP_000693.1	ATP1A2	Yes (9+2/9+0)	
47522750	71.38	237	283	30.7	8.54	12982.50	NP_999125.1	NP_003365.1	VDAC1	-	Mitochondrion
45269029	57.67	282	404	44.8	5.83	12819.44	AAS55927.1	NP_001092.1	ACTB	Yes (9+2/9+0)	
194038726	60.45	214	531	57.8	7.85	11883.86	XP_001929120.1	NP_002645.3	PKM2	Yes (9+2/9+0)	
194038730	55.37	196	531	58.0	7.71	10961.99	XP_001929125.1	NP_002645.3	PKM2	Yes (9+2/9+0)	
47522630	47.67	228	430	47.4	9.01	10848.51	NP_999093.1	NP_002071.2	GOT2	-	Mitochondrion
48675943	39.66	170	527	59.7	8.19	10220.16	NP_001001640.1	NP_000231.1	MAOA	-	Mitochondrion
47522940	29.47	200	509	54.2	7.68	10189.01	NP_999227.1	NP_000099.2	DLD	-	Mitochondrion
47522738	49.30	226	781	85.7	8.05	10184.35	NP_999119.1	NP_001089.1	ACO2	-	Mitochondrion
284795272	26.53	202	1014	111.7	5.41	9818.50	NP_001165224.1	NP_689509.1	ATP1A3	Yes (9+2/9+0)	
262072947	39.30	179	313	33.2	8.95	9237.20	BAI47781.1	NP_000099.2	DLD	-	Mitochondrion
194040124	53.64	221	453	50.4	4.86	9143.33	XP_001925125.1	NP_821133.1	TUBB	Yes (9+2/9+0)	
194043400	46.58	192	2044	230.4	6.74	9005.07	XP_001929604.1	NP_477352.2	PI4KA	Yes (9+0)	
81174757	31.14	172	167	18.7	7.02	8881.72	ABB58920.1	NP_116093.1	TUBA1C	-	
90569223	47.70	160	174	19.5	5.77	8850.57	ABD94500.1	NP_006073.2	TUBA1B	Yes (9+2/9+0)	
194043861	56.42	172	452	50.3	5.07	8702.13	XP_001928233.1	NP_006000.2	TUBA1A	Yes (9+2/9+0)	
194035320	42.57	162	491	54.5	4.73	7609.80	XP_001924562.1	NP_525125.2	TUBA3D	-	
194037939	47.50	165	501	56.2	4.81	6961.95	XP_001924816.1	NP_001060.1	TUBB2A	Yes (9+2/9+0)	
112980811	42.31	146	260	27.8	7.20	6575.18	ABI29187.1	NP_002037.2	GAPDH	Yes (9+2)	
4454540	55.88	146	170	18.8	9.77	6092.69	AAD20940.1	NP_001142.2	SLC25A4	-	Mitochondrion
148879235	50.90	144	167	18.6	9.91	6022.71	CAN99572.1	NP_001143.2	SLC25A5	-	Mitochondrion
47522760	60.86	127	442	47.6	9.31	5712.76	NP_999131.1	NP_000174.1	HADHB	-	Mitochondrion
47523786	38.87	139	283	30.6	8.66	5710.45	NP_999529.1	NP_005653.3	VDAC3	-	Mitochondrion
47522864	30.54	116	1254	144.8	8.57	5596.55	NP_999186.1	NP_004990.3	MYO6	Yes (9+0)	
113205498	26.96	106	434	47.1	7.96	5568.52	NP_001037992.1	NP_001967.3	ENO3	-	
298160980	43.54	134	441	47.8	9.51	5321.07	NP_001177161	NP_001350.1	DECR1	-	Mitochondrion
5052383	55.50	136	191	19.9	9.25	5312.53	AAD38527.1	NP_002037.2	GAPDH	Yes (9+2)	
37934198	61.15	134	296	31.8	8.13	5310.98	AAP68768.1	NP_001350.1	DECR1	-	Mitochondrion
295442674	58.23	134	328	35.4	9.31	5302.01	ADG21261.1	NP_001350.1	DECR1	-	Mitochondrion
833798	56.20	121	605	69.4	6.30	5266.12	CAA30970.1	NP_000468.1	ALB	-	Serum
255683404	46.46	118	452	50.8	8.69	5237.17	NP_001157479.1	NP_002159.2	IDH2	-	Mitochondrion
47523600	53.00	97	500	56.6	8.25	5174.30	NP_999428.1	NP_000654.2	ABAT	-	Mitochondrion
89574151	59.57	108	282	29.5	8.10	5035.22	ABD77301.1	NP_005909.2	MDH2	Yes (9+2)	Mitochondrion
194043055	41.13	99	479	52.3	6.11	4926.57	XP_001924933.1	NP_000681.2	ALDH2	-	Mitochondrion
47522774	45.98	105	733	84.7	5.01	4844.08	NP_999138.1	NP_001017963.2	HSP90AA1	Yes (9+2/9+0)	
47522682	53.80	100	539	58.6	7.64	4838.74	NP_999066.1	NP_000523.2	PCCB	-	Mitochondrion
47523016	39.55	99	804	92.5	4.83	4833.64	NP_999268.1	NP_003290.1	HSP90B1	Yes (9+2/9+0)	
88683157	46.28	103	296	32.9	6.28	4696.74	CAJ77723.1	NP_116093.1	TUBA1C	-	
217039113	36.79	104	1245	139.0	6.90	4602.43	ACJ76845.1	NP_005327.1	HDLBP	Yes (9+0)	
164541	53.36	97	298	31.8	8.27	4528.76	AAA31071.1	NP_005909.2	MDH2	Yes (9+2)	Mitochondrion
47523794	54.42	113	294	31.6	7.56	4429.99	NP_999534.1	NP_001171712.1	VDAC2	-	Mitochondrion
49274643	32.31	64	520	58.2	8.13	4421.82	NP_001001864.1	NP_000889.3	MAOB	-	Mitochondrion
153792600	32.52	93	2512	272.1	6.42	4171.04	NP_001093400.1	NP_004095.4	FASN	Yes (9+0)	
194036470	50.00	77	256	28.6	9.47	3710.92	XP_001928906.1	NP_001679.2	ATP5F1	-	Mitochondrion
47523720	40.68	64	558	63.1	7.99	3682.06	NP_999495.1	NP_000166.2	GPI	Yes (9+0)	
294805368	52.13	77	658	73.8	8.88	3402.27	ADF42518.1	NP_000089.1	CPT2	-	Mitochondrion
194039391	37.02	49	724	83.2	5.03	3302.08	XP_001929605.1	NP_031381.2	HSP90AB1	Yes (9+2/9+0)	
47522680	46.72	72	944	106.6	6.02	3291.18	NP_999069.1	NP_938149.2	GANAB	Yes (9+0)	
194033595	39.94	70	666	73.8	5.88	3263.17	XP_001927830.1	NP_005338.1	HSPA5	Yes (9+2/9+0)	
194041763	32.03	66	793	86.8	7.03	3179.92	XP_001927564.1	NP_002851.2	ALDH18A1	-	Mitochondrion
47523762	14.02	60	1220	134.6	5.86	3163.43	NP_999517.1	NP_001673.2	ATP2B1	Yes (9+2/9+0)	
194041191	43.54	67	480	52.7	6.14	3106.74	XP_001926664.1	NP_003356.2	UQCRC1	-	Mitochondrion
47523626	43.55	66	806	89.2	5.26	3056.19	NP_999445.1	NP_009057.1	VCP	Yes (9+2/9+0)	
194035831	38.81	62	1224	138.4	7.66	2947.43	XP_001928742.1	NP_001091868.1	COPA	Yes (9+2/9+0)	
47522898	32.07	65	421	46.3	8.68	2872.51	NP_999204.1	NP_001120800.1	ACADM	Yes (9+2/9+0)	Mitochondrion
194042498	34.64	64	1403	161.1	6.40	2861.82	XP_001926058.1	NP_038479.1	MYOF	Yes (9+0)	
164518958	58.98	59	334	36.6	5.86	2742.65	NP_001106758.1	NP_002291.1	LDHB	Yes (9+0)	
57527987	39.86	62	577	67.6	6.68	2703.18	NP_001009578.1	NP_002435.1	MSN	Yes (9+2/9+0)	
47522814	23.03	49	647	69.0	7.97	2691.73	NP_999159.1	NP_001922.2	DLAT	Yes (9+2)	Mitochondrion
194033625	41.77	70	632	71.5	6.68	2690.59	XP_001924858.1	NP_001027392.1	STXBP1	Yes (9+0)	
194043700	28.20	54	532	60.5	8.72	2540.53	XP_001927726.1	NP_001063.2	UGT1A6	-	
194037604	27.59	57	1225	136.0	5.97	2525.45	XP_001927856.1	NP_060918.2	CAND1	Yes (9+0)	
194036657	21.42	56	1849	208.6	5.83	2449.70	XP_001928045.1	NP_006412.2	ARFGEF1	Yes (9+0)	
166244455	42.82	53	439	48.4	6.90	2436.27	ABY86572.1	NP_000265.1	OAT	Yes (9+0)	Mitochondrion
35384836	71.66	49	314	32.9	7.97	2423.76	AAQ84564.1	NP_000117.1	ETFA	-	Mitochondrion
194043180	28.25	54	963	106.1	5.12	2417.35	XP_001925929.1	NP_001025177.1	AP2B1	Yes (9+0)	
47523768	61.89	60	454	52.4	7.62	2371.34	NP_999520.1	NP_000111.1	EPHX1	-	
281427372	38.48	44	421	47.5	8.94	2321.76	NP_001163994.1	NP_000131.2	FECH	Yes (9+0)	Mitochondrion
194042320	33.30	55	916	102.3	6.74	2307.52	XP_001929048.1	NP_000180.2	HK2	-	Mitochondrion
297591979	42.82	51	439	48.5	6.90	2281.81	NP_001172070	NP_000265.1	OAT	Yes (9+0)	Mitochondrion
194033419	32.17	49	373	44.4	6.40	2252.47	XP_001924268.1	NP_001104547.1	EZR	-	

256838109	29.64	48	361	40.0	9.32	2250.57	NP_001157984.1	NP_002626.1	SLC25A3	Yes (Global)	Mitochondrion
281427374	51.96	47	535	57.4	6.54	2235.57	NP_001163991.1	NP_006422.1	CCT2	Yes (9+2/9+0)	
194039357	20.18	46	1204	136.2	5.54	2208.32	XP_001929500.1	NP_065801.1	XPO5	Yes (9+0)	
47522610	36.54	46	520	56.4	8.27	2206.56	NP_999103.1	NP_000427.1	OXCT1	-	Mitochondrion
194043064	32.74	48	1283	139.9	6.76	2200.10	XP_001925307.1	NP_006827.1	GCN1L1	-	
194044286	38.87	47	746	83.0	5.14	2153.66	XP_001926037.1	NP_001036041.1	RRBP1	Yes (9+2/9+0)	
47523618	46.34	65	464	51.6	8.06	2130.13	NP_999441.1	NP_004068.2	CS	-	Mitochondrion
194038542	48.78	48	533	57.6	8.24	2111.25	XP_001929208.1	NP_005580.1	ALDH6A1	-	Mitochondrion
47522692	36.98	51	430	47.9	7.39	2095.52	NP_999062.1	NP_001599.1	ACADL	-	Mitochondrion
56792845	38.62	52	189	20.7	5.20	2063.80	AAW30622.1	NP_997195.1	TUBA3E	-	
194039315	22.99	42	1092	120.8	6.61	2048.16	XP_001926726.1	NP_002812.2	PTK7	Yes (9+2/9+0)	
57527982	20.93	40	583	68.5	6.27	1967.97	NP_001009576.1	NP_002897.1	RDX	Yes (9+2/9+0)	
47523670	33.38	43	737	80.1	8.03	1957.09	NP_999471.1	NP_000405.1	HSD17B4	-	
194033415	64.38	34	233	27.3	5.97	1953.12	XP_001928755.1	NP_001104547.1	EZR	-	
194038427	16.79	46	2138	246.8	5.29	1892.55	XP_001927057.1	NP_001020029.1	SPTB	Yes (9+0)	Serum
194037873	9.31	40	623	67.4	6.84	1875.35	XP_001925764.1	NP_062832.1	GPR162	-	
194041602	25.93	45	405	44.3	9.66	1870.76	XP_001926332.1	NP_001600.1	ACADSB	-	Mitochondrion
47523464	30.07	38	439	48.8	5.71	1864.84	NP_999353.1	NP_005207.2	DDOST	Yes (9+0)	
47523114	50.60	49	334	36.4	6.58	1864.09	NP_999039.1	NP_005908.1	MDH1	Yes (9+2/9+0)	
194039421	10.32	53	252	28.5	5.78	1827.29	XP_001927000.1	NP_058625.2	CLIC5	-	
54020966	52.21	44	339	38.5	6.93	1815.71	NP_001005726.1	NP_001002858.1	ANXA2	Yes (9+2/9+0)	
1900	28.71	35	303	35.1	8.53	1734.32	CAA27575.1	NP_001668.1	ATP1B1	Yes (9+0)	
194042318	30.10	36	917	102.4	6.73	1700.42	XP_001928917.1	NP_079406.3	HKDC1	Yes (9+0)	
164669	33.33	39	417	45.1	5.58	1677.94	AAA31120.1	NP_003839.2	SUCLG2	-	Mitochondrion
47523726	35.86	34	608	68.7	6.55	1672.20	NP_999498.1	NP_002941.1	RPN1	Yes (9+0)	
194033647	26.97	32	864	97.2	6.87	1629.01	XP_001928157.1	NP_004399.2	DNM1	Yes (9+2/9+0)	
194042126	21.73	40	1376	166.0	6.71	1627.65	XP_001928377.1	NP_003741.1	EIF3A	Yes (9+2/9+0)	
113205650	30.00	35	780	85.3	8.18	1614.54	NP_001038015.1	NP_000280.1	PFKM	Yes (9+0)	
38569762	36.96	40	46	4.9	5.11	1606.21	AAR24399.1	NP_004083.3	ECHS1	-	Mitochondrion
194037849	18.36	37	1514	167.8	6.29	1600.25	XP_001925235.1	NP_000005.2	A2M	-	Serum
833800	32.47	34	696	76.9	7.03	1598.88	CAA30943.1	NP_001054.1	TF	-	
1921	24.47	35	997	109.7	5.36	1594.81	CAA33169.1	NP_733765.1	ATP2A2	Yes (9+2/9+0)	
194034783	42.50	33	320	36.0	9.20	1585.75	XP_001924385.1	NP_067022.1	SQRDL	-	Mitochondrion
194042284	47.20	28	322	35.0	6.60	1578.17	XP_001925338.1	NP_005262.1	GLUD1	-	Mitochondrion
194038105	13.03	36	1665	188.2	6.28	1557.41	XP_001925566.1	NP_006026.3	CDC42BPB	Yes (9+2/9+0)	
68445604	16.80	37	1851	214.8	8.44	1549.94	BAE03307.1	NP_001135967.1	MYO5A	Yes (9+2/9+0)	
288860138	22.56	38	953	107.1	6.13	1525.19	NP_001165837.1	NP_001137533.1	COPB1	Yes (9+0)	
148747288	59.94	35	322	35.6	9.23	1522.53	NP_001092072.1	NP_073591.2	SFXN1	-	Mitochondrion
164543	52.94	36	289	31.7	6.57	1504.67	AAA31072.1	NP_005908.1	MDH1	Yes (9+2/9+0)	
95117652	31.18	33	744	81.6	8.27	1472.88	ABF57019.1	NP_000280.1	PFKM	Yes (9+0)	
194041527	31.99	26	572	62.3	6.38	1466.69	XP_001927831.1	NP_001377.1	DPYSL2	-	
194040685	20.35	27	1081	121.7	4.97	1449.04	XP_001926818.1	NP_002262.3	IPO5	-	
48675953	29.44	30	445	50.2	6.70	1441.61	NP_001001643.1	NP_001485.2	GDI2	-	
47523848	26.37	37	455	48.9	8.82	1439.55	NP_999562.1	NP_001924.2	DLST	-	Mitochondrion
194042529	10.96	29	894	103.7	5.45	1431.12	XP_001927307.1	NP_001094.1	ACTN2	-	
154101332	38.28	33	128	14.6	9.72	1429.92	ABS58492.1	NP_000775.1	CYP27A1	-	Mitochondrion
194036006	29.00	30	531	59.2	7.36	1403.29	XP_001926412.1	NP_005989.3	CCT3	Yes (9+2/9+0)	
163915141	28.12	32	626	70.8	8.35	1374.22	NP_001106518.1	NP_000746.2	CRAT	-	Mitochondrion
194044007	29.36	30	596	66.3	8.13	1373.89	XP_001924775.1	NP_055720.3	GLS	Yes (9+0)	Mitochondrion
47523864	28.53	32	750	83.3	8.19	1373.12	NP_999570.1	NP_000246.2	MUT	Yes (9+0)	Mitochondrion
194039401	27.21	33	985	106.9	6.51	1367.83	XP_001929628.1	NP_065796.1	AARS2	-	Mitochondrion
178056753	25.76	26	854	97.4	7.49	1352.27	NP_001116644.1	NP_002854.3	PYGL	-	
7547271	45.14	25	175	20.0	6.84	1349.22	AAB35333.2	NP_055720.3	GLS	Yes (9+0)	Mitochondrion
264681456	39.44	28	426	46.6	7.85	1338.76	NP_001161107.1	NP_002216.2	IVD	-	Mitochondrion
153792027	47.48	24	417	44.5	7.90	1316.24	NP_001093402.1	NP_000282.1	PGK1	Yes (9+2/9+0)	
194042961	17.19	29	1059	118.2	8.35	1301.53	XP_001929589.1	NP_001130010.1	ACAD10	Yes (9+2/9+0)	
194037640	25.84	25	770	85.2	7.59	1300.79	XP_001926622.1	NP_036322.2	ALDH1L1	-	
194035060	18.40	28	1793	193.0	6.10	1299.51	XP_001924346.1	NP_055874.2	TLN2	Yes (9+0)	
194039730	47.49	32	537	57.7	8.28	1299.49	XP_001928195.1	NP_001071.1	ALDH5A1	-	Mitochondrion
178056732	43.10	22	355	40.4	5.54	1282.65	NP_001116588.1	NP_002061.1	GNAI2	Yes (9+2/9+0)	
264681432	57.99	26	319	35.8	5.92	1280.04	NP_001161111.1	NP_001144.1	ANXA4	Yes (9+2/9+0)	
194042272	46.82	23	299	32.7	7.01	1273.72	XP_001925088.1	NP_005262.1	GLUD1	-	Mitochondrion
19919838	39.91	28	431	48.1	6.89	1270.06	AAM08402.1	NP_055720.3	GLS	Yes (9+0)	Mitochondrion
51592133	21.20	24	618	68.4	5.58	1266.73	NP_001004042.1	NP_001681.2	ATP6V1A	Yes (9+2/9+0)	
281427370	41.44	27	543	59.4	7.15	1264.63	NP_001163993.1	NP_006420.1	CCT7	Yes (9+2/9+0)	
47522686	17.68	25	413	44.8	8.13	1246.59	NP_999063.1	NP_000008.1	ACADS	Yes (9+2/9+0)	Mitochondrion
194043981	18.97	26	1128	128.8	6.62	1238.57	XP_001928589.1	NP_995314.1	NCKAP1	Yes (9+0)	
194043678	22.88	25	953	105.7	5.39	1222.71	XP_001925937.1	NP_002798.2	PSMD1	Yes (9+0)	
147223308	17.72	27	632	69.3	8.02	1218.08	CAN13201.1	NP_536350.2	GNAS	Yes (9+2/9+0)	
47522618	20.90	29	1067	116.8	6.16	1202.85	NP_999099.1	NP_054706.1	VCL	Yes (9+0)	
91214448	78.82	22	203	21.8	6.39	1199.86	ABE27954.1	NP_001152759.1	TPI1	Yes (9+0)	
146741316	15.74	30	1201	135.5	7.21	1188.26	BAF62313.1	NP_003929.4	AP3D1	Yes (9+0)	
194037097	41.54	31	260	29.2	7.01	1185.00	XP_001927840.1	NP_000058.1	CA2	Yes (9+0)	
178056466	26.85	26	447	50.8	8.07	1184.59	NP_001116555.1	NP_000700.1	BCKDHA	-	Mitochondrion
47523308	26.52	27	641	70.1	5.82	1180.83	NP_998931.1	NP_005337.2	HSPA1B	Yes (9+2/9+0)	Mitochondrion
113205874	59.15	19	213	23.4	9.96	1176.04	NP_001038071.1	NP_001688.1	ATP5O	-	Mitochondrion
194036880	26.35	26	463	52.5	6.84	1164.62	XP_001927701.1	NP_004541.1	NDUFS2	-	Mitochondrion
190360601	37.59	28	423	48.3	7.87	1157.66	NP_001121914.1	NP_001473.1	GATM	-	Mitochondrion
194044193	17.73	26	1455	158.3	7.23	1155.59	XP_001926385.1	NP_000028.3	ANK1	Yes (9+2/9+0)	Serum
194044406	19.72	26	791	89.5	7.05	1150.85	XP_001927066.1	NP_002827.1	PTPRA	Yes (9+0)	
4102210	37.93	24	87	9.4	9.86	1147.20	AAD01440.1	NP_003553.2	SLC25A11	-	Mitochondrion
47523722	46.18	21	314	34.1	9.00	1145.52	NP_999496.1	NP_005318.3	HADH	Yes (Global)	Mitochondrion
178056512	18.10	24	641	70.3	6.35	1103.02	NP_001116600.1	NP_005518.3	HSPA1L	Yes (9+2/9+0)	
223950621	11.70	19	1128	118.6	5.66	1084.52	NP_001138854.1	NP_001092004.1	BAT3	Yes (9+0)	
68124034	31.07	25	309	33.6	6.80	1084.17	CAJ03391.1	NP_001393.1	EEF1A1	Yes (9+2/9+0)	

1616950	19.13	25	920	102.4	7.43	1082.36	AAB16869.1	NP_000623.2	ITGAM	-	
194042197	33.94	24	218	24.3	9.16	1079.28	XP_001925957.1	NP_115709.3	C10orf58	Yes (9+0)	
194044118	41.89	24	475	55.4	6.15	1069.62	XP_001924839.1	NP_064505.1	UGGT1	-	
148225750	23.86	22	859	96.6	5.41	1066.53	NP_001090973.1	NP_006635.2	HSPH1	-	
194043684	16.67	27	360	40.4	6.18	1044.04	XP_001926541.1	NP_002233.2	KCNJ13	-	
118403904	26.46	19	189	19.9	6.79	1042.96	NP_001072131.1	NP_009193.2	PARK7	Yes (9+0)	
194043642	15.15	19	904	101.4	6.02	1042.93	XP_001925117.1	NP_001165906.1	RAB3GAP1	Yes (9+0)	
194042134	20.99	10	243	26.6	7.28	1037.11	XP_001928552.1	NP_006784.1	PRDX3	Yes (9+2/9+0)	Mitochondrion
47523792	25.99	25	781	85.5	5.86	1031.46	NP_999532.1	NP_001091679.1	CTNNB1	Yes (9+2/9+0)	
194041957	30.86	17	499	55.4	5.40	1025.25	XP_001929355	NP_116116.1	INA	Yes (9+0)	
106073338	27.36	18	731	84.0	6.52	1017.04	ABF81978.1	NP_005600.1	PYGM	Yes (9+0)	
47523818	26.85	20	499	56.4	7.25	1010.86	NP_999546.1	NP_742127.1	CAMK2D	Yes (9+2/9+0)	
76097691	41.08	24	297	34.3	4.87	1000.87	ABA39527.1	NP_003371.2	VIM	Yes (9+0)	
1236646	20.88	23	455	49.3	6.06	989.27	AAC48775.1				Serum
118403792	49.30	23	357	39.1	5.62	987.02	NP_001072151.1	NP_057334.1	NDRG2	Yes (9+0)	
52631983	34.42	19	337	37.5	6.30	985.81	AAU85385.1	NP_004437.2	EPRS	Yes (9+0)	
50979303	26.84	17	503	57.3	6.74	983.83	NP_999466.1	NP_001743.1	CAT	Yes (9+0)	
47523306	22.72	18	757	88.1	6.27	983.58	NP_998934.1	NP_009330.1	STAT1	-	
171465894	17.25	15	568	61.6	5.69	980.45	ACB46190.1	NP_001012679.1	SLC3A2	Yes (9+0)	
47522660	34.37	17	579	62.8	7.62	969.59	NP_999079.1	NP_001432.2	FAAH	Yes (9+0)	
194044375	14.09	18	646	70.4	7.71	968.09	XP_001927148.1	NP_115890.2	ACSS1	-	Mitochondrion
178056392	27.40	15	354	40.5	5.69	958.51	NP_001116589.1	NP_006487.1	GNAI3	Yes (9+2/9+0)	
190360675	27.63	20	427	47.3	7.81	953.98	NP_001121955.1	NP_005794.1	FLOT1	-	
194042491	18.53	24	1009	116.9	6.46	947.66	XP_001925416.1	NP_004960.2	IDE	-	
2997739	59.76	18	82	9.4	7.05	933.97	AAC08590.1	NP_005150.1	ACTC1	Yes (9+2/9+0)	
195972993	16.35	16	685	77.1	6.65	931.03	NP_001124446.1	NP_003147.2	STIM1	Yes (9+0)	
194035330	15.97	20	864	97.3	8.38	928.45	XP_001924430.1	NP_056138.1	KIAA0776	Yes (9+0)	
194044120	53.61	23	360	40.9	5.64	927.81	XP_001924866.1	NP_064505.1	UGGT1	-	
178056550	26.64	24	533	56.8	6.89	925.57	NP_001116634.1	NP_006614.2	PHGDH	Yes (9+0)	
194041349	18.21	17	280	30.3	9.16	921.67	XP_001926718.1	NP_001001331.1	ATP2B2	Yes (9+2/9+0)	
194037880	29.52	22	664	73.5	5.38	917.17	XP_001925819.1	NP_003931.2	USP13	-	
194036093	19.54	20	609	68.4	8.38	900.60	XP_001926976.1	NP_065385.2	PBXIP1	-	
194034213	16.21	16	833	95.8	6.70	889.49	XP_001926027.1	NP_055807.1	DAAM1	Yes (9+0)	
194039491	25.96	16	366	39.6	7.15	879.55	XP_001927373.1	NP_005521.1	IDH3A	-	Mitochondrion
194035054	21.94	17	556	61.8	8.85	878.97	XP_001929115.1	NP_116246.2	LACTB	-	Mitochondrion
194040871	12.57	20	1575	171.5	6.99	870.67	XP_001924275.1	NP_056281.1	PTPN23	Yes (9+0)	
194033403	38.31	22	556	60.3	5.99	869.34	XP_001928240.1	NP_110379.2	TCP1	Yes (9+2/9+0)	
157427728	15.99	15	1076	117.8	7.43	867.53	NP_001098772.1	NP_001087.2	ACLY	Yes (9+0)	
194033639	36.83	19	372	41.8	9.25	863.32	XP_001927971.1	NP_079348.1	PTGES2	Yes (9+0)	
194041569	5.18	14	1970	216.6	6.30	859.42	XP_001926837.1	NP_056069.2	KIF13B	-	
194034221	27.43	21	339	38.1	8.75	842.06	XP_001928783.1	NP_057113.1	DHRS7	Yes (9+0)	
47522636	33.41	16	413	46.4	7.20	837.76	NP_999092.1	NP_002070.1	GOT1	Yes (9+0)	
291622246	33.33	23	417	48.3	4.46	833.09	NP_001167604.1	NP_004334.1	CALR	Yes (9+0)	
197251946	22.97	17	418	47.4	5.88	827.85	NP_001127815.1	NP_005712.1	ACTR3	Yes (9+2/9+0)	
194043438	28.24	22	386	42.6	9.17	827.33	XP_001927482.1	NP_005975.1	SLC25A1	-	Mitochondrion
194036351	8.08	20	1832	196.9	5.34	823.98	XP_001926434.1	NP_077719.2	NOTCH2	-	
194042314	15.34	15	789	88.0	8.27	819.68	XP_001928933.1	NP_003162.2	SUPV3L1	-	Mitochondrion
147780441	10.57	17	1741	192.3	7.15	813.50	CAN59660.1	NP_009224.2	C4A	-	Serum
194041795	41.02	15	256	29.0	7.18	812.74	XP_001928790.1	NP_002620.1	PGAM1	Yes (9+0)	
194042063	20.69	19	836	92.9	5.24	801.64	XP_001927134.1	NP_001001936.1	AFAP1L2	-	
1304179	10.71	18	448	47.3	7.05	778.33	BAA07817.1	NP_000499.1	FGA	-	Serum
194035289	19.34	14	574	62.8	6.68	777.64	XP_001927130.1	NP_002517.1	NT5E	Yes (9+2/9+0)	
2407184	13.21	17	333	35.8	8.46	771.36	AAB94053.1	NP_002037.2	GAPDH	Yes (9+2)	
2258465	31.83	17	333	35.0	9.23	768.51	AAB94003.1	NP_003840.2	SUCLG1	-	Mitochondrion
194041803	13.69	16	1030	113.1	6.24	766.78	XP_001928946.1	NP_071757.4	MMS19	-	
194041977	12.35	15	1206	138.9	5.03	763.04	XP_001929461.1	NP_055535.2	SLK	Yes (9+2/9+0)	
208972300	21.71	17	152	16.9	7.75	759.32	ACI32712.1	NP_008862.1	SLC2A3	-	
194018678	17.55	15	678	76.8	5.43	745.26	NP_001123431.1	NP_000932.3	POR	Yes (9+0)	
120564445	45.08	14	264	28.9	6.93	745.12	ABM30148.1	NP_001389.2	ECH1	-	Mitochondrion
194038734	19.08	18	765	86.1	7.08	743.90	XP_001929226.1	NP_006355.2	SEC23A	Yes (9+0)	
178056478	10.35	19	396	43.3	6.29	742.87	NP_001116691.1	NP_000047.1	BCKDHB	-	Mitochondrion
72535190	14.15	9	205	22.6	7.05	739.41	NP_001026957.1	NP_004152.1	RAB1A	Yes (9+2/9+0)	
123186755	31.04	17	364	40.6	6.13	727.73	ABM69185.1				
194035996	16.20	14	463	52.3	9.48	723.90	XP_001924629.1	NP_839943.2	IQGAP3	-	
264681430	28.97	13	397	41.9	8.40	722.82	NP_001161110.1	NP_006102.2	ACAA2	-	Mitochondrion
194037572	26.73	15	505	56.2	8.21	712.69	XP_001929492.1	NP_005403.2	SHMT2	Yes (9+2)	Mitochondrion
85792253	29.48	15	407	46.4	5.48	698.79	ABC84194.1	NP_001958.2	EIF4A2	Yes (9+2/9+0)	
155369760	25.57	18	661	74.8	7.50	696.57	NP_001094498.1	NP_009223.2	ACOX1	Yes (9+0)	
113205608	23.59	15	284	32.2	10.73	696.39	NP_001038007	NP_000961.2	RPL6	-	Ribosome
194041249	28.74	14	421	46.6	8.90	694.19	XP_001925979.1	NP_060867.2	CHDH	-	Mitochondrion
51592147	13.24	15	710	80.7	5.85	692.68	NP_001004050.1	NP_002717.3	PREP	Yes (9+0)	
194041376	10.97	9	693	77.9	8.25	687.67	XP_001924800.1	NP_115545.3	ACAD11	-	
194035777	20.67	12	421	47.2	7.33	680.63	XP_001929419.1	NP_001008661.1	CCBL2	-	
261532847	27.70	14	361	37.7	7.25	679.94	ACX85429.1	NP_006105.1	TOMM40	-	Mitochondrion
47523472	10.02	12	539	60.2	7.30	679.22	NP_999358.1	NP_742077.1	CAMK2B	-	
194041257	27.82	14	266	29.3	7.83	676.34	XP_001926099.1	NP_060867.2	CHDH	-	Mitochondrion
47523872	14.00	15	643	68.1	6.67	672.19	NP_999575.1	NP_000444.1	SLC5A5	-	
146741290	20.67	15	358	42.0	5.68	668.90	BAF62300.1	NP_002063.2	GNAQ	Yes (9+2/9+0)	
194042806	20.65	17	460	49.5	6.34	666.79	XP_001927837.1	NP_001147.1	ANXA7	Yes (9+2/9+0)	
194041218	25.38	14	390	45.9	8.09	664.58	XP_001928126.1	NP_001127703.1	NT5DC2	-	
281324305	30.57	16	350	38.7	5.35	663.35	ADA60694.1				
5052379	29.10	13	189	22.0	5.25	661.81	AAD38525.1	NP_001076581.2	GPD2	-	Mitochondrion
212525788	17.46	15	676	70.7	9.88	661.05	ACJ26765.1	NP_598006.1	SYN1	Yes (9+0)	
194034423	15.55	11	463	50.9	8.69	658.23	XP_001926853.1	NP_079160.1	L2HGDH	Yes (9+0)	Mitochondrion
194036285	21.89	14	233	26.3	9.76	657.09	XP_001924916.1	NP_036245.1	CA14	Yes (9+0)	

194038709	19.85	17	398	44.5	7.99	656.26	XP_001928700.1	NP_036560.1	NPTN	Yes (9+0)	
194033574	13.02	19	845	89.4	4.88	655.98	XP_001927353.1	NP_775960.4	CRB2	-	
194034593	5.95	17	1058	119.3	5.57	646.88	XP_001925408.1	NP_065905.2	KIAA1468	-	
47522608	17.65	13	629	69.2	5.95	644.85	NP_999106.1	NP_002942.2	RPN2	Yes (9+0)	
11558496	13.68	15	636	67.1	7.17	643.85	CAC17816.1	NP_000444.1	SLC5A5	-	
194035640	19.97	14	741	84.6	8.48	641.97	XP_001924598.1	NP_006200.3	ENPP2	-	
194044626	24.39	14	246	28.1	4.83	641.33	XP_001927289.1	NP_003395.1	YWHAB	Yes (9+2/9+0)	
88861940	65.75	15	73	7.9	8.19	636.80	ABD52877.1	NP_001606.1	ACTA2	Yes (9+2/9+0)	
194033664	26.97	13	445	51.9	6.19	636.65	XP_001928746.1	NP_002531.3	ODF2	Yes (9+2/9+0)	
165973420	30.22	14	364	40.3	5.76	636.01	NP_001107174.1				
113205668	52.32	13	151	16.7	9.44	628.63	NP_001038021.1	NP_004519.1	MGST3	Yes (9+0)	
194041649	2.83	11	741	83.5	4.88	626.99	XP_001926615.1	NP_060650.2	DHX32	-	Mitochondrion
5835866	20.09	9	229	26.2	4.89	625.83	NP_008637.1	YP_003024029.1	MT-CO2	-	Mitochondrion
98283613	26.49	13	385	42.4	8.29	624.08	ABF58001.1	NP_008830.2	IDH3B	-	Mitochondrion
47522772	12.31	15	650	74.0	5.78	623.06	NP_999137.1	NP_005177.2	CAPN1	Yes (9+2/9+0)	
194034893	29.57	15	470	51.7	5.34	619.05	XP_001929453.1	NP_060615.1	FAM82A2	-	Mitochondrion
178056945	8.66	11	1062	118.2	7.68	618.67	NP_001116686.1	NP_065175.4	VARS2	-	Mitochondrion
194042189	25.10	15	502	53.9	7.30	618.46	XP_001924213.1	NP_001148.1	ANXA11	-	
47523958	14.76	18	271	28.7	7.01	612.93	NP_999619.1	NP_932766.1	AQP1	Yes (9+0)	
194040859	16.29	16	798	87.6	7.37	610.94	XP_001926951.1	NP_056281.1	PTPN23	Yes (9+0)	
20378720	24.10	12	361	40.1	5.94	605.93	AAM20954.1				
18699303	26.42	13	352	38.9	5.36	604.78	AAL78518.1				
194043977	10.40	11	1250	136.9	5.08	603.46	XP_001928441	NP_001123917.1	SSFA2	-	
89573851	23.81	12	252	28.4	7.96	603.04	ABD77151.1	NP_002991.2	SDHB	Yes (9+0)	Mitochondrion
186886352	27.67	12	477	53.2	7.77	597.10	ACC93575.1	NP_037518.3	SLC25A24	-	Mitochondrion
194041502	20.45	14	934	103.9	4.89	596.05	XP_001925857.1	NP_005373.2	NEFM	Yes (9+2/9+0)	
47522712	23.29	12	322	35.6	6.38	594.26	NP_999108.1	NP_003672.1	PDXK	Yes (9+0)	
288860136	31.33	13	332	36.6	8.07	592.73	NP_001165834.1	NP_005557.1	LDHA	Yes (9+0)	
194040972	21.78	15	381	42.7	6.80	589.42	XP_001924801.1	NP_065843.3	NCEH1	-	
47523628	8.31	11	963	108.8	5.31	587.52	NP_999442.1	NP_001141.2	ANPEP	-	
20378700	25.55	13	364	40.6	6.80	586.35	AAM20944.1				
178056588	15.92	4	201	22.1	5.73	586.30	NP_001116645.1	NP_112243.1	RAB1B	Yes (9+2/9+0)	
195539468	29.34	10	259	26.7	6.04	578.75	NP_001124202.1	NP_055049.1	HSD17B8	Yes (9+0)	
194041955	17.97	13	562	65.1	6.05	575.56	XP_001929313.1	NP_001127845.1	NT5C2	-	
194033409	26.24	12	221	24.7	8.88	573.89	XP_001926475.1	NP_000627.2	SOD2	-	Mitochondrion
83415427	26.10	13	364	40.5	5.76	572.55	ABC17921.1				
222090428	18.64	12	499	55.6	9.25	567.66	ACM42422.1	NP_036345.2	MLYCD	Yes (9+0)	Mitochondrion
194041424	10.94	11	1088	124.0	6.48	567.20	XP_001926790.1	NP_001093631.1	XPO7	-	
211926963	25.55	12	364	40.5	5.92	566.31	BAG82701.1				
258590765	4.33	13	1269	133.4	8.56	566.11	CAZ66650.1	NP_003595.1	IRS4	-	
55926209	38.16	13	207	22.9	6.70	563.68	NP_001007519.1	NP_001531.1	HSPB1	Yes (9+2/9+0)	
113205600	23.12	13	359	42.0	6.23	563.38	NP_001038003.1	NP_002058.2	GNA11	Yes (9+2/9+0)	
262072813	50.70	15	286	31.5	8.94	561.34	BAI47714.1	NP_057226.1	HSD17B12	Yes (9+0)	
146741296	5.25	11	629	65.2	8.15	560.28	BAF62303.1	NP_006112.3	KRT1	-	
228008282	28.68	11	401	45.1	4.96	559.44	BAH57697.1	NP_004148.1	PRKAR2A	Yes (9+2/9+0)	
226533691	22.85	9	407	46.1	7.55	558.96	NP_001152778.1	NP_002603.1	PDK4	-	Mitochondrion
194040622	21.21	13	627	70.2	5.38	555.27	XP_001929180.1	NP_002661.2	PLS1	-	
29027441	21.05	11	361	40.2	5.31	554.11	AAO62090.1				
194043917	13.94	12	531	58.1	5.80	554.01	XP_001925672.1	NP_000201.2	ITGA6	-	
29027457	25.27	12	364	40.6	6.25	552.77	AAO62098.1				
194042794	19.09	8	351	40.0	8.65	547.48	XP_001925861.1	NP_612366.1	CCDC109A	Yes (9+0)	
148235351	29.32	13	249	27.4	8.00	539.09	NP_001090944.1	NP_066552.2	NDUFV2	-	Mitochondrion
194044001	44.67	14	244	27.3	9.32	537.80	XP_001924675.1	NP_055177.2	HIBCH	Yes (9+0)	Mitochondrion
33468754	50.55	13	182	20.6	4.94	537.16	BAC81558.1				
18652142	23.55	13	361	40.1	5.48	536.19	AAL76974.1				
194045104	1.90	10	1839	205.2	6.09	535.46	XP_001926529.1	NP_113584.3	HUWE1	Yes (9+2/9+0)	
194044901	13.63	10	587	65.9	5.30	533.41	XP_001925971.1	NP_005023.2	PLS3	Yes (9+0)	
167001855	19.69	12	259	29.5	9.39	530.30	NP_001095290.1	NP_003850.1	DPM1	Yes (9+0)	
194042814	9.68	12	1095	118.2	7.09	530.27	XP_001928228.1	NP_004913.2	SEC24C	Yes (9+2/9+0)	
83415443	20.50	12	361	40.0	5.29	528.84	ABC17929.1				
227430407	11.86	10	489	54.4	5.82	528.79	NP_001153087.1	NP_002264.1	KRT8	-	
194043572	7.93	12	1576	175.6	5.34	527.30	XP_001927025.1	NP_005886.2	GOLGA3	Yes (9+2/9+0)	
194034542	4.43	12	1670	186.0	6.67	524.92	XP_001925806.1	NP_003248.3	TJP1	Yes (9+0)	
2036	30.92	13	249	27.7	9.14	523.84	CAA34633.1	NP_002622.2	PGD	Yes (9+0)	
94981331	7.49	12	601	67.9	9.10	522.22	ABF49559.1	YP_003024036.1	MT-ND5	-	Mitochondrion
219521966	21.38	14	421	46.9	8.53	519.76	NP_001137171.1	NP_060708.1	AGK	Yes (9+0)	Mitochondrion
112980823	29.55	11	176	20.0	4.61	518.67	ABI29193.1	NP_003397.1	YWHAZ	Yes (9+2/9+0)	
18699305	23.71	11	350	39.3	6.37	517.15	AAL78519.1				
31074212	10.91	8	605	68.3	9.04	515.54	AAP37947.1	NP_004740.2	TBRG4	-	
29027439	23.82	11	361	40.2	6.65	515.47	AAO62089.1				
194034394	12.11	11	801	90.8	5.20	512.50	XP_001926660.1	NP_005921.2	CTAGE5	Yes (9+0)	
194041212	11.90	10	504	55.4	6.67	511.57	XP_001928031.1	NP_006832.1	SLC38A3	-	
194036047	27.20	14	397	45.5	9.14	510.59	XP_001928886.1	NP_004623.1	DAP3	Yes (Global)	Mitochondrion
194042990	10.62	12	1300	140.6	6.32	510.21	XP_001924891.1	NP_000611.1	NOS1	Yes (Global)	
194040423	28.49	11	372	39.9	9.48	510.11	XP_001929615.1	NP_055156.1	MTCH1	-	Mitochondrion
44890896	66.67	12	66	7.6	5.10	509.84	BAD12120.1	NP_001123910.1	SPTAN1	-	
194036886	16.21	9	506	53.7	8.21	509.17	XP_001927869.1	NP_000300.1	PPOX	-	Mitochondrion
162138236	5.38	10	1265	140.1	7.40	506.11	ABX82822.1	NP_006286.1	VARS	Yes (9+0)	
194037910	20.13	13	313	34.4	6.52	505.44	XP_001924223.1	NP_001834.2	CNTN1	Yes (9+0)	
194038870	13.28	10	640	70.6	8.06	505.12	XP_001928503.1	NP_004554.2	PCK2	-	Mitochondrion
178056464	11.15	9	529	60.6	6.11	505.06	NP_001116693.1	NP_000511.2	HEXA	Yes (9+0)	
194041508	12.02	11	757	84.1	5.14	502.69	XP_001924735.1	NP_006149.2	NEFL	Yes (9+0)	
194038813	19.54	12	563	63.2	5.94	501.13	XP_001924849.1	NP_057190.2	SCFD1	Yes (9+0)	
167908793	7.43	9	1184	132.2	6.93	501.09	NP_001108142.1	NP_003322.3	TYK2	-	
51507647	24.75	11	295	33.6	6.10	499.78	CAE46349.1				

47523232	11.49	11	940	107.5	6.81	498.80	NP_998969.1	NP_055129.2	DDX58	-	
164664454	27.66	14	394	43.3	8.90	497.20	NP_001106914.1	NP_006108.2	PECI	Yes (9+0)	
194037636	33.49	13	209	23.3	5.34	496.16	XP_001927984.1	NP_036322.2	ALDH1L1	-	
194033945	15.93	10	408	45.4	5.16	495.92	XP_001925536.1	NP_005038.1	PSMD5	Yes (9+0)	
194041047	26.34	10	243	27.4	7.90	495.10	XP_001926114.1	NP_004042.1	BDH1	-	Mitochondrion
194042264	43.66	14	71	8.0	9.58	494.10	XP_001924961.1	NP_005262.1	GLUD1	-	Mitochondrion
194042691	1.75	11	4346	474.5	6.32	493.34	XP_001929357.1	NP_066267.2	ANK3	Yes (9+2/9+0)	
47522708	1.27	8	864	99.0	5.35	492.02	NP_999054.1	NP_005410.1	STAT2	-	
194040694	11.16	9	251	27.4	9.91	490.95	XP_001927364.1	NP_000273.2	PCCA	Yes (9+0)	Mitochondrion
194018686	26.13	12	199	22.4	9.31	488.98	NP_001123435.1	NP_065393.1	RTN4	Yes (9+0)	
194035905	4.11	10	2411	280.1	4.98	488.97	XP_001929304.1	NP_003117.2	SPTA1	Yes (9+0)	Serum
47523446	12.37	10	1091	123.1	5.27	488.68	NP_999348.1	NP_000713.2	CACNA2D1	Yes (9+0)	
47523744	14.18	10	529	58.2	6.49	488.60	NP_999507.1	NP_005100.1	OXSR1	-	
194034149	35.32	9	218	25.2	6.40	487.99	XP_001924714.1	NP_057366.2	AK3	Yes (9+2/9+0)	Mitochondrion
89886177	33.75	14	317	35.7	6.35	481.86	NP_001034839.1	NP_002446.2	MTX1	Yes (9+0)	Mitochondrion
20378702	21.70	10	364	40.5	5.92	481.25	AAM20945.1				
147225187	14.60	13	726	80.2	6.06	478.15	CAN13319.1	NP_000535.3	TAP2	Yes (9+0)	
23598133	21.17	10	359	39.8	5.27	477.89	AAN35110.1				
194045128	10.76	12	539	61.7	7.03	477.70	XP_001927166.1	NP_060181.2	GDPD2	Yes (Global)	
211578396	22.98	8	457	50.4	8.32	475.16	NP_001129982.1	NP_066923.3	NFS1	-	Mitochondrion
29027459	20.88	10	364	40.5	6.13	472.44	AAO62099.1				
178056623	27.98	11	243	27.0	7.30	472.27	NP_001116685.1	NP_004729.1	VAPB	Yes (9+0)	
194036227	23.73	10	472	52.5	6.64	470.44	XP_001929678	NP_003935.2	SELENBP1	Yes (9+0)	
90569225	37.37	10	99	11.6	4.73	469.64	ABD94501.1	NP_001123910.1	SPTAN1	-	
45359363	33.33	12	144	15.6	8.19	468.76	AAS59066.1	NP_056195.3	SAMM50	Yes (9+0)	Mitochondrion
62867359	29.41	8	170	19.3	5.25	468.32	BAD95982.1				
178056852	14.62	12	807	91.6	7.15	465.77	NP_001116541.1	NP_001081.1	ABCF1	Yes (9+2/9+0)	
6606313	54.17	12	96	11.6	8.46	465.04	AAF19166.1	NP_001226.2	SERPINH1	Yes (9+2/9+0)	Serum
116047849	37.57	11	189	22.4	5.72	462.99	ABJ53147.1	NP_000841.1	GSTM4	-	
18652158	16.94	10	360	39.9	5.92	461.92	AAL76982.1				
194038528	16.39	9	421	46.5	6.98	459.12	XP_001929053.1	NP_006812.3	ACOT2	-	Mitochondrion
41176612	45.74	10	94	10.5	4.67	453.11	AAR99598.1	NP_068656.2	FGG	-	Serum
194036104	12.45	7	490	54.4	6.21	451.36	XP_001929411.1	NP_079483.3	FLAD1	Yes (9+0)	
56606869	77.45	11	102	11.3	4.46	450.31	AAW02819.1	NP_004915.2	ACTN4	Yes (9+2/9+0)	
194045027	27.61	9	268	29.4	9.69	449.70	XP_001926000.1	NP_940852.3	APOOL	Yes (9+0)	
157427709	7.12	8	1026	117.3	5.62	447.22	NP_001098761.1	NP_005566.2	LNPEP	-	
194038437	13.28	9	580	65.9	6.11	447.10	XP_001925608.1	NP_071919.2	MPP5	Yes (9+2/9+0)	
194037945	26.12	10	268	29.8	7.64	446.77	XP_001924443.1	NP_004323.2	BPHL	Yes (9+0)	
23598145	21.98	11	364	40.6	5.76	446.24	AAN35116.1				
194036926	14.66	11	839	93.9	5.21	444.12	XP_001925499.1	NP_060472.2	OXR1	Yes (9+0)	Mitochondrion
194036421	11.27	7	772	86.3	5.38	442.04	XP_001924396.1	NP_001007554.1	CSDE1	-	
194039309	6.76	9	1717	192.4	6.06	441.09	XP_001929249.1	NP_055595.2	CUL7	-	
29027437	23.55	10	361	40.1	5.88	440.69	AAO62088.1				
15082142	40.74	8	108	11.7	7.34	438.82	AAK84036.1	NP_000627.2	SOD2	-	Mitochondrion
194041384	9.48	9	1034	117.0	8.68	436.52	XP_001925087.1	NP_212132.2	DOCK7	Yes (9+0)	
194036512	11.26	11	613	67.5	8.43	434.60	XP_001927385.1	NP_006612.2	AHCYL1	Yes (9+2/9+0)	
113205612	27.72	11	267	30.1	6.00	432.62	NP_001038006.1	NP_006545.1	MTX2	Yes (9+0)	Mitochondrion
194038751	30.11	10	269	30.1	9.66	432.15	XP_001924288.1	NP_085134.1	SLC25A21	-	Mitochondrion
219521982	24.19	8	339	37.8	5.49	431.32	NP_001137178.1	NP_009106.1	ERLIN2	Yes (9+0)	
194037239	27.27	8	297	33.4	7.21	429.86	XP_001926338.1	NP_003303.2	TST	-	Mitochondrion
178056175	24.91	7	269	29.4	6.05	424.53	NP_001116558.1	NP_940991.1	BSG	Yes (9+0)	
194043190	35.92	11	284	33.1	9.23	424.08	XP_001928943.1	NP_003625.2	NIPSNAP1	Yes (9+0)	
47523704	8.01	7	537	60.8	8.68	421.08	NP_999484.1	NP_002750.1	EIF2AK2	-	
5835868	6.19	1	226	25.0	9.99	419.21	NP_008639.1	YP_003024031.1	MT-ATP6	-	Mitochondrion
194034883	7.50	12	973	110.1	6.01	418.16	XP_001929396.1	NP_065908.1	VPS18	Yes (9+0)	
148231223	14.12	10	524	55.1	5.66	417.36	NP_001090898.1	NP_065797.2	MAVS	-	
201066356	2.23	9	986	109.9	6.81	414.96	NP_001128439.1	NP_004429.1	EPHA4	Yes (9+0)	
194043535	27.00	6	237	25.1	9.10	411.94	XP_001927120.1	NP_116172.2	CBR4	-	
194038210	14.36	9	599	66.8	6.32	411.51	XP_001924682.1	NP_005056.3	SEL1L	-	
194044288	7.09	9	846	87.4	10.08	411.06	XP_001926148.1	NP_001036041.1	RRBP1	Yes (9+2/9+0)	
138753471	51.55	10	161	18.1	4.50	410.68	CAM59483.1	NP_006817.1	YWHAQ	Yes (9+2/9+0)	
33468744	37.57	9	181	20.7	5.25	409.24	BAC81553.1				
156601158	14.43	11	769	84.6	6.74	408.53	ABU86738.1	NP_000202.2	ITGB2	-	
161511655	21.32	7	272	28.7	8.87	403.72	ABX71843.1				Serum
194033435	4.46	9	381	41.9	8.75	403.55	XP_001926443.1	NP_149972.1	LDHAL6B	-	
194042764	7.39	6	568	63.6	9.25	403.43	XP_001928175.1	NP_003892.2	SGPL1	-	
51507653	21.02	9	295	33.5	5.31	398.86	CAE46352.1				
194038857	6.80	7	1000	109.0	4.94	396.53	XP_001925868.1	NP_078934.3	IPO4	-	
194038633	7.28	7	1017	113.3	6.44	396.03	XP_001924247.1	NP_006706.2	MAN2C1	Yes (Global)	
194043043	19.16	8	261	29.2	7.36	391.31	XP_001926931.1	NP_006808.1	ERP29	Yes (9+0)	
61097883	3.27	5	887	101.2	7.01	390.67	NP_001012974.1	NP_002638.2	PIK3C3	Yes (9+0)	
44885994	6.95	9	662	75.5	5.69	390.59	BAD11809.1	NP_002453.2	MX1	-	
194043083	33.22	8	289	32.2	5.43	390.53	XP_001928729.1	NP_055545.1	MLEC	-	
148747594	29.25	12	318	34.3	5.97	386.13	NP_001092068.1	NP_000993.1	RPLP0	-	Ribosome
178056558	16.28	9	215	23.7	8.06	385.08	NP_001116652.1	NP_004153.2	RAB5A	Yes (9+2/9+0)	
277349569	15.59	8	513	55.4	8.24	384.32	NP_001162173.1	NP_006431.2	TXNRD2	-	Mitochondrion
47522828	3.65	11	768	86.1	6.30	382.61	NP_999166.1	NP_003225.2	TFRC	-	
47523870	39.29	8	224	25.0	6.01	382.47	NP_999573.1	NP_004896.1	PRDX6	Yes (9+2/9+0)	
194044373	15.68	5	389	43.3	6.81	381.81	XP_001927122.1	NP_065392.1	C20orf3	-	
111038267	17.11	6	450	50.0	6.39	380.96	ABH03530.1	NP_002204.2	ITGB5	-	
168828757	14.40	8	361	40.0	6.19	379.20	ACA33865.1				
148747342	5.32	6	1090	120.6	5.97	375.18	NP_001092055.1	NP_003655.3	AP3B1	Yes (9+0)	
164507	17.13	7	467	51.1	7.09	374.11	AAA51295.1				Serum
47523192	12.24	6	474	52.2	7.21	373.00	NP_998993.1				Serum
194035688	13.45	8	617	68.1	8.28	372.57	XP_001924875.1	NP_001909.2	DBT	Yes (9+2)	Mitochondrion

194037951	14.55	9	378	42.5	6.57	372.53	XP_001926779.1	NP_109591.1	SERPINB1	Yes (9+2/9+0)	Serum
56606867	47.89	7	71	8.3	5.33	370.60	AAW02818.1	NP_001123477.1	ACTN1	Yes (9+2/9+0)	
194040817	3.76	10	2290	267.0	5.30	368.46	XP_001925616.1	NP_002069.2	GOLGA4	Yes (9+2/9+0)	
194043483	39.63	9	270	30.0	5.63	365.32	XP_001929673.1	NP_000745.1	COMT	Yes (9+0)	
194038248	11.49	7	653	72.7	7.12	365.32	XP_001925968.1	NP_001010854.1	TTC7B	Yes (9+0)	
156120140	6.50	6	1246	137.5	6.21	364.72	NP_001095287.1	NP_008860.4	SKIV2L	Yes (9+0)	
47523266	8.72	9	562	61.7	7.09	364.47	NP_998954.1	NP_079509.5	COASY	Yes (9+0)	
194035589	9.50	7	853	98.8	8.56	363.41	XP_001924990.1	NP_055661.3	KIAA0196	Yes (9+0)	
194033889	16.27	7	381	41.5	8.10	362.74	XP_001925382.1	NP_115679.2	HSDL2	-	
194036638	15.97	6	288	32.7	6.99	362.26	XP_001924756.1	NP_057111.1	LACTB2	-	
194039712	9.75	2	277	31.7	8.02	362.00	XP_001927184.1	NP_002824.1	PTPN9	-	
194040681	7.65	5	353	41.5	9.60	361.08	XP_001925853.1	NP_064506.3	UGGT2	-	
47523746	32.51	7	243	25.7	7.83	360.98	NP_999508.1	NP_000311.2	QDPR	Yes (9+0)	
194043067	37.00	9	327	37.5	7.94	360.79	XP_001928267.1	NP_115690.3	COQ5	-	Mitochondrion
297307135	7.52	9	944	103.1	6.28	359.74	NP_001171998	NP_061141.2	UNC45A	-	
47522844	4.21	8	1661	186.7	6.51	358.09	NP_999174.1	NP_000055.2	C3	-	Serum
47522860	24.62	8	260	27.8	8.68	357.20	NP_999184.1	NP_066284.2	DHRS4	Yes (9+0)	
62082662	7.59	8	435	49.6	6.35	355.74	AAX62160.1	NP_002094.2	GYS1	-	
194037681	3.55	5	1410	161.7	5.66	355.19	XP_001926390.1	NP_003557.2	EEA1	Yes (9+2/9+0)	
194041147	6.48	12	1065	121.8	6.11	353.09	XP_001925272.1	NP_000087.1	CP	-	Serum
194038973	25.35	9	288	32.0	7.18	353.07	XP_001929258.1	NP_000261.2	PNP	-	
194040608	20.77	7	337	39.2	8.38	352.60	XP_001928815.1	NP_001073138.1	CAB39L	-	
56417363	15.44	8	395	42.7	7.65	350.41	AAV90625.1	NP_001900.1	CTSD	-	
219522024	5.29	5	416	46.5	5.29	350.00	NP_001137199.1	NP_057626.2	MST4	-	
194036773	10.34	8	793	91.3	5.11	349.17	XP_001927795.1	NP_055785.2	KIFAP3	Yes (9+2/9+0)	
194044039	24.49	7	147	16.9	6.51	348.93	XP_001926810.1	NP_005268.1	GPM6A	Yes (9+0)	
196122275	9.32	9	1041	115.2	5.74	348.04	ACG69792.1	NP_002201.1	ITGAV	Yes (9+0)	
33468740	16.57	6	169	19.3	5.07	346.76	BAC81551.1				
194041008	13.13	6	358	40.5	6.32	346.04	XP_001926476.1	NP_057390.1	DNAJB11	Yes (9+2/9+0)	
146741286	5.65	7	1204	132.7	7.05	344.29	BAF62298.1	NP_005219.2	EGFR	-	
194045003	2.89	3	1039	116.1	6.02	342.84	XP_001926323.1	NP_002628.2	PHKA1	-	
194033668	14.86	9	592	66.7	6.13	341.99	XP_001925593.1	NP_004477.3	GOLGA2	Yes (9+2/9+0)	
194043603	36.44	10	247	28.5	5.21	341.09	XP_001924932.1	NP_919337.1	STX2	-	
5835872	7.84	8	459	51.8	9.54	340.42	NP_008643.1	YP_003024035.1	ND4	-	Mitochondrion
270289750	12.20	8	541	58.5	7.42	338.81	NP_001161887.1	NP_002970.2	SCP2	-	Mitochondrion
281324303	19.14	7	350	38.8	5.20	338.55	ADA60693.1				
47522702	16.31	7	325	36.5	6.99	337.23	NP_999055.1	NP_006057.1	AKR1A1	Yes (9+0)	
194044779	8.11	7	518	59.7	6.05	337.11	XP_001928144.1	NP_689794.1	MOSPD2	-	
62529273	9.12	6	691	74.6	5.15	336.96	AAX84942.1	NP_001741.4	CAST	-	
285818414	24.78	7	456	51.3	5.44	336.33	ADC38880.1	NP_002005.1	FKBP4	Yes (9+2/9+0)	
194043676	6.60	5	500	57.6	8.46	334.96	XP_001924701.1	NP_079415.3	ARMC9	-	
194034195	20.41	6	338	38.1	7.80	334.58	XP_001925715.1	NP_000691.1	ANXA1	Yes (9+2/9+0)	
194033835	26.32	8	247	28.5	9.31	333.29	XP_001925026.1	NP_056284.1	NIPSNAP3A	Yes (9+0)	
194035833	8.74	9	709	78.6	6.09	331.52	XP_001928821.1	NP_056146.1	NCSTN	-	
194042282	10.39	9	356	38.3	10.26	329.19	XP_001925311.1	NP_005262.1	GLUD1	-	Mitochondrion
197251936	20.27	8	370	41.6	8.18	328.60	NP_001127827.1	NP_006400.2	ARPC1A	Yes (9+0)	
51493747	14.11	5	326	35.6	8.82	325.84	AAU04861.1	NP_001957.2	EHHADH	-	
194036667	6.94	6	591	65.3	8.51	325.61	XP_001926336.1	NP_037389.4	SGK3	-	
47523060	9.78	6	511	57.6	6.27	324.34	NP_999293.1	NP_005596.2	PPP3CA	Yes (9+2/9+0)	
47523430	2.63	7	1367	154.9	5.86	323.59	NP_999337.1	NP_000866.1	IGF1R	-	
194043996	8.94	6	414	45.1	8.78	322.77	XP_001925935.1	NP_071748.2	OSGEPL1	-	
194041049	13.50	7	637	69.6	5.90	321.82	XP_001926202.1	NP_004078.2	DLG1	Yes (9+2/9+0)	
213021239	10.67	7	506	55.1	6.55	321.09	NP_001132942.1	NP_067017.2	SLC30A1	-	
45268993	26.97	7	304	33.9	7.06	321.04	AAS55909.1	NP_006301.3	NPEPPS	Yes (9+0)	
194044826	14.22	7	415	47.9	8.82	320.96	XP_001927474.1	NP_001135858.1	PDK3	Yes (9+0)	Mitochondrion
194038457	27.53	7	316	34.9	9.07	317.72	XP_001928802.1	NP_057110.3	RDH11	Yes (9+0)	
509403	10.77	8	427	48.7	5.58	317.12	CAA84355.1	NP_005795.2	DDX39	-	
16506695	3.17	9	2300	252.4	6.14	315.60	AAL23907.1	NP_000867.2	IGF2R	-	
48675951	7.93	8	555	62.7	6.49	314.87	NP_001001641.1	NP_001970.2	EPHX2	-	
262204898	7.75	6	581	65.9	6.29	314.80	BAI48029.1	NP_000886.1	LTA4H	Yes (9+0)	
47523714	9.68	7	620	67.6	6.49	314.11	NP_999490.1	NP_620124.1	RHOT2	Yes (9+0)	Mitochondrion
194041915	3.01	6	1861	206.5	5.80	313.34	XP_001928428.1	NP_004184.1	GBF1	Yes (9+0)	
7108677	32.26	7	124	14.2	4.94	312.17	AAF36511.1	NP_003325.2	UBA1	-	
194044822	18.75	4	272	30.5	6.44	312.10	XP_001927404.1	NP_006397.1	PRDX4	Yes (9+2/9+0)	
194041043	19.25	7	187	20.6	10.59	311.32	XP_001926007.1	NP_976060.1	BDH1	-	Mitochondrion
262204920	23.93	7	280	29.8	6.52	310.87	BAI48040.1	NP_060911.2	PECR	-	
6007614	4.50	6	622	68.7	8.62	310.62	AAF00977.1	NP_003031.3	SLC4A2	-	
117606675	7.08	5	226	25.0	8.88	310.31	ABK41958.1	NP_003042.3	SLC16A1	Yes (9+0)	
119663043	34.17	5	120	13.0	7.08	310.18	CAJ45466.1				Serum
194038349	9.12	2	351	38.2	6.46	309.83	XP_001926466	NP_001076.2	SERPINA3	-	Serum
194033453	9.93	5	443	50.4	8.12	308.72	XP_001929253.1	NP_060379.2	RMND1	Yes (Global)	
194042948	18.38	7	272	31.8	7.28	305.51	XP_001929498.1	NP_001035196.1	HVCN1	-	
194037091	7.69	8	533	59.6	5.83	304.72	XP_001927203.1	NP_003900.1	CPNE3	-	
194037904	21.43	7	224	25.4	8.75	304.20	XP_001927215.1	NP_001687.1	ATP6V1E1	Yes (9+2/9+0)	
194040683	8.79	6	762	87.3	5.49	303.14	XP_001925875.1	NP_064506.3	UGGT2	-	
194038408	33.49	6	209	22.9	5.59	300.66	XP_001924364.1	NP_056255.2	MTHFD1L	-	Mitochondrion
194035680	2.67	9	487	56.6	6.60	300.51	XP_001925424.1	NP_001559.1	EIF3E	Yes (9+0)	
194038347	5.91	2	423	46.6	6.21	300.11	XP_001928637.1	NP_001076.2	SERPINA3	-	Serum
194033616	6.89	6	842	91.8	6.52	300.05	XP_001924749.1	NP_073744.2	FAM129B	-	
194033565	7.40	6	838	95.2	5.17	299.77	XP_001927144.1	NP_036329.3	RABGAP1	-	
194037798	10.14	9	483	53.0	5.83	298.64	XP_001925480.1	NP_055617.1	KIAA0528	Yes (9+0)	
160333742	7.92	8	240	26.4	4.55	297.80	NP_001103895.1	NP_055695.2	CD302	-	
194041767	5.00	9	580	63.3	7.83	297.65	XP_001927663.1	NP_056446.4	TCTN3	Yes (9+0)	
21914408	11.50	7	226	25.1	7.52	297.18	AAM81376.1	NP_001760.1	CD9	-	
285818454	7.09	7	875	98.5	6.71	296.80	ADC38900.1	NP_061878.3	MIOS	-	

112292697	14.96	8	361	40.3	6.37	296.08	ABI14828.1				
150251019	22.87	4	223	25.3	8.40	293.71	ABR67998.1	NP_037542.1	AK4	-	Mitochondrion
210062464	20.06	5	314	34.3	6.62	293.21	ABY85807.2				Serum
194034135	5.19	4	905	100.2	7.34	293.02	XP_001924252.1	NP_079172.2	ERMP1	Yes (Global)	
194038835	24.49	7	294	31.2	9.01	292.75	XP_001926763.1	NP_064580.2	SDR39U1	-	
194038897	5.51	5	363	40.7	8.13	289.66	XP_001924450.1	NP_036376.2	SLC7A8	-	
47522786	12.60	6	508	56.9	7.88	286.80	NP_999145.1	NP_006750.3	UGP2	Yes (9+0)	
194038584	7.11	7	985	107.4	5.92	286.53	XP_001926782.1	NP_149107.4	NEK9	-	
47522960	9.34	6	289	31.7	7.69	286.28	NP_999238.1	NP_001748.1	CBR1	Yes (9+0)	
194044583	10.73	6	662	72.9	8.31	286.14	XP_001925939.1	NP_065069.1	RALGAPB	-	
194035955	1.97	6	1570	173.2	5.66	286.12	XP_001927750.1	NP_937879.1	ARHGEF11	Yes (9+0)	
55742658	2.01	7	3139	344.6	6.39	286.01	NP_999129.1	NP_002102.4	HDH	-	
148224365	21.69	5	272	30.6	6.01	283.88	NP_001090922.1	NP_004921.1	CAPZB	Yes (9+0)	
1907268	34.07	8	226	25.5	7.75	278.87	CAA62960.1	NP_001096137.1	PSMA4	Yes (9+0)	
194037792	12.93	4	348	39.1	5.25	278.48	XP_001925124.1	NP_005495.2	BCAT1	Yes (9+0)	
168208446	14.96	8	361	40.6	5.99	278.30	ACA21808.1				
212549623	13.05	5	406	47.0	5.38	278.15	NP_001131101.1	NP_055866.1	ERP44	-	
72535208	9.62	8	707	80.7	8.00	277.88	NP_001026966.1	NP_058197.2	OAS2	-	Mitochondrion
194041831	11.00	5	582	63.2	8.09	277.85	XP_001929210.1	NP_116098.2	PYROXD2	-	
194042130	6.33	7	458	50.3	10.17	277.70	XP_001927430.1	NP_998814.1	SFXN4	-	Mitochondrion
80971504	14.92	5	295	32.9	4.87	277.61	NP_001032223.1	NP_001012321.1	RPSA	Yes (9+2)	Ribosome
194038415	7.40	5	933	100.8	6.74	277.08	XP_001924552.1	NP_005947.3	MTHFD1	Yes (9+2/9+0)	
194035052	16.76	3	173	19.9	9.28	276.53	XP_001929064.1	NP_057614.1	RAB8B	Yes (9+2/9+0)	
37787313	16.25	5	480	51.5	6.09	275.98	AAP69607.1	NP_660202.3	NAPRT1	-	
194038611	30.15	5	199	22.0	7.14	274.20	XP_001926158.1	NP_665877.1	GSTZ1	-	
164023822	12.40	5	250	29.5	10.67	274.10	NP_001106688.1	NP_000962.2	RPL7	-	Ribosome
194044571	8.12	4	542	60.1	7.42	273.25	XP_001928649.1	NP_005408.1	SRC	Yes (9+2/9+0)	
281324325	12.19	6	361	40.1	5.92	272.57	ADA60704.1				
194040771	7.40	5	919	100.5	6.70	272.43	XP_001926328.1	NP_001001486.1	ATP2C1	Yes (9+2/9+0)	
121483580	12.26	7	514	59.7	6.24	272.36	ABM54178.1	NP_001367.2	DYNC1H1	Yes (9+2/9+0)	
147903595	18.18	5	286	33.0	5.85	271.55	NP_001090924.1	NP_006126.1	CAPZA1	Yes (9+0)	
194043375	15.49	5	284	33.3	6.65	271.03	XP_001929544.1	NP_002737.2	MAPK3	Yes (9+2/9+0)	
194040283	11.24	6	694	79.1	5.97	269.32	XP_001925428.1	NP_072047.4	VPS52	Yes (9+0)	
153791794	1.52	5	2177	250.6	8.62	265.71	NP_001093398.1	NP_000251.3	MYO7A	Yes (9+2/9+0)	
194037982	15.66	4	249	27.4	6.23	265.13	XP_001925942.1	NP_110437.2	TXNDC5	Yes (9+0)	
194041367	5.14	4	798	85.9	8.32	264.22	XP_001924516.1	NP_037468.1	SEC61A1	Yes (9+0)	
194042025	6.78	6	826	93.5	7.72	262.44	XP_001927910.1	NP_065969.3	GPAM	Yes (9+0)	Mitochondrion
195539478	7.58	5	871	98.2	7.50	261.61	NP_001124201.1	NP_067638.3	TRPV4	-	
194035155	7.10	6	873	99.5	8.57	261.14	XP_001925514.1	NP_009145.1	SEC63	Yes (9+0)	
194034987	24.86	5	185	20.4	5.27	260.98	XP_001926469.1	NP_001073936.1	MYO5B	Yes (9+0)	
194041118	13.37	5	374	41.8	7.37	259.38	XP_001926115.1	NP_064576.1	MRPS22	-	Mitochondrion
194040827	20.92	7	325	34.2	8.94	258.25	XP_001925834.1	NP_031361.2	DLEC1	-	
47522662	17.01	6	194	21.6	4.70	257.61	NP_999076.1	NP_006658.1	PGRMC1	Yes (9+0)	
3746944	31.85	7	135	15.1	5.01	257.49	AAC64130.1	NP_002624.2	PGM1	Yes (9+2/9+0)	
194042214	5.80	5	345	37.1	9.89	256.87	XP_001927462.1	NP_055209.2	GHITM	Yes (9+0)	
158518476	23.19	7	332	36.8	8.60	256.69	NP_001103527.1	NP_036371.1	SIRT3	-	Mitochondrion
56711366	20.77	6	260	29.4	7.85	256.56	NP_001008688.1	NP_005172.1	CA3	-	
194037724	6.76	6	710	80.5	9.06	255.98	XP_001928177.1	NP_059136.2	MDM1	Yes (9+0)	
47523632	13.39	7	239	27.3	5.57	255.20	NP_999444.1	NP_002809.2	PSME2	-	
112980817	17.54	6	211	24.6	11.18	254.76	ABI29190.1	NP_000959.2	RPL4	-	Ribosome
194043670	7.04	3	341	39.9	6.89	253.75	XP_001924776.1	NP_057373.1	CAB39	-	
262272069	6.97	3	445	51.5	6.93	253.74	NP_001160145.1	NP_003809.1	CDS2	Yes (9+0)	Mitochondrion
194038961	17.59	6	216	24.2	7.39	251.36	XP_001929102.1	NP_116235.2	RAB2B	Yes (9+2/9+0)	
68132074	47.11	4	121	13.7	6.77	250.17	AAY85303.1	NP_055040.2	PPP2R1A	Yes (9+2/9+0)	
23598087	14.20	7	169	18.8	8.65	249.97	AAN35094.1				
194041927	14.41	5	236	26.7	8.07	248.31	XP_001925933.1	NP_005727.1	ACTR1A	Yes (9+2/9+0)	
194034199	17.34	6	248	27.6	5.44	247.81	XP_001928042.1	NP_002779.1	PSMA3	Yes (9+0)	
29888113	10.20	4	255	28.1	5.71	246.23	AAP03004.1				
162138213	6.27	3	558	62.9	8.25	245.96	ABX82812.1	NP_066983.1	BAT5	-	
194036686	14.08	3	206	21.6	8.47	245.82	XP_001926083.1	NP_001158228.1	ASPH	-	
47523420	6.87	5	335	36.5	6.77	245.53	NP_999331.1	NP_055290.1	DHDH	-	
22651586	14.49	4	276	31.8	8.66	245.25	AAM01192.1	NP_002728.1	PRKCA	Yes (9+2/9+0)	
47523694	6.02	4	266	28.1	5.20	245.01	NP_999483	NP_001003962.1	CAPNS1	Yes (9+2/9+0)	
194042938	1.33	7	676	79.5	8.73	243.66	XP_001929381.1	NP_001137251.1	IFT81	Yes (9+2/9+0)	
194036695	9.06	4	298	31.7	9.70	243.36	XP_001926739.1	NP_002856.1	RAB2A	Yes (9+2/9+0)	
194038538	12.58	6	469	50.6	7.47	242.73	XP_001929141.1	NP_872282.1	COQ6	-	Mitochondrion
194040293	19.62	7	423	45.1	6.80	242.36	XP_001925503.1	NP_003181.3	TAPBP	-	
194044054	18.06	8	227	26.0	6.90	242.23	XP_001924754.1	NP_699174.1	ENPP6	-	
47522874	17.11	5	380	42.9	5.35	242.20	NP_999191.1	NP_002725.1	PRKAR1A	Yes (9+2/9+0)	
47523668	21.94	7	155	17.6	9.66	241.81	NP_999465.1	NP_665735.1	MGST1	-	Mitochondrion
194036345	9.17	6	763	87.1	5.71	240.72	XP_001926313.1	NP_001002811.1	PDE4DIP	Yes (9+2/9+0)	
50604627	8.20	5	683	75.9	7.69	238.92	AAT79534.1	NP_001986.2	ACSL1	-	Mitochondrion
194044904	2.19	1	411	44.9	6.42	238.77	XP_001926493.1	NP_001116078.1	LAMP2	-	
38569737	2.40	5	1418	161.0	6.34	237.37	AAR24388.1	NP_001009567.1	MRC1L1	-	
13569571	20.97	4	267	30.0	5.38	237.31	AAK31151.1	NP_002600.1	PDGFRB	Yes (9+0)	
194044500	8.38	4	489	53.9	5.49	237.20	XP_001929362.1	NP_000169.1	GSS	-	
2970693	4.92	4	996	114.9	7.65	237.20	AAC06039.1	NP_002218.2	JAK1	-	
154147607	9.57	6	700	79.8	4.98	236.40	NP_001093658.1	NP_001739.2	CAPN2	Yes (9+2/9+0)	
212549619	14.53	6	468	54.2	6.15	236.32	NP_001131099.1	NP_055399.1	ERO1L	-	
194036298	3.91	4	742	82.6	5.57	234.34	XP_001926797.1	NP_055664.3	SV2A	Yes (9+0)	
194044996	19.19	5	198	22.2	9.92	234.08	XP_001928223.1	NP_000998.1	RPS4X	Yes (9+0)	Ribosome
157427738	13.23	6	310	33.6	8.43	233.33	NP_001098778.1	NP_036373.1	SIRT5	-	
194036543	9.14	5	514	58.6	6.71	233.09	XP_001925705.1	NP_006504.2	SARS	Yes (9+0)	
29335683	26.27	6	118	13.8	4.55	232.64	CAD83090.1	NP_002046.1	GFAP	Yes (9+0)	
194042568	5.97	6	670	73.1	5.76	231.89	XP_001924892.1	NP_005637.3	TARBP1	-	

47522728	4.14	5	1086	120.7	6.57	231.30	NP_999114.1	NP_005063.1	SLC12A4	-	
298160993	7.28	3	151	16.5	6.76	231.20	NP_001177169	NP_005267.2	GPD1	Yes (9+2)	
194041396	16.91	6	207	22.2	9.26	230.84	XP_001928827.1	NP_001689.1	AUH	-	Mitochondrion
194036727	7.07	5	580	64.2	5.69	230.33	XP_001926285.1	NP_002341.1	LYN	-	
113205780	17.58	5	330	35.2	8.15	229.97	NP_001038049.1	NP_001880.2	CRYZ	Yes (9+0)	
194035496	3.76	4	691	75.6	6.49	229.46	XP_001925284.1	NP_079527.1	ARHGAP39	-	
194042639	2.43	1	535	57.8	9.35	229.35	XP_001925518.1	NP_004569.2	RAB4A	Yes (9+2/9+0)	
194042006	7.18	7	599	67.1	5.82	227.59	XP_001924595.1	NP_065116.3	XPNPEP1	-	
1916278	51.95	5	77	8.7	7.12	226.22	AAB51264.1	NP_000500.2	FGG	-	Serum
1839512	10.34	3	174	19.1	5.43	225.50	AAB47132.1	NP_001093422.2	ITPR1	-	
54020970	3.92	2	536	59.8	7.94	224.41	NP_001005730.1	NP_001005750.1	GBA	-	
164664472	7.14	4	602	69.9	8.18	224.04	NP_001106922.1	NP_006236.1	PPP2R5D	Yes (9+0)	
194037976	13.37	3	344	38.1	6.30	222.45	XP_001925820.1	NP_110437.2	TXNDC5	Yes (9+0)	
194038855	6.03	2	348	37.9	7.24	221.58	XP_001928049.1	NP_057660.2	GMPR2	-	
294489384	5.93	6	894	99.4	8.48	221.56	NP_001170960.1	NP_064504.2	ZC3HAV1	-	
116175265	10.03	4	299	33.1	5.90	221.32	NP_001070688.1	NP_690608.1	RGN	-	
162952052	12.84	6	623	67.8	7.49	221.04	NP_001106151.1	NP_001055.1	TKT	Yes (9+0)	
194035236	3.54	5	508	55.9	6.98	219.82	XP_001924454.1	NP_056414.1	PGM3	-	
4538854	9.25	5	465	54.2	6.76	219.67	CAB39532.1	NP_998784.1	ATP6V1H	Yes (9+0)	
166236027	19.69	4	320	35.0	6.70	219.62	ABY85805.1				Serum
194036794	23.62	3	127	14.2	10.43	217.65	XP_001928685.1	NP_001137146.1	BRP44	-	
198282001	10.57	5	246	28.7	9.60	217.65	NP_001123683.1	NP_003192.1	TFAM	-	Mitochondrion
17062056	43.59	4	78	9.1	4.60	217.20	AAL34983.1	NP_002046.1	GFAP	Yes (9+0)	
194036318	7.34	5	259	28.4	9.74	214.57	XP_001928004.1	NP_003837.1	PEX11B	Yes (9+0)	
219521974	3.35	7	537	59.0	5.71	213.66	NP_001137175.1	NP_003906.2	CPNE1	-	
49274615	4.72	5	784	86.5	5.54	213.28	NP_001001860.1	NP_001005333.1	MAGED1	-	
47522862	2.80	4	1214	133.4	5.83	212.38	NP_999185.1	NP_001954.2	EGF	-	Serum
113205774	7.40	5	770	88.0	6.30	211.09	NP_001038045.1	NP_003141.2	STAT3	Yes (9+0)	
194036835	4.36	4	596	64.7	8.28	210.80	XP_001924895.1	NP_000687.3	ALDH9A1	-	
194043696	1.02	3	2357	257.7	6.76	210.75	XP_001925648.1	NP_060688.1	USP40	-	
82465299	11.38	2	167	17.7	9.38	210.70	CAJ43431.1	NP_001104026.1	FLNA	Yes (9+0)	
194037093	6.05	4	314	35.7	8.16	210.58	XP_001927382.1	NP_057117.2	FAM82B	Yes (9+0)	
21636588	53.33	5	45	5.0	8.73	210.31	AAM70051.1	NP_001001973.1	ATP5C1	-	Mitochondrion
194043873	10.61	3	179	20.5	10.23	210.20	XP_001926172.1	NP_075066.1	MRPL44	-	Mitochondrion
194041813	4.18	3	479	54.0	8.24	209.70	XP_001929069.1	NP_060895.1	PI4K2A	-	
47522666	14.21	4	373	42.0	6.74	207.95	NP_999074.1	NP_001028216.1	GLUL	Yes (9+0)	
194033839	12.50	3	248	28.7	9.28	207.59	XP_001925441.1	NP_056284.1	NIPSNAP3A	Yes (9+0)	
22770997	11.25	4	480	52.9	6.18	207.48	AAN06824.1	NP_001087240.1	TXNRD1	Yes (Global)	
194040465	10.21	3	421	48.1	7.71	206.14	XP_001927489.1	NP_005923.2	MIPEP	-	Mitochondrion
194033672	2.59	3	810	94.0	7.94	206.04	XP_001928885.1	NP_062540.2	LRRC8A	Yes (9+2/9+0)	
226372953	12.17	4	493	54.6	6.48	202.92	NP_001139772.1	NP_003079.1	FSCN1	Yes (9+0)	
562016	23.92	5	209	24.0	6.23	202.31	AAA82036.1	NP_006487.1	GNAI3	Yes (9+2/9+0)	
194038861	2.61	3	1073	119.7	6.67	201.56	XP_001928270.1	NP_060469.4	RNF31	-	
89886173	3.82	5	1046	116.8	6.70	200.58	NP_001034837.1	NP_858058.1	OGT	Yes (9+2/9+0)	
194042883	3.85	4	1118	124.9	6.89	199.64	XP_001925813.1	NP_003950.1	HIP1R	Yes (9+0)	
194040517	4.05	4	1210	137.9	8.84	199.59	XP_001928098.1	NP_075463.2	FRY	Yes (9+0)	
5835864	7.49	5	347	39.0	9.76	199.10	NP_008635.1	YP_002124303.1	ND2	-	
89574001	14.21	5	359	40.5	6.86	198.46	ABD77226.1	NP_005887.2	IDH1	Yes (9+0)	
58801555	7.41	4	432	47.7	6.29	198.17	NP_001011727.1	NP_000678.1	AHCY	Yes (9+2/9+0)	
194037016	4.12	2	582	63.9	9.25	197.62	XP_001929151.1	NP_848927.2	MTDH	Yes (9+0)	
194036565	10.97	6	556	62.7	5.58	197.39	XP_001927252.1	NP_001041675.1	CLCC1	-	
163310773	18.39	4	223	23.8	4.88	196.46	NP_001090990.2	NP_006311.2	PGRMC2	Yes (9+0)	
219382684	21.17	4	222	25.9	6.71	196.07	ACL14180.1	NP_002531.3	ODF2	Yes (9+2/9+0)	
158635942	10.80	5	398	45.7	7.31	195.73	NP_001098775.1	NP_003253.1	SEC62	-	
194041066	5.43	3	405	44.2	6.67	194.57	XP_001929024.1	NP_002204.2	ITGB5	-	
47523544	1.78	3	1746	191.3	5.15	193.92	NP_999395.1	NP_002151.2	TNC	Yes (9+0)	
194034795	17.26	5	168	18.3	9.63	193.79	XP_001924712.1	NP_067022.1	SQRDL	-	Mitochondrion
41688313	5.97	4	771	86.5	5.41	193.64	BAD08664.1	NP_078789.2	FYCO1	Yes (9+2/9+0)	
164708	14.12	3	255	28.7	7.55	190.52	AAA31133.1	NP_066289.2	UBC	Yes (9+2/9+0)	
194033405	16.12	5	397	41.3	7.43	189.35	XP_001928380.1	NP_005882.2	ACAT2	-	
194044820	8.16	2	245	28.1	6.54	188.84	XP_001926441.1	NP_001028755.2	ACOT9	-	Mitochondrion
343072	40.00	7	25	3.0	10.17	187.70	AAA32030.1	YP_003024030.1	MT-ATP8	-	Mitochondrion
194035700	9.91	3	222	25.8	6.64	187.34	XP_001925233.1	NP_000635.2	AGL	-	
148747492	3.89	3	642	65.8	7.52	187.30	NP_001092053.1	NP_000414.2	KRT2	-	
194044290	5.94	3	387	44.9	7.09	185.26	XP_001926522.1	NP_055241.1	SNX5	-	
153012290	5.23	5	153	16.9	9.58	184.77	ABS50358.1	NP_006507.2	SLC2A1	Yes (9+0)	
194035029	3.73	2	429	49.4	8.84	184.76	XP_001927058.1	NP_071331.2	CSNK1G1	Yes (9+2/9+0)	
195562223	10.67	3	300	34.3	7.36	184.67	ACG50182.1	NP_690601.1	ARPC2	-	
194044003	8.57	2	140	15.8	4.88	183.66	XP_001924740.1	NP_002185.1	INPP1	Yes (9+0)	
194035562	1.75	6	1085	120.3	7.42	183.43	XP_001924570.1	NP_060952.2	ASAP1	-	
47523636	3.16	3	1234	138.5	6.68	182.40	NP_999446.1	NP_000177.2	CFH	Yes (9+0)	Serum
194037514	1.85	3	594	65.4	5.06	181.08	XP_001927687.1	NP_001973.2	ERBB3	-	
194035979	13.43	2	216	24.8	9.44	181.02	XP_001924915.1	NP_078816.2	MRPL24	-	Mitochondrion
194034342	4.79	5	605	68.0	5.82	180.78	XP_001926644.1	NP_060264.3	KIAA1797	-	
190360653	6.49	3	262	29.6	8.78	180.40	NP_001121932.1	NP_001073941.1	FITM2	-	
194041404	8.45	4	485	53.9	6.28	179.59	XP_001926450.1	NP_006406.1	SPTLC1	Yes (Global)	
194044361	15.44	5	298	33.4	5.47	178.92	XP_001928328.1	NP_071363.1	NAPB	Yes (9+2/9+0)	
194034043	7.93	3	353	38.2	8.62	178.59	XP_001925894.1	NP_036335.1	GRHPR	Yes (9+0)	
194042090	5.56	4	665	74.0	8.43	178.56	XP_001925646.1	NP_079291.2	HSPA12A	Yes (9+0)	
297591961	2.12	4	614	69.4	7.72	178.07	NP_001172069	NP_055051.1	GNPAT	Yes (9+0)	
22774002	5.55	3	541	58.2	6.54	177.54	AAN07167.1				Serum
194044496	2.57	4	662	70.5	5.12	177.09	XP_001929330.1	NP_821158.2	GGT7	-	
531145	35.14	2	37	4.2	9.32	175.73	AAA20914.1	NP_002464.1	MYH9	Yes (9+2/9+0)	
194035678	14.14	4	290	33.1	9.35	175.65	XP_001925316.1	NP_055488.1	TTC35	Yes (9+0)	
1839510	28.03	4	132	14.8	5.78	175.43	AAB47131.1	NP_001093422.2	ITPR1	-	

114326179	10.11	4	188	21.5	9.52	174.52	NP_001041538.1	NP_006398.1	ARL6IP5	-	
194042148	4.55	4	1078	119.6	5.78	172.81	XP_001927517.1	NP_009121.1	SEC23IP	Yes (9+0)	
194041120	2.67	3	1125	126.6	5.60	172.37	XP_001926139.1	NP_004757.1	COPB2	Yes (9+2/9+0)	
147223350	7.51	5	892	94.1	7.08	171.03	CAN13170.1	NP_000278.3	PEX6	-	
41688291	20.81	3	149	16.8	5.54	170.70	BAD08645.1	NP_078789.2	FYCO1	Yes (9+2/9+0)	
264681474	7.48	2	361	40.5	8.27	170.32	NP_001161108.1	NP_057006.1	NSDHL	-	
194040306	1.05	5	855	94.0	8.62	170.19	XP_001925606.1	NP_006763.2	SYNGAP1	-	
194038431	14.68	5	361	38.8	5.38	169.67	XP_001925486.1	NP_001019389.1	GPHN	Yes (9+0)	
194044250	2.49	3	1124	128.1	6.10	168.82	XP_001926187.1	NP_056007.1	PLCB1	-	
194038715	2.78	3	1223	133.9	6.43	168.34	XP_001926127.1	NP_002490.2	NEO1	Yes (9+0)	
7288152	18.09	3	282	31.4	7.23	168.31	BAA92850.1	NP_001975.1	ESD	-	
194037864	13.90	4	259	28.4	7.44	168.28	XP_001925656.1	NP_057403.1	COPS7A	Yes (9+0)	
45359365	18.85	3	122	13.5	5.02	167.51	AAS59067.1	NP_056255.2	MTHFD1L	-	Mitochondrion
47523914	5.17	2	503	56.8	8.12	165.81	NP_999597.1	NP_000777.1	CYP51A1	Yes (Global)	
82542245	3.33	3	751	84.7	4.81	165.75	ABB82034.1	NP_958817.1	APP	-	
89275684	6.08	3	296	33.4	5.97	165.69	ABD66221.1	NP_000055.2	C3	-	Serum
194044632	3.93	3	610	67.7	9.07	165.19	XP_001927442.1	NP_001118228.1	PABPC1L	-	
194034444	9.35	2	278	31.6	4.89	165.15	XP_001928284.1	NP_110382.3	TMX1	-	
194042750	7.54	3	398	43.6	8.53	164.69	XP_001925115.1	NP_066952.1	PPA1	Yes (9+0)	
47523688	7.63	4	249	28.7	7.28	164.68	NP_999476.1	NP_000793.1	FOLR1	-	
194035526	2.24	3	1117	124.2	6.49	163.95	XP_001926231.1	NP_113654.4	TRAPPC9	-	
194043481	4.06	2	961	104.2	6.79	163.33	XP_001929677.1	NP_001661.1	ARVCF	Yes (9+2/9+0)	
21229475	8.92	2	157	17.8	9.47	163.19	AAL40813.2	NP_002047.2	GFPT1	-	
194042820	1.58	2	1841	197.9	6.86	163.08	XP_001928205.1	NP_055852.2	KIAA0913	-	
194037790	8.35	5	395	44.3	6.98	162.79	XP_001925095.1	NP_005495.2	BCAT1	Yes (9+0)	
148226851	12.50	4	88	10.3	9.95	162.45	NP_001090933.1	NP_001003713.1	ATP5J2	-	Mitochondrion
194038274	1.65	3	1942	223.4	5.34	161.74	XP_001926860.1	NP_004230.2	TRIP11	-	
114199061	31.00	4	100	10.8	5.36	161.21	ABI54124.1				Serum
195182334	29.27	4	82	9.3	5.36	161.15	CAQ34911.1	NP_000199.2	INSR	-	
194038475	2.62	2	496	56.2	8.54	160.52	XP_001925531.1	NP_060669.1	EXD2	-	
194045011	1.86	3	753	82.6	9.38	159.75	XP_001928754.1	NP_004290.2	ABCB7	-	Mitochondrion
1754491	8.76	3	388	43.9	5.67	159.73	BAA09616.1	NP_000629.3	VTN	Yes (9+0)	Serum
4995880	7.57	4	317	35.3	9.09	159.60	CAB44278.1	NP_002299.2	LGALS9	-	
9968805	8.44	2	225	25.6	7.49	159.02	CAC06755.1	NP_001076.2	SERPINA3	-	Serum
194040853	10.98	3	255	29.4	6.46	158.84	XP_001926855.1	NP_065080.1	LZTFL1	-	
194040344	2.81	3	1102	120.5	6.33	158.15	XP_001926579.1	NP_056060.2	ANKS1A	Yes (9+2/9+0)	
194043541	1.41	2	1704	195.9	7.85	156.93	XP_001927668.1	NP_060101.3	DDX60	-	
47522710	2.28	1	659	73.2	6.92	156.69	NP_999050.1	NP_005898.2	MAN1A1	-	
194043164	2.01	4	2191	238.5	7.58	156.60	XP_001925559.1	NP_001138890.1	TTC28	-	
154147577	2.54	3	1023	115.8	5.66	154.45	NP_001093664.1	NP_071451.2	IFIH1	-	
189086693	30.86	2	81	9.8	5.06	154.06	ACD75764.1	NP_000104.1	TOR1A	-	
67518138	2.22	2	1172	129.0	5.59	153.66	AAY68305.1	NP_002200.2	ITGAL	-	
194035295	5.46	4	623	69.5	8.59	153.05	XP_001927626.1	NP_006363.4	SYNCRIP	Yes (9+0)	
42742504	32.73	2	55	6.2	9.36	153.02	AAS45280.1	NP_004353.1	CLGN	-	
194043781	33.87	3	124	13.8	7.34	152.45	XP_001928708.1	NP_005887.2	IDH1	Yes (9+0)	
78172717	6.11	4	737	79.6	8.59	151.79	ABB29449.1	NP_000584.2	TAP1	Yes (9+0)	
194042618	3.66	3	929	102.9	8.06	150.39	XP_001924673.1	NP_031383.1	COG2	Yes (9+0)	
47523866	10.53	4	342	37.8	6.80	150.28	NP_999571.1	NP_620156.1	GALM	-	
47522764	2.76	3	798	88.2	5.47	150.08	NP_999133.1	NP_391988.1	ITGB1	-	
194041371	11.15	3	278	30.7	6.24	149.19	XP_001924646.1	NP_003698.1	RUVBL1	Yes (9+0)	
194039792	1.83	4	438	47.7	11.28	148.97	XP_001926215.1	NP_066408.1	HIST1H2AG	-	
213021241	10.16	2	246	27.4	6.76	148.69	NP_001132944.1	NP_002782.1	PSMA6	Yes (9+0)	
47522644	4.64	3	732	81.2	5.55	148.57	NP_999088.1	NP_001631.3	APEH	Yes (Global)	
194038586	5.02	3	219	24.9	6.42	148.44	XP_001926746.1	NP_006818.3	TMED10	Yes (9+0)	
1399282	24.44	4	135	15.0	9.03	148.22	AAB03248.1	NP_000185.1	HPRT1	Yes (9+0)	
165973438	7.81	2	192	20.4	10.59	147.86	NP_001107173.1	NP_543011.2	C20orf108	-	
194038351	3.78	1	423	47.0	7.17	147.83	XP_001928857.1	NP_001076.2	SERPINA3	-	Serum
194035082	5.74	3	505	56.8	6.77	147.38	XP_001926297.1	NP_004989.2	MYO1E	-	
194034056	5.42	2	517	57.4	6.61	147.07	XP_001924254.1	NP_000683.3	ALDH1B1	-	Mitochondrion
157043065	1.09	1	829	93.1	5.82	145.95	ABV02066.1	NP_003174.3	ADAM17	-	
104295129	6.01	4	383	42.9	4.86	145.33	ABF72034.1	NP_777283.1	AK5	-	
38230151	18.35	1	109	12.0	5.76	145.29	AAR14175.1	NP_000025.1	ALDOA	Yes (9+2/9+0)	
194035516	5.17	2	580	66.2	9.07	145.05	XP_001927718	NP_777582.3	ADCK5	-	
194041877	4.93	3	203	23.2	8.82	144.17	XP_001926760.1	NP_056263.1	DPCD	-	
194043202	4.44	2	743	84.6	5.20	144.14	XP_001926499.1	NP_115580.2	ASCC2	-	
172072661	3.37	2	505	55.2	7.23	143.54	NP_001116458.1	NP_055121.1	C22orf28	Yes (9+0)	
47523562	3.25	2	338	37.9	7.42	143.19	NP_999410	NP_004857.4	SCAMP1	Yes (9+0)	
194037756	12.16	3	222	24.1	7.94	141.61	XP_001925094.1	NP_055814.1	RAB21	Yes (9+2/9+0)	
190360623	2.65	2	980	109.4	6.46	141.10	NP_001121934.1	NP_056392.2	RAI14	-	
194035181	5.91	4	423	47.5	6.98	140.95	XP_001925325.1	NP_003071.2	SMPD2	-	
194041204	3.94	2	660	73.5	7.14	139.68	XP_001924052.1	NP_002209.2	ITIH4	-	Serum
1845	9.36	3	406	45.3	5.96	138.79	CAA48565.1	NP_000657.1	ACY1	-	
47522718	8.85	2	113	12.5	7.08	138.66	NP_999109.1	NP_001335.1	DAD1	-	
194033614	3.32	3	723	83.3	5.73	138.01	XP_001924733.1	NP_612370.3	LRSAM1	-	
62948008	11.62	3	198	22.4	6.11	137.98	AAY23007.1	NP_001028675.1	SAR1B	Yes (9+2/9+0)	
3116334	19.05	3	84	9.4	4.84	137.94	BAA25983.1	NP_066293.2	KRT34	-	
194035291	0.95	3	946	110.2	6.67	137.77	XP_001927354.1	NP_722523.1	SNX14	-	
194043991	2.75	3	363	41.7	8.18	137.45	XP_001926651.1	NP_060941.2	ZC3H15	-	
194041887	2.83	4	849	95.4	5.03	137.32	XP_001927694.1	NP_001135906.1	MGEA5	-	
194038441	13.77	4	247	28.2	9.36	137.25	XP_001928349.1	NP_057078.1	ATP6V1D	Yes (9+0)	
188998336	5.08	2	433	49.0	7.88	136.07	ACD67895.1	NP_000160.1	GLA	-	
194042374	2.42	2	661	71.3	5.80	135.92	XP_001925493.1	NP_001005751.1	FAM21A	-	
23598071	19.84	3	257	29.2	8.18	135.89	AAN35088.1				
166796061	14.48	3	297	34.4	9.72	135.84	NP_001107756.1	NP_000960.2	RPL5	-	Ribosome
194041231	2.04	2	1520	168.2	5.02	135.58	XP_001925389.1	NP_009115.2	NISCH	-	

58618085	16.30	2	184	21.3	8.34	134.95	AAW80613.1	NP_006200.3	ENPP2	-	
218664471	3.59	2	334	37.6	7.30	134.30	NP_001136304.1	NP_037415.1	MAT2B	-	
194038797	13.81	3	210	23.3	7.17	134.05	XP_001924362.1	NP_079428.2	NUBPL	-	
48675947	9.39	2	330	37.4	6.76	133.89	NP_001001642.1	NP_002724.1	PRKAG1	Yes (9+0)	
189232885	16.50	3	200	22.2	9.66	133.48	CAQ34905.1	NP_067026.3	SRPRB	Yes (9+0)	
194018716	10.94	3	64	7.4	9.52	133.09	NP_001123450.1	NP_037519.2	UQCR10	-	
194044404	10.42	4	307	34.5	8.07	132.83	XP_001924843.1	NP_110438.1	MRPS26	-	Mitochondrion
2959454	3.90	4	462	52.6	5.27	131.64	BAA25134.1	NP_001918.3	DES	-	
194037253	6.02	4	166	17.9	9.50	131.16	XP_001925123	NP_002464.1	MYH9	Yes (9+2/9+0)	
194037024	5.56	3	414	47.6	8.91	130.69	XP_001929306.1	NP_057026.3	MTERFD1	-	Mitochondrion
194035577	8.01	2	312	34.7	5.55	130.33	XP_001928100.1	NP_777571.1	FAM84B	-	
45269007	25.20	2	123	14.1	7.34	129.86	AAS55916.1	NP_005497.1	SCARB2	-	
194042069	1.31	3	765	86.2	5.22	129.35	XP_001929397.1	NP_065991.3	FAM160B1	-	
14134126	3.96	3	227	25.6	8.79	129.34	AAK54250.1	NP_000560.5	FCGR3A	-	
194041183	4.67	3	835	89.4	4.49	129.06	XP_001924305.1	NP_002366.2	MAP4	Yes (9+0)	
190360617	4.21	3	285	31.5	8.97	127.57	NP_001121924.1	NP_079119.3	CYBRD1	-	
212549625	9.85	3	264	29.9	9.74	127.16	NP_001131091.1	NP_000997.1	RPS3A	-	Ribosome
194040980	2.60	1	539	60.7	6.39	126.67	XP_001928521.1	NP_005078.2	FXR1	Yes (9+0)	
194033457	8.47	3	307	32.9	6.43	126.32	XP_001924766.1	NP_056255.2	MTHFD1L	-	Mitochondrion
16798651	11.11	2	153	18.1	11.66	124.84	AAL29467.1	NP_000972.1	RPL19	-	Ribosome
5835865	3.31	2	514	56.9	6.70	124.77	NP_008636.1	YP_003024028.1	MT-CO1	-	Mitochondrion
5733715	33.33	2	84	9.5	6.18	124.63	AAD49731.1	NP_002128.1	HNRNPA2B1	-	
164511	9.39	1	181	19.1	7.20	124.55	AAA03572.1				Serum
113205654	3.82	3	419	47.4	8.21	124.49	NP_001038016.1	NP_001816.2	CKMT2	-	Mitochondrion
58332862	2.66	2	413	43.9	8.88	123.90	XP_001924600.1	NP_001004426.1	PLA2G6	-	
194040687	1.89	1	740	81.1	8.46	123.61	XP_001926834.1	NP_005757.1	FARP1	-	
194033870	0.74	1	1478	165.6	7.08	123.48	XP_001924429.1	NP_003631.2	IKBKAP	Yes (9+0)	
285818458	1.25	1	883	99.2	6.52	123.08	ADC38902.1	NP_689596.4	DIS3L2	-	
194044443	5.75	2	174	19.1	6.29	123.01	XP_001926038.1	NP_054731.2	REM1	-	
194041521	11.47	2	218	23.8	5.85	122.29	XP_001927627.1	NP_004322.1	BNIP3L	-	Mitochondrion
194040789	4.73	2	402	44.9	8.37	122.13	XP_001925335.1	NP_612390.1	OXNAD1	-	
194041866	20.14	2	144	16.3	7.34	121.90	XP_001924538.1	NP_112233.2	SFXN3	-	Mitochondrion
194033873	0.92	4	870	97.4	9.22	121.89	XP_001924583.1	NP_061987.3	EPB41L4B	-	Serum
285818422	2.82	2	959	106.1	6.28	121.85	ADC38884.1	NP_004434.2	EPHB3	-	
194033682	2.70	3	593	65.6	5.55	121.78	XP_001928994.1	NP_116198.2	FAM73B	-	
194038629	2.08	2	529	59.7	8.59	121.74	XP_001926766.1	NP_065154.2	ADCK1	Yes (9+0)	
194037330	3.50	3	515	54.9	6.46	120.81	XP_001927253.1	NP_002263.2	KRT4	-	
194038625	3.25	2	338	38.3	5.64	119.91	XP_001928925	NP_036243.1	AHSA1	-	
36244564	42.31	2	52	5.8	6.51	119.67	AAQ85119.1	NP_002799.3	PSMD2	Yes (9+0)	
8489819	4.72	3	381	43.3	8.43	119.54	AAF75766.1	NP_000929.1	POLR2B	-	
194034171	17.86	3	196	20.5	5.48	119.37	XP_001924327.1	NP_055973.2	KANK1	-	
194044581	2.97	2	1077	119.9	5.74	119.27	XP_001925792.1	NP_055472.1	KIAA0406	-	
219521970	6.30	2	365	41.9	9.14	118.92	NP_001137173.1	NP_060831.2	AGPAT5	Yes (9+0)	
194040555	7.77	2	193	21.4	6.35	118.78	XP_001926949.1	NP_037470.1	ALG5	-	
194042433	2.94	3	374	41.0	8.19	118.50	XP_001925032.1	NP_004888.2	MINPP1	-	
194036775	5.52	4	743	82.4	5.48	118.44	XP_001928008.1	NP_851607.2	SCYL3	-	
194037044	1.62	3	555	62.8	6.64	118.37	XP_001924873.1	NP_060914.2	PDP1	-	Mitochondrion
47522790	4.62	2	303	33.2	8.05	118.27	NP_999147.1	NP_001768.1	CD47	Yes (9+0)	
55742638	2.61	2	537	58.4	6.65	118.22	NP_998981.1	NP_000192.2	ICAM1	-	
194044056	2.34	1	556	64.6	6.24	118.11	XP_001926144.1	NP_114159.2	SNX25	-	
147906477	7.34	2	177	19.8	9.85	117.77	NP_001090946.1	NP_009035.3	RPL10A	Yes (9+2)	Ribosome
48374071	9.18	2	316	35.8	6.29	117.07	NP_001001539.1	NP_001619.1	AKR1B1	Yes (9+0)	
4454998	30.30	3	99	10.9	4.67	116.50	AAD21027.1	NP_006807.1	LMAN2	-	
148747138	3.02	3	596	67.5	6.96	116.08	NP_001092074.1	NP_075067.2	VPS33A	Yes (9+0)	
194034487	4.15	2	289	31.7	9.31	115.66	XP_001927561.1	NP_068374.1	OTX2	-	
194044585	6.63	2	347	38.9	5.91	114.95	XP_001928975.1	NP_065069.1	RALGAPB	-	
148225574	25.00	4	76	8.8	10.23	114.83	NP_001090942.1	NP_004365.1	COX6C	-	Mitochondrion
194036332	5.37	2	428	48.5	7.75	114.61	XP_001928381.1	NP_057445.3	ACP6	-	
4098624	17.36	2	121	14.4	4.82	114.37	AAD00349.1	NP_002529.1	OCLN	-	
194039558	4.69	2	597	66.2	5.82	114.07	XP_001926980.1	NP_078856.4	EFTUD1	-	
62700699	20.99	3	81	9.0	5.86	113.81	CAI79418.1	NP_004512.1	KIF5B	Yes (9+2/9+0)	
194037231	1.55	2	776	83.2	8.54	113.61	XP_001924679.1	NP_203744.1	MICALL1	-	
292485838	3.49	2	887	96.5	6.67	113.42	ADE28534.1	NP_660208.2	SPATA5	-	Mitochondrion
194034081	2.48	1	524	58.5	6.49	113.09	XP_001925068.1	NP_060891.3	TBC1D2	-	
194044383	1.93	2	1292	143.9	6.96	112.59	XP_001927324.1	NP_647537.1	ATRN	-	
262036913	8.40	2	250	27.8	9.45	111.42	BAI47592.1	NP_006402.1	AGPAT1	-	
83026499	10.31	2	97	10.9	4.54	111.38	ABB96285.1	NP_068839.1	ITM2B	-	
194043799	2.53	2	316	35.5	8.02	111.06	XP_001926406.1	NP_006046.1	LANCL1	-	
55742703	5.14	1	253	28.9	6.93	110.43	NP_999018.1	NP_001107008.1	FOLR2	-	
195539470	5.79	2	484	55.0	7.03	110.17	NP_001124205.1	NP_000017.1	ADSL	-	
194042842	6.49	1	262	28.7	8.02	109.06	XP_001929190.1	NP_653190.2	COMTD1	Yes (9+0)	
194033849	3.78	2	793	88.3	8.18	108.82	XP_001925175.1	NP_536856.2	SLC44A1	-	
194018664	3.02	1	463	52.4	6.13	108.14	NP_001123430	NP_000479.1	SERPINC1	-	Serum
55167422	9.12	2	274	29.4	6.38	107.95	BAD67216				Serum
72535184	13.81	2	181	20.4	5.72	107.58	NP_001026954.1	NP_001168.1	ARL1	Yes (9+2/9+0)	
194034243	0.32	2	6165	712.1	5.27	107.46	XP_001925379.1	NP_878918.2	SYNE2	Yes (9+0)	
285818488	2.11	2	710	78.5	7.27	106.19	ADC38917.1	NP_008864.3	SLC5A3	-	
194035040	1.70	2	648	70.2	7.59	105.80	XP_001928776.1	NP_003913.3	HERC1	-	
178056462	7.34	2	354	39.2	5.40	105.80	NP_001116695.1	NP_000296.2	PON2	Yes (9+0)	
194037912	4.23	3	852	96.9	5.78	105.71	XP_001924655.1	NP_037509.3	PDZRN4	-	
4579751	2.09	1	815	89.6	5.39	104.65	BAA75064.1	NP_001137357.1	PPP1R12A	-	
148724910	4.37	2	549	61.1	6.64	104.44	CAN87698.1	NP_001701.2	CFB	-	Serum
190589916	2.44	1	574	65.6	7.03	104.44	ACE79217.1	NP_002825.3	PTPN11	-	
66352015	4.72	2	572	65.1	6.84	104.05	AAY44742.1	NP_733821.1	LMNA	-	
194034693	4.42	4	724	84.8	7.61	104.01	XP_001928744.1	NP_004739.3	CCPG1	-	

1911	3.55	1	338	39.3	8.56	103.84	CAA29415.1	NP_002722.1	PRKACB	Yes (9+2/9+0)	
47523538	5.21	4	557	59.8	9.17	103.73	NP_999396.1	NP_005147.3	ROD1	Yes (9+0)	
285818484	6.75	2	326	36.1	8.88	102.71	ADC38915.1	NP_001410.2	ELAVL1	Yes (9+0)	
194043406	1.36	2	664	74.8	5.62	102.13	XP_001929625.1	NP_116164.2	KLHL22	-	
73853886	4.98	1	221	24.9	5.35	101.67	NP_001027528.1	NP_899059.1	RAB27A	Yes (9+2/9+0)	
86450157	2.83	2	600	66.5	5.91	101.54	ABC96267.1	NP_057441.1	LIMA1	Yes (9+0)	
194040661	2.20	2	910	103.0	8.32	101.52	XP_001928146.1	NP_006313.1	TUBGCP3	Yes (9+0)	
190589912	3.56	1	337	39.0	9.03	101.51	ACE79215.1	NP_002721.1	PRKACA	Yes (9+2/9+0)	
194042012	3.12	2	674	75.4	6.81	100.61	XP_001924864.1	NP_058432.1	ADD3	Yes (9+0)	
194034773	0.98	2	1018	111.6	8.22	100.52	XP_001926177.1	NP_000329.2	SLC12A1	-	
118403822	6.78	2	236	25.7	5.29	100.51	NP_001072147.1	NP_004347.1	CD81	Yes (9+0)	
36244528	30.56	1	36	4.2	6.60	99.89	AAQ85117.1	NP_002796.4	PSMC5	Yes (9+2/9+0)	
113205776	5.93	2	405	44.5	6.90	98.55	NP_001038050.1	NP_001893.2	CTH	-	
47523440	1.69	1	650	70.2	7.43	98.39	NP_999343.1	NP_005107.4	SLC23A2	-	
60097959	0.41	1	3674	424.6	5.91	97.65	NP_001012408.1	NP_003998.1	DMD	Yes (9+2/9+0)	
222136624	8.71	2	241	25.6	5.02	97.33	NP_001138398.1	NP_002789.1	PSMB6	-	
194041943	4.04	1	322	36.1	9.42	96.55	XP_001929154.1	NP_849189.1	SFXN2	-	Mitochondrion
154101328	5.21	1	211	23.7	6.64	96.22	ABS58490.1	NP_803882.1	CYP20A1	-	
148535230	0.60	1	2340	264.6	6.46	96.17	ABQ85554.1	NP_942131.1	ACACA	Yes (9+0)	
194038650	4.96	2	423	46.4	5.55	96.02	XP_001926526.1	NP_002426.1	MPI	-	
148225172	9.76	1	82	9.3	9.38	95.88	NP_001090937.1	NP_002480.1	NDUFA4	-	Mitochondrion
194040511	5.06	1	178	19.8	9.14	95.54	XP_001927896.1	NP_919299.3	B3GALTL	-	
194041263	2.53	1	553	61.1	6.81	95.22	XP_001926497.1	NP_808881.3	PDE12	-	
194038056	2.24	1	847	92.6	7.53	94.87	XP_001925164.1	NP_001099038.1	KIF13A	-	
48374067	2.39	2	921	102.1	6.90	94.85	NP_001001537.1	NP_002209.2	ITIH4	-	Serum
194038534	7.69	1	351	38.3	5.52	94.79	XP_001929109.1	NP_689657.1	PTGR2	-	
212549651	2.83	1	566	63.2	8.32	94.77	NP_001131104.1	NP_006336.3	SLC30A9	Yes (9+0)	
113205616	9.35	2	214	24.6	10.14	94.42	NP_001038008.1	NP_006004.2	RPL10	Yes (9+2)	Ribosome
222136592	7.32	1	205	23.0	6.04	94.27	NP_001138374.1	NP_002786.2	PSMB3	Yes (9+0)	
119352456	36.84	2	57	6.4	4.78	93.77	ABL63831.1	NP_001830.1	CNN3	Yes (9+0)	
33356119	20.00	1	60	6.8	5.26	93.61	AAQ16316	NP_009218.2	MME	-	
194041068	2.34	1	513	56.7	7.97	93.36	XP_001926717.1	NP_001019831.2	KALRN	-	
194036541	3.97	2	705	77.9	6.00	93.25	XP_001924575.1	NP_002950.3	SORT1	-	
194035628	8.38	3	382	42.4	9.28	92.93	XP_001924315.1	NP_066301.1	SNTB1	Yes (9+0)	
13160449	45.00	2	20	2.2	7.25	92.86	CAC32854.1	NP_002849.1	ABCD3	Yes (9+0)	
90903447	1.94	1	620	69.8	5.12	92.46	ABE02286.1	NP_001120.3	AEBP1	-	
155964300	19.85	2	131	14.3	5.11	92.41	ABU40196.1	NP_620419.2	SDR16C5	-	
157427724	4.49	2	334	37.6	6.73	91.59	NP_001098770.1	NP_006828.2	COPS5	-	
194043313	3.10	1	355	40.7	7.61	91.01	XP_001929116.1	NP_116246.2	GNAZ	Yes (9+2/9+0)	Mitochondrion
194042500	5.41	1	185	21.4	9.69	90.85	XP_001926078.1	NP_038479.1	MYOF	Yes (9+0)	
196259976	5.76	2	469	49.7	6.93	90.78	NP_001124517.1	NP_001070984.1	SLC39A7	Yes (9+0)	
194039375	5.53	2	199	22.4	8.40	90.67	XP_001927232.1	NP_689945.2	RSPH9	-	
194044667	5.39	2	427	48.2	8.69	90.48	XP_001926018.1	NP_057021.2	PIGT	-	
194038799	12.40	1	129	13.5	10.23	90.43	XP_001925166.1	NP_079428.2	NUBPL	-	
47522880	5.28	2	568	61.3	6.99	90.36	NP_999195.1	NP_001027536.1	GGT1	Yes (9+0)	
238915589	3.14	1	287	33.8	5.25	90.23	NP_999136.1	NP_001822.2	CLU	Yes (9+0)	
194043317	3.86	2	673	76.7	8.27	90.18	XP_001925930.1	NP_004318.3	BCR	Yes (9+0)	
194035427	8.96	1	134	14.9	7.30	89.92	XP_001928573.1	NP_001132982.1	ECHDC1	-	
118403902	4.17	1	288	31.5	7.66	89.71	NP_001072132.1	NP_658985.2	APOA1BP	Yes (9+0)	Serum
194041571	8.02	1	187	21.0	6.79	89.37	XP_001924212.1	NP_036463.1	MSRA	-	
45269041	20.75	2	106	12.0	8.62	89.24	AAS55933.1	NP_000997.1	RPS3A	-	Ribosome
138752628	28.45	2	116	12.6	9.80	89.16	CAM32246.1	NP_001830.1	CNN3	Yes (9+0)	
71849672	2.76	2	869	94.0	6.05	89.11	AAZ50617.1	NP_981961.1	CD163	-	
194033986	1.57	2	762	84.8	7.55	88.51	XP_001925873.1	NP_115547.1	CEP78	Yes (9+0)	
194035485	3.90	1	538	61.2	8.81	88.24	XP_001925089.1	NP_079527.1	ARHGAP39	-	
194036225	7.58	1	264	29.0	5.91	87.83	XP_001929676.1	NP_002787.2	PSMB4	Yes (9+0)	
194038280	2.92	1	548	61.3	5.95	87.70	XP_001927091.1	NP_705933.2	SLC24A4	-	
30909255	3.98	2	251	28.3	5.14	87.59	AAP37552.1	NP_061984.2	HLA-DRA	-	
194038425	1.65	1	1154	127.3	6.57	87.22	XP_001926828.1	NP_056364.1	PLEKHG3	-	
164664444	5.62	2	356	41.7	8.13	86.70	NP_001106907.1	NP_002328.1	LRPAP1	-	
194043107	2.25	1	757	86.7	7.15	86.16	XP_001929245.1	NP_569733.2	UBE3B	Yes (9+2/9+0)	
194041402	1.23	2	1058	115.7	7.47	85.50	XP_001926329.1	NP_004551.2	ROR2	-	
194038512	1.16	2	1804	199.7	8.24	85.40	XP_001928473.1	NP_056371.1	SIPA1L1	-	
194037165	2.79	2	358	40.6	7.20	85.27	XP_001928704.1	NP_663786.2	SEPT3	Yes (9+2/9+0)	
297307131	12.42	3	306	33.2	11.24	84.99	NP_001171996	NP_057034.2	MRPL2	-	Mitochondrion
194041354	3.04	1	461	53.5	6.25	84.95	XP_001926911.1	NP_443715.1	IFT122	Yes (9+2/9+0)	
10257510	4.60	1	239	25.8	5.11	84.89	AAF68432.3	NP_000472.2	AMT	-	Mitochondrion
14269030	60.00	1	40	4.7	6.51	84.60	AAK57997.1	NP_000168.1	GSN	Yes (9+0)	
153792082	3.58	2	755	86.4	6.21	84.36	NP_001093405.1	NP_001547.1	IKBKB	-	
194039722	2.11	2	474	52.2	5.40	84.14	XP_001928023.1	NP_057440.2	DCDC2	-	
194037217	2.66	2	752	83.8	7.14	84.13	NP_001011507.1	NP_005552.3	LAMP1	-	
190360625	1.56	1	961	108.4	6.92	84.03	NP_001121935.1	NP_001155855.1	ARHGEF2	Yes (9+0)	
194035033	2.33	1	429	49.7	5.88	83.93	XP_001928534.1	NP_003090.2	SNX1	Yes (9+0)	
68132076	16.85	1	89	10.0	5.17	83.87	AAY85304.1	NP_001171034.1	PPP2R1B	-	
194044687	5.05	1	317	35.8	8.07	83.45	XP_001928924.1	NP_005460.2	ACOT8	Yes (9+0)	
194040538	0.96	1	1148	129.1	6.25	83.36	XP_001925924.1	NP_056493.3	NBEA	-	
178056482	7.64	2	458	50.5	5.77	83.30	NP_001116607.1	NP_001013728.2	PLIN5	-	
194035719	4.74	1	274	30.5	6.23	83.00	XP_001926413.1	NP_002052.1	GCLM	Yes (9+0)	
190360639	4.79	2	167	18.6	6.18	82.72	NP_001121941.1	NP_005092.1	ISG15	-	
194040835	6.23	1	257	28.6	9.33	82.69	XP_001926074.1	NP_005098.2	EXOG	-	Mitochondrion
38098644	15.97	1	144	15.7	6.62	82.57	AAR10973.1	NP_000628.2	GSR	-	Mitochondrion
194038668	3.35	2	328	36.7	5.43	82.56	XP_001927445.1	NP_005688.2	SCAMP2	-	
194041821	2.88	1	416	46.3	5.21	82.55	XP_001929145.1	NP_001002261.1	ZFYVE27	-	
194042464	2.71	2	553	63.8	8.35	81.94	XP_001925987.1	NP_036552.1	IFIT5	-	
298160923	7.86	2	318	36.5	5.53	81.94	NP_001177141	NP_076424.1	DDRGK1	-	

194036468	4.39	1	342	37.0	5.74	81.62	XP_001928840.1	NP_077007.1	WDR77	-	
194034275	8.48	2	342	37.3	8.37	81.25	XP_001924827.1	NP_002442.2	MTAP	-	
255068732	19.64	2	112	12.4	8.25	81.24	CAX36905.1	NP_000574.2	GC	-	Serum
44889640	29.03	1	62	7.4	9.41	79.90	AAS48423.1	NP_001005505.1	CACNA2D2	Yes (9+0)	
114326183	10.00	1	180	20.5	5.67	79.88	NP_001041537.1	NP_001651.1	ARF4	Yes (9+2/9+0)	
212549653	2.08	2	336	38.9	7.37	79.79	NP_001131106.1	NP_443107.1	VPS26B	Yes (9+0)	
256838117	2.00	1	501	55.1	8.00	79.78	NP_001157982.1	NP_001006642.1	SLC25A25	-	Mitochondrion
194041330	13.79	2	261	29.9	6.81	79.54	XP_001928770.1	NP_060917.1	TMEM111	Yes (9+0)	
194040765	2.59	1	348	38.3	9.36	78.93	XP_001925073.1	NP_009139.1	MRPL3	Yes (Global)	Mitochondrion
285818434	3.01	2	299	34.4	8.63	78.75	ADC38890.1	NP_060714.3	UQCC	Yes (9+0)	
194034360	3.24	2	649	72.3	9.45	78.40	XP_001927072.1	NP_006561.1	RRAGA	-	
194035338	1.39	1	718	78.7	5.57	77.91	XP_001926093.1	NP_001122089.1	REPS1	-	
194042053	2.07	1	725	79.1	5.54	77.72	XP_001929043.1	NP_940916.2	NHLRC2	-	
154101326	6.18	2	178	19.9	8.65	77.66	ABS58489.1	NP_000952.1	PTGIS	-	
194037700	0.40	2	2481	290.3	6.06	77.49	XP_001928242.1	NP_079390.3	CEP290	Yes (9+2/9+0)	
148233143	2.62	1	534	60.9	6.01	77.45	NP_001090904.1	NP_001017962.1	P4HA1	Yes (9+0)	
47522836	5.61	1	214	23.7	5.68	77.43	NP_999170.1	NP_036515.4	OSTF1	-	
47522740	1.92	1	522	57.7	6.83	77.37	NP_999120.1	NP_000503.1	GALNS	-	
194043214	2.94	1	511	57.3	7.71	77.27	XP_001929232.1	NP_114143.1	TBC1D10A	-	
32170389	2.65	1	378	42.8	8.66	77.20	CAD99201.1	NP_056167.1	POFUT1	-	
113205806	1.24	1	809	90.6	7.21	76.42	NP_001038055.1	NP_000292.1	PLG	-	Serum
194044284	5.21	1	192	21.4	8.72	76.40	XP_001925938.1	NP_000998.1	RPS4X	Yes (9+0)	Ribosome
21703163	11.82	1	110	12.0	5.06	76.35	AAM76079.1				Serum
194033501	4.58	1	262	28.9	9.55	76.17	XP_001926029.1	NP_620132.1	MRRF	-	Mitochondrion
194043246	2.45	1	654	74.2	6.23	75.88	XP_001924672.1	NP_110385.1	OSBP2	-	
194038286	4.01	1	299	34.8	6.76	75.61	XP_001924290.1	NP_005104.2	GOLGA5	Yes (9+2/9+0)	
148237282	10.33	2	213	23.3	10.77	75.48	NP_001090947.1	NP_001030168.1	RPL14	Yes (9+2)	Ribosome
154101338	7.89	1	228	26.1	9.09	75.48	ABS58495.1	NP_001052.2	TBXAS1	-	
194042873	1.14	1	1321	146.6	7.42	74.86	XP_001928455.1	NP_065896.1	PITPNM2	Yes (9+0)	
47523576	2.74	2	292	32.2	7.97	74.69	NP_999413.1	NP_861420.1	HSD11B1	-	
194040461	5.03	2	199	21.6	9.47	74.68	XP_001928899.1	NP_689939.1	EFHA1	-	
264681476	6.22	1	193	21.1	9.35	74.42	NP_001161101.1	NP_001986.2	ACSL1	-	Mitochondrion
194033686	1.22	2	819	90.8	7.25	73.65	XP_001926112.1	NP_066954.2	PPP2R4	Yes (9+0)	
194039637	0.90	1	1224	137.2	7.15	73.63	XP_001927099.1	NP_001119603.1	POLG	-	Mitochondrion
38230149	30.00	1	40	4.2	4.72	73.57	AAR14174.1	NP_005156.1	ALDOC	Yes (9+2/9+0)	
194033494	4.43	2	677	71.2	8.65	73.46	XP_001924326.1	NP_057569.2	VTA1	-	
194038778	2.71	2	406	46.6	6.16	73.36	XP_001928303.1	NP_689419.2	SNX6	-	
56711358	4.67	1	257	27.7	9.32	73.08	NP_001008687.1	NP_898902.1	PRNP	Yes (9+0)	
47522770	3.14	1	446	51.7	5.88	72.69	ACR78279.1	NP_001153647.1	NAT1	-	
194044772	3.02	1	265	28.9	5.76	72.25	XP_001927900	NP_005269.1	GPM6B	-	
38569721	19.67	1	61	7.1	6.77	71.48	AAR24381.1	NP_004499.2	IDI1	-	
47523702	1.02	1	1277	141.9	5.43	71.39	NP_999487.1	NP_000262.2	NPC1	Yes (Global)	
194033953	0.59	1	1870	216.1	5.38	71.05	XP_001925689.1	NP_008949.4	CEP110	Yes (Centrosome)	
3402264	5.93	1	135	14.1	6.93	71.04	CAA63936.1	NP_005007.2	PCBP2	-	
2465404	19.35	1	62	7.4	8.44	70.84	AAB72090.1	NP_006254.1	PSME1	Yes (9+0)	
194034163	3.79	1	475	52.9	5.47	70.57	XP_001925728	NP_003374.3	VLDLR	-	
194044689	1.86	1	538	58.0	8.25	70.40	XP_001926188.1	NP_219489.1	SNX21	-	
33317518	3.79	1	290	33.4	5.57	70.12	AAQ04720	NP_002818.1	PTPN1	-	
194041674	2.59	1	424	47.7	7.96	69.71	XP_001926667.1	NP_006495.1	PTPRE	-	
194042740	0.99	1	1010	114.2	5.90	69.55	XP_001924594.1	NP_071362.1	HERC4	Yes (9+2/9+0)	
194042306	3.38	1	621	72.0	5.53	69.49	XP_001928845.1	NP_056449.1	KIAA1279	-	Mitochondrion
194034610	2.22	1	450	52.9	5.50	69.32	XP_001926091.1	NP_001138439.1	NEDD4L	-	
88861934	17.86	1	56	6.4	8.21	69.32	ABD52874.1	NP_006279.2	THY1	Yes (9+0)	
194039176	1.93	1	517	56.5	8.70	69.18	XP_001925238.1	NP_705841.2	LPCAT4	-	
285818474	1.32	1	909	102.1	5.86	69.03	ADC38910.1	NP_065822.2	HACE1	-	
118403806	6.81	1	191	21.3	6.04	69.01	NP_001072148.1	NP_001034891.1	CDC42	Yes (9+2/9+0)	
92020123	3.83	1	313	34.4	5.22	68.97	BAE93252.1	NP_004360.2	COL6A3	-	
194038461	0.51	1	2541	283.3	6.47	68.97	XP_001926176.1	NP_056161.2	ZFYVE26	-	
65301133	1.94	1	619	70.5	5.31	68.45	NP_001018042.1	NP_000848.1	GUCY1B3	Yes (9+0)	
157427711	1.37	1	729	83.7	6.57	68.30	NP_001098762.1	NP_037386.1	TBK1	Yes (9+2/9+0)	
194035601	7.82	1	179	21.8	8.63	67.96	XP_001927839.1	NP_004996.1	NDUFB9	-	Mitochondrion
98978744	17.74	1	62	6.0	4.13	67.64	ABF59811.1	NP_002036.1	GAP43	-	
178056474	5.76	1	399	45.3	7.90	67.57	NP_001116606.1	NP_000226.2	LIPA	-	
47522706	2.75	1	363	39.7	5.55	67.32	NP_999053.1	NP_002380.3	CD46	Yes (9+0)	
36244585	37.50	1	32	3.6	5.10	67.21	AAQ85120.1	NP_002800.2	PSMD3	Yes (9+0)	
194038386	2.53	1	435	46.6	10.21	67.15	XP_001926906.1	NP_037404.2	SLCO3A1	-	
194038806	0.61	1	1798	197.2	5.29	67.11	XP_001924707.1	NP_056197.2	HECTD1	-	
283443704	3.61	1	527	58.4	5.49	67.07	ADB19861.1	NP_036311.3	FBXO7	-	
117660446	16.90	1	71	8.3	9.31	66.89	ABK55621.1	NP_009031.1	ATP5I	-	Mitochondrion
55983056	9.26	1	108	11.7	4.21	66.74	AAV69970.1	NP_002801.1	PSMD4	-	
194044041	8.08	1	198	21.9	8.18	66.60	XP_001926102.1	NP_005268.1	GPM6A	Yes (9+0)	
194044559	0.52	1	1529	171.1	6.25	66.59	XP_001925182.1	NP_542194.2	C20orf117	-	
45269011	42.86	1	28	2.9	8.02	66.45	AAS55918.1	NP_004574.2	RAB5C	Yes (9+2/9+0)	
194036898	3.44	1	291	31.9	6.67	65.80	XP_001927783.1	NP_001034800.1	DEDD	-	
117661101	5.06	1	237	27.5	11.21	65.75	ABK55654.1	NP_001001.2	RPS6	Yes (9+2/9+0)	Ribosome
194041761	1.07	1	1313	145.4	8.73	65.73	XP_001924696.1	NP_001030126.1	SORBS1	-	
194038451	0.64	2	1400	153.6	8.25	65.33	XP_001925997.1	NP_065766.1	PLEKHH1	-	
148223599	3.97	1	277	30.0	7.30	65.28	NP_001090945.1	NP_002790.1	PSMB7	-	
194045114	2.19	1	457	53.9	5.62	65.22	XP_001924292.1	NP_056000.1	ARHGEF9	-	
165909668	2.94	1	374	42.5	6.04	65.21	ABY73740.1	NP_003105.2	SPAG1	-	
148222424	6.16	1	341	37.3	8.82	65.20	NP_001090895.1	NP_003640.2	DDO	-	
194043095	1.35	1	667	74.4	6.81	65.12	XP_001926116.1	NP_476510.1	GIT2	-	
194035855	1.64	1	610	64.5	7.33	64.71	XP_001929085.1	NP_443100.1	IGSF8	-	
62911467	6.82	1	176	20.1	5.57	64.66	AAY21386.1	NP_004098.1	FCGRT	-	
194043414	0.95	2	839	94.5	8.92	64.52	XP_001929624.1	NP_060221.2	SMPD4	-	

21703165	11.61	1	112	12.1	8.46	64.43	AAM76080.1				Serum
6013139	5.33	1	319	35.3	7.83	64.14	AAF01257.1	NP_001329.1	CXADR	-	
194041688	4.81	1	187	21.3	5.50	63.68	XP_001924596.1	NP_005530.3	INPP5A	Yes (Global)	
194044503	1.00	1	899	102.7	8.54	63.56	XP_001927381.1	NP_065935.2	MYH7B	-	
194036738	8.05	1	174	19.0	5.48	63.19	XP_001927278.1	NP_006321.1	LYPLA1	Yes (9+0)	
15824734	11.28	1	133	14.4	4.37	63.09	AAL09462.1	NP_002282.2	LAMB1	-	
194043576	0.85	1	1056	113.2	8.44	62.93	XP_001928586.1	NP_003556.1	ULK1	-	
194041294	4.46	1	202	23.6	7.88	62.74	XP_001925304.1	NP_886552.2	TRNT1	-	Mitochondrion
229892828	1.57	1	637	72.6	6.29	62.25	NP_001153565.1	NP_006100.2	PRMT5	-	
194034527	2.24	1	804	89.9	7.97	62.22	XP_001924324.1	NP_065976.2	CACHD1	-	
194037728	7.36	1	163	18.4	6.65	61.91	XP_001926365.1	NP_001083173.1	RAP1BL	-	
194041369	8.28	1	169	18.9	5.20	61.41	XP_001924590.1	NP_003698.1	RUVBL1	Yes (9+0)	
194037351	2.01	1	546	59.6	7.37	61.21	XP_001925763.1	NP_056480.1	AAAS	-	
194035587	3.19	1	345	39.1	6.44	60.85	XP_001924939.1	NP_055661.3	KIAA0196	Yes (9+0)	
292485836	3.04	1	559	61.6	9.64	60.65	ADE28533.1	NP_056350.2	SPATS2L	-	
297307137	5.34	1	206	23.7	5.14	60.54	NP_001171999	NP_002873.1	RANBP1	Yes (9+2)	
194035881	4.19	1	430	46.9	6.20	59.83	XP_001929212.1	NP_067012.1	CADM3	-	
194038720	2.50	1	360	39.7	6.04	59.77	XP_001926345.1	NP_112574.3	ADPGK	-	
194038048	2.57	1	428	47.9	5.26	59.68	XP_001924785.1	NP_006357.1	CAP2	-	
194035113	5.78	1	277	30.4	5.05	59.54	XP_001925513.1	NP_059117.3	COQ3	-	Mitochondrion
117660743	20.00	1	155	16.1	9.88	59.46	ABK55635	NP_005167.2	ATP5G2	-	Mitochondrion
194033876	4.56	1	329	34.8	9.89	59.32	XP_001924641.1	NP_114401.2	C9orf5	-	
194038256	0.50	1	2004	224.8	5.88	59.24	XP_001928768.1	NP_001073883.2	CCDC88C	-	
194039437	4.04	1	322	35.4	9.31	59.17	XP_001928208.1	NP_004268.3	SLC25A27	-	Mitochondrion
58332864	3.75	1	507	55.3	8.59	58.80	NP_001011508.1	NP_542970.1	SIRPA	Yes (9+0)	
194040262	6.75	1	237	26.7	7.30	58.53	XP_001929671.1	NP_057361.3	RAB23	Yes (9+2/9+0)	
74136759	4.38	1	297	32.9	6.74	58.43	NP_001028185	NP_003992.3	FCGR2B	-	
190360597	3.24	1	340	38.5	9.38	58.28	NP_001121947.1	NP_057104.2	TFB1M	-	Mitochondrion
194042592	3.45	1	290	32.9	6.37	58.28	XP_001928785.1	NP_005990.1	TSNAX	Yes (9+0)	
47523922	5.17	1	232	26.7	9.23	58.18	NP_999602.1	NP_006361.1	VTI1B	-	
194041392	1.27	1	865	96.0	8.06	57.50	XP_001928494.1	NP_006369.3	SEMA4D	-	
73853894	1.52	1	395	45.1	6.60	57.03	NP_001027529.1	NP_005473.1	PIGK	-	
166796065	3.60	1	333	36.9	8.78	56.87	NP_001107758.1	NP_004084.1	EFNB2	-	
194042826	2.30	1	434	48.6	6.62	56.82	XP_001928771.1	NP_036227.1	AP3M1	Yes (9+0)	
47523738	3.02	1	397	44.8	7.77	56.69	NP_999504.1	NP_061072.3	DNAJA4	Yes (9+2/9+0)	
194044141	12.79	1	172	18.8	5.26	55.76	XP_001926145.1	NP_005796.1	PSMD14	-	
5835869	5.36	1	261	29.7	6.99	55.74	NP_008640.1	YP_003024032.1	MT-CO3	-	Mitochondrion
178057067	5.53	1	380	44.5	5.07	55.41	NP_001116568.1	NP_008996.1	CDC37	Yes (9+0)	
194044757	1.31	1	763	87.1	5.96	55.16	XP_001925292.1	NP_056506.2	WWC3	-	
194042858	1.62	1	743	84.5	8.95	54.68	XP_001927747.1	NP_006806.1	TMED2	Yes (9+0)	
194041378	13.13	1	99	11.0	9.31	54.60	XP_001924889.1	NP_002787.2	PSMB4	Yes (9+0)	
45268999	7.22	1	180	20.4	5.73	54.51	AAS55912.1	NP_002901.2	RENBP	-	
213021233	4.72	1	212	24.7	8.19	54.43	NP_001132945.1	NP_009148.2	PDCD10	Yes (9+0)	
194034417	1.61	1	1059	120.6	6.24	54.22	XP_001924665.1	NP_004704.2	SDCCAG1	-	
194037760	1.63	1	674	77.3	5.25	53.37	XP_001925371.1	NP_001139685.2	TBC1D15	-	
194033654	3.77	1	265	29.9	8.31	53.25	XP_001928369.1	NP_057119.2	COQ4	-	
194034734	1.34	1	1117	127.4	8.48	53.06	XP_001927765.1	NP_005145.3	USP8	-	
30523349	4.71	1	255	27.8	5.85	53.05	AAP31511.1	NP_997647.1	FN1	Yes (9+0)	Serum
194037506	5.26	1	209	22.8	6.99	53.01	XP_001927658.1	NP_001771.1	CD63	-	
194033676	1.86	1	538	59.2	8.60	52.69	XP_001928954.1	NP_055723.1	DOLK	-	
194033387	4.38	1	297	33.8	7.36	52.40	XP_001925977	NP_005913.2	MAP3K4	-	
194040970	1.04	1	1345	147.5	6.30	52.10	XP_001924564.1	NP_073600.3	FNDC3B	Yes (9+0)	
201066354	0.99	1	708	79.4	5.38	51.98	NP_001128438.1	NP_036228.1	APPL1	Yes (9+0)	
194041343	3.45	1	319	34.4	7.08	51.96	XP_001926535.1	NP_899195.1	SEC13	Yes (9+2/9+0)	
47522944	1.88	1	532	59.9	7.75	50.80	NP_999229.1	NP_002012.1	FMO1	-	
194042620	3.60	1	278	30.1	6.65	50.52	XP_001924694.1	NP_000020.1	AGT	-	Serum
194034958	5.71	1	210	24.0	9.06	50.29	XP_001925024.1	NP_060717.1	TMEM30A	Yes (9+0)	
190360643	1.13	1	887	97.6	5.45	50.24	NP_001121930.1	NP_001690.2	AXL	-	
264681438	5.16	1	213	23.6	8.48	50.02	NP_001161114.1	NP_006310.1	CDIPT	Yes (9+0)	
113196921	6.67	1	135	15.3	6.00	50.02	ABI31752.1	NP_000012.1	PSEN1	-	
87137931	33.33	1	57	6.8	4.53	49.74	ABD28177.1	NP_005177.2	CAPN1	Yes (9+2/9+0)	
194039547	9.05	1	232	25.9	7.88	49.64	XP_001928898.1	NP_055969.1	MESDC2	Yes (9+0)	
11544909	38.10	1	21	2.5	9.01	49.28	CAC17633.1	NP_001030590.1	SDHC	-	Mitochondrion
194044635	3.35	1	388	43.6	4.98	49.04	XP_001925602.1	NP_006273.1	STK4	-	
194034612	1.35	1	665	73.8	5.48	48.75	XP_001926350.1	NP_001138441.1	NEDD4L	-	
194043041	0.92	1	866	99.9	6.74	48.62	XP_001924671.1	NP_079229.2	NAA25	-	
194041951	1.06	1	853	94.2	6.14	48.61	XP_001929273.1	NP_060119.3	CNNM2	-	
194044145	10.26	1	156	18.1	7.28	48.44	XP_001926333.1	NP_005796.1	PSMD14	-	
113205568	6.25	1	448	51.7	4.96	48.30	NP_001037995.1	NP_003757.1	BECN1	-	
47522640	1.50	1	732	80.4	7.81	48.14	NP_999090.1	NP_510966.1	CD97	Yes (9+0)	
194036981	5.97	1	201	23.1	8.78	47.49	XP_001925258.1	NP_003105.2	SPAG1	-	
194035472	5.78	1	329	36.8	4.67	47.32	XP_001924798.1	NP_001010892.1	RSPH4A	-	
194036640	2.02	1	346	39.4	9.70	47.21	XP_001924653.1	NP_055109.1	TRAM1	Yes (Global)	
147899515	2.42	1	662	75.2	4.73	46.94	NP_001090891.1	NP_001121782.1	SPARCL1	-	
194043881	1.89	1	529	54.8	10.17	46.90	XP_001926913.1	NP_004495.2	AGFG1	-	
194042031	1.32	1	683	76.6	6.43	46.76	XP_001927977.1	NP_976313.1	ACSL5	-	Mitochondrion
209863049	2.50	1	599	64.9	7.84	46.66	NP_001129438.1	NP_775897.3	SLC26A11	-	
194045106	4.42	1	249	26.7	9.16	46.30	XP_001927882.1	NP_060318.3	FAM120C	Yes (9+0)	
92020110	4.07	1	246	27.3	4.91	46.28	BAE93251.1	NP_001840.3	COL6A2	-	
194035630	0.77	1	905	100.9	7.85	45.52	XP_001924871.1	NP_071328.2	MTBP	-	
56711370	3.03	1	363	40.6	8.05	45.38	NP_001008692.1	NP_055398.1	LMCD1	-	
1769554	3.80	1	237	26.5	7.17	45.09	AAB39988.1	NP_000543.2	VWF	-	Serum
194035758	1.75	1	858	97.7	7.34	44.94	XP_001929199.1	NP_060573.2	LRRC8D	-	
194035839	1.34	1	596	66.6	5.43	44.57	XP_001928921.1	NP_056541.2	DCAF8	-	
194042957	0.85	1	1299	138.0	9.63	44.47	XP_001929568.1	NP_002964.3	ATXN2	Yes (9+0)	

194037921	6.52	1	184	20.7	7.99	44.29	XP_001927316.1	NP_001491.1	GMDS	Yes (9+2)	
58003720	10.59	1	85	9.8	8.62	44.03	AAW62290.1	NP_000132.3	FGFR2	-	
195957254	1.34	1	1191	125.3	8.59	43.93	ACG59405.1	NP_005535.1	IRS1	-	
164614625	4.79	1	188	21.0	5.87	43.58	ABY64538.1	NP_001119574.1	HP	-	Serum
194044095	1.81	1	386	42.3	5.06	43.19	XP_001925879.1	NP_004865.1	BAG4	-	
50054446	1.66	1	722	78.8	5.96	42.75	NP_001001910.1	NP_077726.1	DDX4	-	
194038316	2.56	1	234	27.3	6.16	42.39	XP_001925403.1	NP_075601.1	OTUB2	-	
194036959	3.13	1	351	40.6	4.92	40.08	XP_001925036.1	NP_056528.2	RRM2B	-	
194043613	1.64	1	550	60.2	6.43	39.55	XP_001924277.1	NP_076417.2	AACS	-	
166796051	1.21	1	744	84.6	6.93	38.64	NP_001107751.1	NP_001269.3	CHUK	-	
194035482	7.59	1	224	24.7	7.96	35.62	XP_001926019.1	NP_054785.2	COMMD5	Yes (9+0)	
268607631	1.14	1	964	105.1	7.59	34.68	NP_001161253.1	NP_004127.1	IREB2	-	
194035238	0.56	1	2301	259.0	6.09	29.59	XP_001924484.1	NP_055833.2	DOPEY1	-	