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A comparative global proteomic analysis of the hematopoietic lineages in the crustacean
Pacifastacus leniusculus

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Abstract

In crustaceans as in other invertebrates, the circulating hemocytes are vital for protecting the animal against attacking microorganisms. As many hemocytes are destroyed early during an infection, new hemocytes must fast get in place to prevent disperse of a disease, In order to understand the hematopoietic process in more detail we here report a complete proteomic analysis from purified cell types from the APC of the hematopoietic tissue, via the remaining parts of the HPT to the mature semigranular and granular hemocytes. Several cell type specific proteins are detected and new biomarkers within the crayfish hematopoietic lineage that can be used to increase the understanding of how the differentiation process is regulated is described.

Keywords

Biomarker; crustacea; hematopoiesis; innate immunity; invertebrate; proteome;

Abbreviations

APC, anterior proliferation center; HPT, hematopoietic tissue; KPI, Kazal protease inhibitor; LFQ, label free quantitative; LDL, low density lipoprotein; LGBP, lipopolysaccharide and β -glucan binding protein; SGC, semigranular cell; GC, granular cell; SOD, superoxide dismutase; STAT, signal transducer and activator of transcription; TGase, transglutaminase; VEGF, vascular- endothelial growth factor.

1. Introduction

In crustaceans as in other invertebrates, the circulating hemocytes are crucial for protecting the animal against pathogens, and they are directly engaged in recognition, phagocytosis, melanization via the proPO-system and the creation of toxic products from this reaction (Cerenius et al., 2010, 2008; Söderhäll, 2016). Initially at an infection their innate immune response is rapidly activated, mainly by secretion of the proPO system that lead to melanization, but also of cytokines that rapidly result in new hemocyte production (Söderhäll et al., 2005). This is a very important process as many hemocytes are destroyed early during an infection, and to prevent disperse of a disease, new hemocytes must fast get in place.

The number of circulating hemocytes can vary enormously in response to environmental stressors, during the molting cycle or during an infection. Response to injury or infection leads to a dramatic loss of circulating hemocytes, which is followed by a recovery accomplished by rapid release of new hemocytes from the hematopoietic tissue (HPT) (Söderhäll et al., 2003). Our technique to culture the crayfish hematopoietic progenitor cells *in vitro* has allowed us to do detailed studies of the regulation of crustacean hematopoiesis, for review see (Söderhäll, 2016), and thereby we could isolate a new group of cytokines, which we named astakines, from crayfish plasma (Söderhäll et al., 2005). However, in order to understand the hematopoietic process in more detail we need to be able to follow the differentiation process from the stem cells in the anterior proliferation center (APC) (Noonin et al., 2012) and the rest of the hematopoietic tissue (HPT) to fully mature hemocytes in the circulation. We have sequenced transcriptomes from four different tissues of *Pacifastacus leniusculus* (brain + nerve, hemocytes, hepatopancreas and HPT) the sequences of which are available at GenBank as Bioproject [Accession: PRJNA259594](#). This transcriptome database is now used in order to analyze different stages in the hematopoietic process by a quantitative global proteomics approach, and to possibly find marker proteins to enable lineage tracking for example during an infection.

Proteomic analyses have been performed for various reasons in crustaceans before. In *Pacifastacus leniusculus*, we have earlier used 2-D electrophoresis in order to find marker proteins specific for semigranular and granular hemocytes and could identify a semigranular cell specific Kazal-type protease inhibitor (KPI), and a superoxide dismutase specific for granular hemocytes (Wu et al., 2008). In the shrimp *Fenneropenaeus chinensis*, granulocytes and hyalinocytes were separated by immune-magnetic beads and then these separated, fixed permeabilized hemocytes were analyzed by 2-D gel electrophoresis (Zhu et al., 2018a). By

this method about twenty-one differentially expressed proteins could be detected between hyalinocytes and granulocytes (Zhu et al., 2018a). In another study, iTRAQ proteomic analysis was performed to compare the proteom of total hemocytes of healthy *Procambarus clarkii* with crayfish infected with *Spiroplasma eriocheris* (Xu et al., 2018).

In insects, the use of a monoclonal antibody combined with functional assays was an effective way to identify different hemocyte subsets in the honey bee (Gábor et al., 2017), and has been used to identify a plasma membrane marker by 4E1 monoclonal antibody corresponding to *A. mellifera* hemolectin (Uniprot UD: A0A087ZSR0) (Gábor et al., 2017). A method for separating *Drosophila* hemocytes by differential expression of cell surface molecules on functionally distinct subsets of the hemocytes was described 2004 (Vilmos et al., 2004), and *Drosophila* monoclonal antibody libraries for the different hemocyte classes has been used to define the function of different hemocyte types (Honti et al., 2014; Kurucz et al., 2007). Moreover the Gal4-UAS system based driver construct combined with fluorescent reporters have successfully been used in order to track hemocyte lineages during *Drosophila* hematopoiesis (Evans et al., 2009). However, this sophisticated method is not possible to use for crustaceans. Mass Spectrometry is currently one of the most useful tools for explorative proteomic studies. The so-called shotgun proteomics approach and variants thereof is becoming sufficiently powerful to handle a complete proteome analysis (Mann et al., 2013). Using this strategy, the complete proteomes from samples of purified cell types from the APC of the hematopoietic tissue (Noonin et al., 2012), via the remaining parts of the HPT to the mature semigranular and granular hemocytes are analyzed in the present study.

2. Material and methods

2.1. Animals and cell preparation

Freshwater crayfish, *Pacifastacus leniusculus*, were retrieved from Lake Erken, Sweden. The crayfish were maintained in tanks with aeration at about 10°C. Healthy and intermolt male crayfish were used for the experiments. Five crayfish were used for cell preparation and further individual proteome analysis according to the experimental setup shown in Figure 1.

2.2. Cell preparation

APC and HPT (=without APC) were separately dissected and isolated as previously described (Noonin et al., 2012; Söderhäll et al., 2005). Briefly, after dissection, the tissues were washed with crayfish phosphate-buffered saline (CPBS; 10 mM Na₂HPO₄, 10 mM KH₂PO₄, 150 mM

NaCl, 10 mM CaCl₂ and 10 mM MnCl₂, pH 6.8). Next, the tissues were incubated at room temperature for 20 min in 800 µl in CPBS containing 0.1% collagenase type I and type IV (Sigma-Aldrich, USA). The collagenase solution was removed by centrifugation at 3000 × g for 5 min. The resulting cell pellet was washed five times with 1 ml of CPBS. The total number of cells was quantified by using a hemocytometer and cell viability was analyzed by trypan blue staining. The hemocytes were separated into GC and SGC by Percoll gradient centrifugation as previously described (Söderhäll and Smith, 1983). In brief, 2 ml hemolymph was collected in a 1:1 volume of anti-coagulant buffer (0.14 M NaCl, 0.1 M glucose, 30 mM trisodium citrate, 26 mM citric acid, 10 mM EDTA), pH 4.6. Then, GCs and SGCs were separated using a continuous gradient of 70% Percoll in 0.15 M NaCl. After centrifugation in a swing-out rotor at 3000 × g for 25 min at 4 °C, the resulting cells bands were collected and re-suspended in 0.15 M NaCl. The cell pellet was washed five times with 0.15 M NaCl. The total number of cells was determined by using a hemocytometer.

2.3. Protein preparation

The protein analysis and database searches (2.4) were performed at the Uppsala University Mass Spectrometry Facility (Department of Chemistry-BMC, Analytical Chemistry). Each tissue samples was lysed in a buffer containing 1% β-octyl glucopyranoside and 6M urea. The total protein concentration in the samples was measured using the DC Protein Assay with bovine serum albumin (BSA) as standard. Aliquots corresponding to 15 µg protein were taken out for digestion.

The proteins were reduced, alkylated, in-solution digested by trypsin and desalting by a spin filter (3kDa centrifugal spin filter, Millipore, Ireland). The collected peptide filtrate was vacuum centrifuged to dryness using a Speedvac system. The samples were dissolved in 75 µL 0.1% FA and further diluted 2 times prior to LC-MS/MS analysis.

The resulting peptides from each individual sample were analyzed by LC-MS/MS by separating them in reversed-phase on a C18-column, applying a 150 min long gradient, and electrosprayed on-line to a QEx-Orbitrap mass spectrometer (Thermo Finnigan). Tandem mass spectrometry was performed applying HCD.

2.4. Proteome analysis

For qualitative analysis database searches were done using the software MaxQuant 1.5.1.2 towards proteins from *Pacifastacus leniusculus* SRA experiments Accession number SRX768725 (ABI_SOLID) and Accession number SRX768735 (ION_TORRENT) transcript-

tomes. Moreover searches were performed towards crayfish proteome extracted from Uniprot, and the search parameters used were: Enzyme: Trypsin. Fixed modification was Carbamidomethyl (C), and variable modifications were Oxidation (M), Deamidated (NQ). The search criteria for protein identification were set to at least two matching peptides.

For quantitative analysis, all eighteen individual RAW-data files were quantitatively analyzed using the quantification software MaxQuant 1.5.1.2. Protein identification was performed by a search against the same database as for the qualitative analysis. The results of all samples were combined to a total label free intensity analysis for each sample.

2.5. Data analysis and visualization

The LFQ intensity values and protein IDs were analyzed using the GiaPronto software (Weiner et al., 2018). In GiaPronto the raw protein intensities are log2 transformed and normalized by subtracting the average. A two-tailed Student's t-test (assuming equal variances) was performed and a p-value < 0.05 was considered as statistically significant.

3. Results

3.1. Total global protein – qualitative analysis

A comparison between the four different cell types in the hematopoietic lineage of *P. leniusculus*, was done using four-five replicates of quantitative proteomics according to Figure S1. Transcriptomic data from Bioproject [Accession: PRJNA259594](#) were used to identify proteins, after translation to protein Fasta files. Five crayfish individuals were used for isolation and separation of APC cells, HPT cells, SGC and GC respectively. Due to low number of cells from APC and GC in one individual, only four samples were analyzed for these cell types (Figure 1). The total number of cells, protein concentration and number of identified proteins in each sample are given in Table S1. In the analysis using MaxQuant 1.5.1.2, 2569 proteins were identified in total in the eighteen samples using the SRX768725 transcriptome (Table S2), and 2292 proteins using the SRX768735 transcriptome (data not shown). Proteins detected by using the crayfish proteome extracted from Uniprot did not give any other proteins than the ones detected using the SRX768725 transcriptome database. Since the SRX768725 transcriptome covered all the proteins detected, this database was used for all the following analysis.

3.2. Comparative proteome analysis of HPT cells versus APC cells

In order to find specific proteins that were up- or downregulated in different differentiation stages, we performed direct comparisons between HPT (when HPT is mentioned in the following text it means that the APC is removed) cells versus APC cells, SGC versus HPT cells, GC versus HPT cells and GC versus SGC, respectively. Using significance value of -log₂ pvalue > 5.0 we could identify 166 proteins which were significantly higher expressed in HPT cells compared to APC cells (Figure 2A), whereas no proteins were considered significantly downregulated in HPT cells. However, the proteins that were higher in their expression all showed a modest increase in the HPT cells, with the highest significant log₂ fold change of 2.2 for the uncharacterized protein (cl14380) followed by clathrin heavy chain and ARP 2/3 complex subunit 2 (Figure 3A). Figure 3 shows the proteins that are increased respectively reduced the most when we compared two cell types with each other. On the other hand, this figure does not say anything about the amount of the different proteins found in the respective cell types, only the relative changes between two cell stages.

The protein profiles between HPT cells and APC cells did not differ dramatically, although some upregulated proteins, such as different protease inhibitors indicated that there may be higher abundance of more differentiated cells in the HPT compared to APC (Figure 3A). Nonetheless, an analysis of proteins that are specific or highly expressed in these two tissues compared to circulating SGC and GC stem cells revealed for example several DNA replication licensing factors mcm 2-5 (Table S2: CL13467Contig1, CL1873Contig1, CL5583Contig1, CL5583Contig1) thus, showing characteristics of high proliferative activity and stem cell features in both APC and HPT.

3.3. Comparative proteome analysis of SGC versus HPT cells

More dramatic changes were found when we compared the global proteome of SGC with that of HPT cells. We detected 117 proteins, which were significantly higher in expression in SGC and 426 proteins, which were downregulated in SGC compared to in HPT cells (Figure 2B). In this case the log₂ fold change was significantly larger, and between 4 and 6, compared to from APC to HPT. The twenty proteins that were most highly upregulated from HPT to SGC are illustrated in Figure 3B. However, it should be noted that proteins specific for SGC and not present in HPT are not included in this figure but are instead reported separately in Table 1. The twenty most upregulated proteins (with -log₂ pvalue > 5.0) are shown in Figure 3B, and it is clear that differentiation into cells with immunological functions has taken place from HPT to SGC. Several Kazal protease inhibitors (KPI) are among these, and most up-

regulated is the SGC specific KPI that we have previously identified as a marker protein for SGC (Wu et al., 2008). Also other protease inhibitors, i.e. three serpins are present among these twenty proteins, as well as two so far uncharacterized serine proteases (Figure 3B). Interestingly, one of the most upregulated proteins in SGC apart from the SGC specific KPI was the lipopolysaccharide- and β -glucan binding protein (LGBP) (Lee et al., 2000). Furthermore, a clear reduction of the abundance of proteins involved in cell division is seen, as for example proliferating cell nuclear antigen (PCNA) (Figure 3E).

3.4. Comparative proteome analysis GC versus HPT cells

When comparing the total proteome of GC with that of HPT cells it was clear that these two cell types had fewer proteins in common, and thus GC seems to be further differentiated from the stem cells when compared to SGC (Figure 2C). Fifty-two proteins were significantly higher expressed in GC, and 215 were found to be downregulated. However, it is important to remember that proteins which were not detected in HPT but present in GC are not shown in Figure 2C. Among the twenty highest upregulated proteins, important immune components are detected, such as proPO and four different crustin antimicrobial peptides (Figure 3C). In similarity with SGC many upregulated proteins belong to the serpin and KPI protease inhibitor families, out of which some but not all were similar between these two hemocyte types (Figure 3B-C). However, an increase in antimicrobial peptides of the crustin family and also the mannose binding lectin (Wu et al., 2013) was prominent for GC differentiation in contrast to SGC.

Among the proteins, which were most downregulated in GC compared to HPT cells, a different set of proteins were found (Figure 3F) compared to that for the SGC (Figure 3E). Here we found for example several proteins, which are included in heterogeneous nuclear ribonucleoprotein (hnRNP) complexes (Figure 3F).

3.5. Comparative proteome analysis SGC versus GC cells

As is shown in Figure 2D the protein content of SGC and GC is very similar and we could not find any proteins that were significantly up- or downregulated in GC compared to SGC with a $-\log_2 p\text{-value} > 5.0$. But, after lowering the limit to $-\log_2 p\text{-value}$ to above 4.0, a few proteins were recognized (Figure 2D). Then we could find crustin 1 as the most upregulated protein in GC compared to SGC, and transglutaminase as well as a few other proteins as the most downregulated proteins. This result does not mean that SGC and GC are completely similar since some proteins were detected as unique to SGC and GC respectively (Table 1) and the method

used by GiaPronto for comparison in Figure 3 can not detect proteins that exist only in one of the compared cell types (Weiner et al., 2018). Moreover, the amount of individual proteins differs significantly between the different cell types as will be shown below in section 3.6.

3.6. Cell type specific proteins and possible biomarkers

In order to find specific proteins that could be used as biomarkers for a certain cell type, we used the GiaPronto software to rank proteins that are both upregulated and abundant in a specific cell type. The software then multiplies the \log_2 ratio with values for protein abundance, and then ranks the proteins based upon the obtained value (Weiner et al., 2018). The results presented in Figure 4 show possible biomarker proteins when comparing HPT with APC cells, SGC and GC with HPT respectively, and finally comparing SGC with GC and vice versa. The values on the upper axis show the \log_2 ratio multiplied with the mean abundance of the protein in the specific cell type, and from Figure 4B and C it is evident that the values are high, and thus indicating a dramatic increase of some proteins in SGC and GC compared to HPT cells. In SGC an excellent biomarker clearly is the SGC specific Kazal protease inhibitor, which is the same protein that we earlier have determined as a SGC marker using 2D-gel electrophoresis (Wu et al., 2008). Furthermore LGBP is one of the highly upregulated and abundant proteins, which appear during the differentiation of SGC (figure 4B). In GC on the other hand, proPO is the highest ranked as a possible biomarker. However, this protein is present in SGC as well and thus can only show differentiation compared to HPT cells. The crustins, on the other hand, appear to be good markers for differentiation of GC (Figure 4C). The results shown in Figure 4A, were proteins in HPT are ranked compared to APC cells show interesting results. Proteins such as hemolectin, and crustin 1 clearly show that the HPT contain cells that are precursors of SGC and GC respectively, and these proteins can possibly be used as markers for differentiation into these two lineages within the tissue. We also calculated which proteins that occur in highest amount in the different cell types, and found that hemolectin (CL1Contig139) and TGase (CL606Contig1) are the most common proteins in SGC, whereas proPO (CL689Contig2) and crustin 1 (comp221280) are the most abundant GC proteins (Table S2).

Furthermore, we analyzed which proteins that were only detected in a specific cell type and some of these are listed in Table 1. Here, some new marker proteins can be found and interestingly the JAK/STAT signaling pathway component STAT is only detected in HPT cells. Among putative SGC cell marker proteins some so far uncharacterized proteins such as a VEGF, a LDL receptor and a C-type lectin can be found as well as the matricellular protein

thrombospondin. Surprisingly, the clotting protein (Hall et al., 1999) was detected specifically in SGC (Table 1). In GC we could detect SOD as a specific marker protein that we have detected before, by 2D-gel electrophoresis (Wu et al., 2008). Moreover, a GC specific crustin was detected as crustin 3, and also some previously unknown proteins such as a KPI, a serine protease and a peroxidase domain containing protein (Table 1). In summary several new possible marker proteins were detected for HPT, SGC as well as GC.

4. Discussion

The hemocytes in crustaceans are essential for the animal's ability to defend themselves against pathogenic microbes. During an infection or after a serious wound, hemocytes are consumed and new hemocytes are rapidly needed. Thus, at the site of an infection activated hemocytes release the cytokine astakine1, and possible other substances that induce cell division, differentiation and finally release of new cells from the HPT (Smith and Söderhäll, 1983; Söderhäll et al., 2005; Srirachoen et al., 2005). We need to know more details about how different cell types are formed, and if different pathogens can induce hemocyte formation with special functions. We also need to get more knowledge about how hemocyte formation is regulated, partly to increase knowledge of hematopoiesis in more invertebrate species, but also to develop tools to, for example, detect ongoing infections. A prerequisite for understanding more details about how both blood cell formation and how the immune system works is to be able to differentiate between cells with different functions and study them individually. A decisive advance to decipher the function of different hemocyte types was the cell-separation method developed 35 years ago by Söderhäll and Smith (1983). This method has since then been successfully used to clarify the main differences in function between hyaline cells, SGC and GC for reviews see (Cerenius and Söderhäll, 2018; Jiravanichpaisal et al., 2006). Even more detailed information on hemocyte function comes from studies of horseshoe crab hemocytes, where large and small granules inside the cells were separated by continuous sucrose gradient centrifugation (Shigenaga et al., 1993). They could elegantly show that the large granules contain the components of the clotting reaction, whereas the small granules were filled with antimicrobial peptides like tachypleusins (Nakamura et al., 1988; Shigenaga et al., 1993). We have used another strategy to find proteins in the crayfish GC, which have great similarities to horseshoe crab hemocytes. By isolating GCs and then treating them with a calcium ionophore we induced exocytosis of proteins contained in the granules, and then found

both proteins of the proPO system and a large amount of antimicrobial proteins (Sricharoen et al., 2005).

In the present study, we have deepened the characterization of different cell types in the hemocyte lineage by analyzing the total protein content of each cell type individually. We used four to five individuals and found that the proteome in each of the four cell types was distinctive and the variation between individuals for the most common proteins was only marginal. Not surprisingly, stem cell features were obvious in the APC and HPT cells with high abundance of proteins involved in the cell cycle and DNA replication. We also found that typical mitochondrial proteins were prominent in the APC cells (data not shown), which also shows that they have high metabolic activity and can explain that this part of the hematopoietic tissue has a high production of ROS, which is important for regulating the hematopoietic process as we have shown before (Junkunlo, 2015; Noonin et al., 2012).

We aimed to find proteins that were unique, or at least only found in detectable amount, in one specific cell type, in order to enable us to use these markers to follow how the differentiation process is influenced by various external factors. An interesting finding was that STAT, a component of the JAK-STAT pathway was only found in HPT cells. It shows some consistency with how hematopoiesis is regulated in Drosophila where the JAK-STAT pathway has been shown to be active precisely in that part of the fly lymph gland where prohemocytes are present, and to be required for the maintenance of the prohemocyte stage (Krzemień et al., 2007; Morin-Poulard et al., 2013).

Another HPT-specific protein was pseudouridylate synthase 7 (PUS7). This enzyme is involved in RNA modification by catalyzing the isomerization of uridine to pseudouridine (Safra et al., 2017). In a recent study PUS7 was shown to specifically govern hematopoietic stem cell function, and PUS7 was highly expressed in hematopoietic stem and progenitor cells in mice (Guzzi et al., 2018). The mechanism by which PUS7 regulates stem cell function was elegantly shown to be by activating small tRNA-derived fragments mainly so called tRFs which are processed from the 5' end of tRNA, and these fragments then act as potent inhibitors of protein synthesis. PUS7 was shown to specifically alter a subset of 5'tRFs and these altered fragments then repress translation (Guzzi et al., 2018). Thus, our finding of high PUS7 expression in crayfish HPT cells then indicates that such a regulatory mechanism may be evolutionary conserved.

ADP-ribosylation factors (ARFs) are GTP-binding proteins that regulate membrane traffic and actin remodeling, and we detected an ARF4-like protein as highly expressed in HPT cells. An interesting observation is that this protein was upregulated in WSSV infected *Fen-*

neropenaeus chinensis specifically in hyaline hemocytes (Zhu et al., 2018b). In *P. leniusculus* hyaline cells are rare and as earlier proposed these cells may be similar to prohemocytes that are released upon emergency from the HPT (Hammond and Smith, 2002; van de Braak et al., 2002). Another protein involved in membrane trafficking that was only detected in HPT cells is translocation protein SEC62, similar to Drosophila Dtrp1 (Noël and Cartwright, 1994), which has been shown to be highly upregulated in several cancer cells such as in lymph node metastasis (Bochen et al., 2017).

The SGC population may contain some immature cells and that is why traces of proteins involved in cell division can be seen in this fraction and these are then the ones that are most downregulated. As possible marker proteins for SGC we could confirm that the SGC specific Kazal protease inhibitor is highly expressed in these cells as we found earlier by 2-D gel electrophoresis (Wu et al., 2008). We could now also detect some additional putative markers for SGC and maybe these markers can aid in finding diverse subpopulations of the SGC population. Among these are an hitherto uncharacterized VEGF-like protein, a low density lipoprotein receptor, a C-type lectin, dual oxidase and a thrombospondin. However, an intriguing observation was that the clotting protein was only detected in the SGC fraction. We know that mRNA encoding this protein is expressed in HPT cells and that the protein is secreted and is present in plasma in high amount and function in hemolymph coagulation (Hall et al., 1999; Junkunlo et al., 2018; Wang et al., 2001). The reason for how the clotting protein is attached to specifically to SGC is something, which calls for further investigations.

As earlier we found SOD as a useful marker protein in GC (Wu et al., 2008), but could also identify one new serine protease, and an uncharacterized peroxidase family protein. However, the most highly expressed protein that was unique for GC was crustin 3. An important discovery we made in this study is that the crustin antimicrobial peptides appear to be especially expressed in GC. This finding may be in agreement with the recent study by Suleiman and collaborators (Suleiman et al., 2017) showing that the detection of crustin mRNA expression in various tissues is due to hemocyte (GC) infiltration.

In summary, we have with this global comparative proteomic analysis been able to detect several new biomarkers within the crayfish hematopoietic lineage that can be used to increase the understanding of how the differentiation process is regulated.

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<https://doi.org/10.1016/j.dci.2018.02.003>

Figure legend

Figure 1.

Experimental setup, APC, HPT SGC and GC (or 20x) from five individual crayfish were isolated and analyzed separately according to the schedule. Four samples were used for APC cells and GC. Scale bar = 50 μm

Figure 2.

Volcano plots showing significance and fold change between cell types, blue dots mark up-regulated proteins and red dots down-regulated proteins. A t-test is used to determine statistical significance, and is represented on the y-axis as $-\log_2 p$ value where > 5 is considered significant
A) Comparison of HPT cells versus APC cells; B) Comparison of SGC versus HPT cells; C) Comparison of GC versus HPT cells; D) Comparison of GC versus SGC (for this comparison $(-\log_2 p \text{ value} > 4)$)

Figure 3.

Proteins that are significantly ($-\log_2 p \text{ value} > 5$) up-regulated or down-regulated between two different cell types
A) up-regulated proteins in HPT cells compared to APC cells; B) up-regulated proteins in SGC compared to HPT cells; C) up-regulated proteins in GC compared to HPT cells; D) up-regulated and down-regulated proteins in GC compared to SGC; E) down-regulated proteins in SGC compared to HPT cells; F) down-regulated proteins in GC compared to HPT cells.

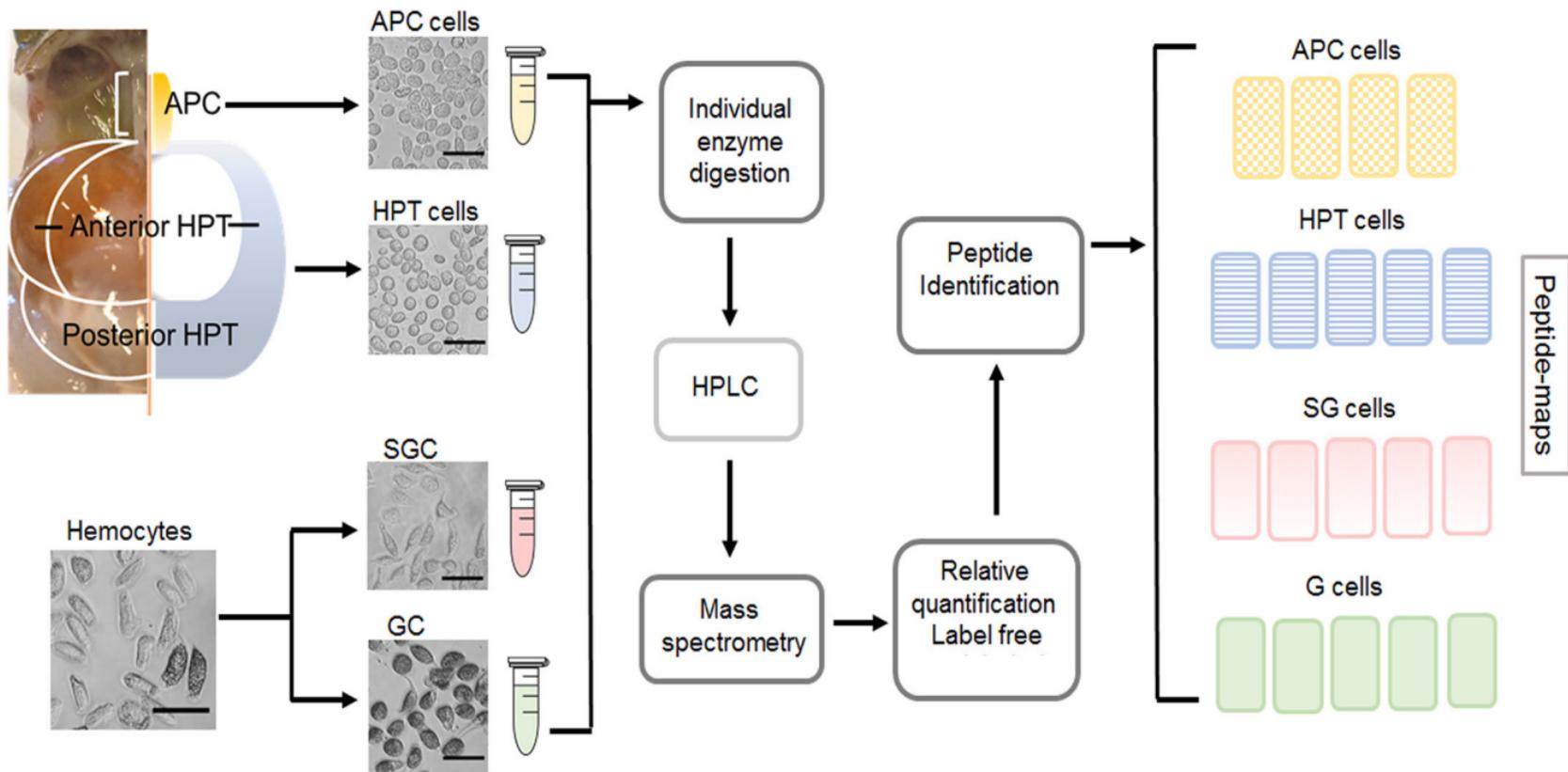
Figure 4.

Biomarkers defined as proteins that are up-regulated and abundant in comparison between two cell types.
A) biomarkers in HPT cells compared to APC cells; B) biomarkers in SGC compared to HPT cells; C) biomarkers in SGC compared to HPT cells; D) biomarkers in SGC compared to GC; E) biomarkers in GC compared to SGC.

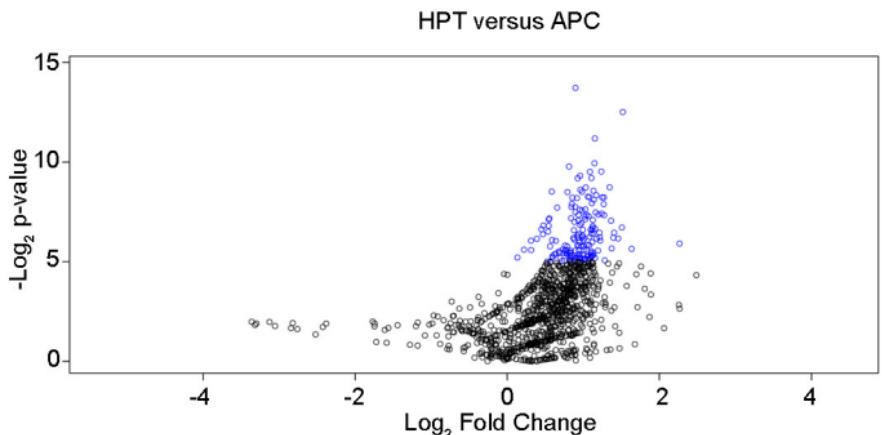
Table 1

Examples of proteins that were detected in only one cell type.

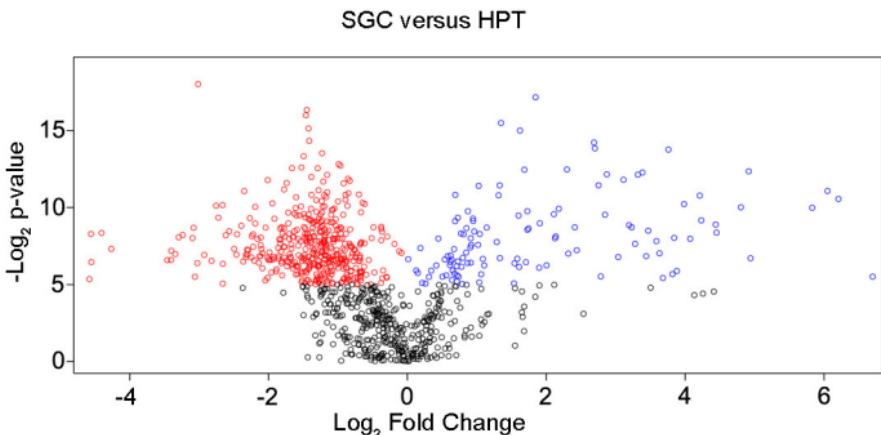
Cell type	Protein name	Accession number in SRX768725
HPT	STAT	comp220390_c1_seq3
HPT	Translocation protein SEC62-like	CL29557Contig1
HPT	Trans-dihydrobenzenediol dehydrogenas	CL3245Contig1
HPT	Pseudouridylate synthase 7	CL445Contig1
HPT	ADP-ribosylation factor 4	CL12208Contig1
SGC	VEGF	CL8885Contig1
SGC	Type I cytoskeletal keratin 9	CL26305Contig1
SGC	C-type lectin	comp220632_c4_seq8
SGC	Clotting protein	CL647Contig2
SGC	Thrombospondin 3a	CL429Contig1
SGC	Low density lipoprotein receptor	comp222144_c1_seq2
SGC	Unknown	CL29825Contig1
SGC	Dual oxidase 1	CL5424Contig1
GC	Unknown	comp209727_c0_seq1
GC	Copper zinc superoxide dismutase SOD	CL7002Contig1
GC	Kazal protease inhibitor	CL11891Contig1
GC	Crustin 3	CL3899Contig1
GC	Purine nucleoside phosphorylase	CL1698Contig1
GC	Serine protease	CL31137Contig1
GC	Peroxidase	CL4181Contig1



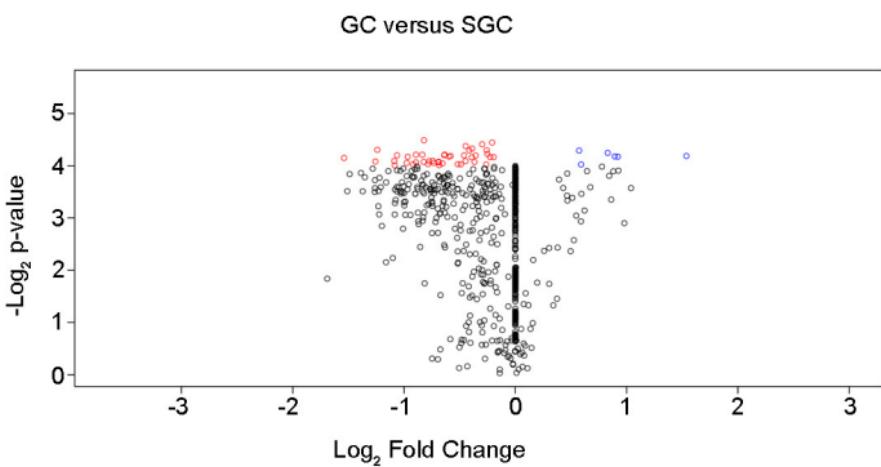
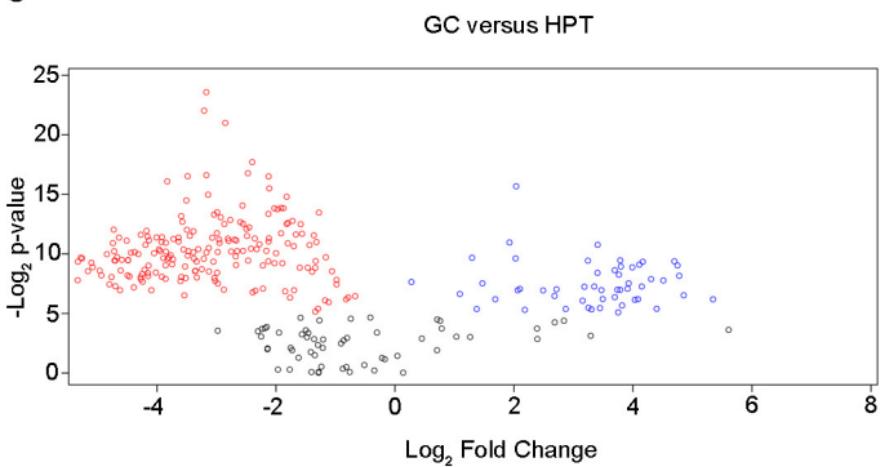
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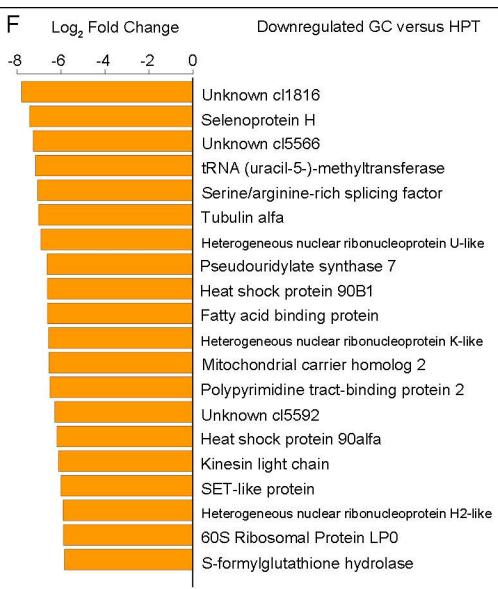
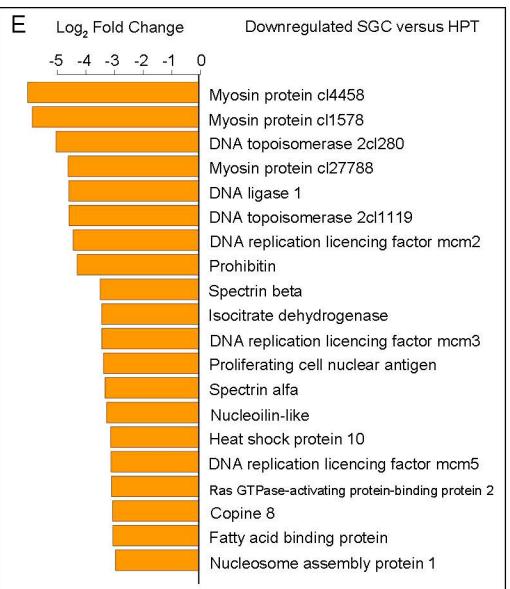
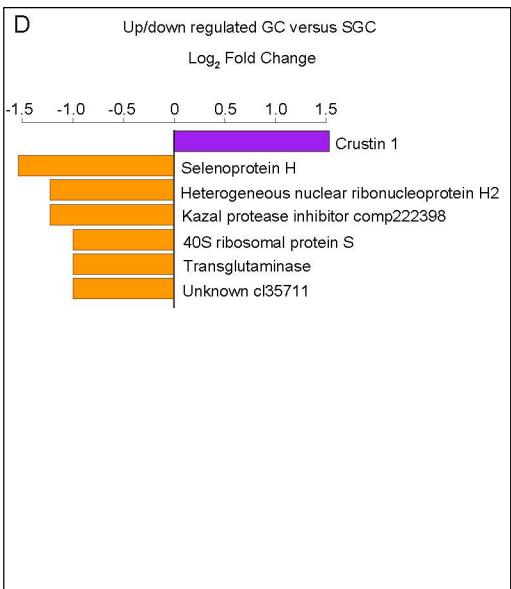
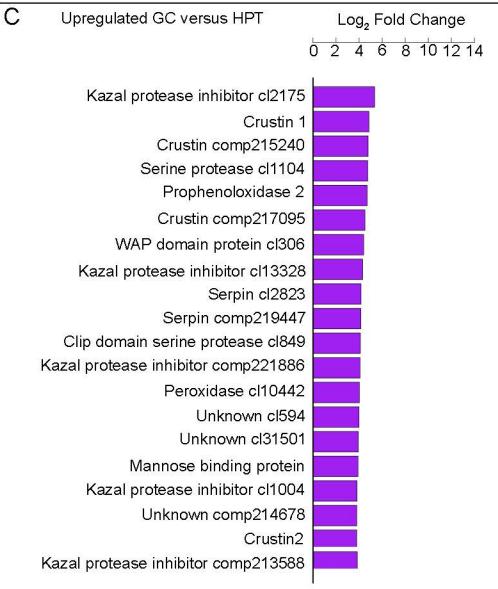
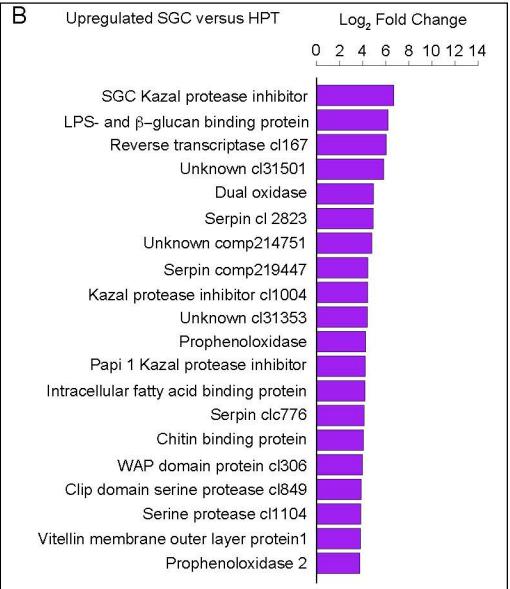
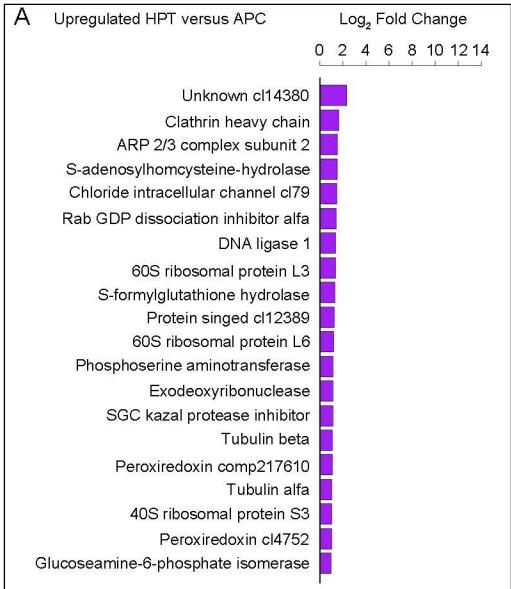


B



C





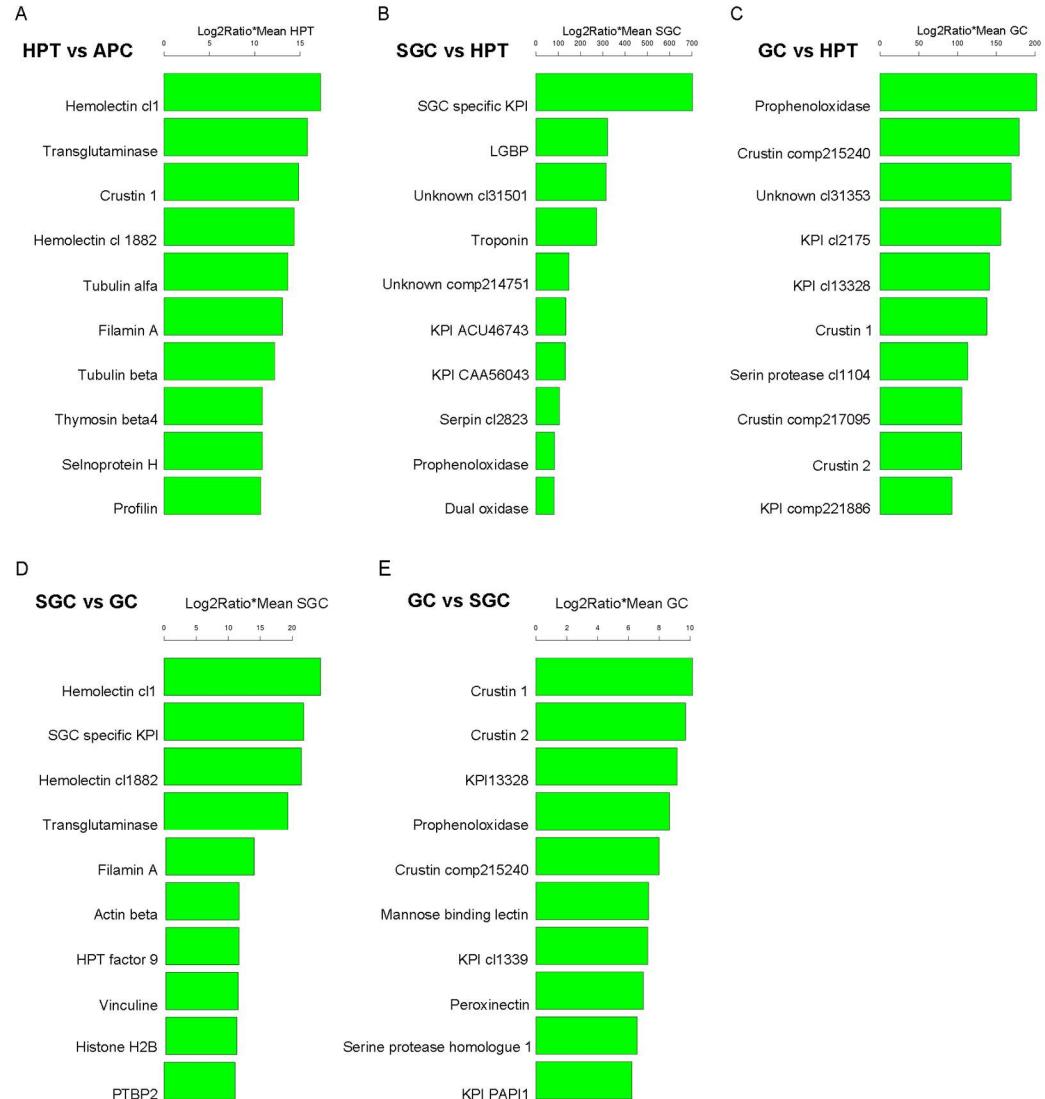


Table 1

Examples of proteins that were detected in only one cell type.

Cell type	Protein name	Accession number in SRX768725
HPT	STAT	comp220390_c1_seq3
HPT	Translocation protein SEC62-like	CL29557Contig1
HPT	Trans-dihydrobenzenediol dehydrogenas	CL3245Contig1
HPT	Pseudouridylate synthase 7	CL445Contig1
HPT	ADP-ribosylation factor 4	CL12208Contig1
SGC	VEGF	CL8885Contig1
SGC	Type I cytoskeletal keratin 9	CL26305Contig1
SGC	C-type lectin	comp220632_c4_seq8
SGC	Clotting protein	CL647Contig2
SGC	Thrombospondin 3a	CL429Contig1
SGC	Low density lipoprotein receptor	comp222144_c1_seq2
SGC	Unknown	CL29825Contig1
SGC	Dual oxidase 1	CL5424Contig1
GC	Unknown	comp209727_c0_seq1
GC	Copper zinc superoxide dismutase SOD	CL7002Contig1
GC	Kazal protease inhibitor	CL11891Contig1
GC	Crustin 3	CL3899Contig1
GC	Purine nucleoside phosphorylase	CL1698Contig1
GC	Serine protease	CL31137Contig1
GC	Peroxidase	CL4181Contig1

Supplementary Table S1.

Cell number, protein concentration and number of identified proteins (from Database searches with the software MaxQuant 1.5.1.2. towards proteins from transcriptome data: Accession number SRX768725/Accession number SRX768735) isolated from five individual crayfish. Purity in % is given for SGC and GC. Crayfish #1 APC and GC could not be analyzed.

Crayfish number/ Cell type	Cell number	Purity (%)	Protein (µg/µL)	Number of identified proteins
Crayfish 1, APC			Nd	Nd
Crayfish 2, APC	170000		0.61	1017/1078
Crayfish 3, APC	73500		0.40	1194/1230
Crayfish 4, APC	62000		0.42	773/819
Crayfish 5, APC	17000		0.17	830/873
Crayfish 1, HPT	806000		2.38	1138/1200
Crayfish 2, HPT	216000		0.78	1379/1414
Crayfish 3, HPT	232000		1.39	1421/1426
Crayfish 4, HPT	64000		0.36	999/1076
Crayfish 5, HPT	134000		0.71	1247/1267
Crayfish 1, SGC	660000	99	1.37	893/975
Crayfish 2, SGC	2652000	98	3.60	926/1022
Crayfish 3, SGC	412500	99	2.52	1042/1119
Crayfish 4, SGC	451500	97	0.74	841/927
Crayfish 5, SGC	150000	96	0.99	882/954
Crayfish 1, GC			Nd	Nd
Crayfish 2, GC	30500	100	0.62	337/391
Crayfish 3, GC	254500	100	2.54	395/472
Crayfish 4, GC	24000	100	0.33	284/320
Crayfish 5, GC	56500	100	1.70	354/404

Supplementary Table S2. Mean Label free quantitative (LFQ) intensity for cell types isolated (APC) n=4; Hematopoietic tissue (HPT) n=5; Semigranular cells (SGC) n=5; Granular cells n=5

Protein IDs	APC mean LFQ intensity	HPT Mean LFQ intensity
CF542373	0	4517000
CL10002Contig1	3310750	8470600
CL1001Contig1	0	2393980
CL1002Contig1	39834500	55998600
CL1004Contig1	10134000	10959800
CL1004Contig3	111345000	187117800
CL1011Contig2	0	0
CL1012Contig1	0	0
CL1013Contig1	0	1385260
CL1013Contig2	7610750	4709380
CL10158Contig1	0	11730600
CL10190Contig1	0	0
CL10206Contig1	40737500	56904200
CL10230Contig1	0	0
CL10237Contig1	0	0
CL1023Contig1	4925950000	6114360000
CL10294Contig1	0	0
CL1030Contig1	0	4496400
CL1031Contig1	15536500	21467200
CL10340Contig1	0	1177960
CL10342Contig1	9083000	8785400
CL1037Contig1	19141500	38942200
CL1039Contig1	2891000	4941200
CL1040Contig2	0	0
CL10423Contig1	0	533140
CL1042Contig1	1680475	1350520
CL1043Contig1	0	1204060
CL10442Contig1	3282500	18690800
CL1045Contig1	156725000	68215600
CL10462Contig1	17617000	4780000
CL1046Contig1	9579500	22760800
CL1055Contig1	224922500	289090000
CL1057Contig1	2709500	3077800
CL10597Contig1	0	0
CL1059Contig1	47357500	59833000
CL10654Contig1	4349750	8676200
CL10669Contig1	5158500	10658800
CL1071Contig1	0	0
CL10730Contig1	0	464160
CL1074Contig1	0	1023440
CL1075Contig1	24836500	32808400

CL10797Contig1	0	1737520
CL1079Contig1	60732500	77551400
CL107Contig1	392200000	413144000
CL107Contig2	37332500	39652400
CL107Contig3	30743750	36745600
CL10811Contig1	0	1151420
CL10818Contig	0	0
CL1081Contig1	10718450	15755400
CL10821Contig1	0	5652000
CL1082Contig1	0	0
CL10831Contig1	0	2713400
CL10841Contig1	0	1641680
CL10899Contig1	0	0
CL1089Contig1	0	0
CL10924Contig1	0	7729000
CL1094Contig1	19839000	41684000
CL10954Contig1	4728500	19305800
CL1097Contig1	658650000	180152000
CL1104Contig1	33531700	32913420
CL110Contig1	0	0
CL110Contig2	0	0
CL1111Contig1	7985000	0
CL11123Contig1	88350500	94219800
CL1112Contig1	0	0
CL1116Contig1	0	0
CL1117Contig1	0	0
CL1119Contig1	120509500	174030600
CL1121Contig1	0	1510680
CL11248Contig1	86899250	36245200
CL11311Contig1	7098250	2923000
CL11333Contig1	6752750	11802400
CL11342Contig1	0	6863120
CL11361Contig1	0	0
CL11389Contig1	0	1823320
CL1140Contig2	5961500	2006400
CL1141Contig1	11674400	12205800
CL11426Contig1	3645500	7895200
CL11427Contig1	2753750	1526420
CL11430Contig1	0	0
CL11439Contig1	0	0
CL1143Contig1	12333500	39161800
CL11440Contig1	10834000	14403000
CL11444Contig1	16549750	20554000
CL1144Contig2	0	5619200
CL11457Contig1	0	0
CL11464Contig1	0	2380000

CL11474Contig1	0	3460200
CL11479Contig1	0	0
CL1149Contig1	1476775	1587340
CL11509Contig1	3670500	0
CL11511Contig1	0	2852600
CL11513Contig1	0	1110880
CL11521Contig1	18447500	21261200
CL1152Contig1	361142500	164704000
CL11540Contig1	0	0
CL11556Contig1	3690250	0
CL11566Contig1	0	0
CL1156Contig1	0	0
CL11589Contig1	0	1264080
CL1158Contig1	2205950	1489580
CL11600Contig1	3442750	1873240
CL11603Contig1	0	2350200
CL11633Contig1	221920000	323296000
CL11638Contig1	9373775	16687800
CL1163Contig1	3113750	10837800
CL11643Contig1	0	666840
CL11647Contig1	0	0
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CL11661Contig1	0	0
CL11675Contig1	4716500	8346200
CL11661Contig1	0	3001200
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CL11698Contig1	3167500	4914820
CL11699Contig1	60123500	83208800
CL1169Contig1	0	464620
CL116Contig2	27111250	47110600
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CL11706Contig1	0	1138380
CL1170Contig1	5126250	46121000
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CL1172Contig1	41344750	81104200
CL1173Contig1	10563000	16547600
CL11762Contig1	3121500	14479680
CL11767Contig1	90009750	83884600
CL11775Contig1	0	0
CL11782Contig1	0	804260
CL1178Contig1	0	0
CL117Contig3	103447500	195820000
CL11808Contig1	0	0
CL11831Contig1	0	0
CL11834Contig1	120436250	112403000
CL1183Contig1	0	0

CL11840Contig1	0	0
CL11862Contig1	6243750	4023960
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CL11887Contig1	1328000	2923820
CL11891Contig1	0	0
CL11894Contig1	0	4354140
CL11900Contig1	0	0
CL11901Contig1	8088500	15113600
CL1194Contig1	0	0
CL11975Contig1	45645000	46484600
CL1198Contig1	0	376340
CL119Contig3	0	0
CL119Contig6	0	0
CL119Contig7	0	0
CL12018Contig1	27823250	25659800
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CL12208Contig1	0	18794000
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CL12869Contig1	4713000	13538000
CL12871Contig1	0	0
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CL12890Contig1	12972500	0
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CL1290Contig1	0	0
CL12910Contig1	302165000	449646000
CL1292Contig1	0	7598800
CL1293Contig1	23875500	43898800
CL12945Contig1	0	0
CL12958Contig1	0	0
CL12992Contig1	677495000	370894000
CL12994Contig1	0	0
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CL13027Contig1	31229750	65843200
CL13036Contig1	0	20055800
CL13059Contig1	0	1972020
CL13066Contig1	0	0
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CL13116Contig1	0	1403960
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CL13159Contig1	0	1430980
CL1315Contig2	31928500	39977600
CL13173Contig1	4308750	21833600
CL13190Contig1	49387500	45900000
CL1319Contig1	0	0
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CL13202Contig1	0	0
CL13240Contig1	1950125000	2508560000
CL1324Contig1	0	987580
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CL1325Contig1	4033500	13152000
CL13300Contig1	0	3041120
CL13307Contig1	16846750	39645600

CL1331Contig1	95274750	166731000
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CL1334Contig1	0	6137000
CL13357Contig1	0	1444880
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CL13398Contig1	11470000	10365200
CL1339Contig1	357960000	264242000
CL133Contig1	0	7410840
CL13413Contig1	79550000	103457000
CL13414Contig1	0	0
CL13433Contig1	65763250	82353200
CL13436Contig1	5018750	0
CL13437Contig1	1108402500	45839000
CL1344Contig1	49636500	65267200
CL1344Contig2	138481500	198944000
CL13467Contig1	46674250	58637200
CL13472Contig1	0	8046600
CL13479Contig1	0	0
CL13481Contig1	366385000	124705400
CL13502Contig1	0	685480
CL13512Contig1	0	0
CL13514Contig1	37316000	54209000
CL13522Contig1	4805000	17340400
CL1356Contig1	38499750	12501800
CL13571Contig1	722275	0
CL13574Contig1	2231000	7600400
CL13578Contig1	0	781640
CL13585Contig1	477722500	339088000
CL13599Contig1	9181500	2048400
CL1359Contig1	0	3361700
CL1360Contig1	53081250	36940200
CL1363Contig2	48366000	69012200
CL13649Contig1	0	0
CL13659Contig1	0	536800
CL1365Contig1	58689500	69770600
CL13676Contig1	12257000	0
CL13695Contig1	174737250	147799800
CL13707Contig1	6567500	7259200
CL13715Contig1	0	2948600
CL1371Contig1	24604250	50697000
CL13723Contig1	2326050	7399240
CL13730Contig1	0	1393560

CL13750Contig1	0	0
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CL1375Contig1	0	30968200
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CL13772Contig1	120480750	51643800
CL13786Contig1	6321800	7561800
CL1378Contig1	25144750	21900400
CL13793Contig1	6765000	2899400
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CL1380Contig1	5685750	0
CL13810Contig1	0	0
CL13821Contig1	0	868240
CL13827Contig1	0	0
CL13828Contig1	14633750	16591000
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CL13833Contig1	0	0
CL13845Contig1	4192750	3919720
CL13860Contig1	35357000	57816800
CL13867Contig1	8113250	17315600
CL13880Contig1	0	543260
CL13895Contig1	0	4755400
CL138Contig2	2427450	4763040
CL13900Contig1	29636750	35816800
CL13904Contig1	7443500	18850400
CL13913Contig1	0	1399280
CL13936Contig1	0	0
CL13937Contig1	3461000	9669400
CL13943Contig1	0	3682360
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CL13960Contig1	172530500	44492400
CL13966Contig1	242160000	253358000
CL13980Contig1	0	1384820
CL13989Contig1	0	0
CL14016Contig1	0	4936800
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CL14027Contig1	0	0
CL1402Contig1	0	917100
CL1402Contig2	0	2238200
CL14047Contig1	0	0
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CL14084Contig1	0	0
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CL14128Contig1	0	3777620
CL14129Contig1	0	4334800
CL14144Contig1	0	1086100

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CL14179Contig1	15321000	25660400
CL1417Contig1	187070500	55729800
CL14186Contig1	0	0
CL1418Contig1	1668175000	1596780000
CL14194Contig1	0	1033860
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CL14201Contig1	1673650	0
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CL1422Contig1	0	0
CL14242Contig1	0	0
CL1424Contig2	0	0
CL14261Contig1	133890000	139956200
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CL14294Contig1	0	0
CL14303Contig1	8474250	23208800
CL14323Contig1	0	0
CL14329Contig1	0	711180
CL14333Contig1	0	3705200
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CL14365Contig1	5206750	1760640
CL14378Contig1	1906650	2939700
CL14380Contig1	13801000	52946200
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CL14424Contig1	45713250	89401400
CL14436Contig1	16816250	31195600
CL14444Contig1	17862500	22683000
CL14453Contig1	2491350	3817500
CL14472Contig1	0	4036200
CL14488Contig1	0	0
CL1448Contig1	0	0
CL1449Contig1	404850	0
CL1449Contig2	31272250	38276000
CL14512Contig1	0	0
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CL1451Contig1	228955000	292972000
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CL14524Contig1	108170500	140682000
CL14529Contig1	0	1019480
CL14553Contig1	0	0

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CL14566Contig1	0	3771600
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CL1466Contig1	0	6513240
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CL1476Contig1	0	0
CL14817Contig1	8386625	10325200
CL1486Contig1	24937000	36400000
CL148Contig1	82467000	113230400
CL1492Contig1	7991750	0
CL14955Contig1	0	526140
CL1497Contig1	52746750	49089000
CL14982Contig1	0	677240
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CL1508Contig1	0	0
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CL15227Contig1	4154000	10194940
CL1522Contig1	0	0
CL153Contig3	0	0
CL1540Contig2	0	4221600
CL1545Contig1	54619500	119615600
CL1547Contig2	18742750	8994200
CL15498Contig1	2896500	4437200
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CL15677Contig1	25761000	34438200
CL1567Contig1	0	0
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CL1573Contig1	0	0
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CL1578Contig1	6088649500	428490000
CL15790Contig1	0	5952820
CL1581Contig1	0	0
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CL15841Contig1	0	1440680
CL15872Contig1	0	0
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CL1598Contig1	0	5887800
CL1601Contig1	311715000	0
CL1605Contig1	0	0

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CL1615Contig1	4549250	11021400
CL1616Contig1	0	0
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CL16266Contig1	24271250	27810200
CL1628Contig1	0	2934000
CL1629Contig1	234842500	253352000
CL16329Contig1	34228750	0
CL1634Contig1	0	864080
CL1635Contig1	23014500	5107900
CL16381Contig1	0	0
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CL16396Contig1	3700000	1547820
CL1640Contig1	0	1068060
CL16418Contig1	59506500	76386200
CL164Contig2	0	0
CL1656Contig1	69201750	77027000
CL1659Contig1	0	0
CL16609Contig1	0	2651400
CL1661Contig1	0	4359000
CL1666Contig1	0	0
CL166Contig2	0	11148400
CL166Contig4	0	2782380
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CL1672Contig1	0	2980640
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CL16748Contig1	0	0
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CL167Contig2	0	4755000
CL1687Contig1	2598750	1331300
CL16882Contig1	0	1160580
CL1690Contig1	0	0
CL1698Contig1	0	0
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CL17126Contig1	5837000	8653400
CL1714Contig1	0	2769200
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CL1719Contig1	0	0
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CL1728Contig1	15973750	29589200
CL17295Contig1	248222500	359592000
CL17333Contig1	54711750	80387400
CL173Contig1	9411250	16044020
CL173Contig2	34336750	28003800

CL1749Contig1	0	1986460
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CL17616Contig1	0	952260
CL1764Contig1	0	2636800
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CL176Contig2	11407500	19916000
CL1773Contig1	33913000	48692800
CL1781Contig1	20566250	19855800
CL17829Contig1	0	1636160
CL1784Contig1	22581500	23932400
CL1786Contig1	0	0
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CL17916Contig1	10460225	10303900
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CL179Contig1	19465500	27580200
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CL1807Contig1	0	0
CL1809Contig1	0	2661600
CL180Contig1	0	2118740
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CL1817Contig1	0	0
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CL18264Contig1	0	8620600
CL1828Contig1	0	0
CL1830Contig2	0	0
CL1834Contig1	24078250	46116800
CL1834Contig2	118294250	155317600
CL183Contig1	27502750	16600200
CL1841Contig1	16986500	21487600
CL18450Contig1	0	11514000
CL1847Contig1	3386500	0
CL18495Contig1	0	0
CL1855Contig1	10723250	13962000
CL185Contig1	8298250	17365000
CL1861Contig1	0	0
CL18659Contig1	0	0
CL18704Contig1	1954725	3081340
CL1870Contig1	0	0

CL1873Contig1	55427750	62569200
CL1874Contig1	0	0
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CL1917Contig1	2916750	0
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CL192Contig4	0	0
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CL19332Contig1	0	0
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CL1970Contig1	1629400	0
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CL1973Contig1	2761500	0
CL1978Contig2	3623250	12432000
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CL1984Contig1	0	0
CL1987Contig1	1333500	0
CL1992Contig1	95983500	111652000
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CL199Contig4	0	0
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CL2022Contig1	0	923520
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CL204Contig2	17695250	29357000
CL2050Contig1	260913000	80002200
CL2059Contig1	0	2296800
CL2062Contig1	43755250	60008000
CL2066Contig1	0	8545400
CL206Contig1	0	4894200
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CL2077Contig1	28427750	39817200
CL207Contig2	3751500	9142600
CL2083Contig1	253515000	243706000
CL208Contig1	0	0
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CL2096Contig2	0	993660
CL209Contig1	24591000	36501000
CL20Contig7	2187750	3828320
CL2103Contig1	11530000	10871600
CL21067Contig1	0	0
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CL2131Contig1	0	0
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CL21379Contig1	596575000	683532000
CL21436Contig1	4165000	19864800
CL21496Contig1	2269975	6366400
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CL214Contig3	462297500	475554000
CL2151Contig1	728672500	691488000
CL21539Contig1	23995500	35761000
CL2155Contig1	0	946380
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CL2188Contig1	0	0
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CL21912Contig1	1013325	930780
CL2194Contig1	0	1078320
CL219Contig1	0	0
CL2200Contig1	3880750	7753560
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CL2208Contig1	0	0
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CL2224Contig1	0	2137000
CL22252Contig1	8878250	0
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CL2231Contig1	0	0
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CL2259Contig1	16891750	9051600
CL226Contig1	7572500	25099800
CL2272Contig1	51886000	81312200
CL2276Contig1	12139750	26663600
CL2283Contig1	222139000	101995800
CL2286Contig1	0	162624
CL2290Contig1	0	0
CL2290Contig2	0	5776620
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CL229Contig2	8134250	9010000
CL2302Contig1	0	1296920
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CL23139Contig1	16655000	33659400
CL2314Contig1	0	0
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CL232Contig2	1557250000	1699600000
CL2336Contig1	151267500	177506000
CL2337Contig2	0	0
CL23426Contig1	2637000	0
CL2345Contig1	4519000	13555600
CL23485Contig1	1799500	4704180
CL23487Contig1	0	0
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CL23819Contig1	94988250	99613400
CL2386Contig1	0	3360440
CL2392Contig2	0	784120
CL2393Contig1	0	1329940
CL239Contig1	0	6392800
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CL23Contig11	236725000	256156000
CL23Contig2	338790000	439192000
CL23Contig3	2630675000	3821200000
CL23Contig8	4930750	34302600
CL23Contig9	0	0
CL2403Contig1	36544250	20147200
CL2407Contig1	0	498240
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CL24179Contig1	0	1702420
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CL2460Contig1	3495750	7490400
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CL25545Contig1	3782500	8192600
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CL25663Contig1	0	2968400
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CL25685Contig1	0	0
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CL2570Contig1	39637000	37418000
CL25723Contig1	0	1152660
CL25745Contig1	0	5397200
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CL25775Contig1	25842000	30689400
CL25779Contig1	0	0
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CL25796Contig1	4018750	10411400
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CL25829Contig1	0	2580800
CL25880Contig1	0	1083560
CL25894Contig1	0	0
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CL2590Contig1	0	0
CL25916Contig1	3553250	8430600
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CL2602Contig1	58987500	200786000
CL26045Contig1	0	0
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CL2610Contig1	6800750	5665800
CL26117Contig1	0	5643260
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CL26143Contig1	19019000	22528400
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CL26165Contig1	0	0
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CL26174Contig1	0	1279260
CL26185Contig1	0	0
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CL26267Contig1	0	0
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CL26376Contig1	20850750	39490400
CL26378Contig1	0	1413280
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CL263Contig3	5441750	9398360
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CL26682Contig1	0	0
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CL26719Contig1	0	0
CL26723Contig1	1932075	0
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CL26787Contig1	20641000	22324000
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CL26909Contig1	0	0
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CL26924Contig1	0	4017540
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CL270Contig2	0	15123200
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CL27254Contig1	0	2663720
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CL2736Contig1	0	0
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CL275Contig3	0	0
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CL2768Contig1	0	0
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CL2771Contig1	0	2311000
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CL280Contig2	155848500	242204200
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CL28126Contig1	0	28520200
CL28130Contig1	0	0
CL2814Contig1	0	3351460
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CL28375Contig1	0	1414240
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CL28440Contig1	15639750	5435600
CL28457Contig1	0	19016600
CL28475Contig1	0	0
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CL2877Contig1	0	0
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CL287Contig3	789035000	857184000
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CL28801Contig1	22609000	38714400
CL28811Contig1	6265250	5634800
CL28836Contig1	0	375560
CL2883Contig1	13673250	11399000
CL28853Contig1	180197500	228606000
CL28859Contig1	351709750	95057400
CL28872Contig1	0	0
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CL28884Contig1	0	2484400
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CL288Contig1	0	743160
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CL28924Contig1	0	460620
CL28929Contig1	0	2332800
CL2892Contig1	221938250	105625800
CL28942Contig1	20633500	31611200
CL28947Contig1	0	3015640
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CL28949Contig1	0	0
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CL28984Contig1	3083000	7704740
CL28990Contig1	19969750	27565800
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CL29066Contig1	0	1929700
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CL29071Contig1	0	0
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CL29113Contig1	0	0
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CL29149Contig1	0	0
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CL29261Contig1	19431500	24218000
CL29267Contig1	0	2486060
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CL29336Contig1	0	0
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CL29973Contig1	7252500	19349400
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CL31323Contig1	0	10319600
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CL31436Contig1	62272750	36273400
CL31437Contig1	0	0
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CL31459Contig1	0	0
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CL31494Contig1	0	4374600
CL31501Contig1	28305500	44984000
CL3151Contig1	0	0
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CL31559Contig1	4271750	14681600
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CL319Contig3	0	29760400
CL3202Contig1	0	0
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CL3304Contig1	148937500	245682000
CL33091Contig1	5509500	21856400
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CL3319Contig1	117222750	131378400
CL3324Contig1	0	1773800
CL332Contig2	138659000	187466000
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CL33410Contig1	0	0
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CL33639Contig1	0	1585900
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CL33913Contig1	0	1079600
CL33971Contig1	68673500	23144200
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CL340Contig1	548992500	665206000
CL340Contig2	0	0
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CL3455Contig1	53995500	52678200
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CL3473Contig1	0	0
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CL3481Contig1	0	0
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CL3487Contig2	3521500	7685800
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CL352Contig1	91712750	88708200
CL35306Contig1	19849500	16915600
CL35313Contig1	11748500	13480000
CL3536Contig1	0	2851200
CL3538Contig1	0	0
CL35392Contig1	22036500	30579600
CL35407Contig1	0	264620
CL3540Contig1	926862500	1312770000
CL35472Contig1	0	2259200
CL3547Contig1	4010250	3590600
CL3550Contig1	132252250	150652000
CL35515Contig1	0	2263600
CL3551Contig1	0	3060000
CL3553Contig1	1656925	0
CL355Contig1	0	1356480
CL355Contig2	4048250	7851200
CL35669Contig1	0	1394520
CL35711Contig1	550460000	567722000
CL35741Contig1	2804750	5040400
CL3584Contig1	0	0

CL35859Contig1	5125075	0
CL35931Contig1	2197825	7097800
CL35977Contig1	0	500920
CL35Contig4	801142500	1169812000
CL36023Contig1	0	764000
CL3610Contig1	0	0
CL36115Contig1	54076250	94848000
CL3611Contig1	0	19459200
CL3615Contig1	7711250	12522200
CL3619Contig1	8035750	15469000
CL3619Contig2	14103025	12353200
CL36201Contig1	0	0
CL362Contig1	99854500	140018000
CL3633Contig1	459377500	537640000
CL3643Contig1	27558250	26926400
CL36470Contig1	13559000	22745400
CL364Contig1	0	0
CL3656Contig1	6585250	15995200
CL36570Contig1	8260000	15857800
CL36577Contig1	0	1725960
CL3659Contig1	0	0
CL365Contig1	7869500	16234000
CL36726Contig1	9917000	11661000
CL36836Contig1	0	1890680
CL36872Contig1	2583750	0
CL36915Contig1	0	0
CL36954Contig1	6631750	15910800
CL3696Contig1	0	0
CL3705Contig1	0	1058900
CL3706Contig1	2532500	13875780
CL3719Contig1	0	0
CL3720Contig1	0	2411440
CL372Contig1	0	7234200
CL372Contig2	0	0
CL37369Contig1	0	0
CL3738Contig1	50050500	54964200
CL3742Contig1	0	0
CL37448Contig1	55860250	63361800
CL37489Contig1	3459000	8304800
CL37503Contig1	49665750	3112200
CL37563Contig1	0	6684000
CL376Contig1	2033100000	2428360000
CL376Contig3	219512500	216136000
CL37712Contig1	40276250	7723000
CL3771Contig1	1295100	3493200
CL377Contig1	0	0

CL37891Contig1	0	2476400
CL3794Contig1	106514000	120192200
CL3798Contig1	1448775000	1482040000
CL3802Contig1	0	0
CL3804Contig1	0	1533280
CL380Contig2	0	0
CL3818Contig1	3936750	7171600
CL381Contig1	24347750	23236800
CL38214Contig1	34219500	41112800
CL38256Contig1	0	0
CL3829Contig1	3876000	7070400
CL3839Contig1	0	360380
CL3848Contig1	175850000	144294000
CL3849Contig2	18203250	27013400
CL384Contig1	265017500	97823200
CL384Contig3	482300000	287374000
CL3851Contig1	0	7471800
CL3857Contig2	0	0
CL38584Contig1	41485750	78631000
CL38602Contig1	6051250	0
CL3867Contig1	0	0
CL3868Contig1	0	0
CL38708Contig1	0	0
CL3871Contig1	0	0
CL38797Contig1	0	837100
CL38801Contig1	0	7077200
CL3883Contig1	2002425	3097380
CL38887Contig1	0	18111600
CL388Contig1	0	0
CL38931Contig1	52776250	82600600
CL38935Contig1	0	4264400
CL3893Contig1	0	0
CL3899Contig1	0	0
CL391Contig2	9719625	44010200
CL3921Contig1	78404500	78140600
CL3930Contig1	0	0
CL3934Contig1	7491000	0
CL3935Contig1	14657750	5725000
CL3936Contig1	0	0
CL3947Contig1	0	0
CL3967Contig1	0	0
CL3972Contig1	0	3587400
CL3974Contig1	0	0
CL3978Contig1	0	0
CL397Contig2	0	5152600
CL3981Contig1	4112250	11644600

CL3981Contig2	0	5437400
CL3995Contig2	0	263500
CL3996Contig1	312197500	312618000
CL399Contig1	0	0
CL4005Contig1	25466500	23295200
CL4013Contig1	64451000	22453600
CL4018Contig1	0	718320
CL4025Contig1	88476250	29511400
CL4027Contig1	0	13027000
CL4064Contig1	98276750	143071000
CL4075Contig1	0	8937640
CL407Contig1	0	0
CL4085Contig1	96453000	39242400
CL40Contig5	0	0
CL4116Contig1	14761000	18728000
CL411Contig2	7172750	16850200
CL411Contig3	36613750	33104200
CL412Contig1	0	2478800
CL4139Contig1	0	1238920
CL414Contig1	59866750	80691400
CL4158Contig1	0	1650180
CL4159Contig1	0	0
CL415Contig2	0	15195600
CL4161Contig1	0	4231600
CL4163Contig1	0	523500
CL416Contig1	0	0
CL4173Contig1	110371250	132196400
CL4180Contig1	0	3427020
CL4181Contig1	0	0
CL4188Contig1	319682500	372342000
CL4224Contig1	1664145000	107730600
CL423Contig1	326505000	199732000
CL4245Contig1	552922500	604478000
CL426Contig1	0	0
CL426Contig2	0	0
CL4276Contig1	0	2584000
CL4285Contig1	0	1297560
CL4288Contig1	20933000	34069400
CL4291Contig1	0	2473000
CL4292Contig1	0	0
CL429Contig1	0	0
CL4311Contig1	0	0
CL4326Contig1	0	0
CL432Contig2	70299000	74804000
CL433Contig1	589355000	587046000
CL433Contig3	0	0

CL4344Contig1	33254000	41034000
CL434Contig1	0	0
CL4354Contig1	237085250	264068000
CL4355Contig1	0	2416400
CL435Contig1	22688250	29602800
CL4369Contig1	0	0
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CL437Contig2	8331250	10082200
CL4391Contig1	284822500	16825000
CL4407Contig1	0	344500
CL4408Contig1	52156250	54074600
CL441Contig1	0	0
CL4426Contig1	8940500	5936000
CL443Contig1	2217200	3691200
CL4443Contig1	10882250	8479400
CL4458Contig1	10056214250	454396000
CL445Contig1	0	23221400
CL447Contig1	0	3709800
CL4490Contig1	0	0
CL4528Contig1	8933250	2320600
CL453Contig1	54301000	62527200
CL4549Contig1	5034450	9114200
CL4558Contig1	0	0
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CL455Contig1	4896500	0
CL4565Contig1	0	0
CL457Contig1	24454250	44761200
CL4602Contig1	0	0
CL4607Contig1	4918000	11409800
CL460Contig1	20433250	42742800
CL4624Contig1	0	0
CL4639Contig1	0	799640
CL4648Contig1	73304750	13919800
CL4651Contig1	191587750	122016000
CL4659Contig1	0	8020800
CL465Contig1	0	0
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CL4685Contig1	15123250	34364600
CL468Contig2	4269000	4686800
CL4692Contig1	221692500	0
CL469Contig1	0	0
CL4709Contig1	0	5527060
CL470Contig1	0	0
CL472Contig1	43789500	59385000
CL4730Contig1	12644000	23584000

CL4741Contig1	0	560800
CL4752Contig1	153857500	231544000
CL4753Contig1	177322500	251134000
CL4778Contig1	8405500	0
CL477Contig3	40457000	36388600
CL47Contig4	53645750	75816200
CL4805Contig1	0	4875800
CL4816Contig1	0	3674400
CL4821Contig1	0	0
CL4837Contig1	19362500	15126600
CL4854Contig1	10981750	27505200
CL4863Contig1	54449000	34496000
CL4883Contig1	0	0
CL4896Contig1	2252950	1854940
CL4904Contig1	0	0
CL4917Contig1	0	0
CL492Contig1	0	0
CL4931Contig1	1668525	0
CL4939Contig1	3156500	10785200
CL4943Contig1	0	0
CL4946Contig1	0	0
CL4951Contig1	0	0
CL4957Contig1	3191500	9780400
CL4958Contig1	81438000	125158000
CL4986Contig1	0	0
CL5006Contig1	0	15451000
CL5008Contig1	0	10624600
CL5018Contig1	13569750	17873200
CL501Contig1	129128250	39065600
CL5022Contig1	90903000	113697600
CL5030Contig1	0	2000600
CL5031Contig1	0	6164800
CL5059Contig1	0	0
CL5061Contig1	0	4920200
CL5062Contig1	0	0
CL5065Contig1	4723000	17337400
CL5076Contig1	56108000	77957400
CL5088Contig1	18908000	58495200
CL5091Contig1	4441250	18235600
CL5092Contig1	0	0
CL5100Contig1	0	1330740
CL5109Contig1	0	0
CL5110Contig1	0	0
CL5113Contig1	0	0
CL5122Contig1	2032100000	107837400
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CL5169Contig1	0	16109800
CL5177Contig1	17729250	29722000
CL517Contig2	0	0
CL5199Contig1	0	1298920
CL5203Contig1	0	0
CL5208Contig1	23644000	26696400
CL5214Contig1	8007750	19624200
CL521Contig2	52473000	60786800
CL5235Contig1	0	0
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CL5239Contig1	1036663500	68335200
CL523Contig1	2656750	2115600
CL524Contig1	0	1789080
CL5253Contig1	0	0
CL5264Contig1	102376000	110413600
CL527Contig2	7352750	19063400
CL5280Contig1	0	0
CL5286Contig1	0	0
CL528Contig1	0	5743200
CL5308Contig1	0	4432260
CL5321Contig1	11163000	18790000
CL5327Contig1	65751750	72447200
CL533Contig2	0	0
CL5346Contig1	17392000	19954400
CL5348Contig1	40927750	14070400
CL5355Contig1	6761000	11451400
CL5359Contig1	0	0
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CL5400Contig1	0	4345580
CL540Contig1	0	0
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CL542Contig1	0	0
CL542Contig3	0	0
CL5430Contig1	0	545900
CL5432Contig1	0	0
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CL5505Contig1	20045750	26396000
CL5513Contig1	0	0
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CL5534Contig1	0	0
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CL5559Contig1	0	0

CL5583Contig1	47808250	60828200
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CL5600Contig1	7353750	11785800
CL5605Contig1	90840750	42198600
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CL5619Contig1	222207500	248278000
CL5622Contig1	0	0
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CL5632Contig1	45205250	73577000
CL5649Contig1	3239000	5945200
CL5652Contig1	2139200	0
CL5657Contig1	2560750	1428400
CL567Contig1	0	0
CL5680Contig1	0	1413540
CL5681Contig1	2762250	10771460
CL5685Contig1	0	1728680
CL5687Contig1	0	0
CL5694Contig1	177454250	195020000
CL5704Contig1	0	9180600
CL570Contig1	0	0
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CL571Contig1	0	0
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CL5735Contig1	1719025	0
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CL5743Contig1	25556750	33118200
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CL5747Contig1	0	0
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CL5766Contig1	0	0
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CL577Contig1	27498000	32670200
CL5783Contig1	8326750	0
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CL5813Contig1	4216650	4592780
CL581Contig2	21686500	24233600
CL5822Contig1	0	0
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CL5831Contig1	4109350	4698140
CL5833Contig1	51867500	69361800
CL5838Contig1	0	1844040
CL5839Contig1	0	0
CL5842Contig1	52930000	46856600
CL5846Contig1	236127500	332652000

CL5849Contig1	0	517300
CL5858Contig1	0	1244300
CL5870Contig1	56046500	58867600
CL5871Contig1	421565000	542812000
CL5878Contig1	0	3108920
CL587Contig1	0	0
CL587Contig2	0	0
CL5880Contig1	49399500	53967200
CL589Contig1	0	0
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CL591Contig1	262720000	263380000
CL5922Contig1	33621250	27760800
CL5927Contig1	60000000	77390400
CL5943Contig1	86956000	99029800
CL5947Contig1	0	0
CL594Contig1	57810000	126676000
CL5966Contig1	0	0
CL5967Contig1	0	2724000
CL5974Contig1	38729250	41752600
CL598Contig2	0	0
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CL5997Contig1	24428500	28860800
CL599Contig1	0	0
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CL6002Contig1	232822500	314672000
CL6005Contig1	1582425	0
CL6008Contig1	0	3519620
CL6013Contig1	0	3164000
CL6022Contig1	0	0
CL6028Contig1	38624250	0
CL6029Contig1	146180000	198914000
CL6037Contig1	11717000	18522600
CL6048Contig1	13304500	19596000
CL604Contig1	65903000	89379400
CL6052Contig1	0	4428200
CL6058Contig1	0	192276
CL605Contig2	0	2111200
CL6060Contig1	0	0
CL606Contig1	13540250000	17458000000
CL607Contig1	97871750	116018400
CL6081Contig1	32957750	34957000
CL608Contig1	85020500	64662600
CL6097Contig1	20971000	36734400
CL6123Contig1	214827500	155299400
CL6124Contig1	0	787000
CL6130Contig1	29970250	44807000

CL6132Contig1	0	0
CL6133Contig1	0	1600520
CL6146Contig1	35713750	41690600
CL6147Contig1	1890025	4615300
CL614Contig1	11484500	20496600
CL6151Contig1	0	0
CL6159Contig1	65584000	80420200
CL6170Contig1	0	2920040
CL6175Contig1	0	0
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CL618Contig1	16278500	30701400
CL6198Contig1	0	8870400
CL61Contig2	0	0
CL6204Contig1	0	0
CL6223Contig1	0	0
CL622Contig1	0	0
CL6233Contig1	389387500	492606000
CL6234Contig1	1750575	3370000
CL6239Contig1	0	2917000
CL6241Contig1	586312500	844322000
CL6244Contig1	0	0
CL6248Contig1	0	1198800
CL624Contig1	20497750	21730000
CL624Contig2	0	2017600
CL6250Contig1	4076500	0
CL625Contig1	0	0
CL6260Contig1	0	0
CL6268Contig1	0	0
CL6269Contig1	0	0
CL626Contig1	0	0
CL6270Contig1	14397500	22479000
CL6286Contig1	0	3247200
CL628Contig3	0	408500
CL6293Contig1	0	0
CL6295Contig1	5988450	10664520
CL6311Contig1	0	0
CL6317Contig1	3970400	5610360
CL631Contig1	3241000	2576000
CL6327Contig1	4125500	11481200
CL6335Contig1	0	344060
CL6366Contig1	7928500	0
CL6376Contig1	2960500	5283040
CL6379Contig1	16204500	26129000
CL6380Contig1	13293000	2682600
CL6384Contig1	25245000	11777200
CL6390Contig1	0	0

CL6397Contig1	26187500	14888200
CL6406Contig1	1543725	1556200
CL6410Contig1	12502375	20881400
CL6411Contig1	0	2109000
CL6418Contig1	0	0
CL6422Contig1	0	2339200
CL6443Contig1	90604250	82655600
CL6447Contig1	26876500	46910000
CL6451Contig1	71927000	110770200
CL6454Contig1	499615000	567216000
CL6466Contig1	0	1138400
CL647Contig2	0	0
CL6500Contig1	0	1506440
CL6502Contig1	15105250	6217200
CL6503Contig1	0	0
CL651Contig1	0	0
CL6536Contig1	17141750	22669600
CL6540Contig1	1492100	2486420
CL6549Contig1	83866500	91147400
CL6553Contig1	0	0
CL655Contig1	0	1209380
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CL6578Contig1	1917210000	89774200
CL6589Contig1	275050000	359042000
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CL6612Contig1	0	824680
CL6617Contig1	150941500	80557600
CL6622Contig1	7856750	16518600
CL6623Contig1	0	0
CL6625Contig1	124932500	152594000
CL662Contig1	0	0
CL663Contig2	72097500	157534800
CL6655Contig1	661197500	676676000
CL6667Contig1	0	0
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CL6691Contig1	25873250	0
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CL66Contig1	0	2509800
CL6708Contig1	0	0
CL6708Contig2	0	0
CL670Contig2	0	0
CL6711Contig1	0	0
CL6714Contig1	122917750	137535800
CL6718Contig1	0	0

CL6719Contig1	0	0
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CL673Contig1	136471750	166335600
CL6742Contig1	227445000	0
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CL6750Contig1	90123250	82974200
CL6751Contig1	0	0
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CL6773Contig1	0	0
CL6779Contig1	14051250	18805600
CL6791Contig1	1976100	2874660
CL679Contig1	7971500	11676380
CL6807Contig1	0	510440
CL6810Contig1	0	0
CL6813Contig1	0	2524600
CL6820Contig1	0	0
CL6829Contig1	0	0
CL6837Contig1	14906750	31170400
CL683Contig2	85853000	109138000
CL6845Contig1	167732500	222248000
CL6848Contig1	0	0
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CL6857Contig1	0	0
CL6859Contig1	0	1432220
CL6863Contig1	3229250	14496800
CL6865Contig1	981467500	1066640000
CL6877Contig1	41685000	0
CL687Contig1	5586750	29317000
CL6883Contig1	0	0
CL6887Contig1	34895750	45493600
CL689Contig2	421322500	648908000
CL6910Contig1	0	0
CL691Contig1	0	0
CL6942Contig1	0	3391320
CL6952Contig1	21868250	39512800
CL6964Contig1	8928000	9336580
CL6969Contig1	69692750	64172000
CL6973Contig1	19795500	43345800
CL7001Contig1	50197500	66228600
CL7002Contig1	0	0
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CL7016Contig1	8146250	7095600
CL7021Contig1	0	1681280
CL703Contig1	0	2230000
CL7048Contig1	3505250	0
CL708Contig2	99096250	98815000

CL713Contig1	4276450000	7015040000
CL714Contig1	6934750	12387400
CL716Contig3	3563000	6702600
CL718Contig1	322102500	182518000
CL7207Contig1	0	924220
CL722Contig1	227427500	269612000
CL7268Contig1	0	0
CL726Contig1	0	1943140
CL7305Contig1	27659050	11635200
CL7314Contig1	0	0
CL731Contig1	0	0
CL732Contig1	0	1567660
CL734Contig1	0	843480
CL735Contig2	42620000	0
CL736Contig2	0	1107360
CL7410Contig1	0	0
CL7449Contig1	2450000	0
CL745Contig1	121412500	0
CL7464Contig1	268872500	11832800
CL747Contig1	4167000	1983580
CL748Contig1	2081800	5775100
CL74Contig2	3075000	4086000
CL751Contig1	0	3883600
CL752Contig1	3157500	12496600
CL757Contig2	0	2447860
CL759Contig1	93511750	124773200
CL75Contig10	0	0
CL75Contig5	0	0
CL7662Contig1	28427500	0
CL7668Contig1	0	1152220
CL7675Contig1	5879000	0
CL7738Contig1	4498250	14579800
CL7756Contig1	0	1231440
CL775Contig1	0	0
CL775Contig2	28351750	36047600
CL7761Contig1	0	2339400
CL7773Contig1	0	2456200
CL7800Contig1	25906500	29588000
CL7804Contig1	0	0
CL7842Contig1	26666750	32138400
CL7874Contig1	0	0
CL789Contig1	0	985920
CL792Contig1	0	0
CL793Contig1	54363650	68580600
CL794Contig1	0	0
CL7961Contig1	0	3040000

CL79Contig1	83305250	137246000
CL801Contig1	0	1444760
CL802Contig1	72389250	23042400
CL806Contig1	183232500	174026000
CL80Contig1	0	5769400
CL80Contig5	0	0
CL8104Contig1	0	0
CL811Contig1	8767000	41204200
CL811Contig2	1113815000	1361700000
CL8137Contig1	0	12803400
CL813Contig1	29195250	39544200
CL8144Contig1	0	9856000
CL8148Contig1	0	0
CL817Contig1	0	0
CL819Contig1	3003000	0
CL820Contig1	0	1248720
CL8213Contig1	17847750	20356800
CL8240Contig1	7207500	0
CL825Contig1	62366250	55918200
CL8272Contig1	0	0
CL827Contig1	0	0
CL829Contig1	57784750	76607800
CL830Contig2	366175000	575166000
CL8316Contig1	57923250	42843000
CL8360Contig1	40073750	14008400
CL838Contig1	103445000	121554000
CL83Contig2	0	0
CL83Contig4	26450250	42674200
CL8461Contig1	0	6028400
CL8477Contig1	0	0
CL847Contig1	0	14668600
CL8493Contig1	0	908700
CL849Contig1	21967150	38344400
CL8501Contig1	0	0
CL858Contig1	0	1907520
CL8593Contig1	14690000	21596400
CL859Contig1	0	0
CL85Contig1	547910000	571950000
CL85Contig2	52433500	69846600
CL8602Contig1	0	0
CL863Contig1	0	0
CL8649Contig1	0	0
CL8677Contig1	0	0
CL867Contig1	114249500	148696000
CL868Contig1	33142750	33425800
CL8691Contig1	0	0

CL86Contig1	4667125	10023080
CL86Contig2	0	0
CL8717Contig1	711096000	38422400
CL8729Contig1	0	1558000
CL873Contig1	0	2824000
CL875Contig1	39079750	61878800
CL8773Contig1	0	0
CL87Contig2	0	0
CL880Contig1	5820750	11890400
CL8847Contig1	3466250	7761800
CL8866Contig1	0	0
CL8885Contig1	0	0
CL8887Contig1	0	912520
CL88Contig3	0	0
CL890Contig1	0	0
CL894Contig1	0	0
CL902Contig1	0	1183760
CL9030Contig1	0	8114000
CL903Contig1	5272250	16054000
CL9047Contig1	5305500	6536600
CL9070Contig1	0	26490600
CL909Contig1	0	1513960
CL911Contig1	0	8860400
CL9145Contig1	0	0
CL9188Contig1	0	406660
CL921Contig1	0	0
CL9232Contig1	5005125	9796160
CL9269Contig1	6233500	18162400
CL930Contig1	65580250	68696400
CL9325Contig1	4854750	7809000
CL9336Contig1	2689000	0
CL9350Contig1	4057000	7031000
CL9395Contig1	0	0
CL941Contig1	0	0
CL942Contig1	0	0
CL944Contig1	0	3232200
CL9455Contig1	0	646580
CL9463Contig1	0	925100
CL946Contig1	7915500	9391000
CL9475Contig1	68216000	67925400
CL948Contig1	32814750	16486800
CL9508Contig1	0	0
CL952Contig1	0	0
CL9557Contig1	27555250	19049200
CL9592Contig1	0	0
CL9598Contig1	8096500	16675400

CL9604Contig1	68377500	0
CL962Contig2	0	0
CL967Contig1	25338250	33526800
CL968Contig1	3099500	2714400
CL971Contig1	0	0
CL9748Contig1	0	0
CL980Contig1	5131250	17553800
CL988Contig1	3575750	9561000
CL9908Contig1	0	7864680
CL9915Contig1	0	0
CL991Contig1	164685000	167138000
CL994Contig1	78974000	86794400
clc_contig_10989	0	688320
clc_contig_11353	1076150	0
clc_contig_11405	0	0
clc_contig_11621	0	0
clc_contig_11775	0	0
clc_contig_1194	0	0
clc_contig_12214	0	538600
clc_contig_12860	29923750	37172400
clc_contig_13446	7371875	11165400
clc_contig_13559	0	0
clc_contig_13675	0	0
clc_contig_1484	0	1426840
clc_contig_168	0	0
clc_contig_1868	3863000	6226200
clc_contig_19003	0	2094240
clc_contig_20871	0	0
clc_contig_21807	0	0
clc_contig_2323	3060250	12398800
clc_contig_2350	131187000	159027800
clc_contig_2957	0	0
clc_contig_32048	0	0
clc_contig_3313	0	0
clc_contig_3345	49722500	73884600
clc_contig_3351	0	1856900
clc_contig_3446	47243500	21295600
clc_contig_3707	2721182500	184154200
clc_contig_4463	70434750	91606800
clc_contig_4686	1960300	0
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clc_contig_6306	43966750	30361800
clc_contig_776	0	11229800
clc_contig_8113	0	0
clc_contig_865	0	0
clc_contig_906	90941500	136670000

clc_contig_9899	0	0
comp105440_c0_se	654857500	646544000
comp114420_c0_se	3653250	0
comp144606_c0_se	0	1321360
comp148805_c0_se	197590000	237158000
comp151965_c0_se	0	1872820
comp153231_c0_se	0	1066400
comp153964_c0_se	5788750	0
comp160025_c0_se	0	1659080
comp163045_c0_se	0	1951940
comp163328_c0_se	0	8297800
comp178066_c0_se	0	1659740
comp179662_c0_se	0	0
comp179682_c0_se	0	0
comp180863_c0_se	35010500	41419200
comp182051_c0_se	0	0
comp182923_c0_se	0	0
comp183562_c0_se	0	5416740
comp184329_c0_se	0	707140
comp184396_c2_se	0	0
comp184627_c0_se	0	1460620
comp185201_c0_se	0	348160
comp186261_c0_se	0	0
comp189439_c0_se	4465250	2122000
comp190485_c0_se	412840000	596484000
comp192404_c0_se	28229750	29184200
comp192800_c1_se	0	0
comp193954_c0_se	0	14639800
comp194610_c0_se	0	0
comp194964_c1_se	6294500	13501800
comp195573_c0_se	0	0
comp195660_c0_se	0	1163800
comp195889_c0_se	0	2039020
comp196223_c0_se	0	0
comp196442_c0_se	15114750	17914600
comp196734_c0_se	12585750	2174600
comp196748_c0_se	1896375	1375000
comp197048_c0_se	0	0
comp197552_c0_se	0	6664940
comp197706_c0_se	1278375	0
comp197779_c0_se	0	0
comp197862_c0_se	0	0
comp198050_c0_se	0	606780
comp198327_c0_se	1164775	0
comp198458_c0_se	66528750	64435000
comp198635_c0_se	0	0

comp199420_c0_se	11536250	4429960
comp199495_c0_se	3013250	19531800
comp199919_c1_se	11054750	13534200
comp200368_c0_se	0	7638800
comp201153_c0_se	0	0
comp201973_c0_se	61368250	21705400
comp202051_c0_se	0	1725540
comp202833_c0_se	4481500	18212800
comp203274_c0_se	0	968420
comp203286_c0_se	0	2255200
comp203708_c0_se	0	0
comp203982_c0_se	0	4669000
comp204020_c0_se	116078500	215294400
comp204138_c0_se	0	497860
comp205258_c0_se	0	0
comp205372_c0_se	18275000	52600400
comp205431_c0_se	0	5663400
comp205483_c0_se	0	4189520
comp205588_c0_se	0	650940
comp206551_c0_se	426302500	591414000
comp207466_c0_se	0	0
comp207558_c0_se	0	0
comp207872_c1_se	21837250	6380800
comp208118_c0_se	0	1058540
comp208693_c0_se	0	2793800
comp208779_c0_se	0	975200
comp208863_c2_se	0	0
comp209005_c0_se	0	0
comp209257_c0_se	0	5615040
comp209527_c0_se	203967500	234726000
comp209727_c0_se	0	0
comp209786_c0_se	65681750	81232000
comp209962_c0_se	0	3987500
comp210085_c0_se	16132500000	12017980000
comp210174_c1_se	33082500	0
comp210292_c0_se	2708000	5266400
comp210438_c1_se	117613750	198916000
comp210662_c0_se	104795500	105334600
comp210675_c0_se	0	4565600
comp210716_c0_se	104535500	123951400
comp211000_c1_se	0	0
comp211359_c0_se	70298250	83143600
comp211726_c0_se	39272500	48853600
comp211738_c1_se	1987825	1361500
comp211837_c0_se	0	0
comp212017_c0_se	0	2136200

comp212026_c2_se	11380250	25490600
comp212066_c0_se	0	0
comp212078_c0_se	16178000	23523200
comp212131_c0_se	50064000	17061200
comp212430_c0_se	0	0
comp212434_c0_se	0	0
comp212782_c1_se	0	1271120
comp212808_c0_se	87884750	108693400
comp212817_c0_se	127070000	179972000
comp212963_c0_se	0	0
comp213030_c0_se	0	2493600
comp213228_c0_se	0	0
comp213229_c0_se	0	0
comp213312_c0_se	121090000	0
comp213485_c1_se	42548250	48367000
comp213588_c0_se	248332500	137477000
comp213674_c3_se	134465500	147726000
comp213833_c0_se	12361000	0
comp213840_c0_se	193892500	249404000
comp213906_c0_se	6936000	18839000
comp214088_c0_se	211477500	213342000
comp214089_c0_se	71121500	58485000
comp214158_c0_se	4910150	1616400
comp214187_c0_se	0	0
comp214245_c0_se	100755000	140834000
comp214248_c0_se	0	5290800
comp214301_c0_se	0	1276920
comp214307_c0_se	25268250	43057800
comp214391_c0_se	0	3863080
comp214393_c1_se	5974500	14081600
comp214526_c0_se	229467500	296876000
comp214526_c0_se	0	0
comp214552_c0_se	75998500	90258800
comp214678_c0_se	133397750	83811600
comp214688_c0_se	0	0
comp214738_c0_se	0	2794800
comp214751_c0_se	39130725	70343200
comp214902_c2_se	70250500	95613000
comp214995_c0_se	3064750	17967600
comp215006_c0_se	65741750	101737000
comp215006_c0_se	142503250	242050000
comp215142_c1_se	186625000	252708000
comp215144_c3_se	58329000	85914600
comp215144_c3_se	105692250	155170000
comp215215_c0_se	0	0
comp215240_c1_se	114713250	196879200

comp215249_c0_se	0	1995140
comp215278_c0_se	98615500	136632000
comp215438_c0_se	0	0
comp215507_c0_se	258032500	336534000
comp215560_c1_se	57880500	80403000
comp215566_c0_se	11234250	6524400
comp215817_c0_se	0	16888600
comp215818_c0_se	0	945120
comp215908_c0_se	6375000	9203800
comp215951_c0_se	15603250000	13001800000
comp215953_c0_se	0	1350160
comp215969_c1_se	0	0
comp216149_c0_se	22601250	33011600
comp216182_c0_se	0	8428000
comp216297_c0_se	0	0
comp216433_c0_se	0	0
comp216433_c0_se	0	0
comp216493_c0_se	0	1090060
comp216504_c0_se	0	0
comp216504_c0_se	2748000	2343400
comp216545_c0_se	0	0
comp216625_c0_se	0	8982400
comp216625_c4_se	3333500	8793600
comp216625_c4_se	0	0
comp216667_c0_se	91037750	79261200
comp216711_c0_se	80025250	40154000
comp216730_c1_se	89533750	125742000
comp216780_c1_se	2634750	0
comp216794_c1_se	102485500	200983400
comp216809_c0_se	5643000	11574800
comp216874_c2_se	0	5069760
comp216933_c1_se	4669000	7893520
comp217095_c0_se	26750250	30262000
comp217109_c1_se	285972500	419378000
comp217156_c0_se	8681750	9642400
comp217187_c0_se	1512545000	1973080000
comp217258_c0_se	3026000	15588000
comp217283_c0_se	0	0
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comp217303_c0_se	27779250	32421400
comp217333_c0_se	35870000	45607000
comp217349_c2_se	24773250	39324400
comp217407_c1_se	101623000	145578000
comp217409_c0_se	7585250	19777400
comp217429_c2_se	8019500	25327000
comp217487_c0_se	0	0

comp217509_c0_se	343067500	286640000
comp217530_c2_se	0	0
comp217610_c0_se	39289000	76256200
comp217630_c1_se	0	860080
comp217686_c0_se	90506250	39295800
comp217692_c0_se	531070000	166968000
comp217697_c0_se	99497250	115513400
comp217736_c1_se	5263000	14074400
comp217744_c3_se	0	0
comp217744_c3_se	0	0
comp217763_c1_se	118035250	24774200
comp217822_c1_se	201821500	290882000
comp217831_c0_se	13564500	13825220
comp217972_c0_se	286912500	378768000
comp217988_c0_se	0	0
comp218026_c0_se	5311700	16251940
comp218099_c0_se	0	0
comp218170_c0_se	0	0
comp218262_c1_se	0	0
comp218291_c0_se	0	0
comp218342_c1_se	0	0
comp218370_c1_se	0	0
comp218456_c3_se	264250000	370756000
comp218460_c1_se	82694000	107640000
comp2185142_c0_s	0	3890620
comp218533_c0_se	2252325000	2311960000
comp218593_c1_se	0	0
comp218630_c0_se	13465500	0
comp218670_c0_se	255887500	311666000
comp218697_c1_se	1024947500	1110162000
comp218700_c0_se	0	0
comp218717_c0_se	82833750	82246000
comp218717_c0_se	508942500	505156000
comp218859_c0_se	55448500	57274600
comp218869_c1_se	9702750	15340200
comp218870_c0_se	7476750	10242400
comp218904_c0_se	1057667500	1455780000
comp218964_c0_se	35736000	24366200
comp218966_c4_se	15052000	23714400
comp218997_c0_se	0	0
comp219004_c0_se	0	1059460
comp219006_c0_se	0	0
comp219010_c0_se	0	4431660
comp219016_c1_se	269241500	88590200
comp219023_c0_se	0	0
comp219161_c1_se	0	0

comp219186_c0_se	0	0
comp219207_c1_se	0	0
comp219229_c0_se	1825175	4367600
comp219237_c0_se	39672750	39974800
comp219270_c1_se	240830000	359724000
comp219283_c1_se	9153500	7776200
comp219344_c1_se	10261250000	6809280000
comp219384_c0_se	0	0
comp219388_c0_se	0	0
comp219423_c2_se	51257500	43065800
comp219432_c1_se	0	917020
comp219434_c0_se	0	5702000
comp219447_c0_se	0	13653400
comp219487_c0_se	10923000	17962800
comp219514_c1_se	0	0
comp219518_c0_se	165402750	61202000
comp219605_c0_se	0	0
comp219606_c1_se	319737500	443600000
comp219626_c1_se	167793500	207268000
comp219662_c2_se	81614500	124326000
comp219670_c2_se	19036000	28332400
comp219771_c0_se	0	1504400
comp219804_c4_se	163230000	188082000
comp219804_c5_se	92350000	124760000
comp219835_c3_se	0	0
comp219865_c0_se	0	0
comp219905_c0_se	0	23768200
comp219905_c0_se	0	0
comp219979_c0_se	13453000	0
comp219981_c0_se	137477500	153936600
comp220013_c0_se	29737250	29373200
comp220013_c1_se	40946500	54390200
comp220038_c1_se	0	623740
comp220039_c2_se	227510750	66121400
comp220050_c1_se	279035000	375826000
comp220061_c0_se	68967750	36953200
comp220069_c4_se	1570822500	1971080000
comp220076_c0_se	157697250	56435600
comp220098_c2_se	0	4702600
comp220116_c0_se	21392250	27137800
comp220132_c0_se	4062200000	4917420000
comp220157_c2_se	0	0
comp220237_c2_se	46165500	51921400
comp220252_c0_se	0	0
comp220256_c0_se	0	0
comp220265_c0_se	0	0

comp220301_c0_se	0	6520800
comp220340_c5_se	0	0
comp220390_c1_se	0	124126000
comp220410_c1_se	6434500	0
comp220439_c0_se	19727000	2865800
comp220469_c1_se	22497250	32365600
comp220490_c0_se	0	0
comp220503_c2_se	0	0
comp220507_c0_se	0	0
comp220513_c0_se	0	0
comp220518_c1_se	159663500	267696000
comp220525_c0_se	0	2043800
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comp220533_c1_se	0	0
comp220539_c0_se	117535250	159276000
comp220632_c4_se	0	0
comp220660_c2_se	4193775	11686900
comp220716_c2_se	0	0
comp220718_c2_se	0	0
comp220728_c0_se	254197500	296634000
comp220751_c2_se	249747500	289070000
comp220752_c2_se	13087000	16499200
comp220761_c3_se	0	0
comp220761_c7_se	2966500	6324300
comp220790_c0_se	4271000	8438600
comp220817_c0_se	37363000	43098200
comp220819_c2_se	0	0
comp220827_c1_se	0	0
comp220830_c0_se	32054000	32486400
comp220907_c0_se	0	773160
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comp220943_c0_se	25077750	23612800
comp220956_c1_se	0	0
comp220966_c0_se	0	0
comp221009_c0_se	0	0
comp221058_c1_se	0	0
comp221092_c0_se	0	0
comp221108_c0_se	0	0
comp221129_c0_se	10676250	7266800
comp221171_c0_se	0	0
comp221184_c0_se	7328000	5786800
comp221192_c0_se	0	0
comp221227_c0_se	12059500	27670600
comp221258_c0_se	6940850	7558040
comp221271_c0_se	0	2395260
comp221280_c0_se	536160000	1296008000

comp221288_c1_se	0	0
comp221289_c0_se	5194250	10951220
comp221315_c1_se	0	0
comp221343_c1_se	3242250	0
comp221345_c0_se	0	0
comp221352_c1_se	132928500	170920000
comp221389_c0_se	0	2945200
comp221395_c1_se	899995000	990826000
comp221427_c0_se	0	1593180
comp221432_c0_se	10282250	13511200
comp221436_c1_se	0	9396520
comp221448_c0_se	0	0
comp221455_c1_se	177412500	176392000
comp221458_c1_se	0	453360
comp221459_c1_se	11666750	8552600
comp221470_c0_se	4572000	11936220
comp221478_c0_se	26751250	34950000
comp221504_c0_se	19628250	47271000
comp221509_c0_se	87455750	124154000
comp221562_c0_se	0	0
comp221598_c5_se	0	233800
comp221601_c2_se	0	0
comp221620_c0_se	0	70108000
comp221634_c0_se	0	0
comp221641_c0_se	34912250	34460800
comp221653_c1_se	74061750	100071400
comp221673_c0_se	0	0
comp221673_c3_se	0	0
comp221713_c2_se	167075000	233734000
comp221716_c1_se	0	916340
comp221730_c3_se	709432500	779682000
comp221737_c0_se	76397000	93400200
comp221737_c0_se	0	3009200
comp221745_c0_se	0	0
comp221750_c4_se	622160000	706644000
comp221787_c0_se	108417500	119842000
comp221797_c1_se	0	0
comp221803_c0_se	217847500	332314000
comp221822_c1_se	0	0
comp221823_c0_se	0	1713820
comp221844_c0_se	0	0
comp221862_c1_se	43149000	60533800
comp221864_c1_se	6455000	40176800
comp221881_c1_se	0	0
comp221886_c1_se	38505000	55676000
comp221886_c1_se	115794000	153416400

comp221900_c2_se	200545000	288000000
comp221907_c0_se	195200000	224780000
comp221921_c1_se	0	0
comp221977_c1_se	0	20509400
comp221978_c1_se	0	0
comp221989_c2_se	0	719600
comp221995_c0_se	1753125	0
comp222018_c0_se	5449750	0
comp222018_c0_se	16826250	19541200
comp222027_c1_se	26051750	57812000
comp222035_c2_se	8327750	12353600
comp222040_c0_se	10394000	20363600
comp222041_c0_se	0	0
comp222060_c1_se	0	0
comp222061_c0_se	0	7028000
comp222109_c0_se	0	0
comp222122_c0_se	0	0
comp222144_c1_se	0	0
comp222153_c1_se	32229250	40188200
comp222161_c0_se	0	0
comp222169_c2_se	18306250	35966000
comp222204_c4_se	0	0
comp222207_c0_se	0	929420
comp222217_c2_se	0	0
comp222224_c0_se	0	0
comp222262_c2_se	4979750	21228000
comp222309_c0_se	47642750	61010400
comp222341_c0_se	0	7035400
comp222341_c1_se	0	2831200
comp222342_c0_se	0	8478800
comp222351_c0_se	0	0
comp222353_c1_se	3452500	18308600
comp222358_c2_se	135852500	205754000
comp222376_c1_se	4088750	7376400
comp222392_c0_se	0	0
comp222397_c0_se	1406945000	2213758000
comp222398_c1_se	409540000	487972000
comp222409_c0_se	88702500	126000000
comp222414_c0_se	0	749800
comp222422_c0_se	8755750	14230200
comp222423_c2_se	4620000	12134600
comp222430_c4_se	902900	6227900
comp222445_c0_se	21577250	38777200
comp222449_c0_se	0	0
comp222455_c0_se	86389000	97318000
comp222459_c0_se	0	0

comp222463_c1_se	0	0
comp222472_c1_se	0	0
comp222475_c1_se	39955000	44189800
comp222481_c3_se	0	0
comp222489_c0_se	0	0
comp222500_c5_se	0	0
comp222524_c3_se	0	0
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comp222557_c0_se	8489000	9102600
comp222565_c0_se	68059500	31996400
comp222566_c3_se	13275750	19841800
comp222569_c1_se	127155250	57478400
comp222576_c2_se	0	0
comp222576_c2_se	0	0
comp222589_c0_se	3367750	6419600
comp222589_c1_se	118884250	145272000
comp222616_c0_se	7206500	17011400
comp222621_c2_se	140237000	195054000
comp222627_c2_se	292122500	102318200
comp222628_c0_se	3858250	2152000
comp222631_c2_se	0	0
comp222634_c2_se	12551000	17945800
comp222656_c1_se	11299000	13467000
comp222661_c0_se	0	0
comp222661_c1_se	43186250	44383200
comp222666_c1_se	0	0
comp222668_c0_se	0	3648800
comp222681_c1_se	143100000	230256000
comp222691_c1_se	0	0
comp222691_c1_se	0	0
comp222693_c1_se	0	0
comp222704_c0_se	0	0
comp222749_c2_se	21602750	25328200
comp222776_c0_se	0	874460
comp222779_c2_se	0	0
comp222814_c0_se	4548500	5108800
comp222825_c1_se	0	0
comp222877_c3_se	0	0
comp222881_c1_se	101901500	143392000
comp222883_c3_se	0	6424940
comp222901_c1_se	0	0
comp222932_c0_se	0	1410900
comp222966_c0_se	33891750	60245400
comp222970_c2_se	0	8321200
comp222974_c0_se	3008000	5804400
comp222995_c2_se	277875000	393802000

comp222996_c0_se	0	2465600
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comp223015_c1_se	0	1259840
comp223017_c0_se	0	0
comp223018_c0_se	62282750	91563200
comp223018_c0_se	0	0
comp223023_c2_se	0	0
comp223026_c0_se	0	0
comp223028_c0_se	5553500	9629000
comp223046_c1_se	0	0
comp223059_c1_se	0	2942260
comp223062_c0_se	0	570220
comp223095_c0_se	0	1238600
comp223104_c0_se	0	0
comp223116_c0_se	259600000	299256000
comp223119_c0_se	4091500	13615200
comp223137_c1_se	0	0
comp223153_c0_se	0	412800
comp223164_c1_se	0	0
comp223166_c0_se	176765000	218728000
comp223212_c0_se	0	0
comp223227_c2_se	0	0
comp223227_c2_se	818812500	802170000
comp223227_c4_se	0	0
comp223235_c1_se	109089750	147776000
comp223243_c2_se	0	0
comp223250_c0_se	0	4461400
comp223265_c4_se	24546750	35101400
comp223267_c0_se	0	0
comp2844134_c0_s	4669250	0
comp3330888_c0_s	45279500	46214200
comp3531585_c0_s	5071750	0
comp5718014_c0_s	0	0
comp60978_c0_seq	11845750	0
comp67446_c0_seq	0	3912200
comp67856_c0_seq	2531750	5652480
comp70980_c0_seq	0	0
comp72386_c0_seq	0	934240
comp7382426_c0_s	0	1064740
comp76150_c0_seq	0	1040240
comp80599_c0_seq	0	0
comp83335_c0_seq	12804000	0
comp88827_c0_seq	115394500	111989000
comp91283_c0_seq	16952000	19354600

ated from *Pacifastacus leniusculus*. Anterior proliferating Center
; (GC) n=4.

SGC Mean LFQ intensity	GC Mean LFQ intensity
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4427670000	10092925000
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0	0
43212300	87116750
33210500	0
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2036400	0
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127217000	0
0	0
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14536800	0
3672920	0
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11043600	0

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5362400	0
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21269200	0
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26157600	0
90994700	17068500
608260000	3777287500
79806000	0
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148892000	39826750
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482420	0
8112800	0
3306020	0
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7164400	0
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4955000	0
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39761100	550587500
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2019400	0
90542800	60855000
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