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The algal selenoproteomes

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Abstract

Background: Selenium is an important trace element, and selenoprotein is its predominant form in vivo. The special structural features of selenoprotein genes have led to the development of a series of bioinformatics methods for the prediction and research of selenoprotein genes. There are some studies and reports on the evolution and distribution of selenoprotein genes in prokaryotes and multicellular eukaryotes, but the systematic analysis of single-cell eukaryotes, especially algae, is very limited.

Results: In this study, we predicted selenoprotein genes in 137 species of algae by using a program we previously developed. More than 1000 selenoprotein genes were obtained. A database website was built to hold these algae selenoprotein genes (www.selenoprotein.com). These genes belong to 42 selenoprotein families, including three novel selenoprotein gene families.

Conclusions: This study reveals the primordial state of the eukaryotic selenoproteome. It is an important clue to explore the significance of selenium for primordial eukaryotes and to build the whole evolutionary spectrum of selenoproteins for all life.

Full-text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed.

However, the manuscript can be downloaded and accessed as a PDF.

Figures

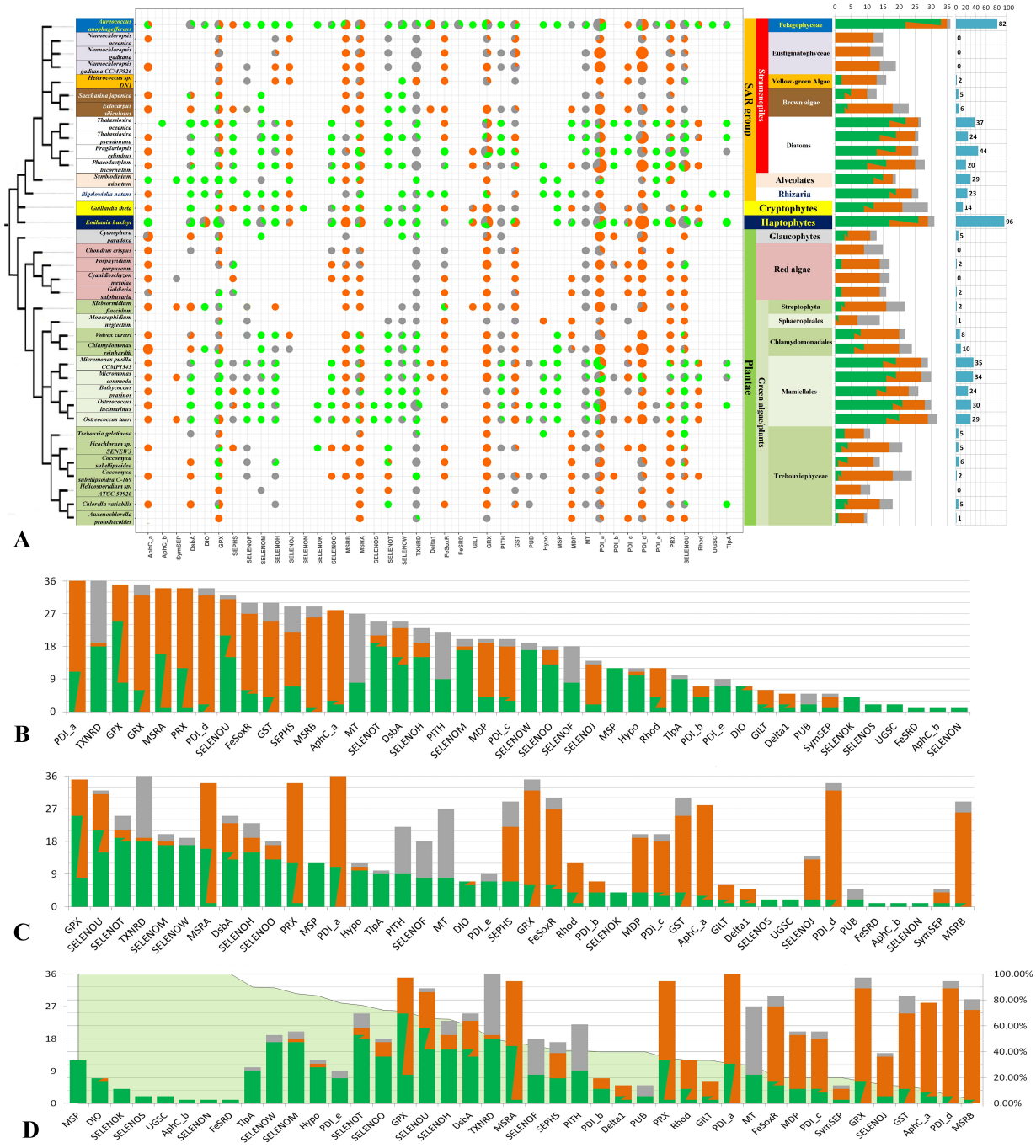


Figure 1

Distribution of algal selenoproteomes

Figure 2

Multiple sequences alignment and phylogenetic analysis of novel selenoproteins

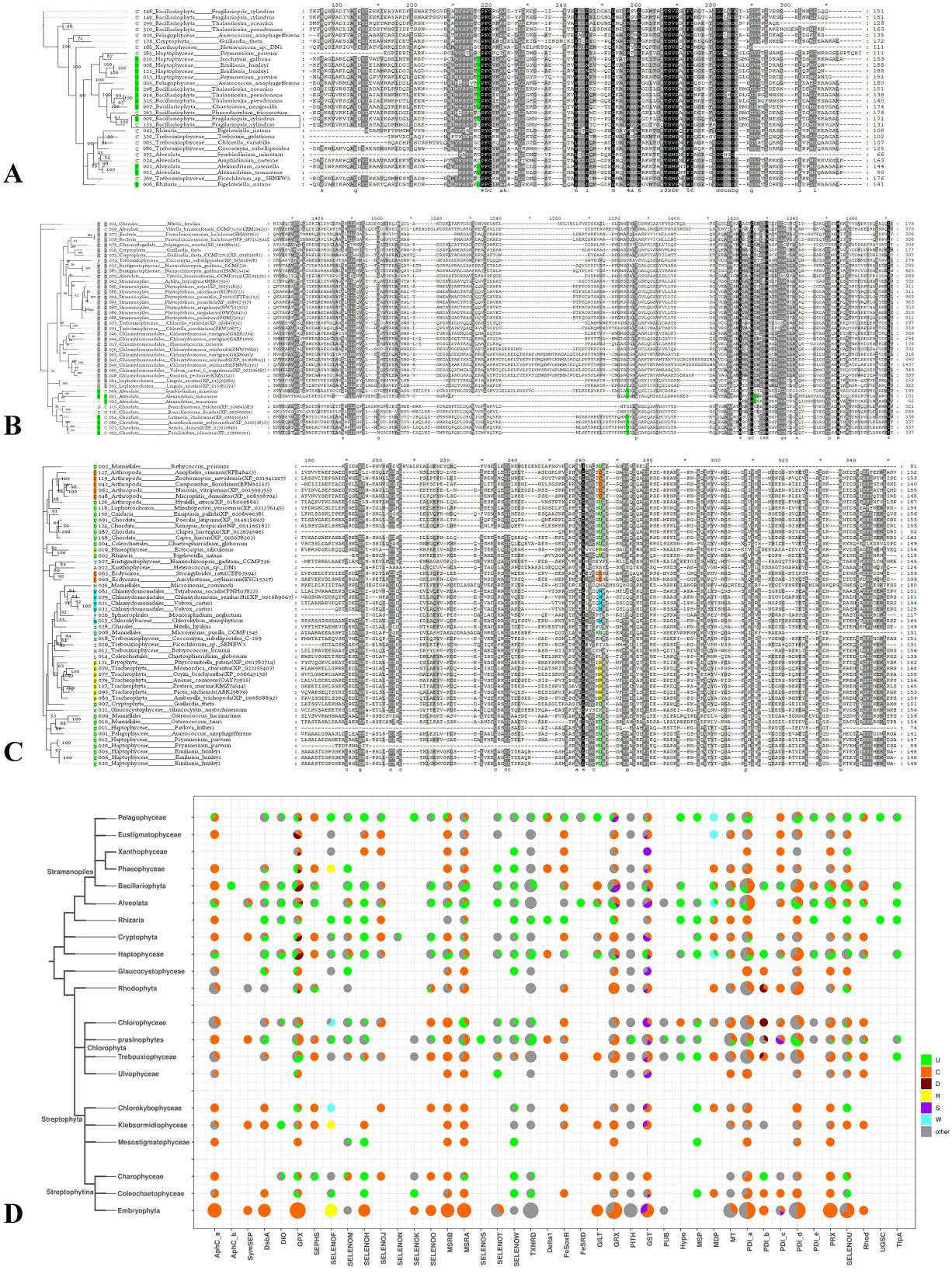
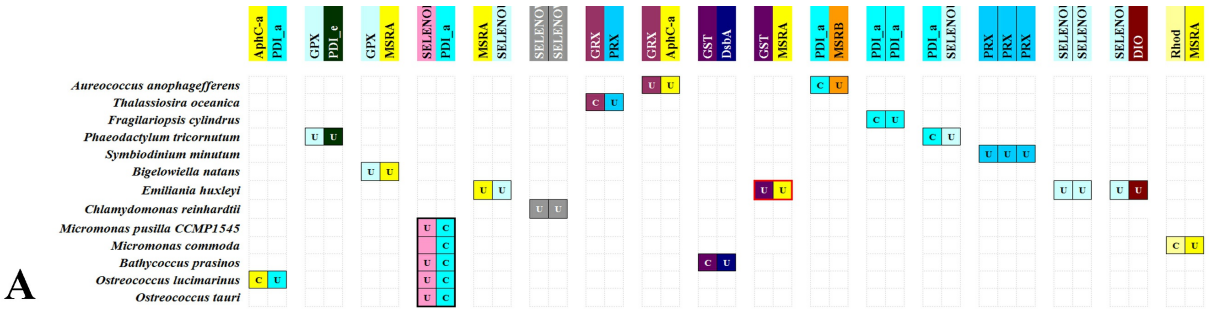


Figure 3

Substitution of Sec with other amino acids in algal selenoproteins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GPX
PDI_e
GPX
MSRA
SELENO
PDI_a
MSRA
SELENO
SELENO
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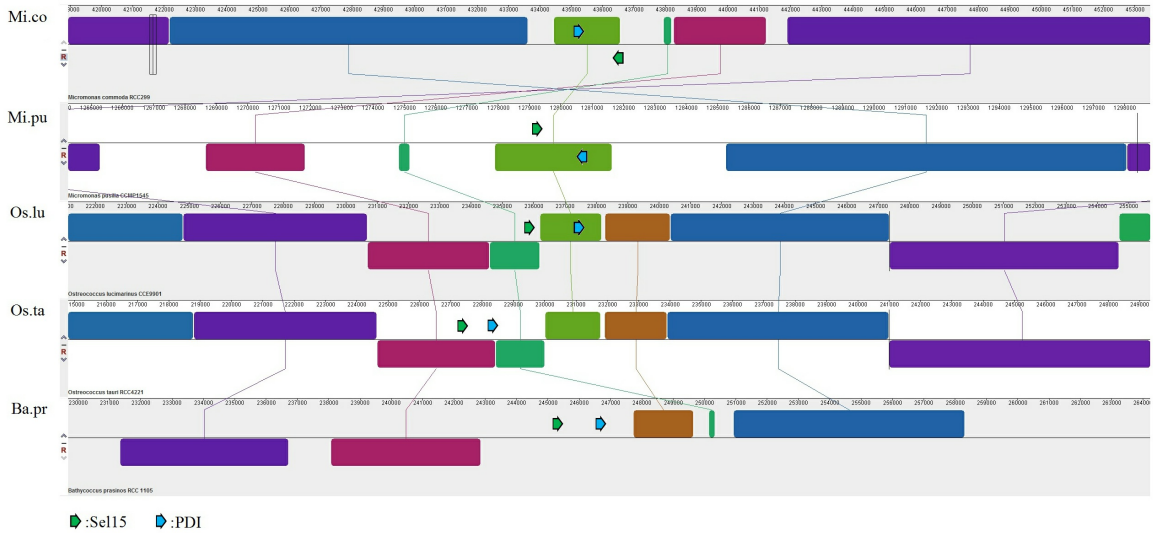
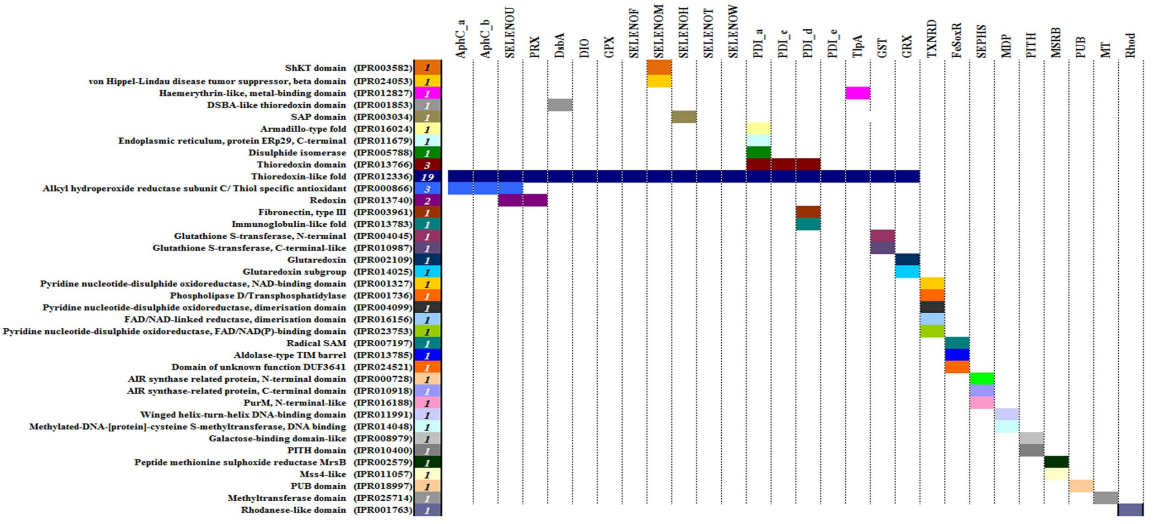
GRX
PRX
GRX
AphC-a
GST
DsbA
GST
MSRA
PDI_a
MSRB
PDI_a
PDI_a
PDI_a
SELENO
PRX
PRX
PRX
SELENO
SELENO
SELENO
DIO
Rhod
MSRA
Aureococcus anophagefferens
Thalassiosira oceanica
Fragilariopsis cylindrus
Phaeodactylum tricornutum
Symbiodinium minutum
Bigelowiella natans
Emiliania huxleyi
Chlamydomonas reinhardtii
Micromonas pusilla CCMP1545
Micromonas commoda
Bathycoccus prasinos
Ostreococcus lucimarinus
Ostreococcus tauri

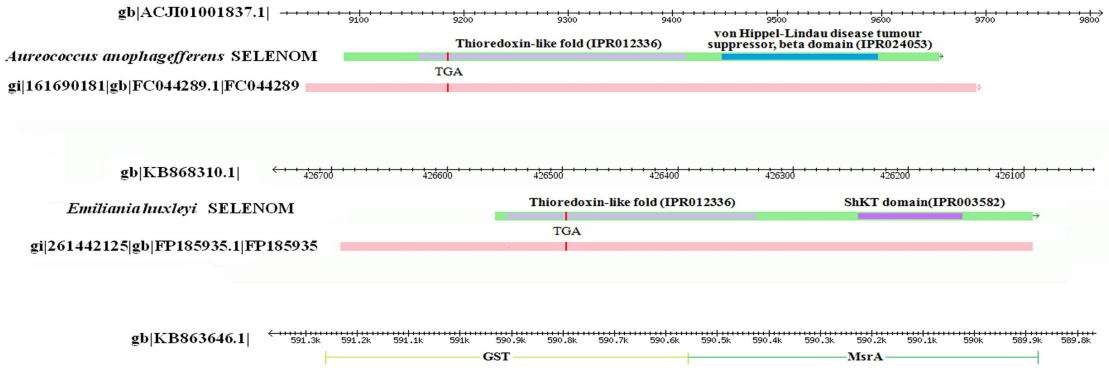
A


Mi.co
Mi.pu
Os.lu
Os.ta
Ba.pr
:Sel15
:PDI

B


AphC_a
AphC_b
SELENOU
PRX
DsbA
DIO
GPX
SELENOF
SELENOM
SELENOH
SELENOT
SELENOW
PDI_a
PDI_e
PDI_d
PDI_e
TpA
GST
GRX
TXNRD
FeSnaR
SEPHS
MDP
PITH
MSRB
PUB
MT
Rhod
ShKT domain (IPR003582)
von Hippel-Lindau disease tumor suppressor, beta domain (IPR024053)
Haemerythrin-like, metal-binding domain (IPR012827)
DSBA-like thioredoxin domain (IPR001853)
SAP domain (IPR003034)
Armadillo-type fold (IPR016024)
Endoplasmic reticulum, protein ERp29, C-terminal (IPR011679)
Disulphide isomerase (IPR005788)
Thioredoxin domain (IPR013766)
Thioredoxin-like fold (IPR012336)
Alkyl hydroperoxide reductase subunit C/ Thiol specific antioxidant (IPR000866)
Redoxin (IPR013740)
Fibronectin, type III (IPR003961)
Immunoglobulin-like fold (IPR013783)
Glutathione S-transferase, N-terminal (IPR004045)
Glutathione S-transferase, C-terminal-like (IPR010987)
Glutaredoxin (IPR002109)
Glutaredoxin subgroup (IPR014025)
Pyridine nucleotide-disulphide oxidoreductase, NAD-binding domain (IPR001327)
Phospholipase D/Transphosphatidylase (IPR001736)
Pyridine nucleotide-disulphide oxidoreductase, dimerisation domain (IPR004099)
FAD/NAD-linked reductase, dimerisation domain (IPR016156)
Pyridine nucleotide-disulphide oxidoreductase, FAD/NAD(P)-binding domain (IPR023753)
Radical SAM (IPR007197)
Aldolase-type TIM barrel (IPR013785)
Domain of unknown function DUF3641 (IPR024521)
AIR synthase related protein, N-terminal domain (IPR000728)
AIR synthase-related protein, C-terminal domain (IPR010918)
PurM, N-terminal-like (IPR016188)
Winged helix-turn-helix DNA-binding domain (IPR011991)
Methylated-DNA-[protein]-cysteine S-methyltransferase, DNA binding (IPR014048)
Galactose-binding domain-like (IPR008979)
PITH domain (IPR010400)
Peptide methionine sulphoxide reductase MrsB (IPR002579)
Mss4-like (IPR011057)
PUB domain (IPR018997)
Methyltransferase domain (IPR025714)
Rhodanese-like domain (IPR001763)

C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von Hippel-Lindau disease tumour suppressor, beta domain (IPR024053)
TGA
gb|KB868310.1|
Emiliania huxleyi SELENOM
gi|261442125|gb|FP185935.1|FP185935
Thioredoxin-like fold (IPR012336)
ShKT domain(IPR003582)
TGA
gb|KB863646.1|
GST
MsrA

Figure 4

Gene clustering and fusion of algal selenoprotein

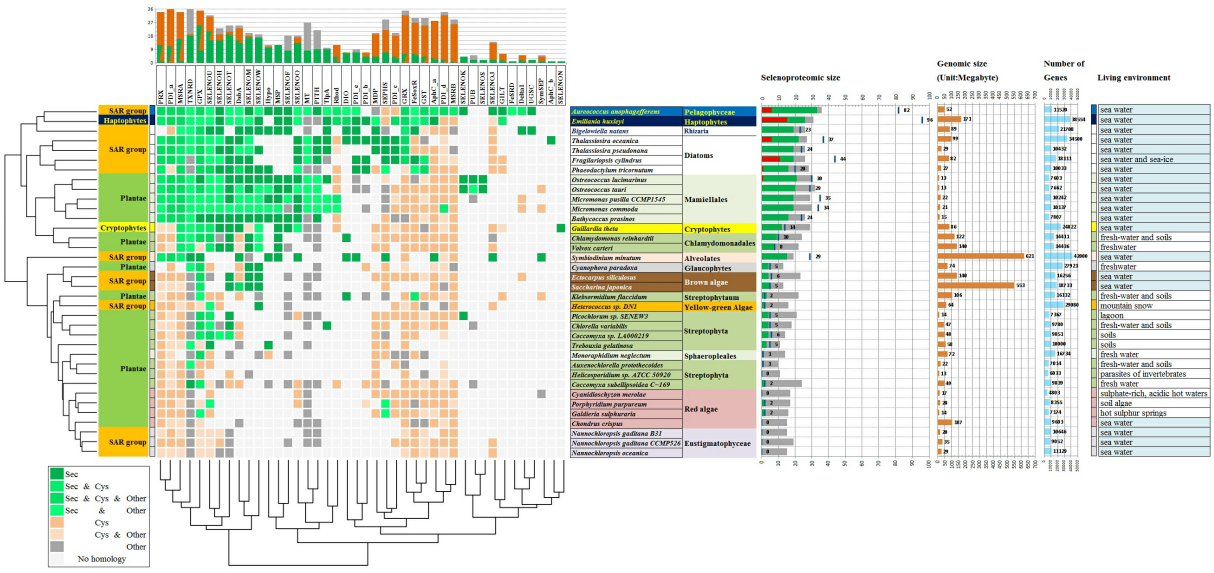

Figure 5

Heatmap of Algae selenoprotein distribution

Supplementary Files

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supplementary_files_2.docx
supplementary_files_3.docx