GEPHE SUMMARY

Gephebase Gene
Hox gene cluster (https://www.gephebase.org/search-criteria?/and+Gene Gephebase=^Hox gene cluster^#gephebase-summary-title)

GepheID
GP00001946

Entry Status
Published

Main curator
Courtier

PHENOTYPIC CHANGE

Trait Category
Morphology (https://www.gephebase.org/search-criteria?/and+Trait Category=^Morphology^#gephebase-summary-title)

Trait
Body plan (number of segments) (https://www.gephebase.org/search-criteria?/and+Trait=^Body plan (number of segments)^#gephebase-summary-title)

Trait State in Taxon A
-

Trait State in Taxon B
loss of segments

Ancestral State
Taxon A

Taxonomic Status
Intergeneric or Higher (https://www.gephebase.org/search-criteria?/and+Taxonomic Status=^Intergeneric or Higher^#gephebase-summary-title)

Taxon A

Latin Name
Drosophila melanogaster (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Drosophila melanogaster^#gephebase-summary-title)

Common Name
fruit fly

Synonyms
Sophophora melanogaster; fruit fly; Drosophila melanogaster Meigen, 1830; Sophophora melanogaster (Meigen, 1830); Drosophila melangaster

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Arthropoda; Mandibulata; Pancrustacea; Hexapoda; Insecta; Dicondylia; Pterygota; Neoptera; Holometabola; Diptera; Brachycera; Muscomorpha; Eremoneura; Cyclorrhapha; Schizophora; Acalyptratae; Ephydroidea; Drosophilidae; Drosophilinae; Drosophilini; Drosophila; Sophophora; melanogaster group; melanogaster subgroup

Parent
melanogaster subgroup () - (Rank: species subgroup) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 32351)

NCBI Taxonomy ID
7227 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 7227)

is Taxon A an Infraspecies?
No

Taxon B #1

Latin Name
Hypsibius dujardini (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Hypsibius dujardini^#gephebase-summary-title)

Common Name
-

Synonyms
Hypsibius dujardini (Doyere, 1840); Hypsibius dujardinii

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Tardigrada; Eutardigrada; Parachela; Hypsibioidea; Hypsibiidae; Hypsibius

Parent
Hypsibius () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 58670)

NCBI Taxonomy ID
232323 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 232323)

is Taxon B an Infraspecies?
No

Taxon B #2

Latin Name
Paramacrobiotus richtersi (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Paramacrobiotus richtersi^#gephebase-summary-title)

Common Name
-

Synonyms
Macrobiotus richtersi; Macrobiotus schultzei; Paramacrobiotus richtersi (Murray, 1911)

Rank
species

Lineage
cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Tardigrada; Eutardigrada; Parachela; Macrobiotoidea; Macrobiotidae; Paramacrobiotus; Paramacrobiotus richtersi group

Parent
Paramacrobiotus richtersi group () - (Rank: species group) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 578131)

NCBI Taxonomy ID
697321 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 697321)

is Taxon B an Infraspecies?
No

Taxon B #3

Latin Name

Milnesium tardigradum (https://www.gephebase.org/search-criteria?/and+Taxon and Synonyms=^Milnesium tardigradum^#gephebase-summary-title)

Common Name

-

Synonyms

Milnesium tardigradum Doyere, 1840

Rank

species

Lineage

cellular organisms; Eukaryota; Opisthokonta; Metazoa; Eumetazoa; Bilateria; Protostomia; Ecdysozoa; Panarthropoda; Tardigrada; Eutardigrada; Apochela; Milnesiidae; Milnesium

Parent

Milnesium () - (Rank: genus) (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 46459)

NCBI Taxonomy ID

46460 (https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id= 46460)

is Taxon B an Infraspecies?

No

GENOTYPIC CHANGE

Generic Gene Name

Antp

Synonyms

3.4; Ant; ANT-C; ANT-P; ANTC; antp; AntP; ANTP; Antp P1; Antp P2; Antp1; AntP1; Aus; BG:DS07700.1; CG1028; DmAntp; DMANTPE1; Dmel\CG1028; DRO15DC96Z; Hu; l(3)84Ba; Ns; Scx

String

7227.FBpp0081161 (http://string-db.org/newstring_cgi/show_network_section.pl?identifier= 7227.FBpp0081161)

Sequence Similarities

Belongs to the Antp homeobox family.

GO - Molecular Function

GO:0043565 : sequence-specific DNA binding (https://www.ebi.ac.uk/QuickGO/term/GO:0043565)
GO:0003677 : DNA binding (https://www.ebi.ac.uk/QuickGO/term/GO:0003677)
GO:0000981 : DNA-binding transcription factor activity, RNA polymerase II-specific (https://www.ebi.ac.uk/QuickGO/term/GO:0000981)

GO - Biological Process

GO:0007419 : ventral cord development (https://www.ebi.ac.uk/QuickGO/term/GO:0007419)
GO:0045944 : positive regulation of transcription by RNA polymerase II (https://www.ebi.ac.uk/QuickGO/term/GO:0045944)
GO:0050767 : regulation of neurogenesis (https://www.ebi.ac.uk/QuickGO/term/GO:0050767)
GO:0007507 : heart development (https://www.ebi.ac.uk/QuickGO/term/GO:0007507)
GO:0009948 : anterior/posterior axis specification (https://www.ebi.ac.uk/QuickGO/term/GO:0009948)
GO:0007494 : midgut development (https://www.ebi.ac.uk/QuickGO/term/GO:0007494)
GO:0042694 : muscle cell fate specification (https://www.ebi.ac.uk/QuickGO/term/GO:0042694)
GO:0007384 : specification of segmental identity, thorax (https://www.ebi.ac.uk/QuickGO/term/GO:0007384)
GO:0048542 : lymph gland development (https://www.ebi.ac.uk/QuickGO/term/GO:0048542)
GO:0014019 : neuroblast development (https://www.ebi.ac.uk/QuickGO/term/GO:0014019)
GO:0007383 : specification of segmental identity, antennal segment (https://www.ebi.ac.uk/QuickGO/term/GO:0007383)

GO - Cellular Component

GO:0005737 : cytoplasm (https://www.ebi.ac.uk/QuickGO/term/GO:0005737)
GO:0005634 : nucleus (https://www.ebi.ac.uk/QuickGO/term/GO:0005634)

UniProtKB Drosophila melanogaster

P02833 (http://www.uniprot.org/uniprot/P02833)

GenebankID or UniProtKB

()

Presumptive Null

Yes (https://www.gephebase.org/search-criteria?/and+Presumptive Null=^Yes^#gephebase-summary-title)

Molecular Type

Gene Loss (https://www.gephebase.org/search-criteria?/and+Molecular Type=^Gene Loss^#gephebase-summary-title)

Aberration Type

Deletion (https://www.gephebase.org/search-criteria?/and+Aberration Type=^Deletion^#gephebase-summary-title)

Deletion Size

unknown

Molecular Details of the Mutation

The three genes Antp Ubx AbdA are missing in the genome sequences of the three tardigrades. This loss is ancient so difficult to evaluate whether the three genes were lost due to a single mutational event or due to successive mutations. The Hox cluster is disorganized in the H. dujardini genome.

Experimental Evidence

Candidate Gene (https://www.gephebase.org/search-criteria?/and+Experimental Evidence=^Candidate Gene^#gephebase-summary-title)

Main Reference

The Compact Body Plan of Tardigrades Evolved by the Loss of a Large Body Region. (2016) (https://pubmed.ncbi.nlm.nih.gov/26776737)

Authors

Smith FW; Boothby TC; Giovannini I; Rebecchi L; Jockusch EL; Goldstein B

Abstract

The superphylum Panarthropoda (Arthropoda, Onychophora, and Tardigrada) exhibits a remarkable diversity of segment morphologies, enabling these animals to occupy diverse ecological niches. The molecular identities of these segments are specifiedÂ by Hox genes and other axis patterning genes during development [1, 2]. Comparisons of molecular segment identities between arthropod and onychophoran species have yielded important insights into the origins and diversification of their body plans [3-9]. However, the relationship of the segments of tardigrades to those of arthropods and onychophorans has remained enigmatic [10, 11], limiting our understanding of early panarthropod body plan diversification. Here, we reveal molecular identities for all of the segments of a tardigrade. Based on our analysis, we conclude that tardigrades have lost a large intermediate region of the body axis-a region corresponding to the entire thorax and most of the abdomen of insects-and that they have lost the Hox genes that originally specified this region. Our data suggest that nearly the entire tardigrade body axis is homologous to just the head region of arthropods. Based on our results, we reconstruct a last common ancestor of Panarthropoda that had a relatively elongate body plan like most arthropods and onychophorans, rather than a compact, tardigrade-like body plan. These results demonstrate that the body plan of an animal phylum can originate by the loss of a large part of the body.

Additional References

RELATED GEPHE

Related Genes

No matches found.

Related Haplotypes

No matches found.

EXTERNAL LINKS

COMMENTS