The genome of sea cucumber

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Intro. To Genomics 485

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outline

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- General genome information
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- Genome assembly
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General information

- Sea cucumbers are not a kind of vegetable, but animals.
- They are marine animals with a leathery skin and an elongated body.

General information

- They are named sea cucumber because of the shape of their body.

General information

- Sea cucumbers don’t have a brain.

General information

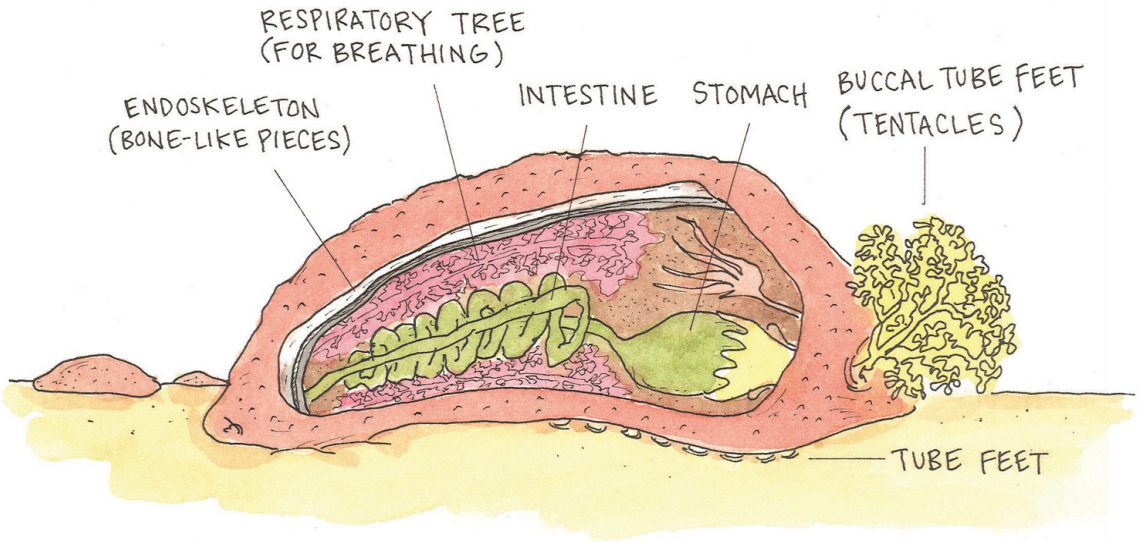
- Sea cucumbers are nocturnal, meaning they are active during the night.

General information

- Sea cucumbers feed on plankton, algae and decaying mater.

General information

- They using tentacles surrounding their mouth.
- They can grow a new tentacle in three weeks if they lose one.



General information

- Size of sea cucumber depends on the species.
- The smallest species can reach 0.12 inches.
- The largest species can reach 3.3 feet in length.

Genome paper

journal

genome sequencing is illumina sequencing

METHODS AND RESOURCES

The sea cucumber genome provides insights into morphological evolution and visceral regeneration

authors

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General genome information

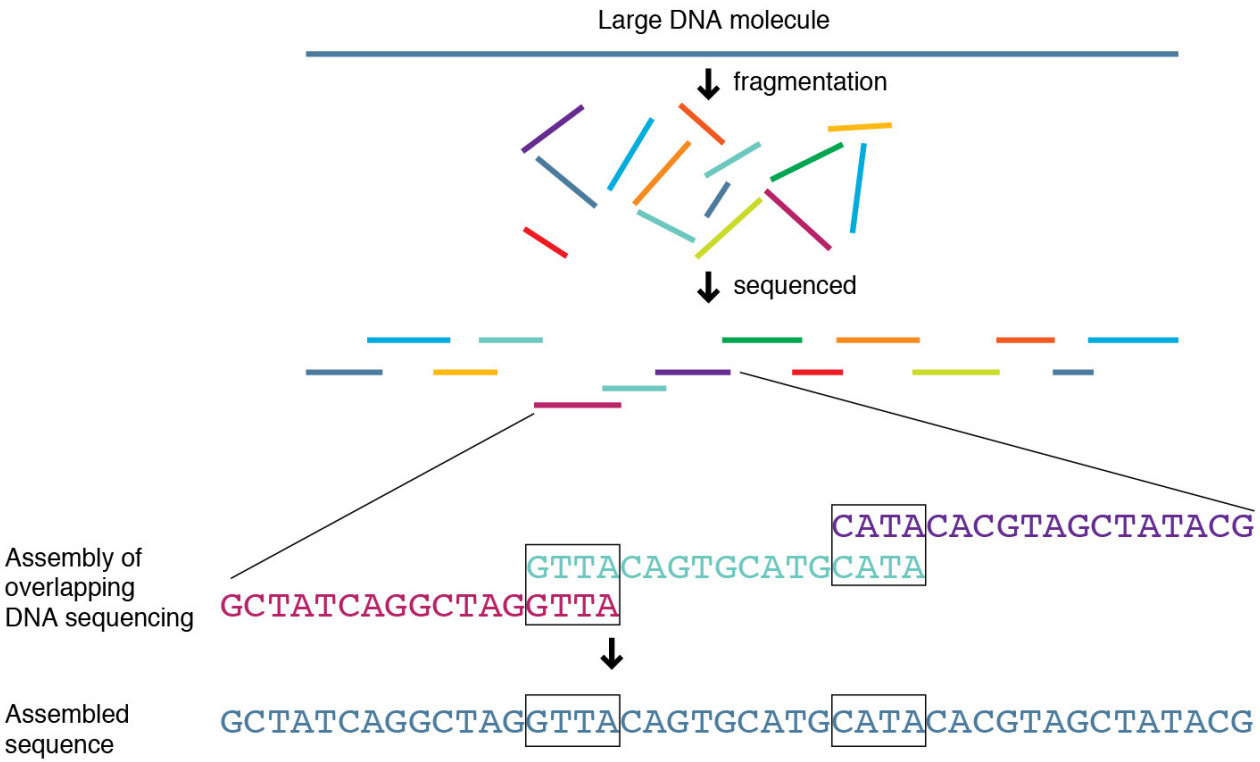
- The genome size is 0.82 Gb
- The source of sea cucumber DNA was from a male Apostichopus.japonicus, it has a fewer DNA transposons.

Sequencing strategy

- Whole genome shotgun was used as sequencing strategy.
- It is a method that breaks DNA into small random pieces for sequencing.

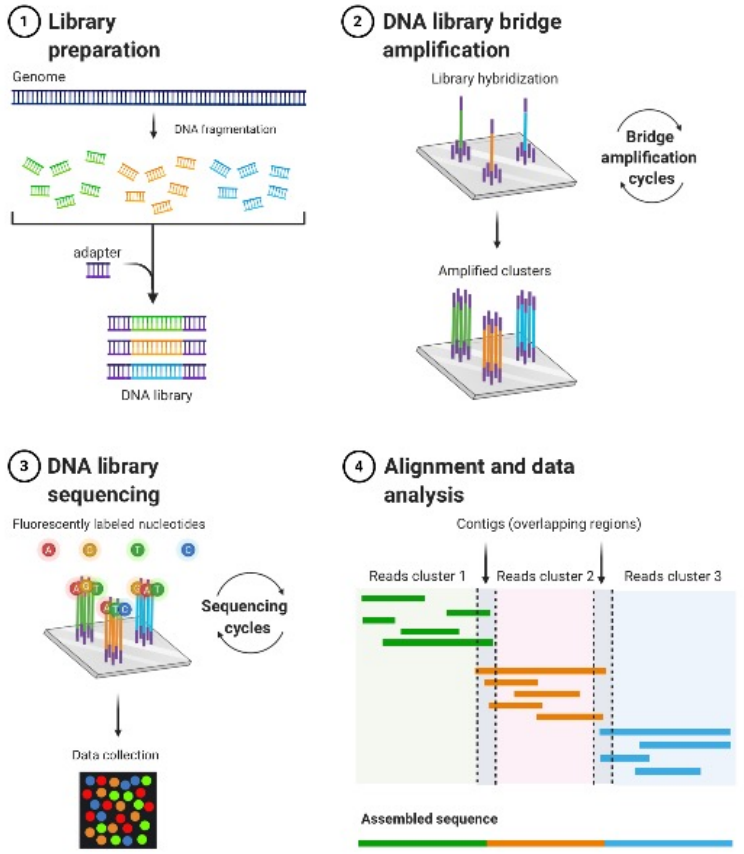
Sequencing strategy

- Whole genome shotgun



Sequencing methods

- Illumina: it is a sequencing method by synthesis.
- It depends on terminating chain synthesis by adding dNTP ´s.

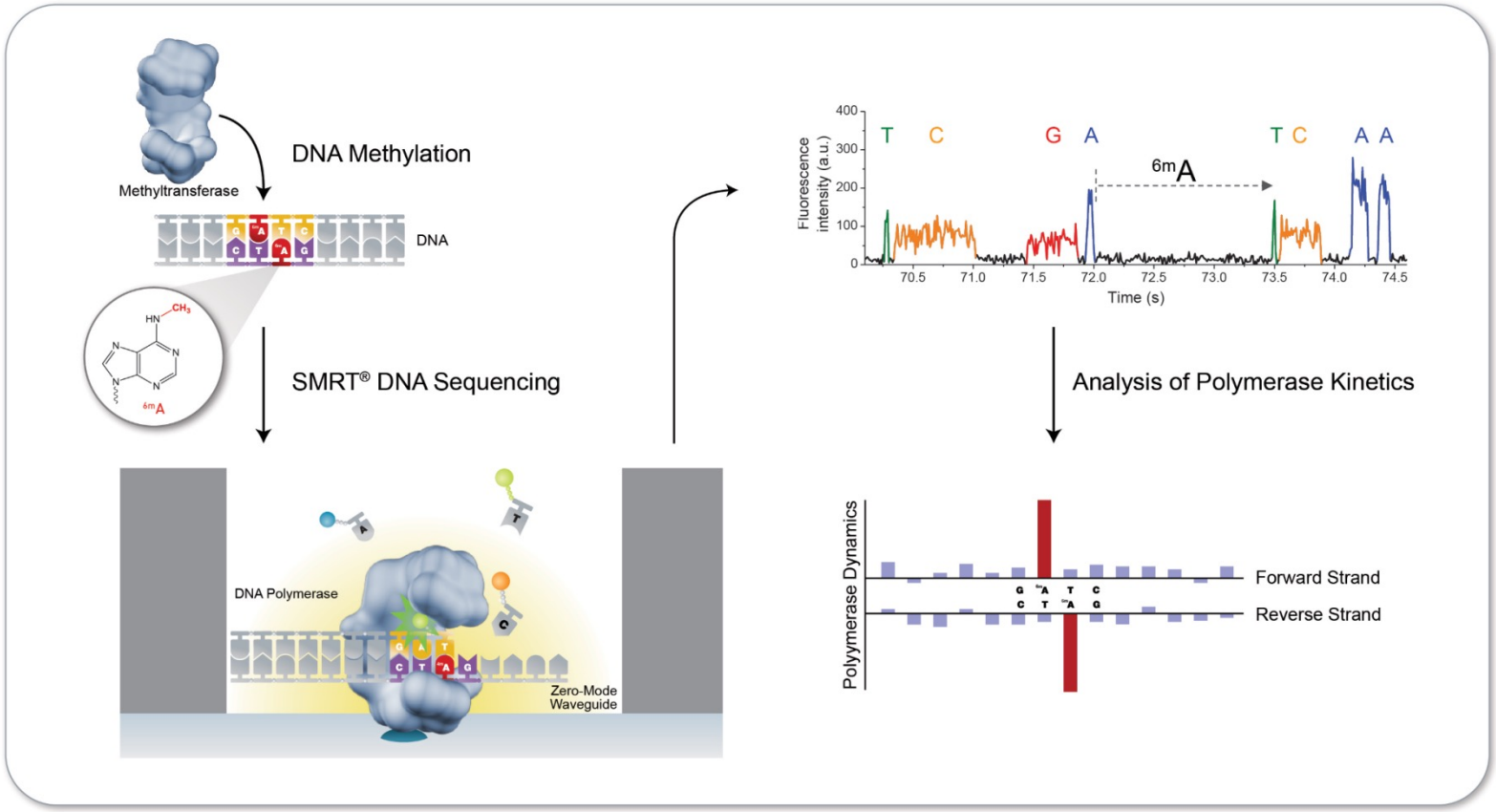


Sequencing methods

- PacBio sequencing: is a sequencing method by synthesis that uses labeled nucleotides but does not terminate the chain synthesis.
- it produces longer reads in short period of time than illumina.

Sequencing methods

- PacBio sequencing



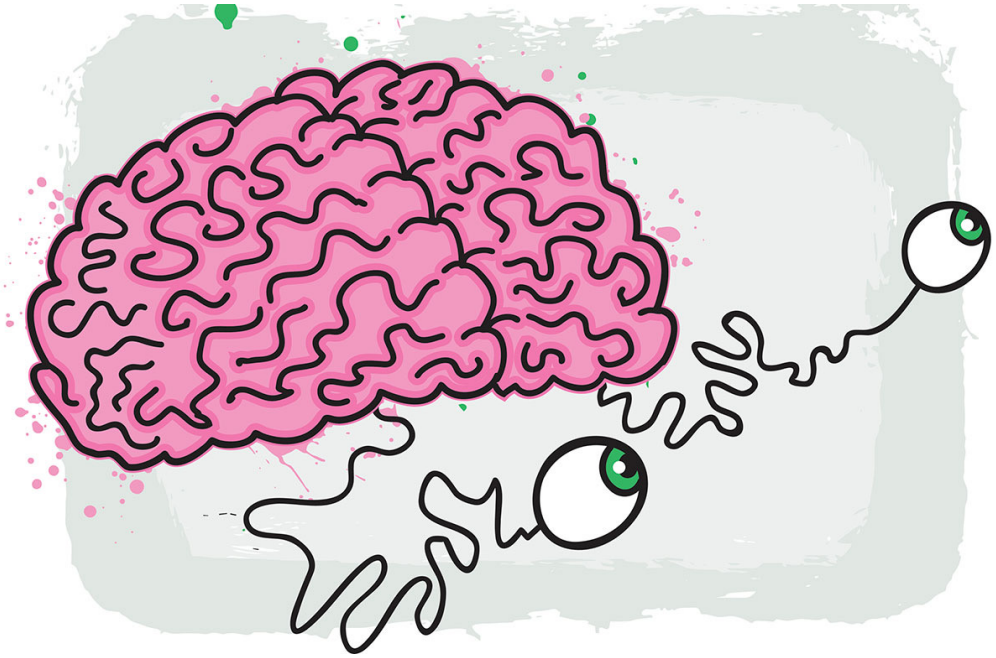
Genome assembly

Table 1. Summary of *A. japonicus* genome assembly.

Genome assembly statistics	
Total length	804,993,085 bp
Number of scaffolds	3,281
Largest contig length	1,074,537 bp
Largest scaffold length	2,494,933 bp
N50 length (contigs)	190,269 bp
N50 length (scaffolds)	486,650 bp
N90 length (scaffolds)	121,462 bp
Number of scaffolds (>N90 length)	1,779
Genome characteristics	
GC content	36.75%

Genome outcome

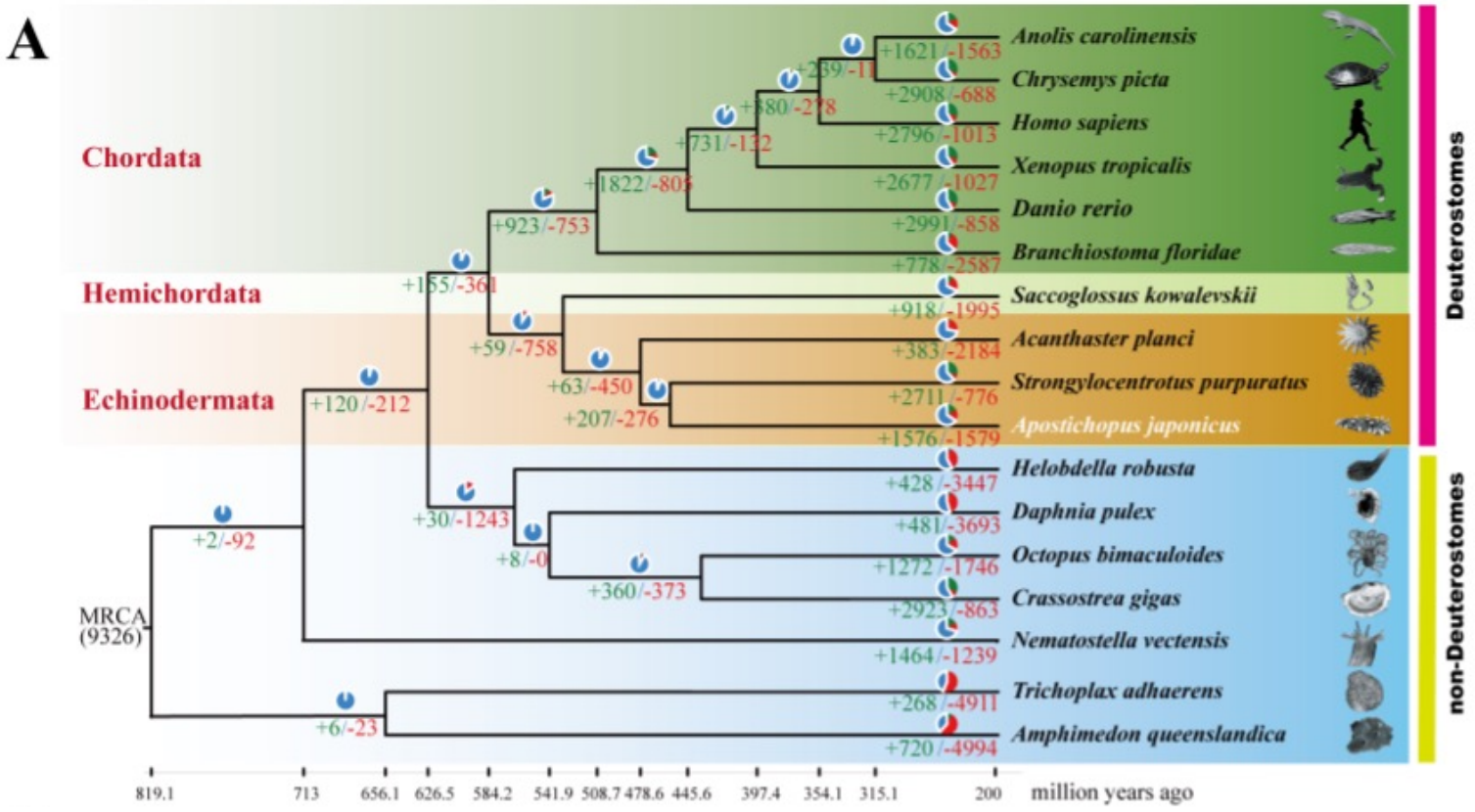
- **nervous system related genes**. Sea cucumber have no true brain or classic sensory organs, but they have a primary central nervous system specifically, a radial nerve cord and various nerve endings scattered through the skin giving them a response to touch and sensitivity to light.



Genome outcome

- The genome data supported these characteristics. Like sea urchins and sea stars, A. japonicus has a large number of genes related to the development of the nervous systems in its genome, whether in adult or larva. However, some crucial genes related to central nervous system development were absent in A. japonicus, S. purpuratus, and A. planci, including hunchback, vax, sax7, pax2, gfap, krox20, L-fng, Gli, and pax3/7. suggesting that all echinoderms have a similar genomic comparison and an absence of central nervous system genes.

Genome outcome



Genome outcome

- One difference is that A. japonicus has some significantly expanded gene families mainly enriched in signal recognition and nervous system, such as tyrosine-protein kinase receptor and netrin receptor UNC5B.
- One of the most expanded gene families was the netrin receptor (234 genes), which expanded many folds compared to related species. The netrin receptor is the key regulator in neuronal cell growth and migration.
- Therefore, the expansion of these gene families might be a compensatory adaptation of the response to the lack of a central nervous system in A. japonicus.

Genome outcome

- Questions
- What is the scientific name of sea cucumber?
- Can they response to the environmental change and how?