

Introduction to Biology. Lecture 14

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Outline

1 Where we are?

- Cell cycle

2 Cell division

- Mitosis

3 Life in late Precambrian

- Cryogenian period and Snowball Earth
- Ediacarian period and multicellularity
- First animals



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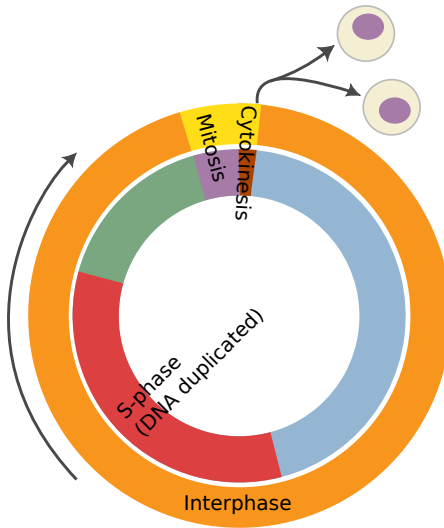


Where we are?

Cell cycle



Cell cycle



Cell division

Mitosis

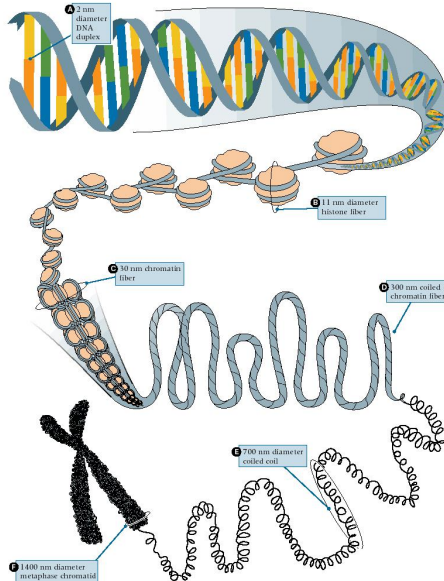


Stages of mitosis

- Prophase
- Metaphase
- Anaphase
- Telophase



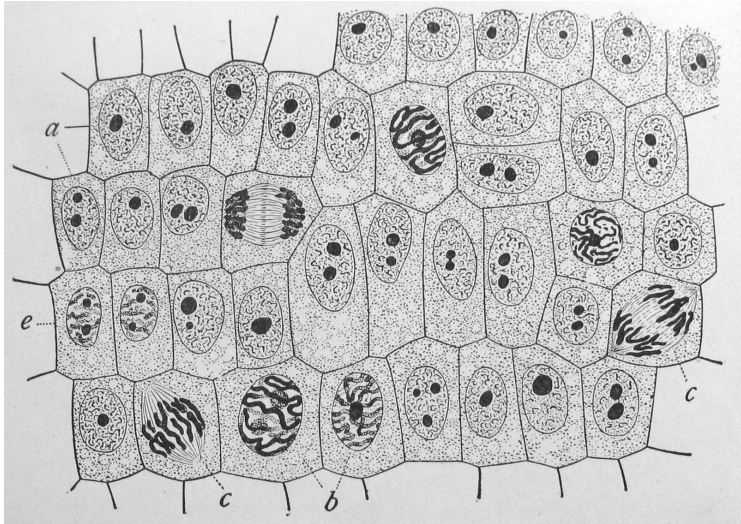
Super-coiling of DNA into chromosome



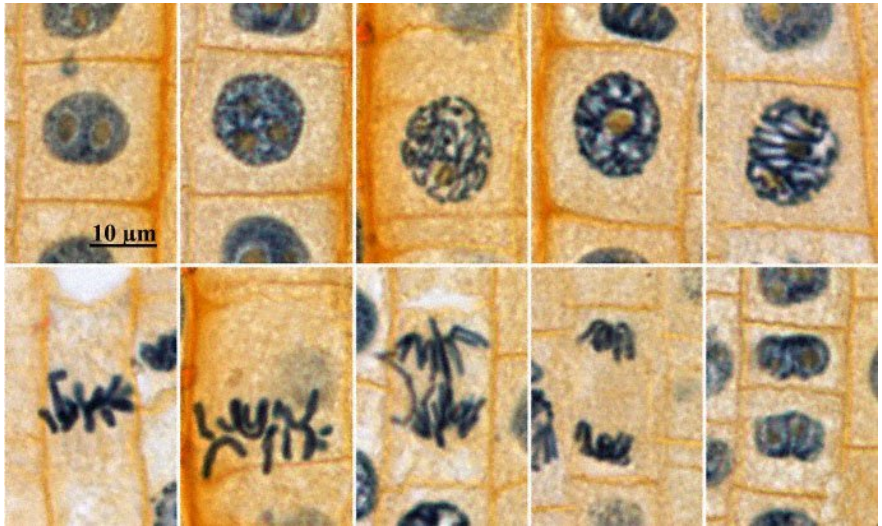
Stages of mitosis



Which stage? (drawing)



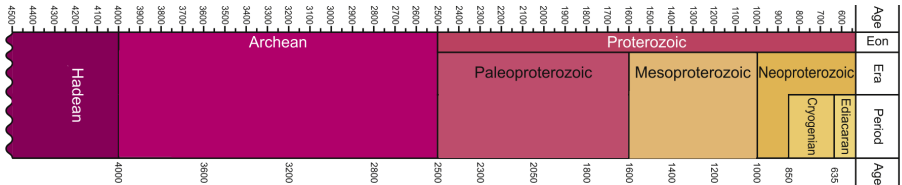
Which stage? (photo)



Life in late Precambrian Cryogenian period and Snowball Earth



Time scale for Precambrian



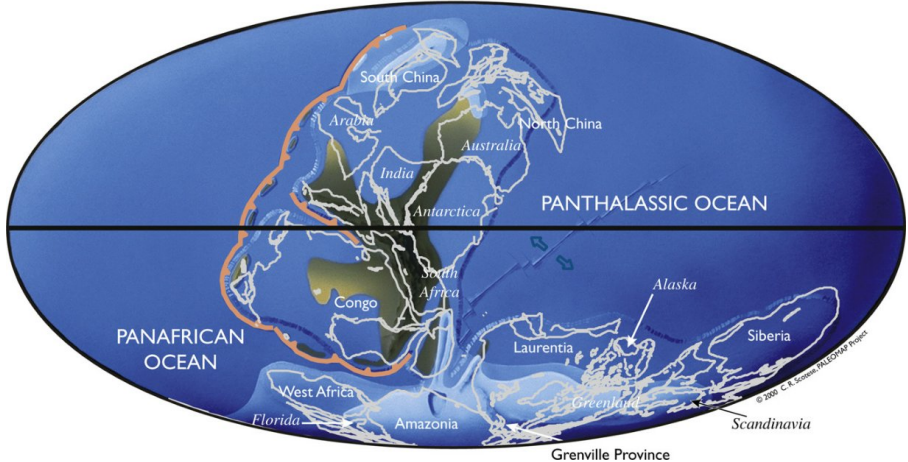
Rodinia—the super-continent

- Tectonic plates formed (and will form) one continent several times
- 650 Mya this continent—Rodinia was formed right over the South Pole



Cryogenian continents which formed Rodinia

650 Ma Cryogenian



Rodinia: view from South Pole

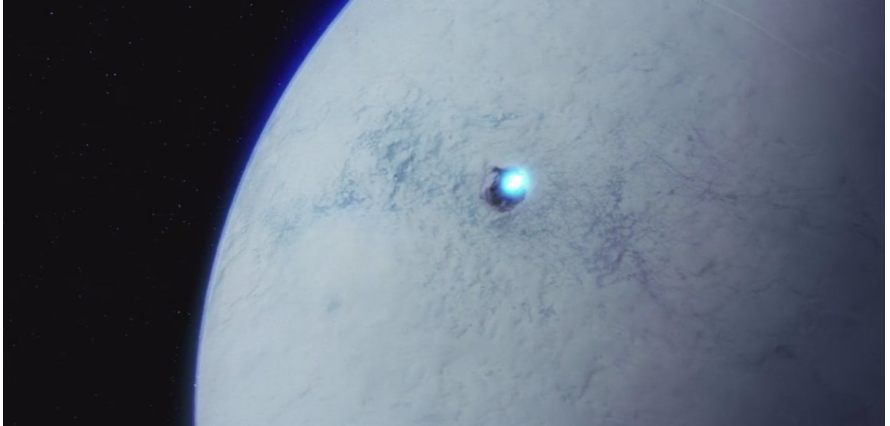


Marionan glaciation: Snowball Earth

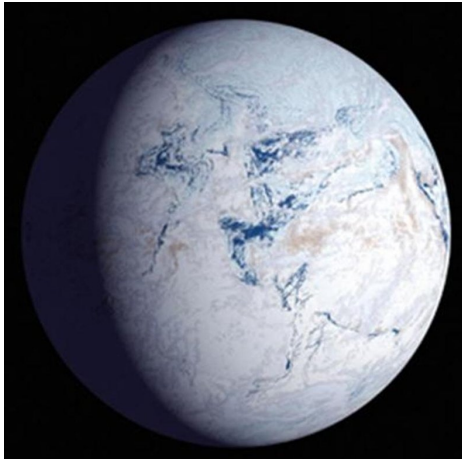
- First global glaciation was started because ice started to concentrate over the pole and increase Earth albedo (this is the positive feedback)
- And because the configuration of continents blocked the equatorial warm current
- And because concentration of oxygen was high but greenhouse gases (like CO₂)—small
- As a result, from time to time Earth was completely covered with ice sheet 1 km tall!



“Star Wars” Hoth, the ice planet



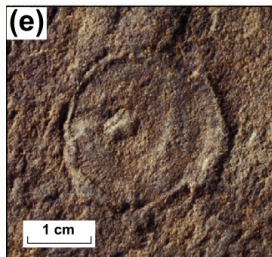
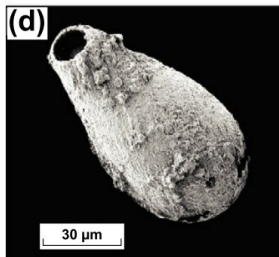
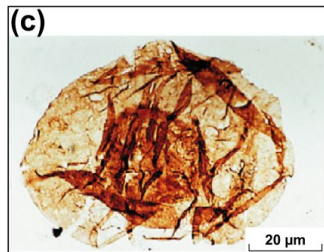
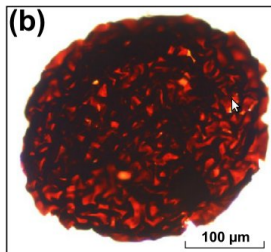
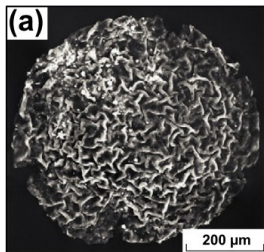
Snowball Earth



The evidence of Marinoan glaciation: diamictite layers everywhere on Earth



Cryogenian fossils

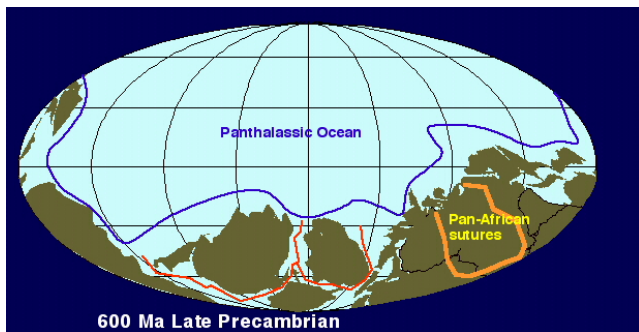


Life in late Precambrian

Ediacarian period and multicellularity

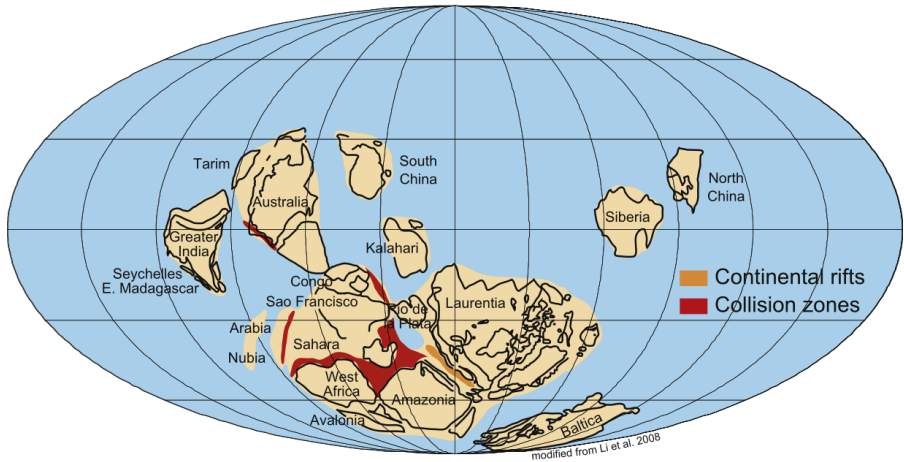


Rodinia breaks



Ediacarian continents

600 Ma Ediacaran

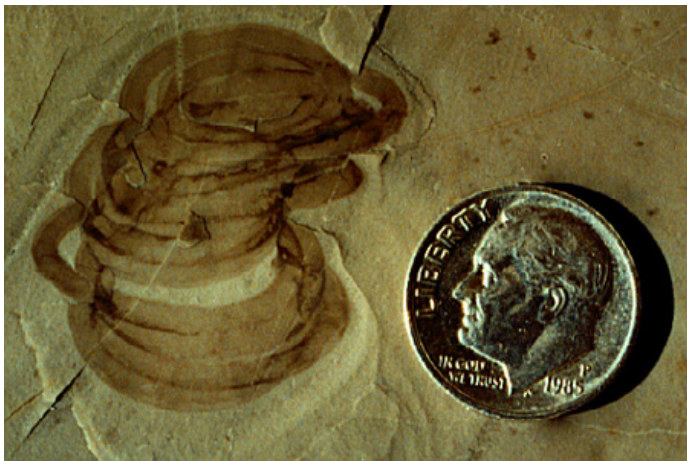


First multicellular life

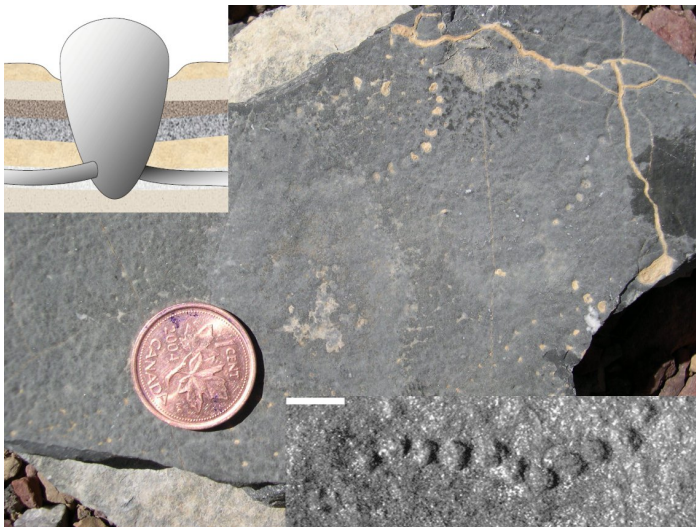
- Apart from some enigmatic forms (like *Grypania* and *Horodyskia*), multicellular eukaryotes were not known before Ediacarian
- From the beginning of Ediacarian, multicellular Lantian **algae** were known, then—**rangeomorphs** from Mistaken Point and then—fabulous “**Ediacara garden**”, the fauna of animals without skeleton



Grypania—the first alga?



Horodyskia and its interpretations



Multicellularity and origin of death

- Ediacarian fossils (and maybe some Cryogenian) were most likely **multicellular**
- Multicellular assemblages were probably originated from incompletely divided cells
- Initially, those assemblages were only benefit from their size, this is the example or race of arms between predator and prey
- Then, they started to use a division of labor: differentiated into somatic and germ cells
- Wheres germ cells are specialized for multiplication and will continue to “live” in next generations, somatic bodies have to die
- Unicellular living organisms are still potentially immortal



Lantian (China) macroscopic algae

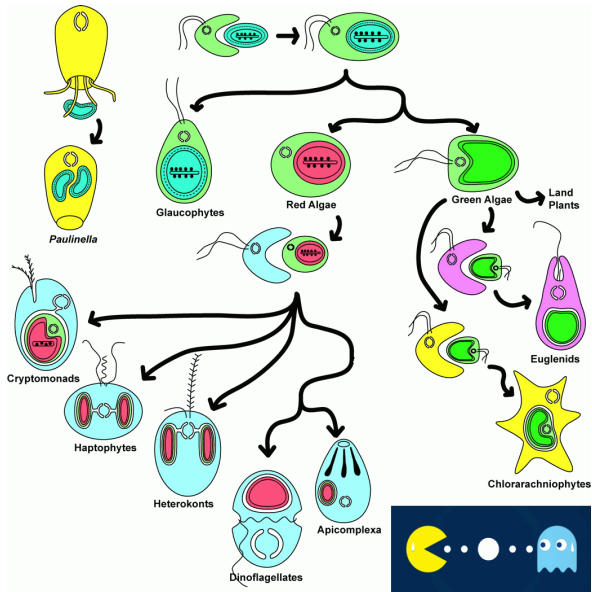


What are algae?

- Eukaryotes which are capable for photosynthesis with chloroplasts
- All chloroplasts were symbiotic (cyanobacteria in the past), and some even secondary symbiotic (other alga in the past)



“Pacman game” of algae origin



Lantian algae: probably, life without animals

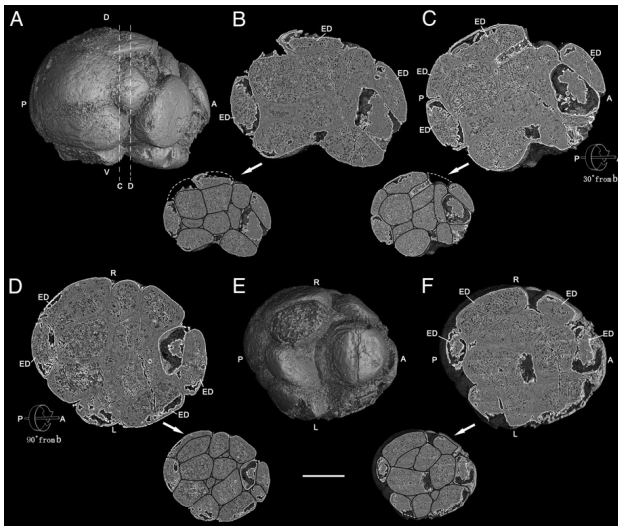


Life in late Precambrian

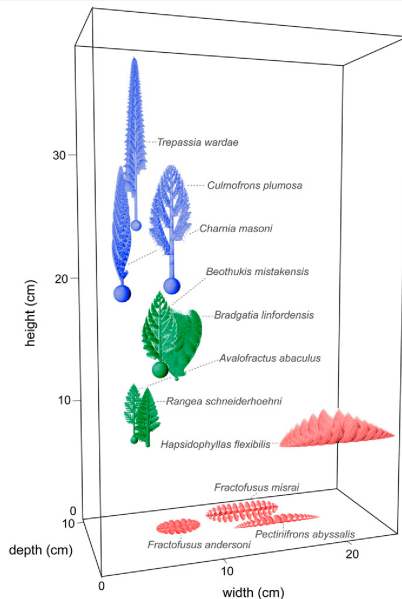
First animals



Doushantuo (China) “embryos”—first animals?



Mistaken Point (Canada) fauna: rangeomorphs



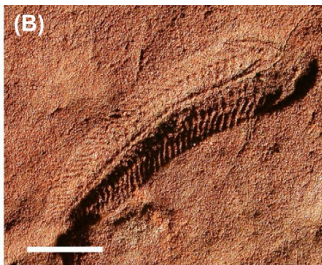
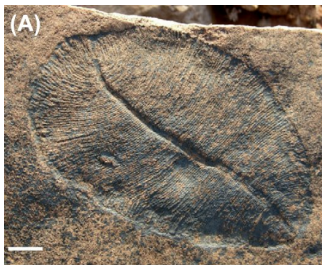
Extant sea pen (Pennatulacea soft corals)



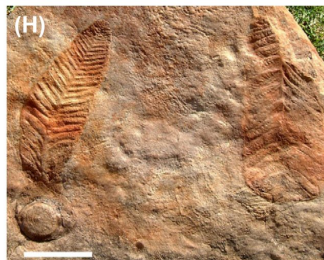
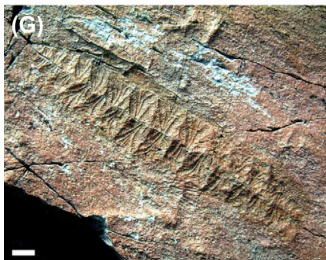
Finding Ediacara biota



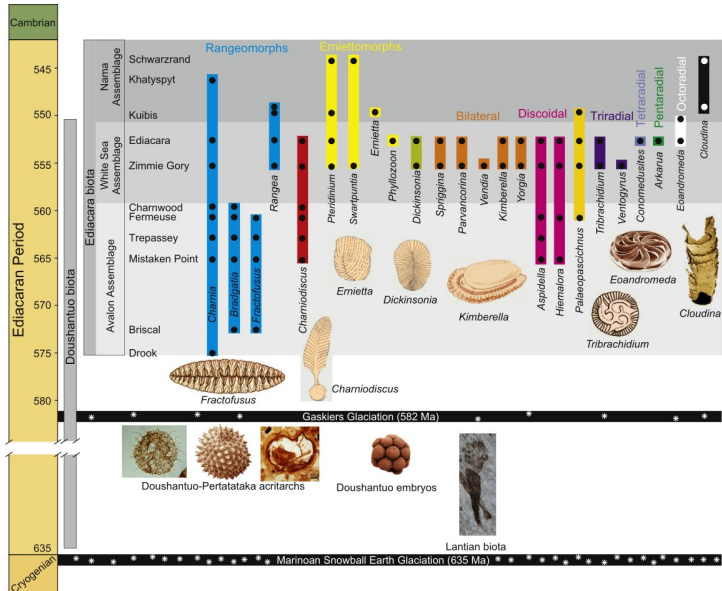
Ediacara Garden: *Dickinsonia*, *Spriggina* etc.



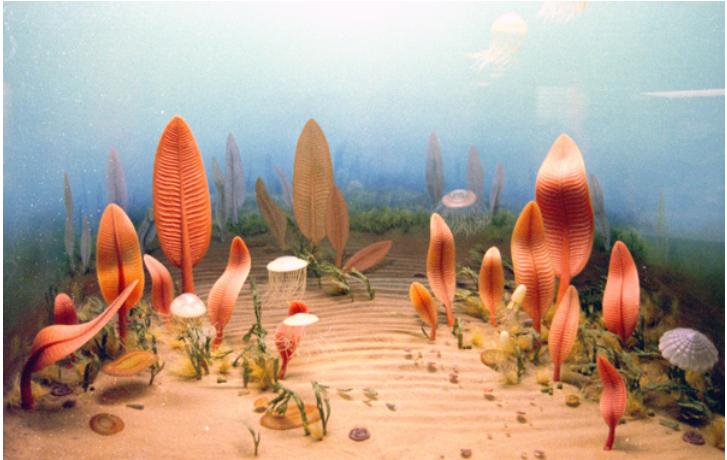
Ediacara Garden: *Eoandromeda*, *Charniodiscus* etc.



Life in Ediacarian



Ediacara “garden”—no predators *of macroscopic size*, nobody had skeleton



Origin of tissues—the most important event in late Precambrian

- **Tissues** are assemblages of similar cells doing the similar job
- Tissues are one level more over the eukaryotic cells
- Multicellular animals also have multiple tissues whereas multicellular algae and cyanobacteria are still on pre-tissues level of complexity
- **Multi-tissued** body is a great achievement, except for cancer...



Summary

- Mitosis is an equal division of nucleus
- In Cryogenian, Marinoan glaciation covered the whole Earth
- In Ediacarian, multi-tissued eukaryotes appeared



For Further Reading



Mitosis.

<http://en.wikipedia.org/wiki/Mitosis>



Ediacara biota.

http://en.wikipedia.org/wiki/Ediacara_biota

