THE GREAT OXYGENATION EVENT

HANNAH DEVENS

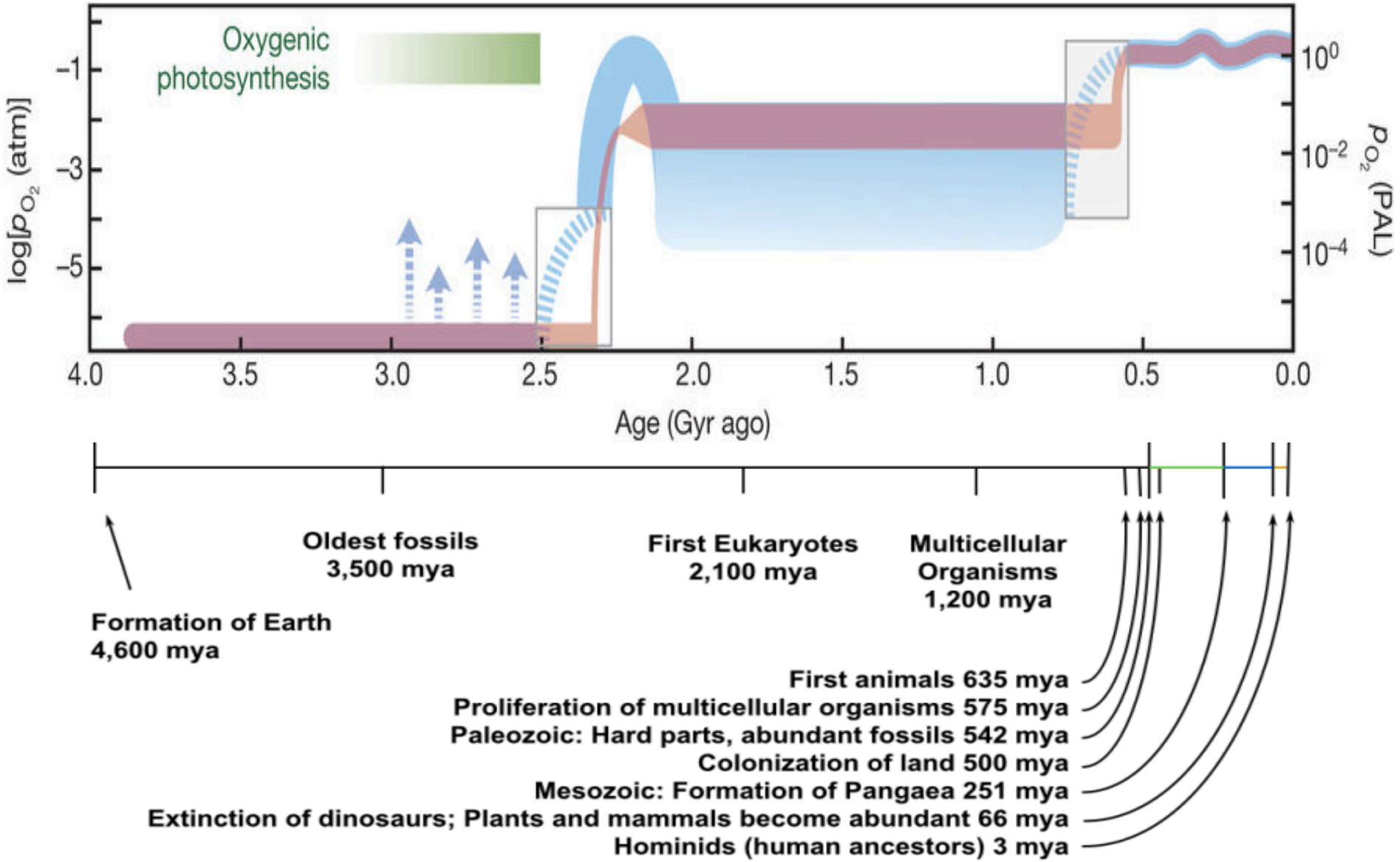
BIO 590S

11/18/17

HOW DID WE GO FROM THIS…

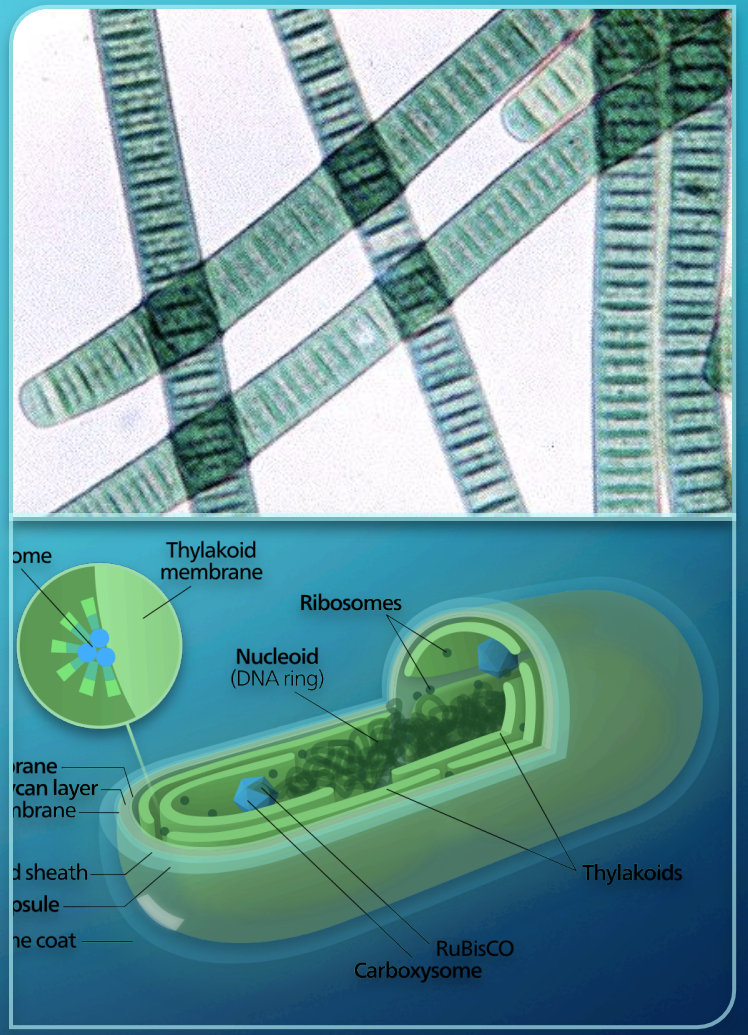
TO THIS?

THE GREAT OXYGENATION EVENT (GOE)



CAUSE: CYANOBACTERIA

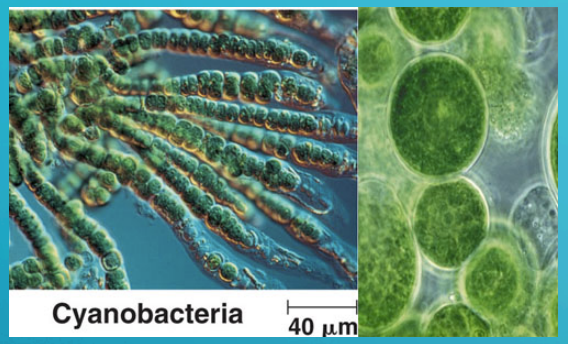
- Unicellular/filamentous/colonial
  - Early=unicellular
- First organisms capable of oxygenic photosynthesis
  - As opposed to anoxygenic photosynthesis (performed by heliobacteria, acidobacteria, etc)
- Primary endosymbiosis
- Advantages of photosynthesis?

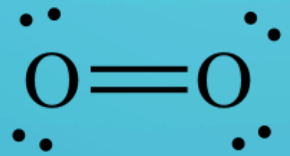


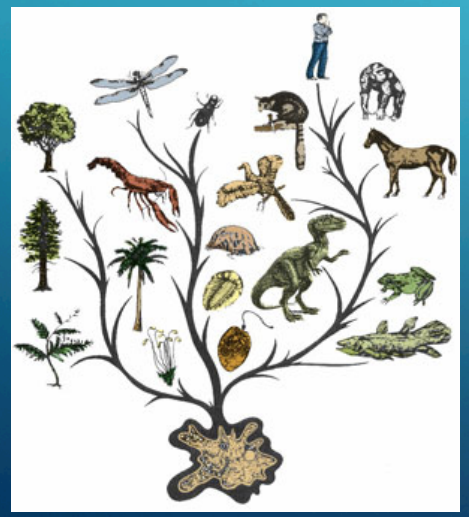
A QUICK PHOTOSYNTHESIS REFRESHER

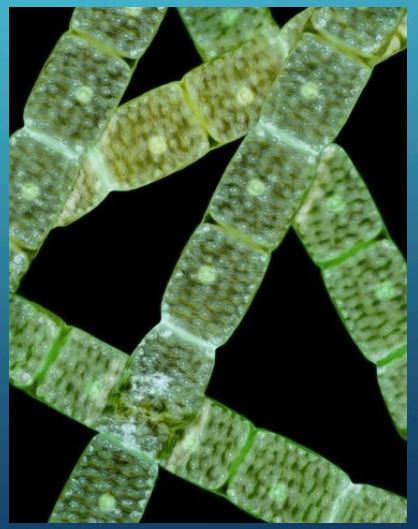
https://www.youtube.com/watch?v=HWqVgpAmf5I

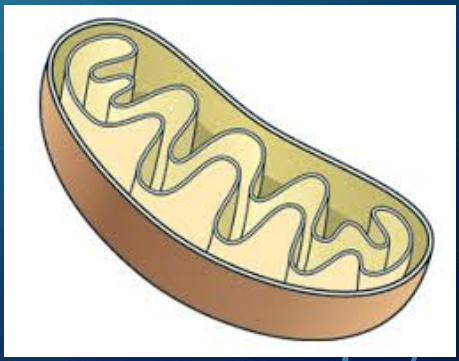
THE GREAT OXYGEN CATASTROPHE?





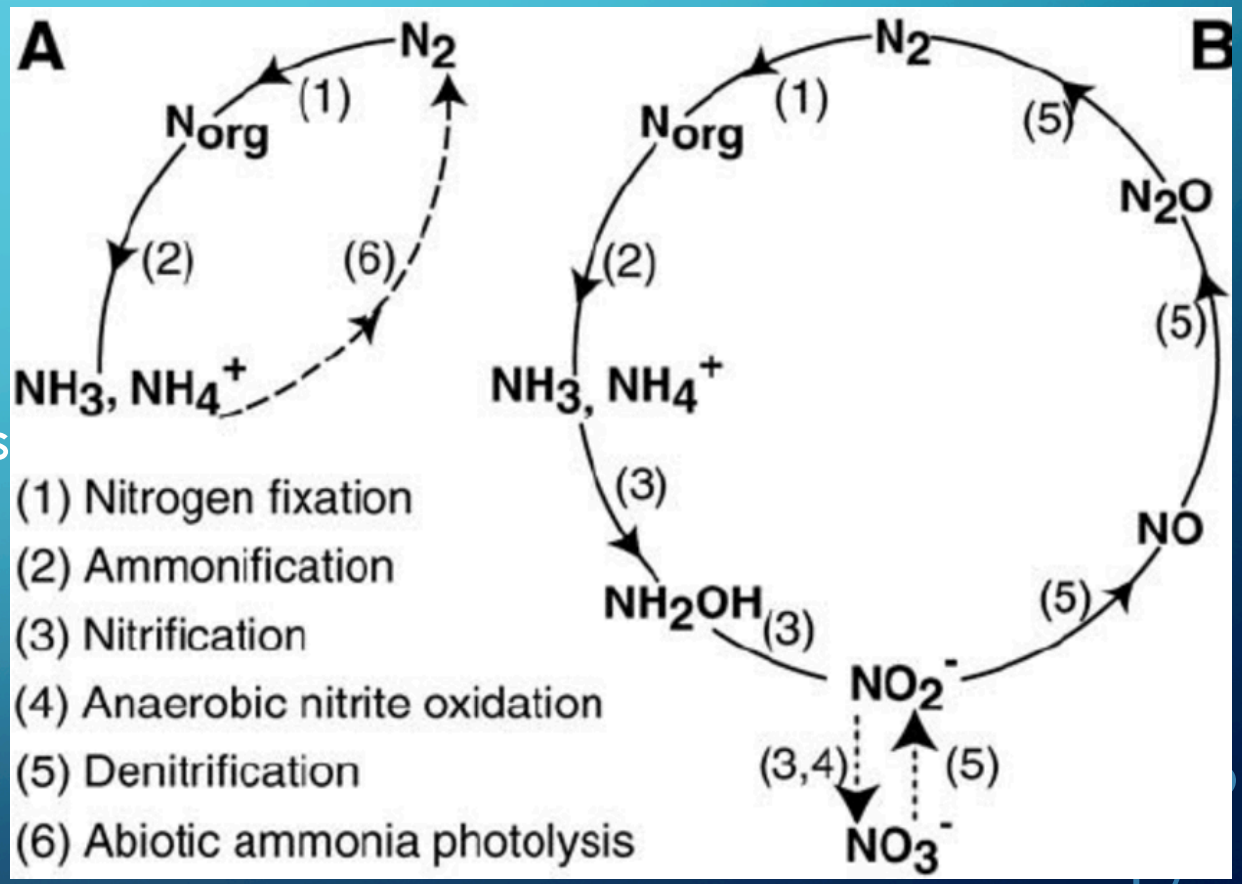






GEOLOGY OF THE GOE: NITROGEN AND OXYGEN CYCLES

- Oxygen sources:
  Weathering, photosynthesis
- Oxygen sinks: aerobic respiration (not
  banded iron formations), reducing gas
  in rocks, atmosphere



HISTORY AND EVIDENCE FOR GOE

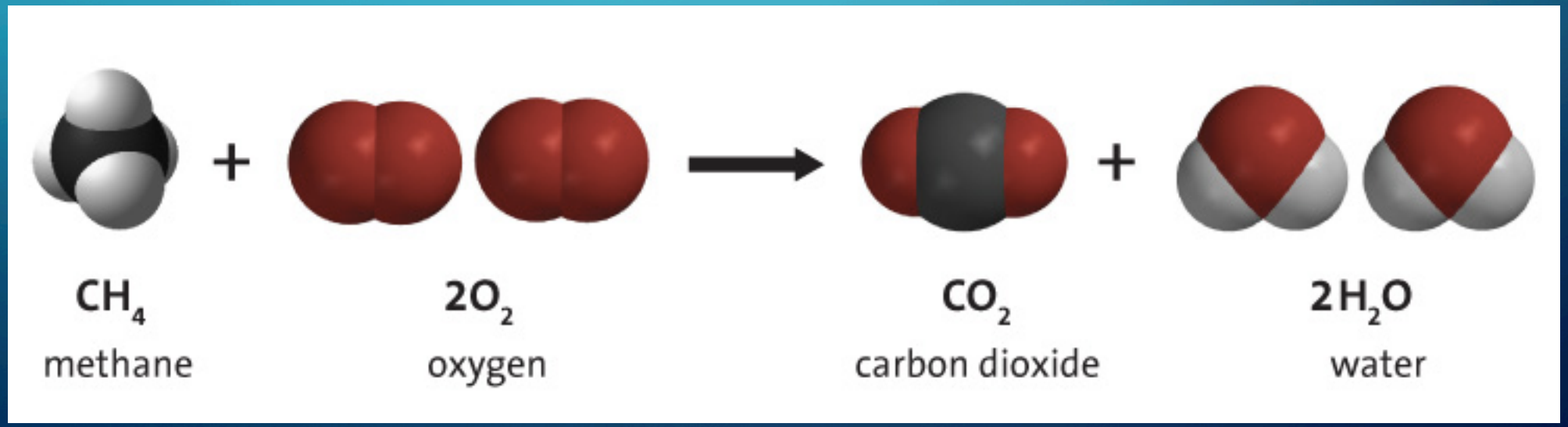
https://www.youtube.com/watch?v=IIA-k_bBcL0

https://www.youtube.com/watch?v=nsdrgtWeq-c&t=1783s at 15:27 to 19:00

https://www.youtube.com/watch?v=Y6haZqkfy_w

EFFECTS OF GOE, IMPLICATIONS FOR ORIGIN OF LIFE RESEARCH

- Huronian Glaciation
- Changed geologic cycles
- Other atmospheric shifts



DEBATE TIME!

- GOE: 2.5-2.0 bya
- Evolution of photosynthesis: sometime before the GOE…
  - ~3.8 bya?
  - ~2.3 bya?
- Debate questions:
  - 1. Is there evidence of a slow buildup of oxygen in the atmosphere before the GOE? How does your side of the argument explain this buildup (or argue against its existence)?
  - 2. How do biomarkers and the fossil record support your side's argument?
  - 3. How do oxygen sinks factor into this discussion? How do they strengthen your argument?

WRAP UP

- Remaining unknowns, areas of ongoing research, and sources of uncertainty
  - Old vs. new model of GOE timeline
  - "Molecular whiffs" of oxygen?
- Food for thought…
  - How does this exploration of the GOE inform our search for extraterrestrial life?
  - What experiments could be carried out in the lab to confirm or deny current conclusions about the GOE and the evolution of photosynthesis?
  - What would have happened if the GOE had never occurred?