Ribozymes – RNA catalysts

"RNA World" – vesicles with self-replicating catalytic RNA

Stromatolites – layered rocks formed by bacterial activity. 3.5 bya

Cyanobacteria – photosynthetic.
– O_2
– cellular respiration is a biochemical adaptation to O_2

Prokaryotes
– cocci – spherical
– bacilli – rod-shaped
– spiral
– 0.5 – 5 μm

cell wall – contains peptidoglycan

↳ Archae lack peptidoglycan

Gram positive – ↑ peptido
Gram negative – ↓ peptido

⇒ capsule or "slime layer" surrounds cell wall

Endospore) - dormant for centuries !!

Fimbria - appendages to attach.

Pili - DNA transfer

TAXIS - directed movement toward or away from a stimulus

i.e. positive & negative chemotaxis.

Flagella - Analagous to flagella in eukaryotes.

↳ exaptation ⇒ process in which existing structures take on new function through descent with modification.

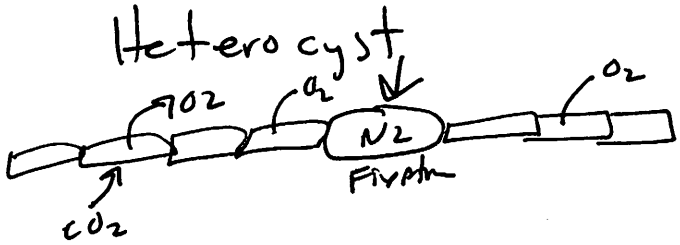
- Circular chromosomes
- NO nucleus (DNA in a region - nucleoid)
- plasmids

- Photoautotrophs
- Chemoautotrophs
- Photoheterotroph
- Chemoheterotroph

1) Obligate Aerobes
2) obligate Anaerobes
3) Facultative Anaerobes

Nitrogen Fixation - N_2 to NH_3 (ammonia)

Metabolic cooperation in prokaryotes:

(1) 

filamentous cyanobacteria Anabaena

(2) Biofilms - tooth decay.

Reproduction
1) Small
2) reproduce by binary fission (20min to 3hrs)
3) short generation times.

Prokaryotes ⇒ Metabolic Diversification!!

Genetic Diversity

1. rapid reproduction
2. mutation
3. genetic recombination

low mutation rate × large population × short generation = DIVERSITY

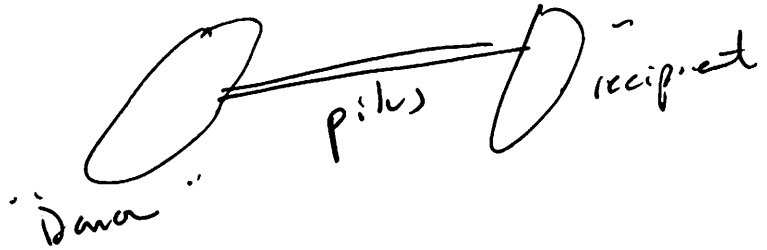
Genetic Recombination

1. Transformation
2. Transduction
3. Conjugation

Transformation – uptake of DNA from another strain

Transduction – viral vector of DNA

Conjugation – "donor" and "recipient" of DNA



F factor (fertility) – DNA a plasmid with code for pilus

– cells ⇒ F^+ – donor
F^- – recipients

Shigella → dysentary → antibiotic resistance

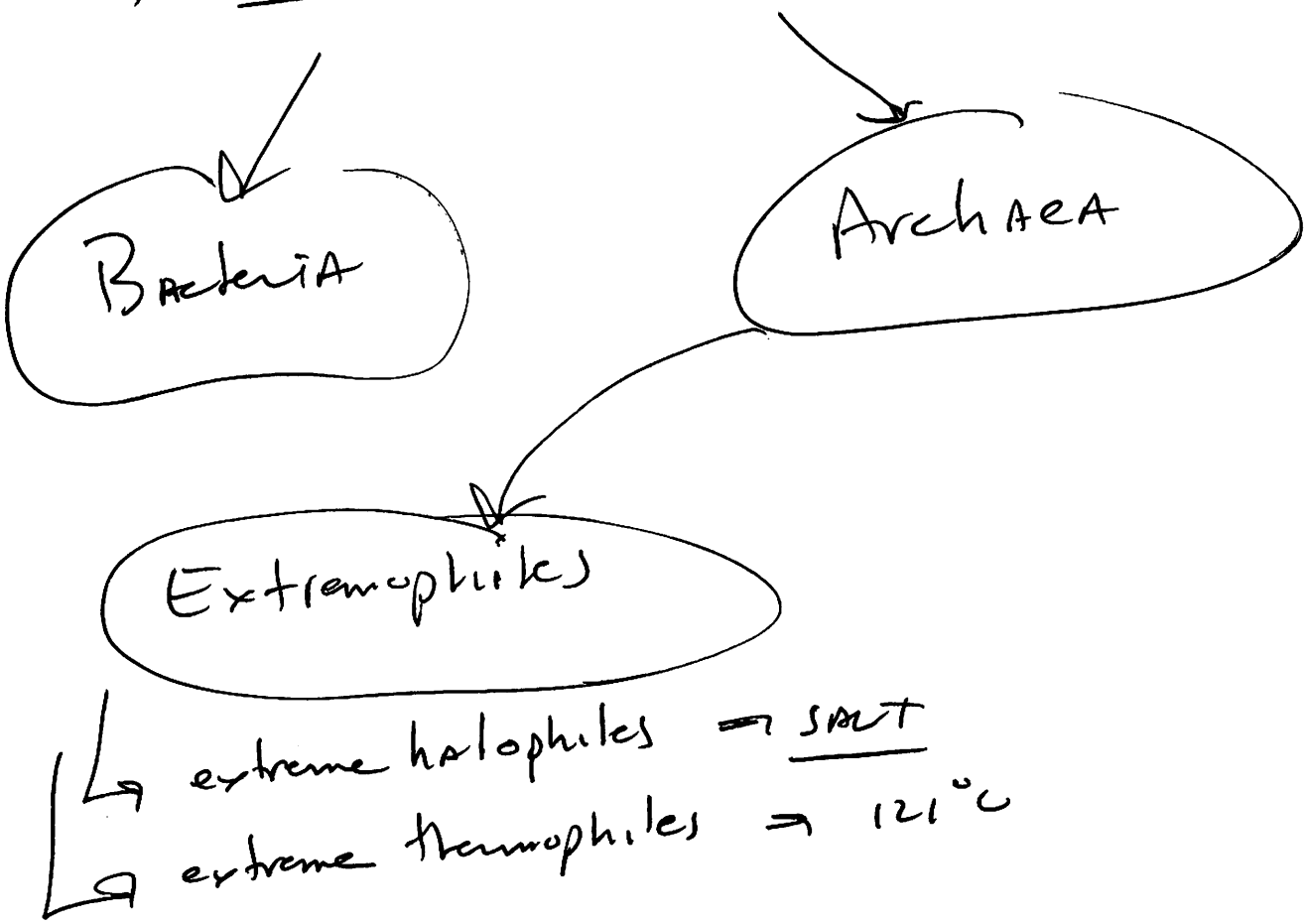
R plasmids (resistance) – confer resistance to certain antibiotics.

↳ can also carry "F" genes and form pili

↳ can confer resistance for up to 10 antibiotics.

Diversity of prokaryotes is immense

→ horizontal gene transfer



↳ extreme halophiles → salt

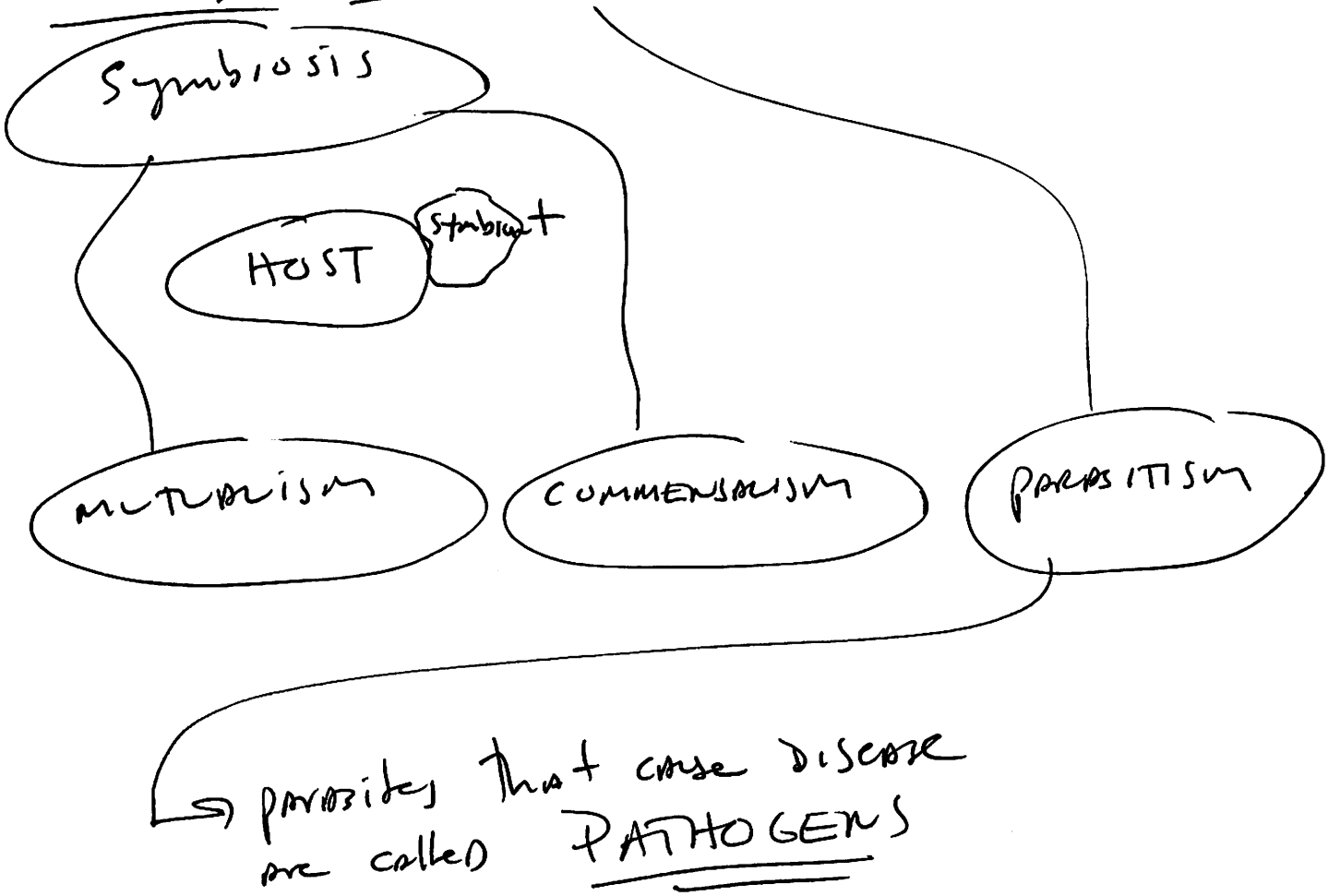
↳ extreme thermophiles → 121°C

⇒ methanogens → swamps → marsh gas
→ sewage → guts of cattle

Role in biosphere

- ⇒ Decomposer
- ⇒ produce O_2
- ⇒ "fix" N_2

Ecological Interactions



⇒ parasites that cause disease are called **PATHOGENS**

MUTUALISTIC BACTERIA

- 500 – 1,000 species of bacteria in human intestines.

Pathogenic Bacteria

- tuberculosis
- diarrheal diseases
- Lyme disease carried by ticks

→ produce poisons ⇒ Exotoxins – secreted by bacteria

⇒ Endotoxins ⇒ part of cell wall

- cholera
- botulism

Salmonella

H. G. Transfer ⇒ can turn harmless bacteria into pathogens.

O157:H7 ⇒ E. coli

phage-mediated horizontal gene transfer (TRANSDUCTION)

Positive

- cheese
  yogurt
- biotech
- bio-plastic polymers
- bioremediation ⇒ sewage
  ⇒ oil
  ⇒ nuclear waste.