Outline of Microbiology
January 2, 2012

Contents

Note: To look up references, see the Consciousness Bibliography, listing 10,000 books and articles, with full journal and author names, available in text and PDF file formats at http://www.outline-of-knowledge.info/Consciousness_Bibliography/index.html.

BIOL>Microbiology

microbiology
Biology {microbiology}| can be about archaebacteria, bacteria, and other microscopic plants and animals.

BIOL>Microbiology>Archaea

archaebacteria
Prokaryotes {archaebacteria} {extremophile} (Archaea) can live in deep sea at high pressure and heat.

Korarchaeota
Earliest archaebacteria {Korarchaeota} evolved into Crenarchaeota and Euryarchaeota.

Nanoarchaeota
Nanoarchaeum equitans {nanoarchae} {Nanoarchaeota} has 500,000-base DNA, has smaller cells than mycoplasmas, and lives in high temperature, and no oxygen. Perhaps, it is symbiotic or parasitic.

BIOL>Microbiology>Archaea>Crenarchaeota

Crenarchaeota
Later archaebacteria {Crenarchaeota} evolved from Korarchaeota. The oldest Crenarchaeota are Thermoproteales, then Sulfolobales, then Desulfurococcales, then Crenarchaeales, and then Caldisphaerales.

sulfolobus
Thermophiles {sulfolobus} can metabolize sulfur.

BIOL>Microbiology>Archaea>Euryarchaeota

Euryarchaeota
Later archaebacteria {Euryarchaeota} evolved from Korarchaeota. The oldest Euryarchaeota are Thermoplasmatales, then Thermococcales, then Methanopyrales, then Methanosarcinales, then Methanomicrobiales, then Mathanococcales, then Methanobacteriales, then Halobacteriales, and then Archaeoglobi. Euryarchaeota include thermophiles.

haloferax
Archaebacteria {haloferax} can metabolize halogens and iron.

halophile
Archaebacteria {halophile} can metabolize halogens.

methanogen
Archaebacteria {methanogen}| can produce and use methane, live in oxygen-free environments, have unusual cell walls, have unusual lipids, and have different RNA nucleotides. They can be spheres or rods and are half of all Archaea.
Archaebacteria {methanobacterium} {methanococcus} can use methane.
Methanogens use hydrogen gas, carbon dioxide or acetate, phosphorus, and nitrogen. They make methane.
methane
With no oxygen, methane does not break down quickly. With no oxygen, ammonia breaks down by ultraviolet light. If methane concentration is higher than carbon dioxide, methane molecules polymerize.
carbon dioxide
With no oxygen, carbon dioxide and iron react to make iron-carbonate siderite. Early-Earth air carbon dioxide was less than eight times current concentration, because rocks do not have siderite.

mycoplasm
Very small bacteria-like cells {mycoplasm}| can cause disease, such as mycoplasmic pneumonia. Archaebacteria include the mycoplasm Thermoplasma.

thermophile
Euryarchaeota include one-celled organisms {hyperthermophilic bacteria} {thermophile}| {thermoacidophile} that live in 180-C ocean vents and use halogens, methane, and/or iron. Thermophiles {archaeoglobus} {aquifex} can grow at 95 C.

BIOL>Microbiology>Bacteria

bacteria
One-celled organisms {bacteria}| can have rigid cell walls, surrounded by polysaccharide capsules.
reproduction
Bacteria have one chromosome. Bacteria reproduce asexually by fission. Some bacteria form spores. Bacteria can have zero, one, or two no-membrane nuclei.
metabolism
Bacteria have no mitochondria. Endoplasmic reticulum has no ribosomes.
tail
Bacteria can have flagella.
types
Bacteria can be parasites, use fermentation, or be saprophytes.
methane
Anaerobic bacteria can produce methane gas.

dormancy in bacteria
Bacteria can lose water, shrink, and stop metabolism {dormancy, bacteria}|.

Gram stain
Bacterial classification can depend on whether stain {Gram stain}| colors cell walls {Gram-positive bacteria} or not {Gram-negative bacteria}. Gram-negative bacteria include Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, and Acinetobacter baumannii.

BIOL>Microbiology>Bacteria>Products

bacteriophytochrome

Deinococcus radiodurans proteins {bacteriophytochrome}| can control gene expression, absorb red light, and fluoresce infrared light.

SOS response
Stressed bacteria first try to repair damaged DNA {SOS response}. Then they derepress genes that make proteins that cause high mutation rates. Bacterial cells can attach RecA protein to single-stranded DNA, which splits LexA regulatory protein, which derepresses genes that cause DNA mutations, which alter drug targets.

type IV secretion system
Gene regions can make secretion proteins {type IV secretion system} (TFSS). TFSS can inject protein toxins into host cells. Helicobacter has CagA gene, which makes CagA protein. Helicobacter injects CagA protein into stomach-lining cells. CagA protein increases stomach-cancer probability. CagA changes and affects cell shape, secretion, and signaling. For example, host cells make cytokines.

BIOL>Microbiology>Bacteria>Groups

culture of bacteria
Bacteria can grow in tubes or on plates {culture, bacteria} {bacterial culture}.

Hfq protein
RNA-binding proteins {Hfq protein} can have more sensitivity in cultures with little fluid motion {low fluid shear}.

biofilm
Bacteria cluster and attach to surfaces to form intercellular matrix {biofilm}|. They exchange signals and proliferate into microcolonies. Matrix can differentiate into different regions. Cells can leave to form new colonies. Substituted furanones block biofilm formation and break up existing ones, because they are similar to acylated homoserine lactones and mimic bacterial signals.

BIOL>Microbiology>Bacteria>DNA Transfer

conjugation in bacteria
Bacteria pylus allows DNA transfer {conjugation, bacteria}|.

pylus
Bacteria have flagella-like parts {pylus} for conjugation.

transduction
DNA from one cell can enter and become part of another cell {transduction}|.

BIOL>Microbiology>Bacteria>Signaling

autoinducer
Bacteria exchange chemical signals {autoinducer} (AI-1), using special receptors, to determine bacteria density by quorum sensing. Autoinducers help make biofilms, make spores, regulate reproduction, release toxin, and emit light. Autoinducers can exchange boron sugars {autoinducer two} (AI-2) with other species. Gram-negative bacteria use signals {acylated homoserine lactone} (ACL). Gram-positive bacteria use peptide signals.

quorum sensing
Bacteria exchange chemical-signal autoinducers, using special receptors, to determine bacteria density {quorum sensing}. If density passes threshold, bacteria make virulence-factor proteins that harm hosts. Bacteria can then make biofilms.

virulence factor
If bacteria density passes threshold, bacteria make proteins {virulence factor} that harm hosts.

BIOL>Microbiology>Bacteria>Kinds

microbe
Organisms can have one cell or be very small {microbe}|.

nanobe
Microbes {nanobe} can be 20 to 150 nanometers diameter, have inner and outer layers, have DNA, and have tendril-like colonies.

actinomycete
Soil bacteria {actinomycete} can make abyssomicin antibiotic.

myxobacteria
Soil bacteria {myxobacteria} include Stigmatella aurantiaca, which makes myxochromide.

saprophyte
Bacteria {saprophyte}| can use putrefaction to get food.

Pelagibacter ubique
Bacteria {Pelagibacter} {SAR11 gene} can have no junk DNA and use ocean carbon. Pelagibacter is in all oceans at all depths. Total mass is more than all fish. Algae use its products. If species have large populations, they can minimize DNA.

pleuromona
Bacteria {pleuromona} can have only 300 to 1000 genes.

rickettsia
Small bacteria-like cells {rickettsia} can grow in other, mostly insect, cells. Rickettsia includes typhus and Rocky Mountain spotted fever, but most rickettsias are harmless.

Wolbachia
Bacteria {Wolbachia} can kill fruitfly eggs and live three weeks.

BIOL>Microbiology>Bacteria>Kinds>Bacillus

bacillus
Rod-like bacteria {bacillus}| include anthrax, diphtheria, typhoid, tuberculosis, and leprosy bacteria.

Chlamydomonas
Bacteria {Chlamydomonas} can have two front flagella, which flex and extend to pull it through water. Flagella have ten microtubule pairs, with one pair in center. Outside nine slide along central pair. Front rhodopsin-like pigment has maximum sensitivity to blue-green light. As in rhodopsin, retinal is inside the seven membrane loops.

E. coli
Bacteria {E. coli bacteria} can inhabit human intestine.

sensation
E. coli can sense sugars, amino acids, toxic ions, and light, using at least twelve different membrane and cell-wall protein receptors. They can compare previous sense qualities to subsequent sense qualities over several seconds, to establish gradients. Gradients change signal strengths by varying loop structures inside receptor proteins.

Receptors signal to G-proteins, which eventually send to six flagella. Signals combine at flagella to move bacterium in same direction or stop, which causes tumbling and random direction. Movements thus find food or escape poisons.

flagella
Flagella use hydrogen-ion gradients to turn eight ratchets at 6000 rpm. Flagella can spiral clockwise or counterclockwise. Flagella can align parallel or radiate from cell in all directions. Aligning and spiraling in same rotation causes forward motion. Radiating, and spiraling in opposite rotation, causes stopping.

halobacteria
Bacteria {halobacteria} (Halobacterium salinarium) can have flagella. Like rhodopsin, retinal pigment lies inside seven loops through membrane. It has maximum sensitivity to orange light, because Halobacterium lives in salt marshes.

pseudomonas
Non-invasive gram-negative rod bacteria {pseudomonas} can cause urinary tract infections, skin infections, and other infections.

BIOL>Microbiology>Bacteria>Kinds>Coccus

coccus
Spherical bacteria {coccus}| can be streptococcus, staphylococcus, or single spheres, such as pneumonia and gonorrhea.

staphylococcus
Spherical bacteria {staphylococcus} can form sphere clumps. Methicillin-resistant Staphylococcus aureus (MRSA) has antibiotic resistance to beta-lactams, by making enzyme that splits antibiotic. Vancomycin-resistant Staphylococcus aureus (VRSA) has antibiotic resistance to beta-lactams, by five-gene cassettes that alter cell-wall receptors.

streptococcus
Spherical bacteria {streptococcus} can form sphere chains.

BIOL>Microbiology>Bacteria>Kinds>Spirochete

spirochete
Spiral-corkscrew bacteria {spirochete} include syphilis.

borrelia
Spiral bacteria {borrelia} can cause Lyme disease.

Helicobacter pylori
Spiral bacteria {Helicobacter pylori} can live in high-acidity human stomachs, cause peptic ulcers, trigger stomach cancers, have cylindrical bodies, and have four flagellae. They can protect against acid reflux and esophagus cancer.
genes
Genome has 1,700,000 bases, has 1550 genes, and varies by 6%. CagA gene makes CagA protein, which increases stomach-cancer probability. CagA gene region makes proteins for type IV secretion system (TFSS). TFSS can inject protein toxins into host cells, and Helicobacter injects CagA protein. In host cells, CagA changes and affects shape, secretion, and signaling. Host cells make cytokines. VacA gene makes VacA protein, which causes vacuoles and coats helper T cells.

spirilla
Spiral-coil bacteria {spirilla} include cholera.

BIOL>Biology>History>Microbiology

Theodor Escherich [Escherich, Theodor]
biologist
Graz, Germany
1885
On Intestinal Bacteria of Infants [1886]; Escherichia coli discovered [1885]
He lived 1857 to 1911.

Frederick W. Twort [Twort, Frederick W.]
biologist
England

1915
bacteriophage discovered [1915]
He lived 1877 to 1950. Félix d'Hérelle discovered it in 1917.