

Biological Invasions: a threat to California Ecosystems

- Taught by Dr. Matteo Garbelotto
 - Matteog@berkeley.edu
 - Office: Third floor Hilgard Hall
 - Office hours: by appointment

Course info

- One two hour lecture per week
- One quiz every week on previous lecture
- Tainter and Baker Forest Pathology book
- Some readings will be posted on the Lab's Web site: www.matteolab.org
 - » Link to UCB course
 - » POWERPOINT LECTURES, assigned readings
 - » Posted on Fridays

Course info

- One final quiz (3 questions out of 9)
- Possibility to improve grade by writing paper (5 pages)
- One computer lab: use of software for genetic analyses
- One field activity Saturday April 11th: participation in UCB SODBLITZ (www.sodblitz.org)

GRADING

- 25% class participation
- 25% weekly quizzes
- 25% final quiz
- 25% field activity participation

EMERGENT FOREST DISEASES: ARE THEY A THREAT TO NATIVE ECOSYSTEMS?

- Intro to Disease
- Native Diseases
- Invasive fungi and emergent disease I
- Invasive fungi and emergent disease II
- Exotic CA pathogens (EPCA): White Pine Blister rust
- EPCA: Dutch Elm Disease
- EPCA: Pine Pitch Canker, Colored Canker of Sycamore
- EPCA: Sudden Oak Death
- Genetic Analyses of Invasive spp
- EPCA: Other invasive Phytophthoras
- Habitat change: Annosum root rot
- Host change: Cypress canker; Armillaria root Rot
- Newly introduced disease and US introduced: Xylella, 1000 canker, Phragmidium violaceum, Chestnut blight
- Finals

EMERGENT FOREST DISEASES: ARE THEY A THREAT TO NATIVE ECOSYSTEMS?

Matteo Garbelotto
U.C.Berkeley

Disease: injurious physiological activity caused by the continuous irritation by a primary causal factor and expressed in characteristic pathological conditions called symptoms

Disease: any disturbance of a plant that interferes with its normal, structure, function or economic value

Primary causal factor=agent

ABIOTIC

BIOTIC (incl. VIRUSES)

Maple scorch



Premature needle yellowing and loss on ponderosa pine

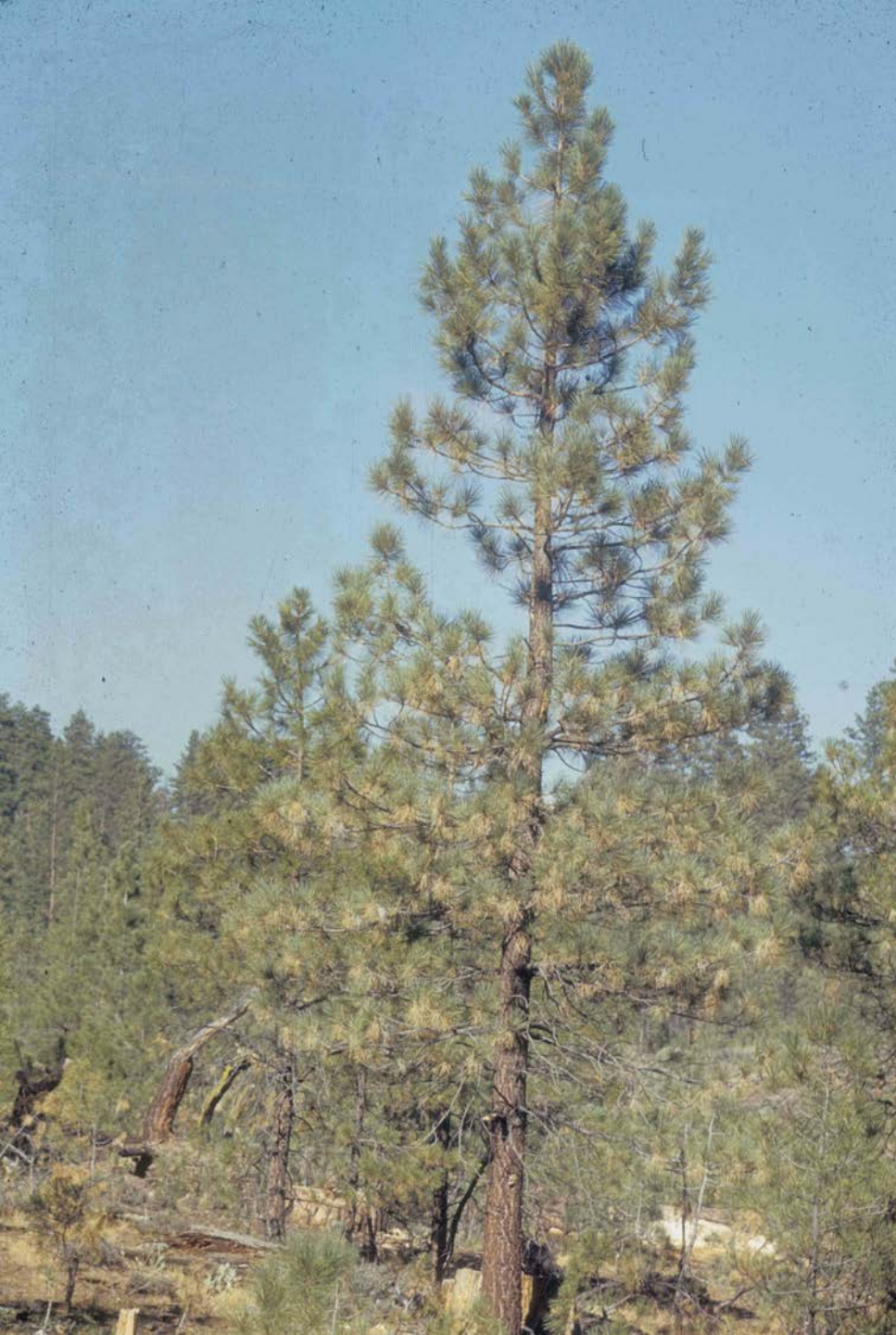


Ozone mottle



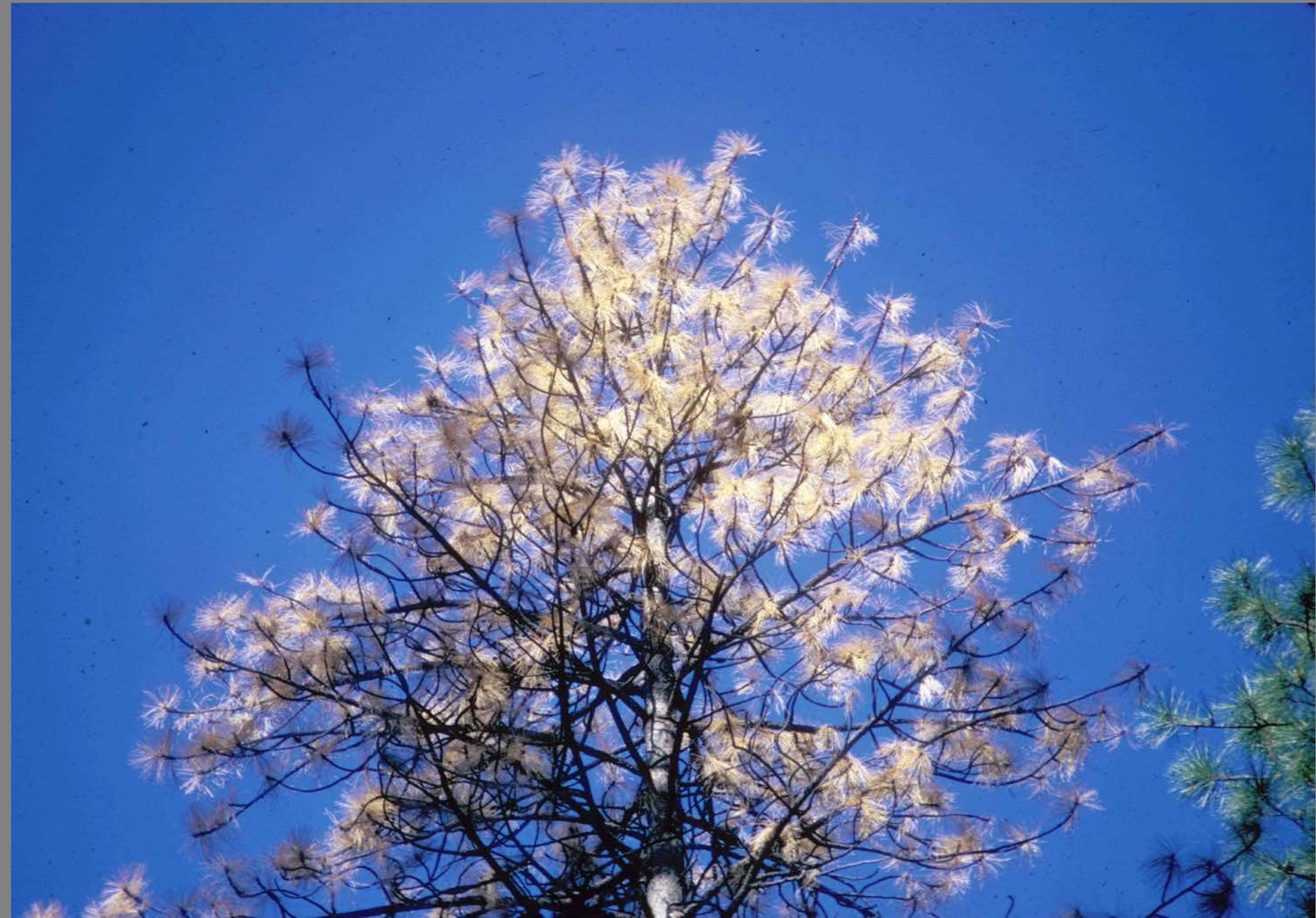
Loss of vigor in ponderosa pine exposed to ozone



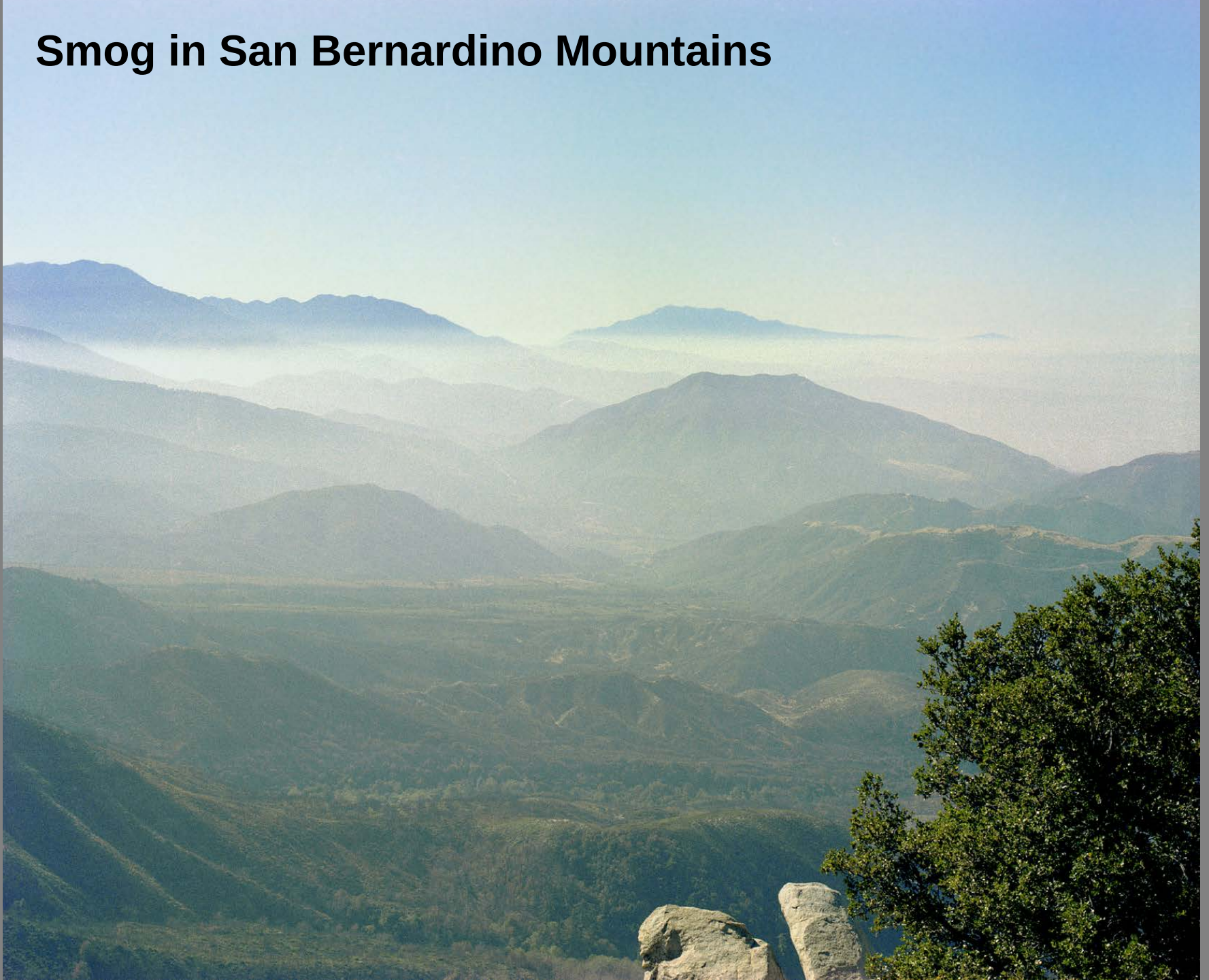


**Smog symptoms on
ponderosa pine in
southern California**

Advanced smog symptoms on ponderosa pine



Smog in San Bernardino Mountains



Acute SO₂ injury



Ash



Persimmon

BIOTIC DISEASES caused by:

Parasitic plants

Bacteria

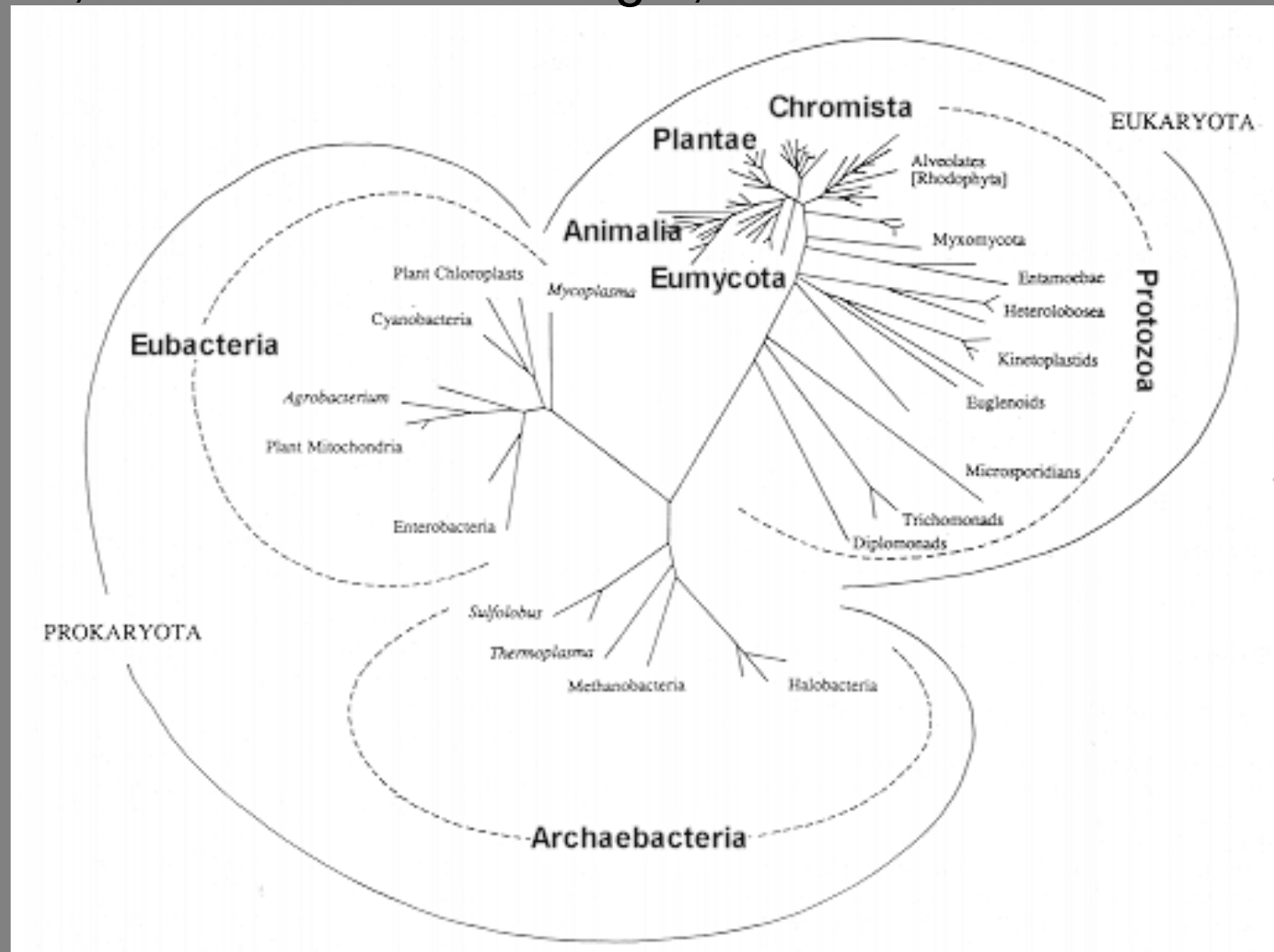
Fungi

Oomycetes

Viruses

Nematodes

Tree of Life, from Patterson & Sogin, 1992



Phorodenron villosum on oak

Leafy mistletoe



UGA4215043b







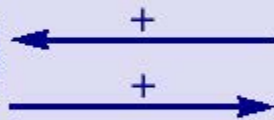
parasite



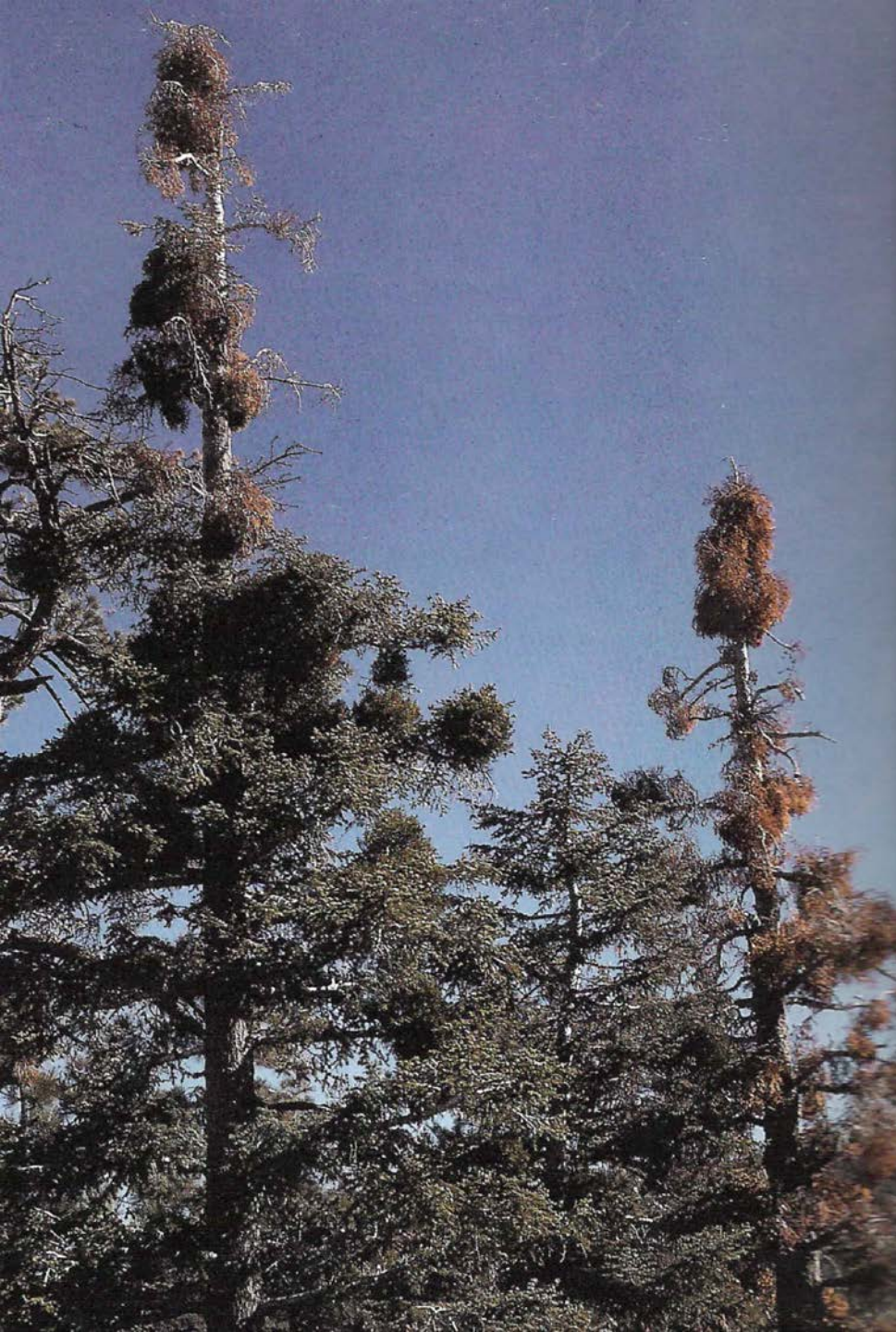
disperser/
vector



host



***Phoradendron pauciflorum*
on white fir**



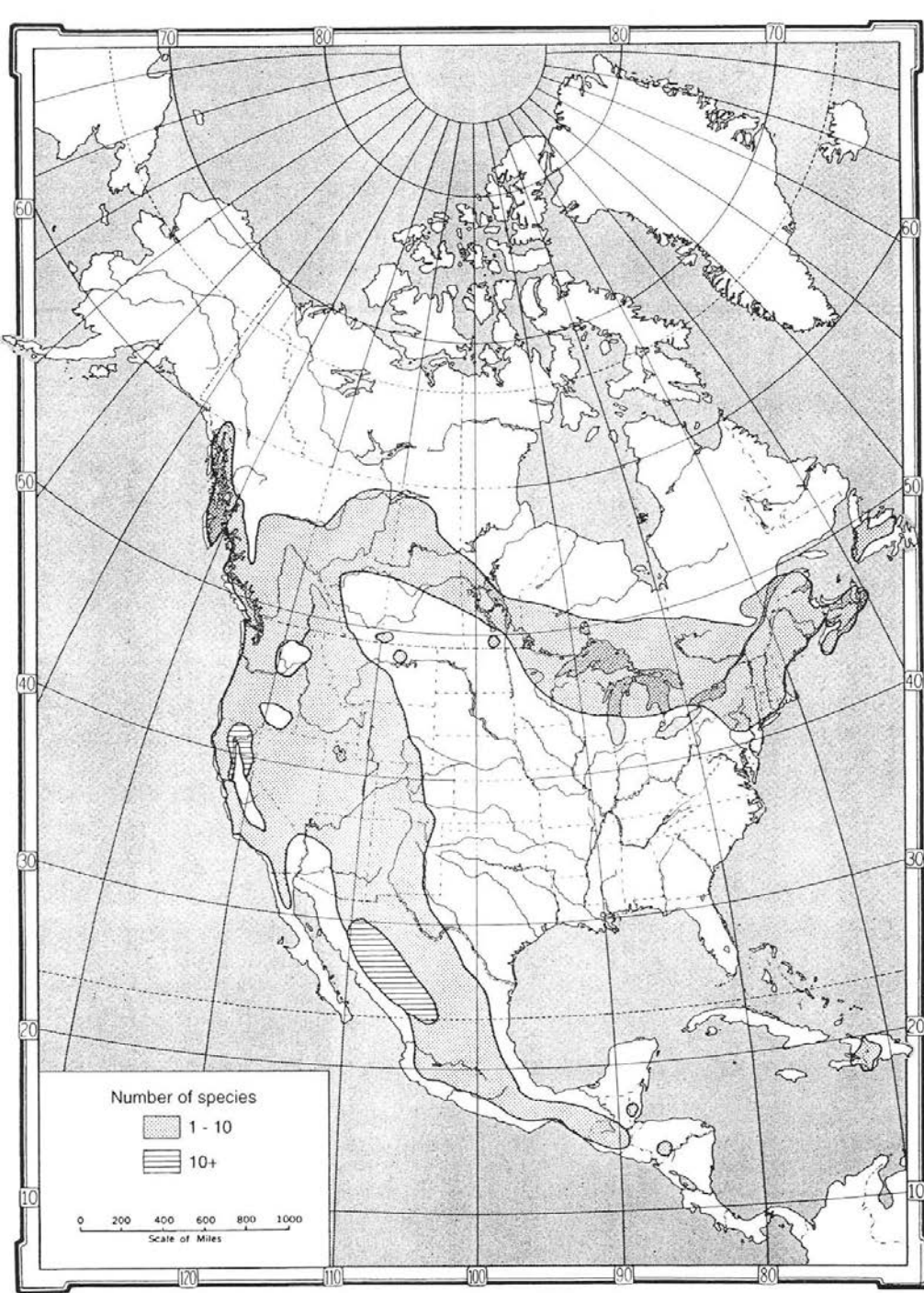
***Phorodendron libocedri*
on incense cedar**







Figure 5.1 –World distribution of *Arceuthobium*. The distribution is primarily in the Northern Hemisphere, crossing the Equator only in Kenya.



Large number of
species because of
high host specificity

Arceuthobium campylopodum
on Jeffrey pine



Arceuthobium douglasii
on Douglas-fir



UGA2250005b

Male flowers



UGA4215028b

Mature female shoots - seeds

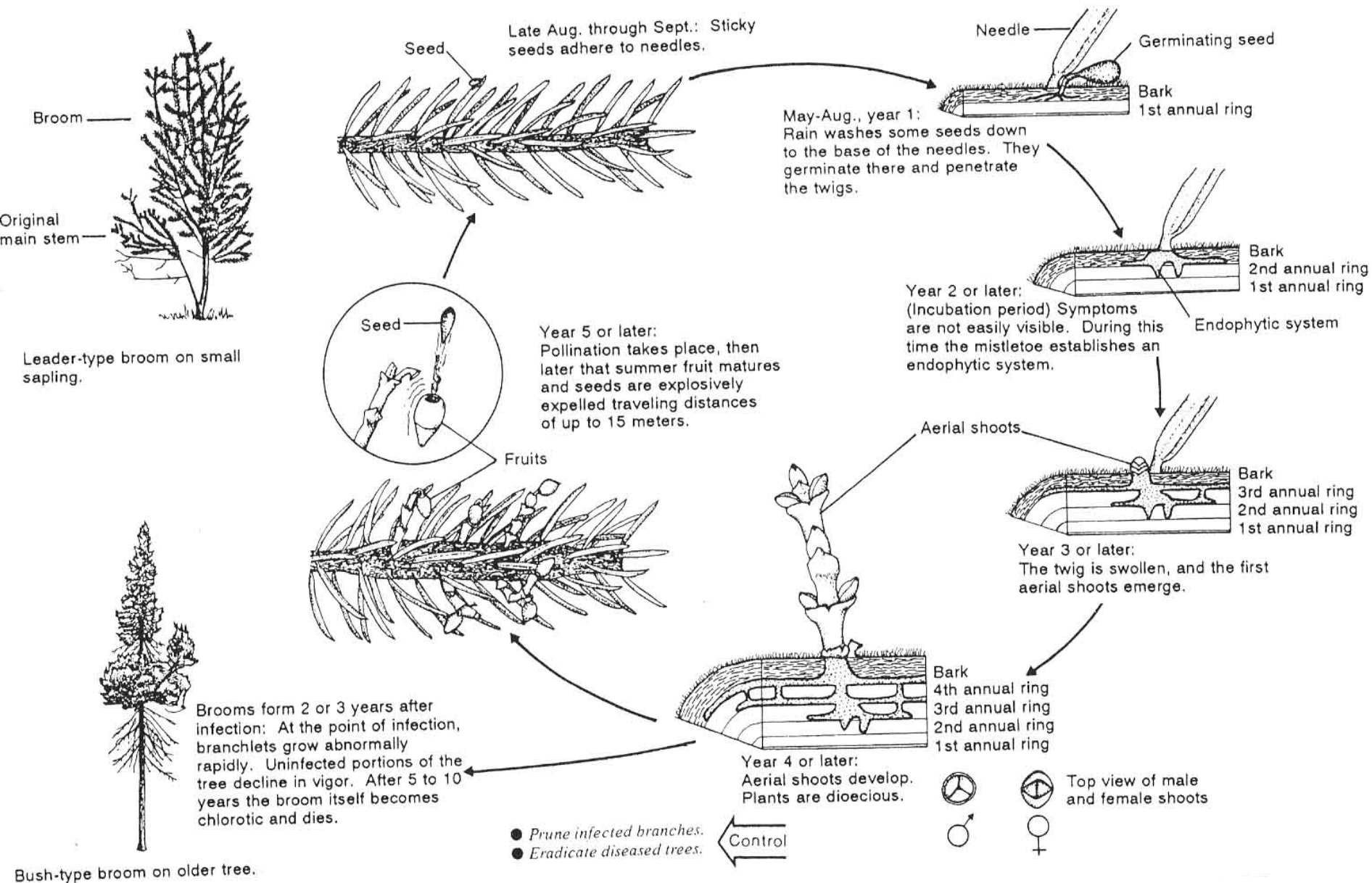


UGA4215030b

Explosive seed dispersal of *Arceuthobium*



UGA2250003b



BACTERIA

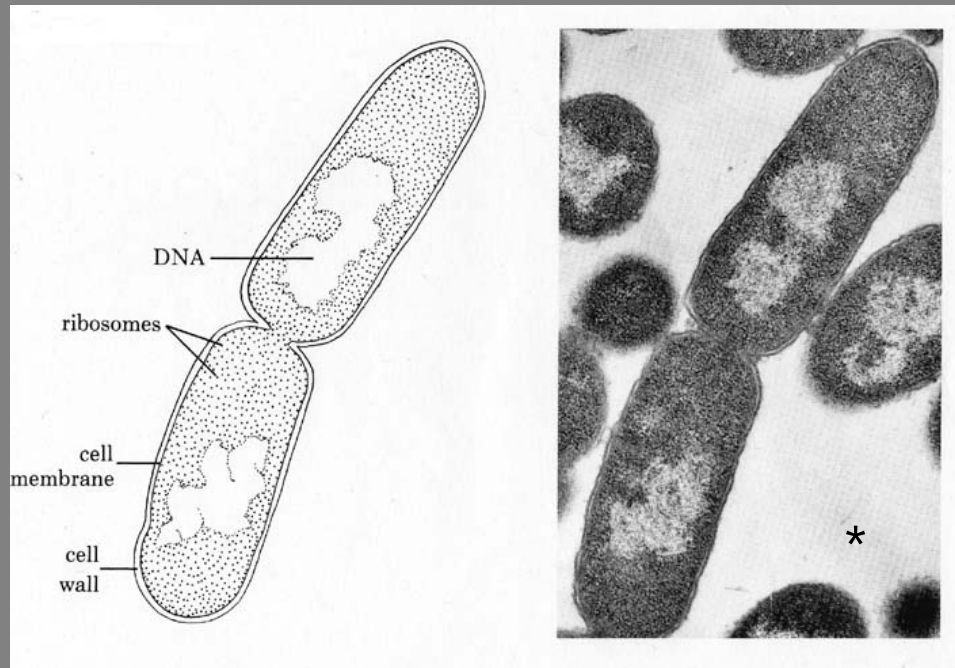
Prokaryotes

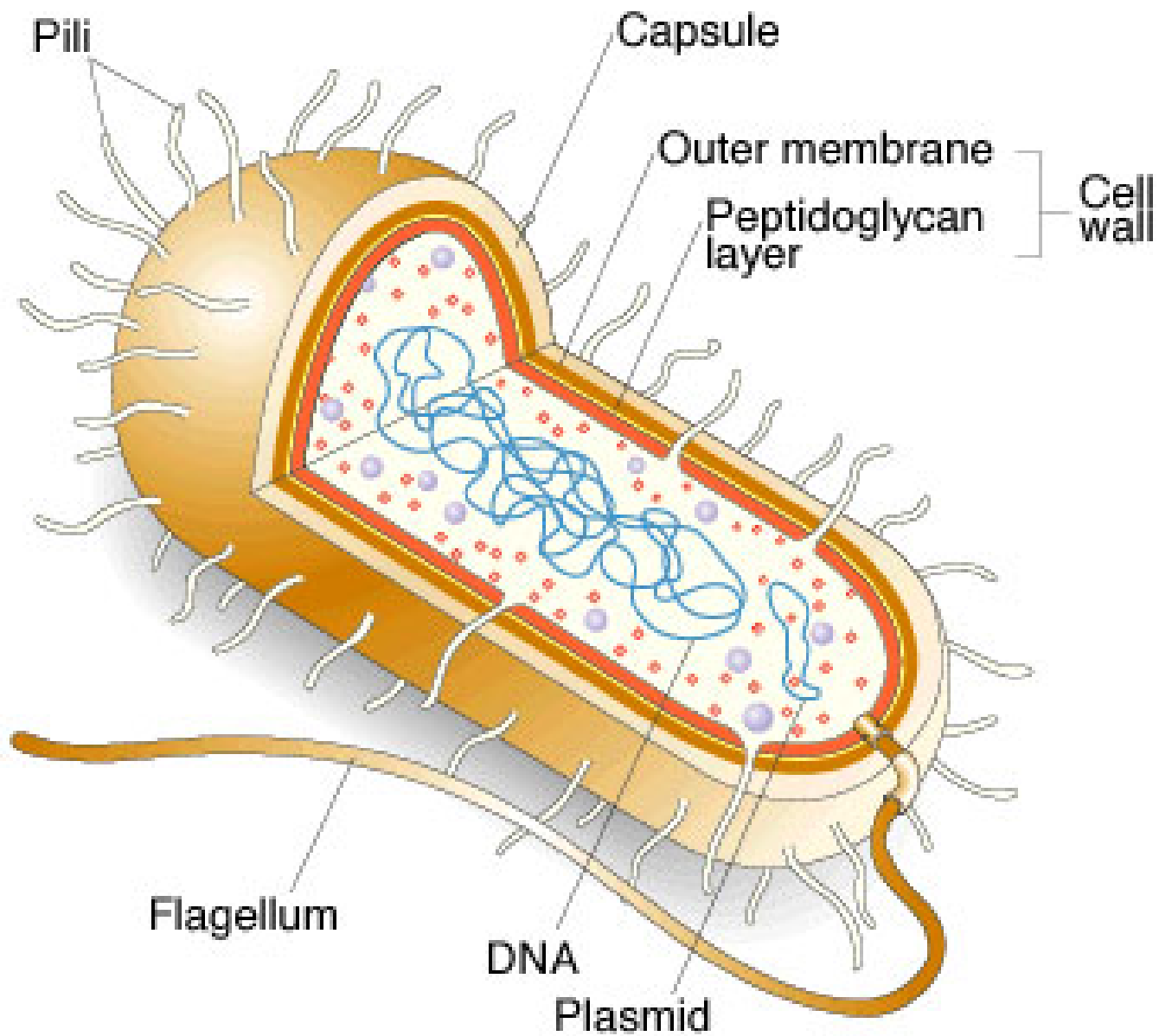
Unicellular

Variously shaped

Do not produce spores

Reproduce by binary fission





Genetic elements

Chromosome (single one, circular)

Plasmids

Primary mechanisms of variation

Mutations

Loss/acquisition of plasmids and transposons

Recombination through: transformation (incorporation in Chromosome of plasmid DNA; conjugation (incorporation of DNA from another bacterium); transduction (incorporation through bacterial viruses called bacteriophages)

Phytoplasma

Prokaryotes lacking a cell wall (MLOs - *Mollicutes*)

Usually vascular pathogens

Generally vectored by insects

VIRUSES and VIROIDS

Submicroscopic particles always intracellular when in the host, infectious and pathogenic

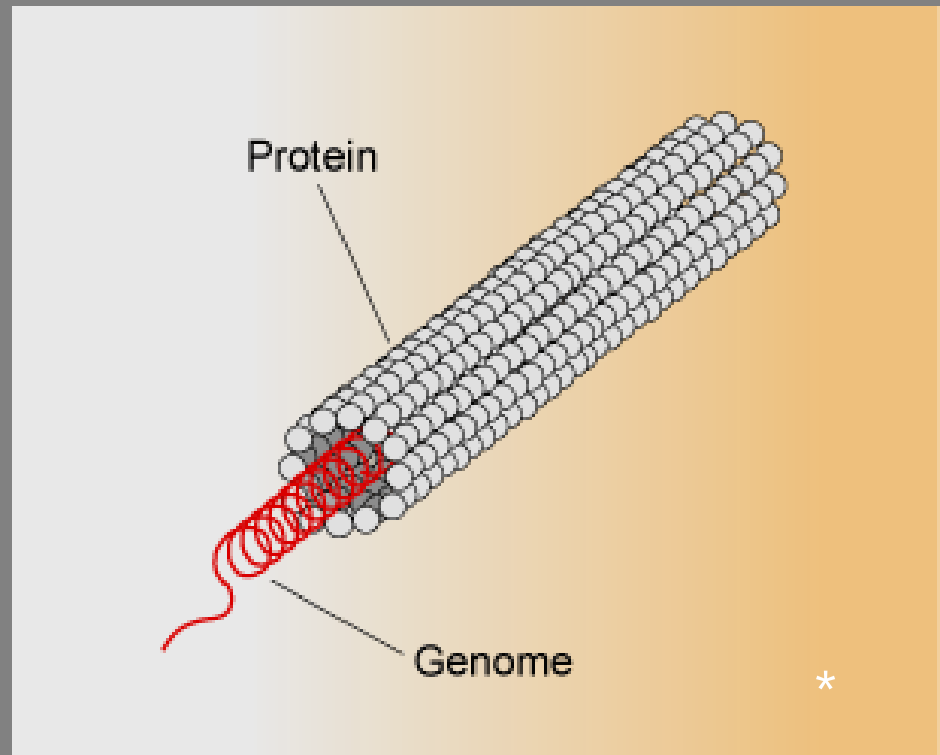
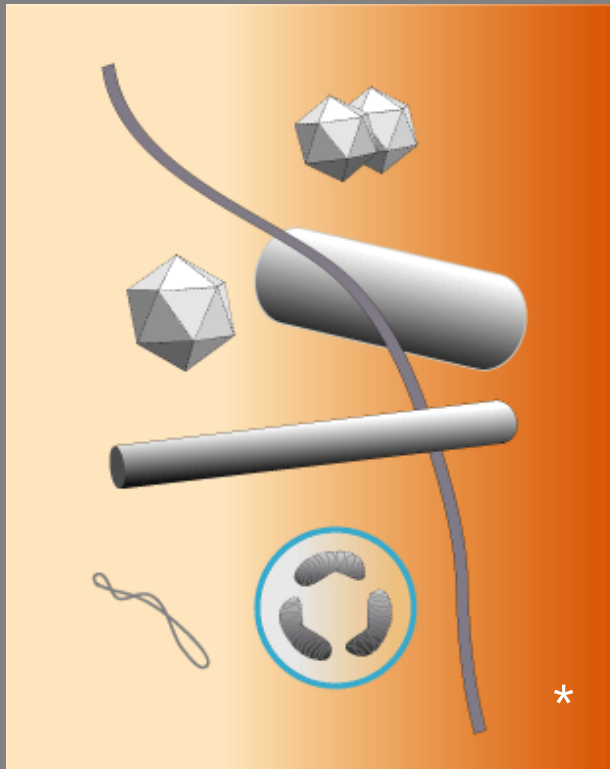
They comprise

Nucleic Acids (RNA or DNA) and a capsid protein

Viroids instead are simply constituted by a single RNA molecule, they do not code for or possess proteins

Nucleic acid: ssRNA, dsRNA, ssDNA, dsDNA

Protein capsid: protects virus during transport



VIRAL REPLICATION

The genome of the virus codes for:

- 1- capsid protein;
- 2- polymerase;
- 3- protein for intracellular movement;
- 4- proteins involved in transmission and relationship with vectors

ssRNA+

