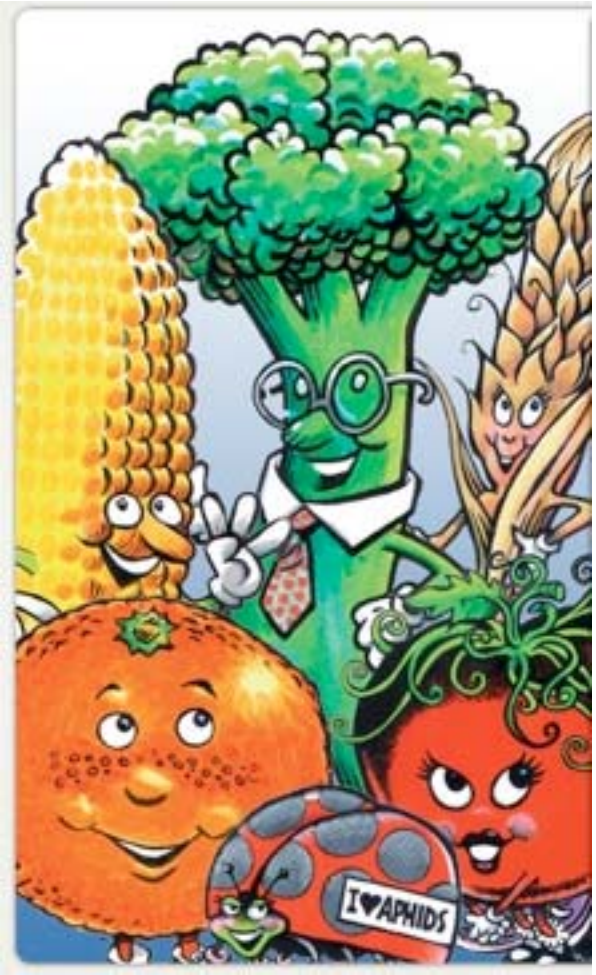
Introduction to Plant Diseases



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Some definitions:

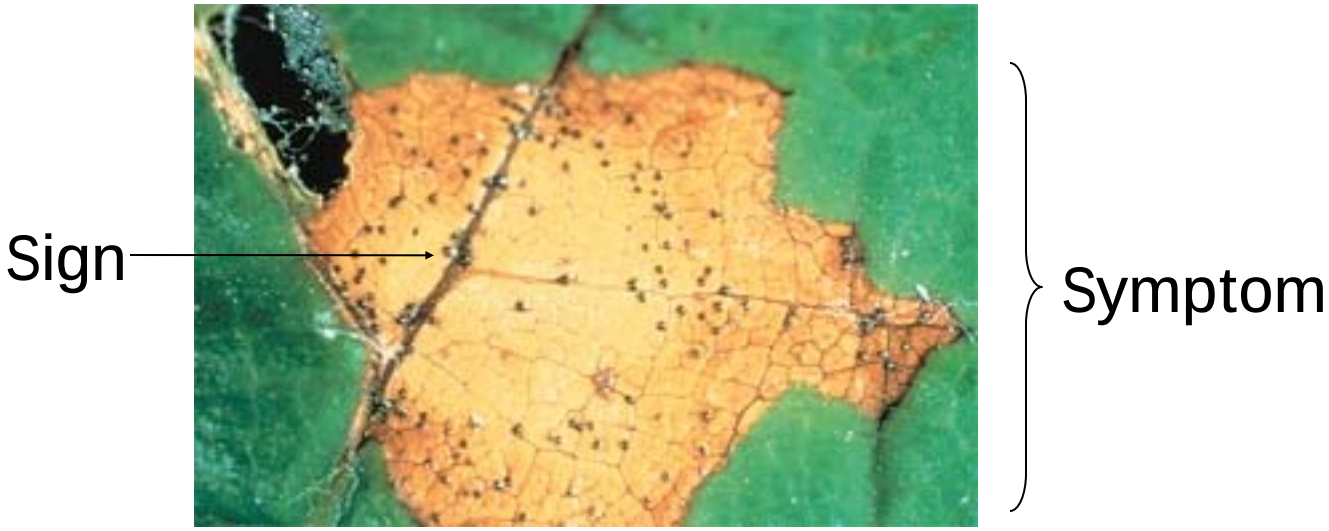
- **Plant disease** = a condition that causes harm to the plant

- Plant diseases caused by plant pathogens (living organisms) are **infectious**

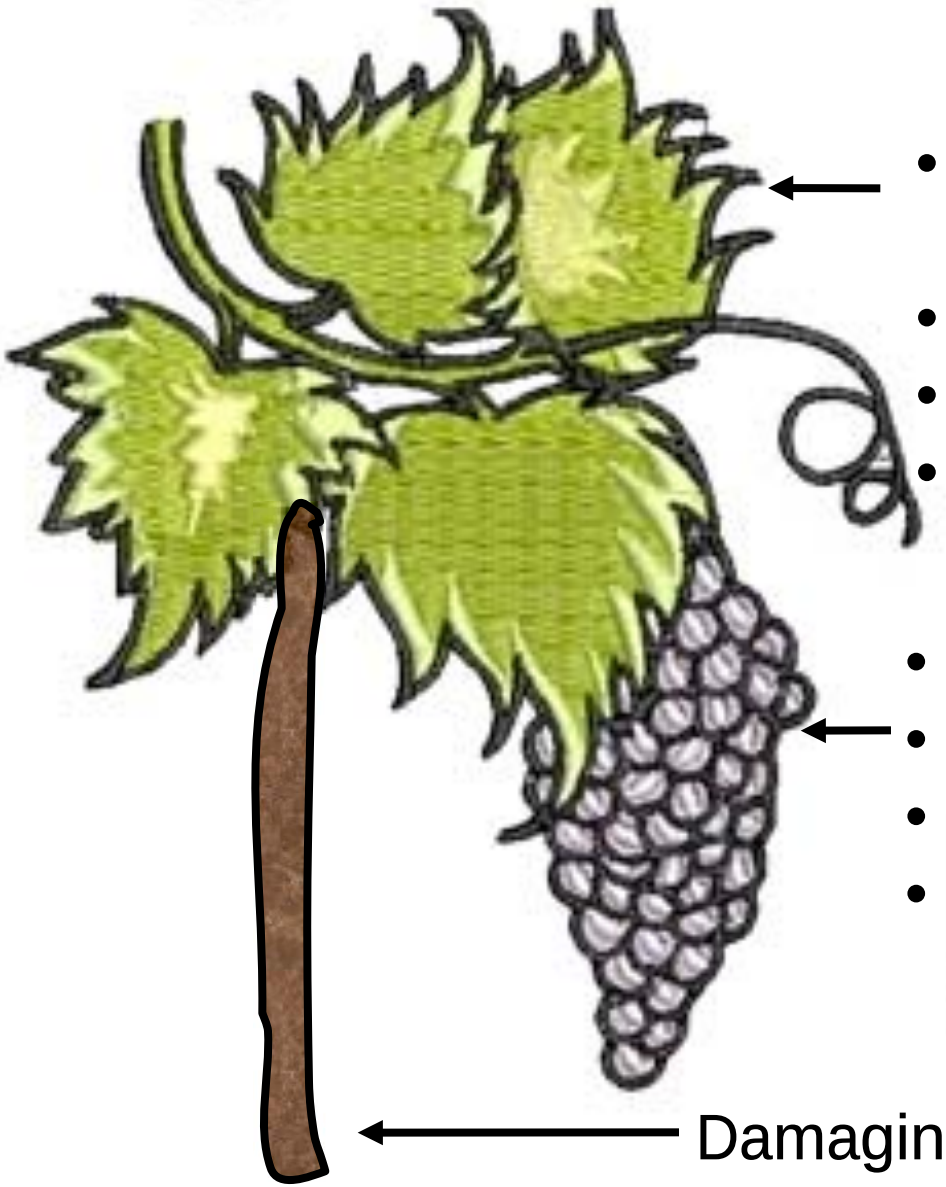
- Plant diseases resulting from abiotic (non-living) causes are **not infectious**

Symptom: expression of disease as a response to a pathogen

Sign: visible pathogen structure or product of a pathogen on a diseased plant



How do pathogens harm plants?



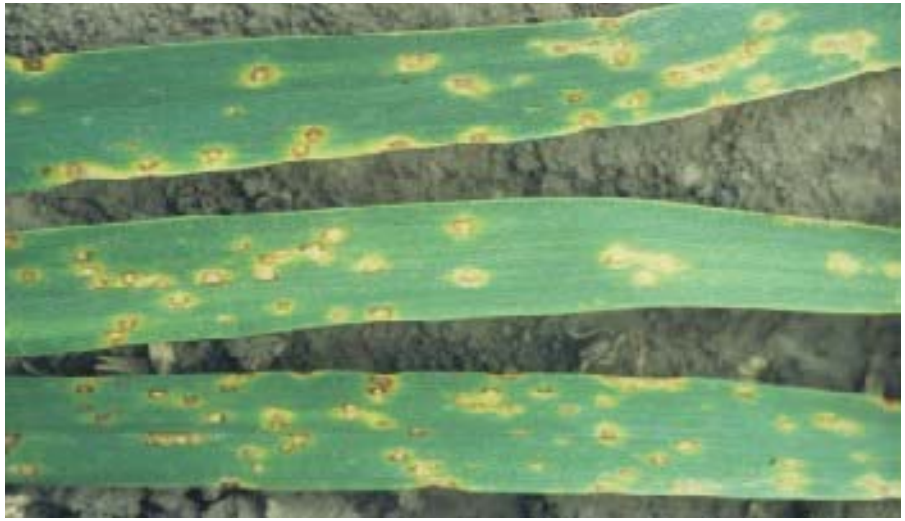
- Reducing photosynthetic leaf area
- Removing photosynthates
- Stunting of plant
- Death of plant

- Marring appearance
- Reducing yield
- Reducing quality (e.g., rot)
- Off-flavors, toxins

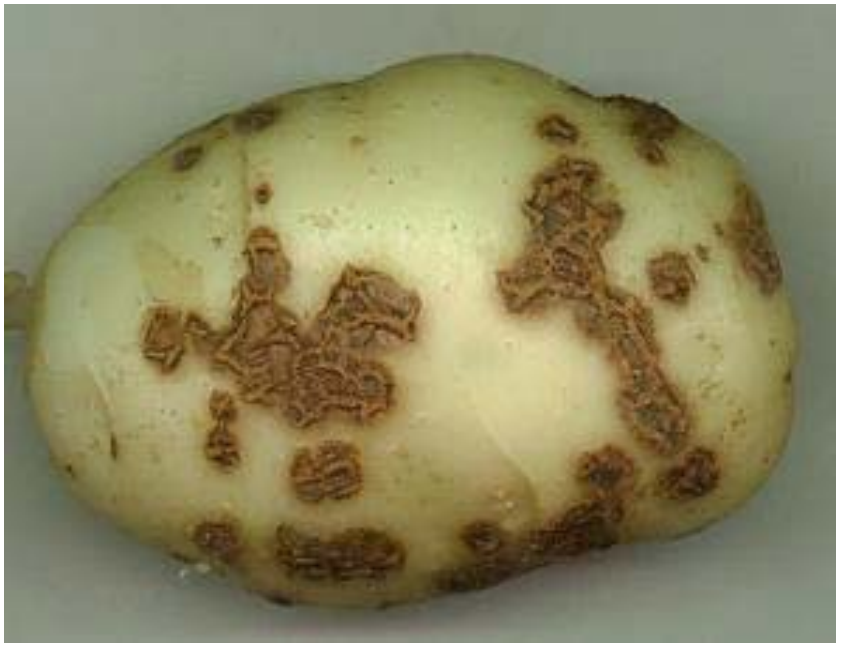
Damaging stems and roots

Disease symptoms

Spots, lesions



Scab



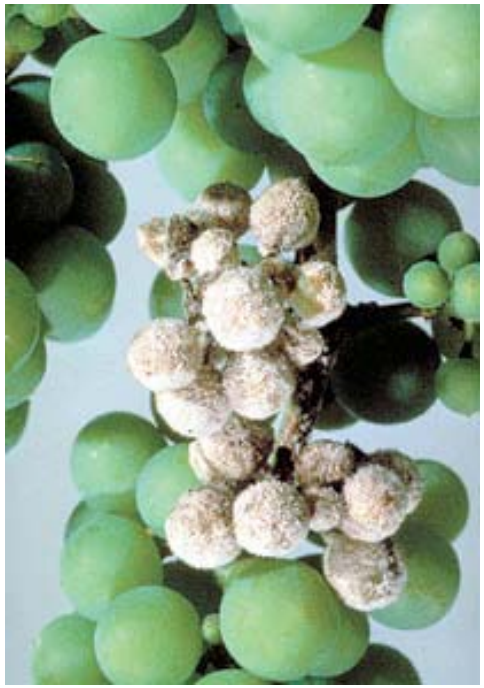
Blight

Rot

Canker

Powdery mildew

Downy mildew



Rust

Wilt

Seedling damping off

Stunting

Strange color patterns (e.g., mosaic, mottle, ringspot)

Growth abnormalities

Galls

Leaf galls are usually made by insects; an exit hole is a good indication that it is caused by an insect

Witches’ broom

Plant decline and death

Plant pathogens

- Fungi
- Bacteria
- Viruses
- Nematodes (worms)
- Parasitic plants

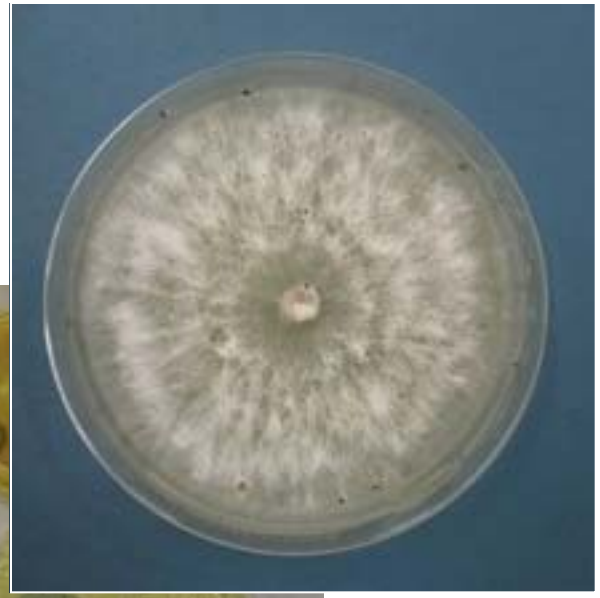
Types of plant pathogens

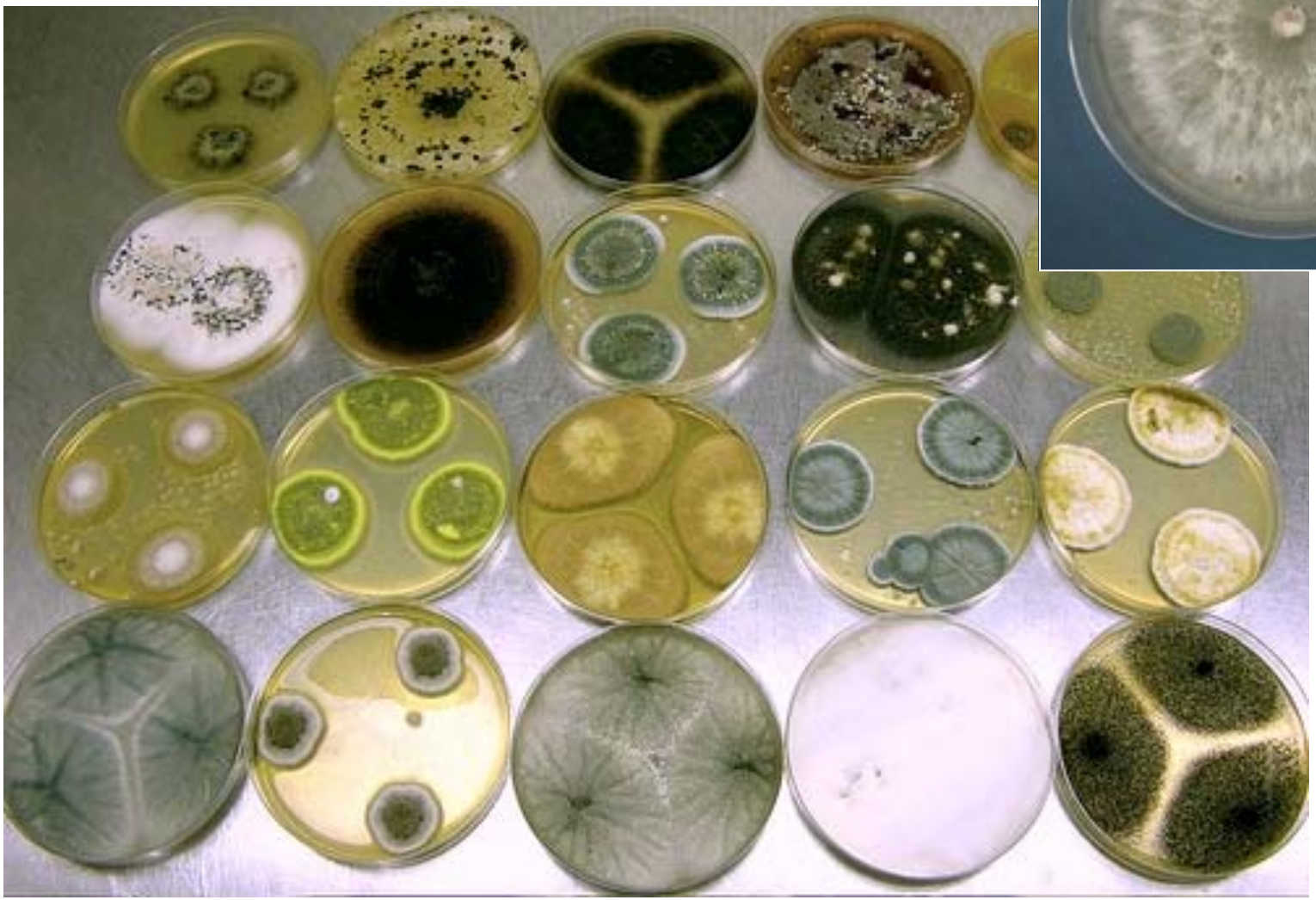
- All plant pathogens are **parasites**
- Some are **obligate parasites** (obtain nutrients only from living plant cells – cannot be grown in culture)
- Some are **facultative parasites** (can live on living or dead plant tissue – usually can be grown in culture)
- **Necrotrophs** kill plant cells in advance of growth to be able to absorb nutrients

Fungi

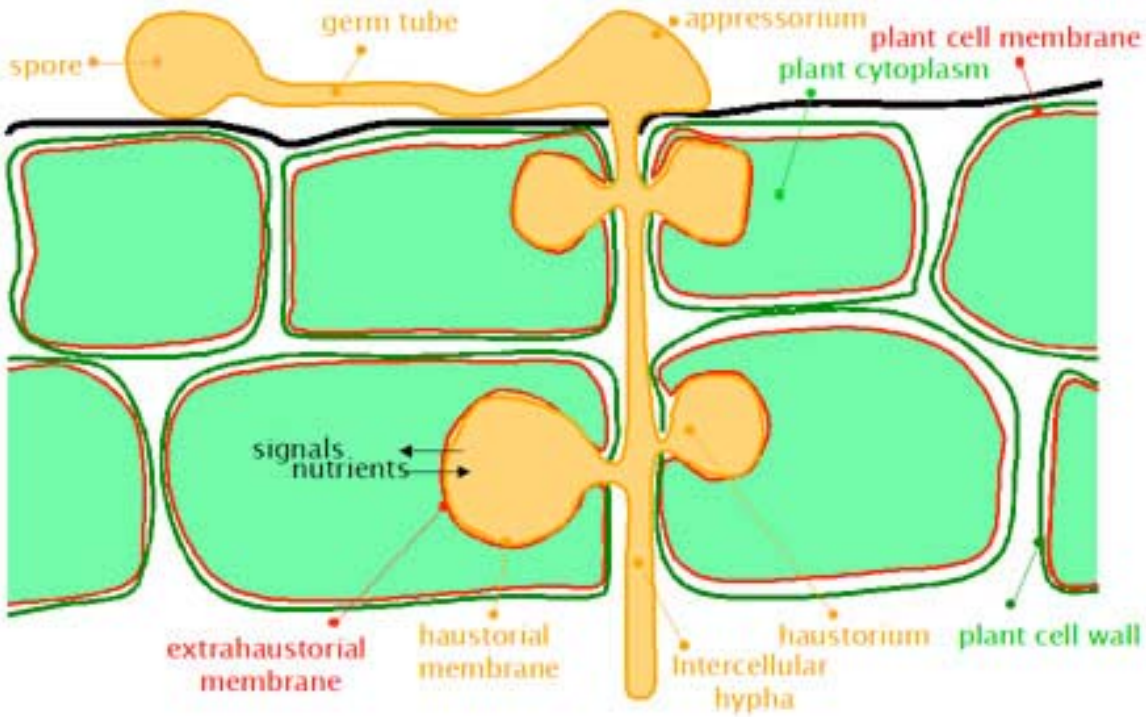
- Threadlike body (mycelium)
- Reproduce by spores
- Like moisture and damp places
- Penetrate plants directly or through stomates or wounds
- Produce enzymes and toxins
- Overwinter in infected plant parts or in soil

Fungi look fuzzy in culture

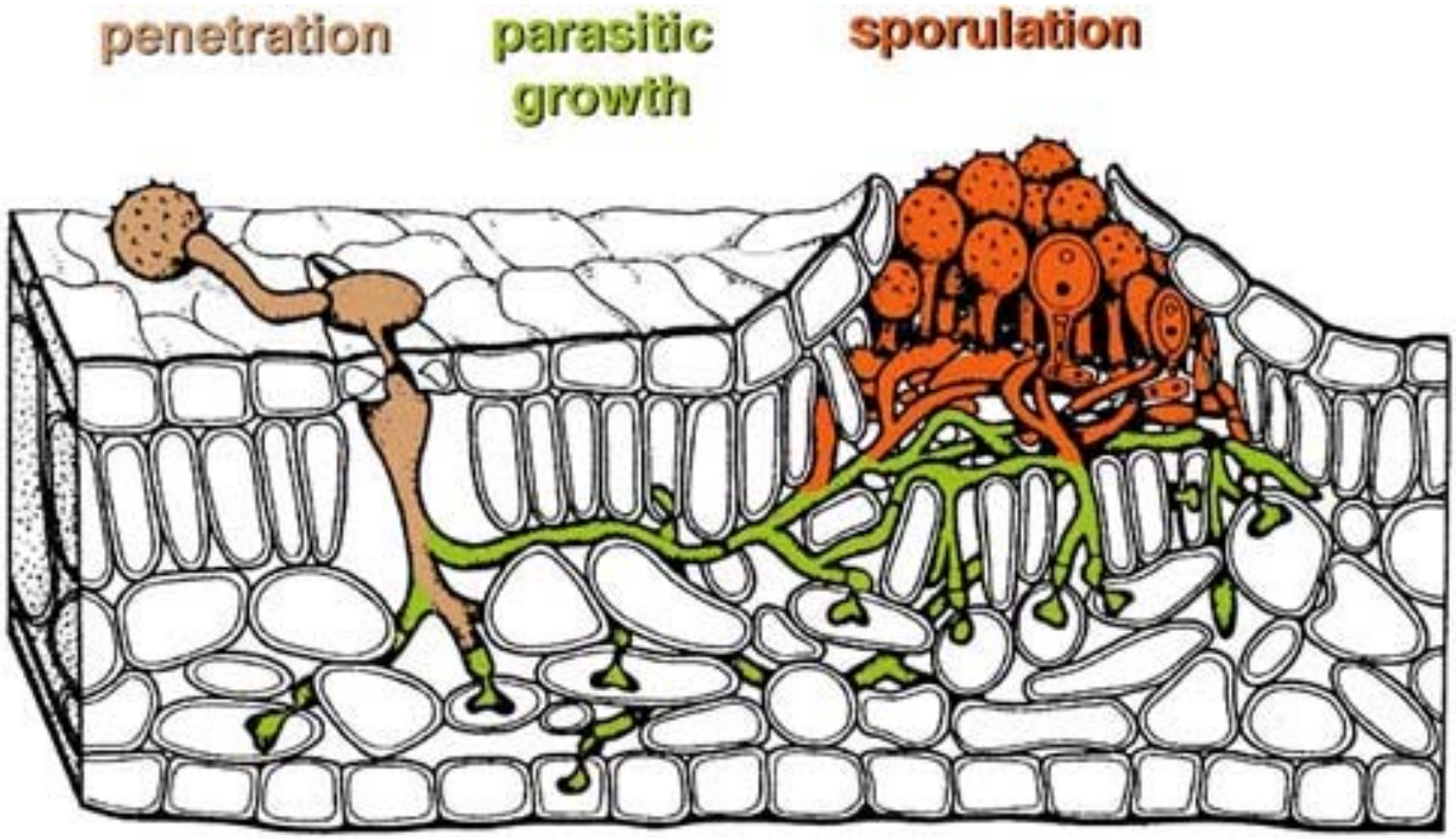




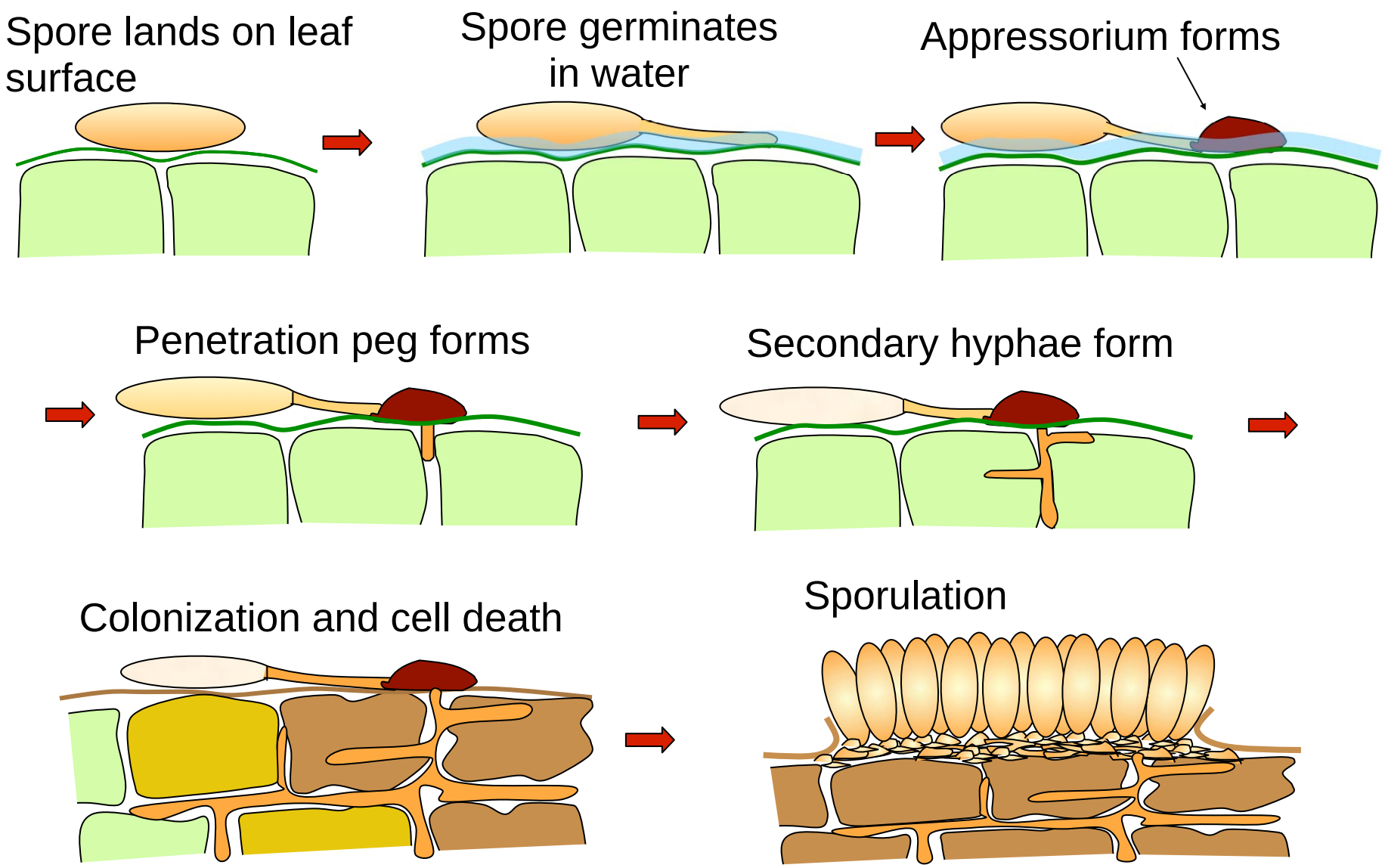
Obligate parasites obtain nutrients from plant cells via **haustoria**



Infection process of obligately parasitic fungus



Infection process of necrotrophic fungus



Fungi propagate by spores

Fungal spores are usually dispersed by wind or rain

Spores are either exposed or enclosed in special structures (fruiting bodies)

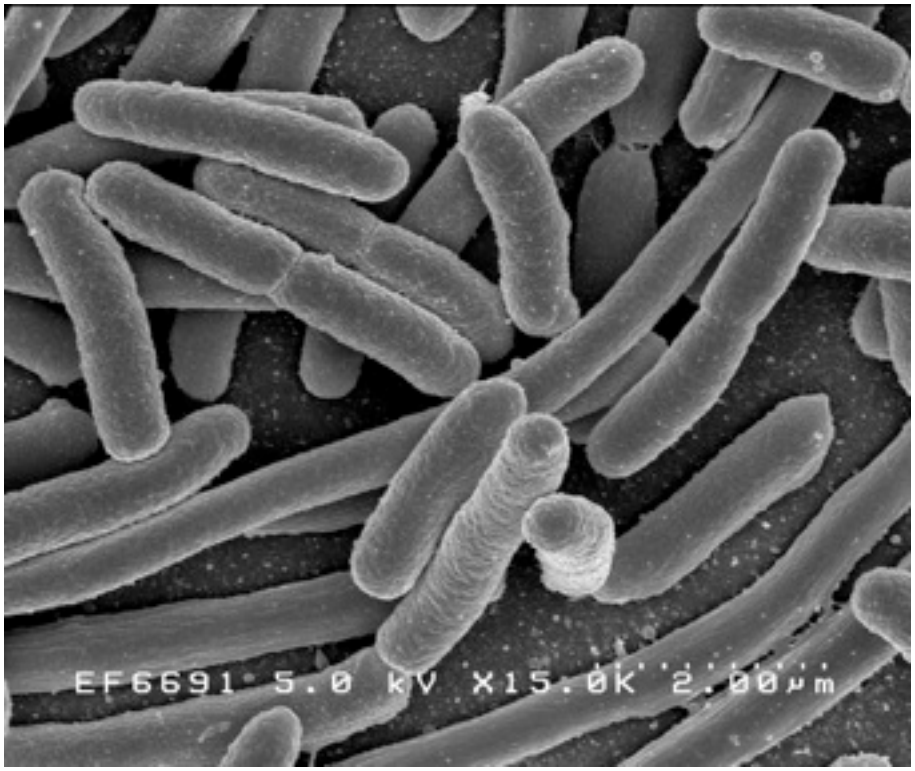
Exposed:

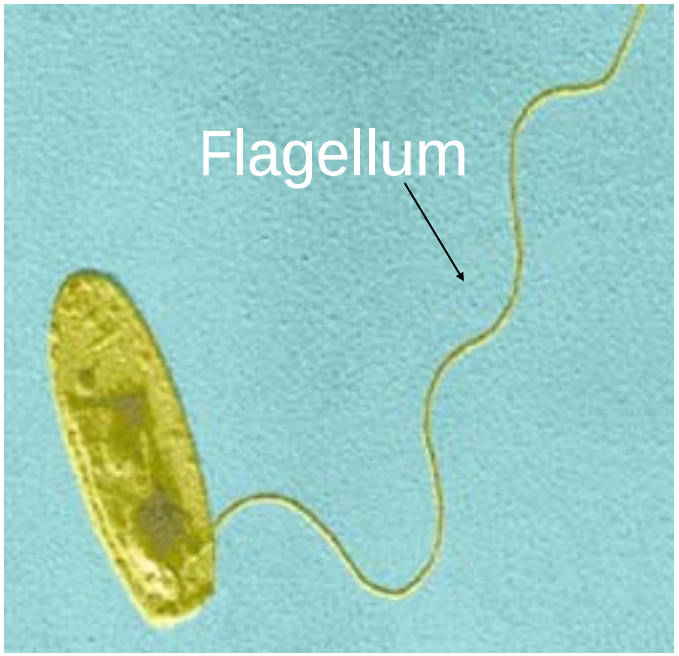
Enclosed:

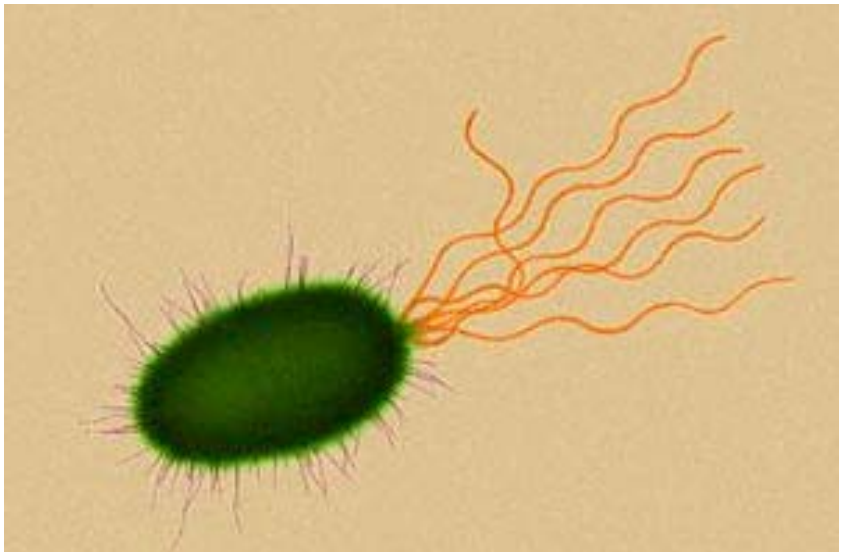
Bacteria

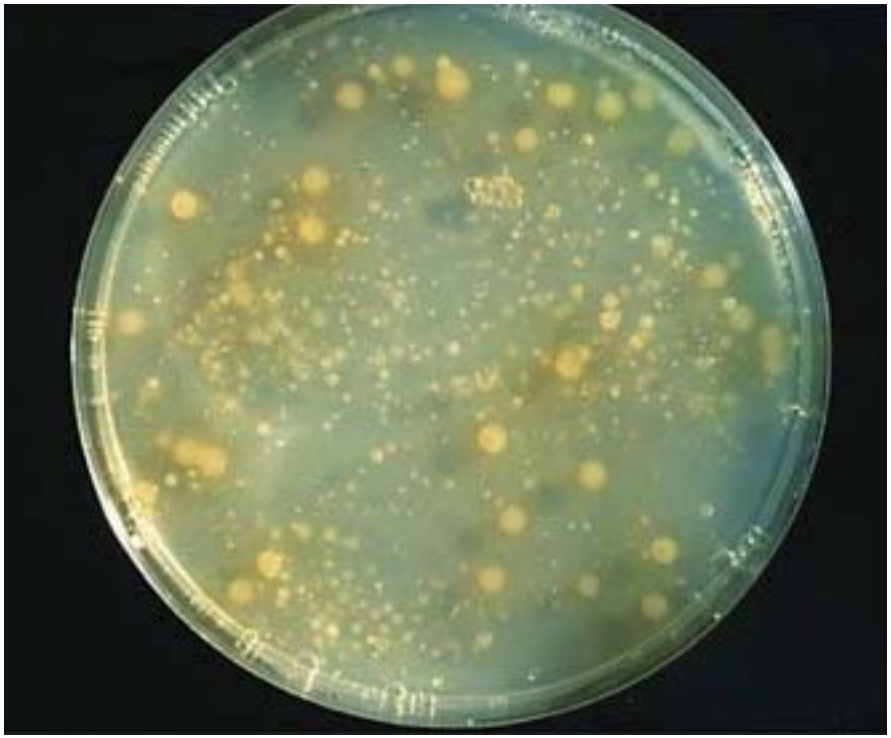
- Single cells, grow in colonies
- Reproduce by cell division
- Enter plants passively through wounds or stomata
- Absorb food from surroundings
- Dispersed by rain, insects, equipment
- Overwinter in infected plant parts or soil

Bacteria can swim by means of flagella







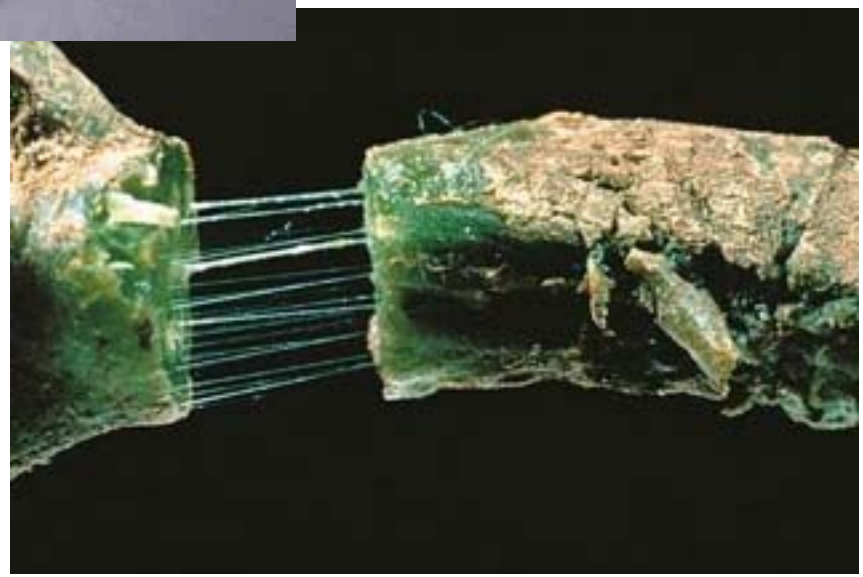


Bacterial colonies in culture look slimy

Diagnostic indicators

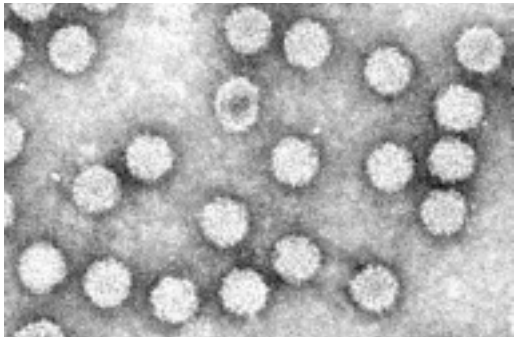
Watersoaking

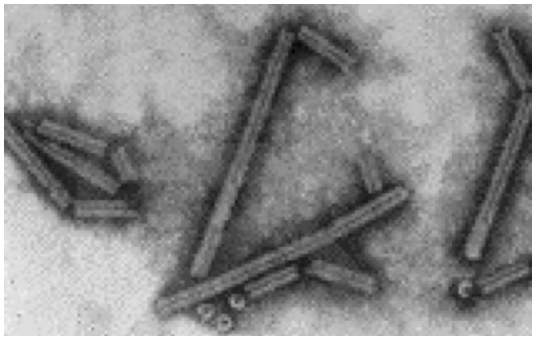
Bacterial ooze



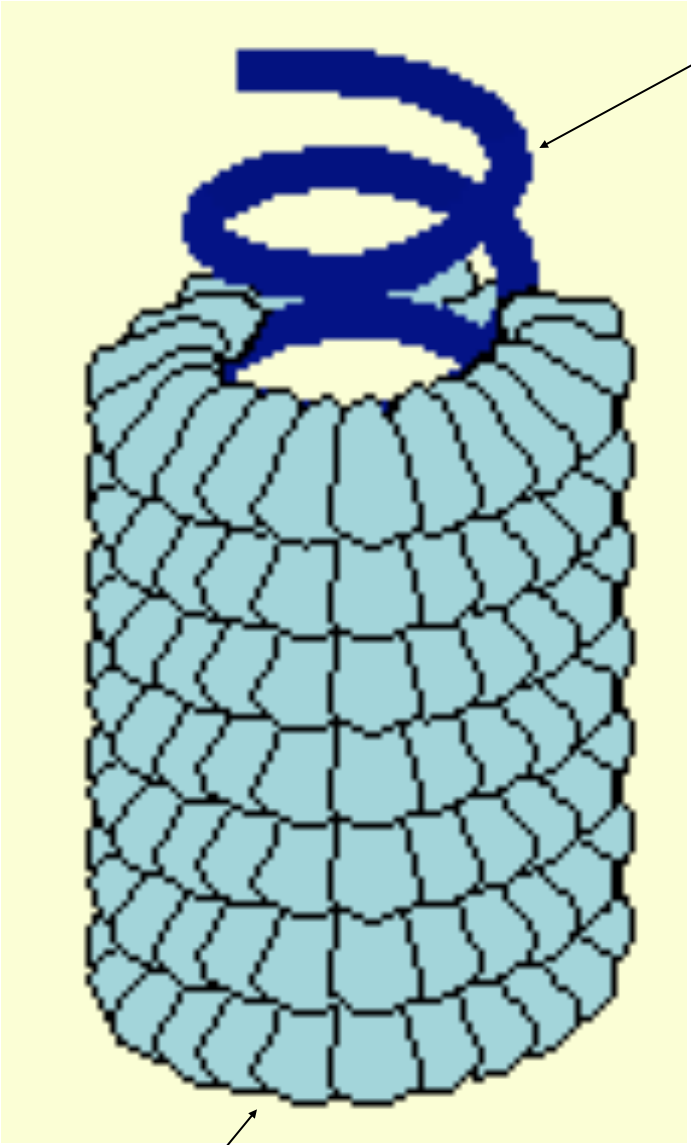
Stringing

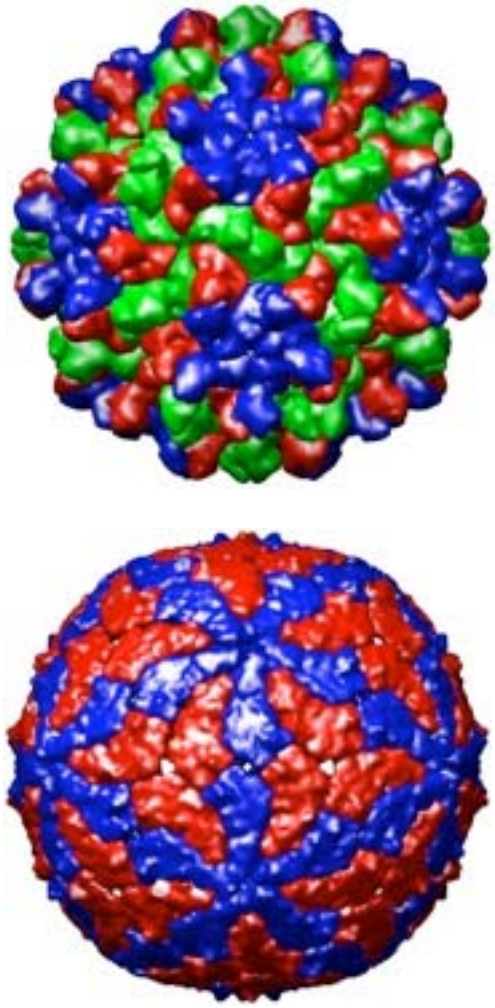
Viruses





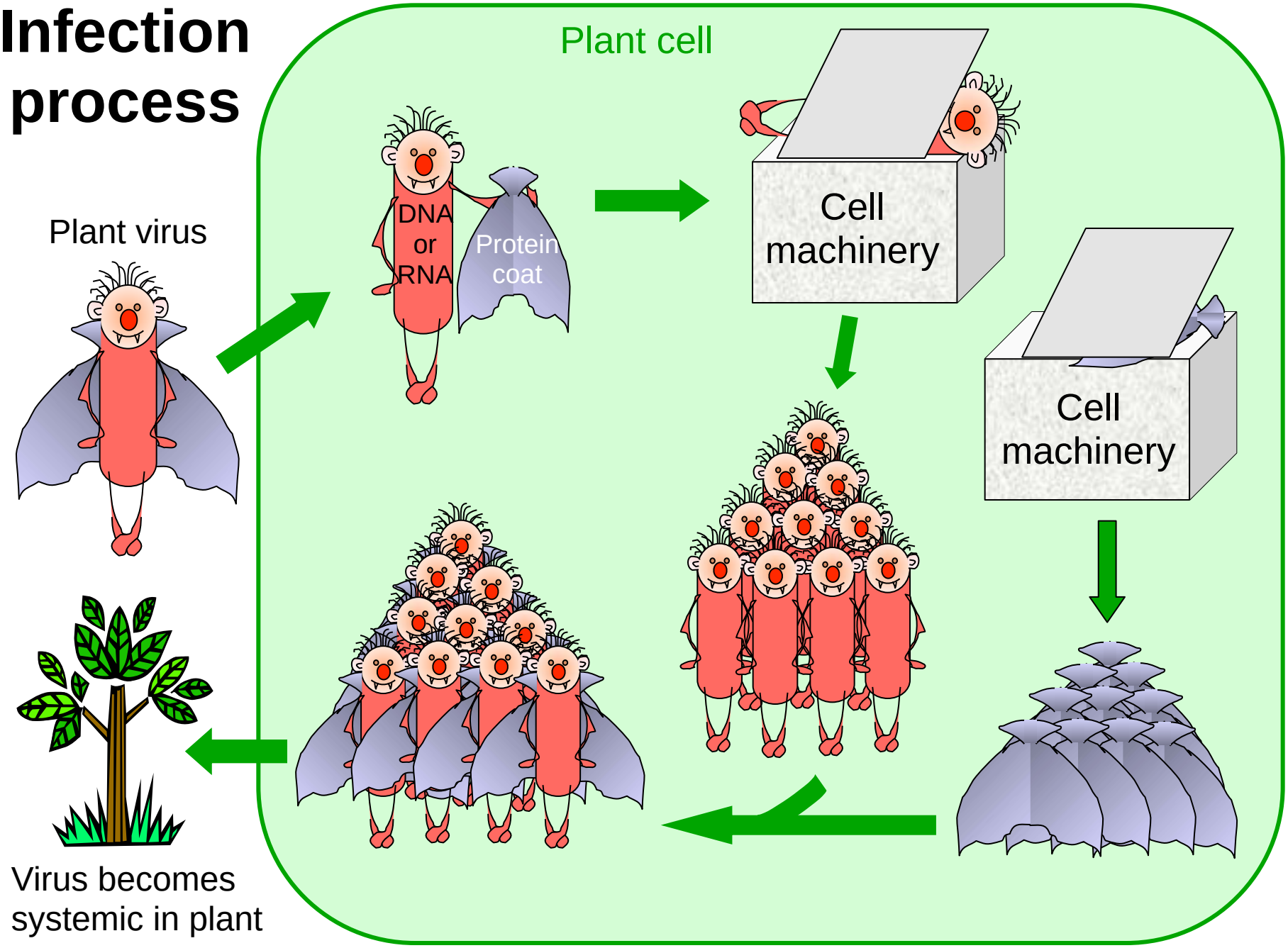
- Tiny particles made up of genetic material surrounded by a protein coat
- Can’t reproduce on their own, only with the help of plant cell
- Interfere with plant cell function
- Become systemic in the plant
- Virus diseases can’t be cured





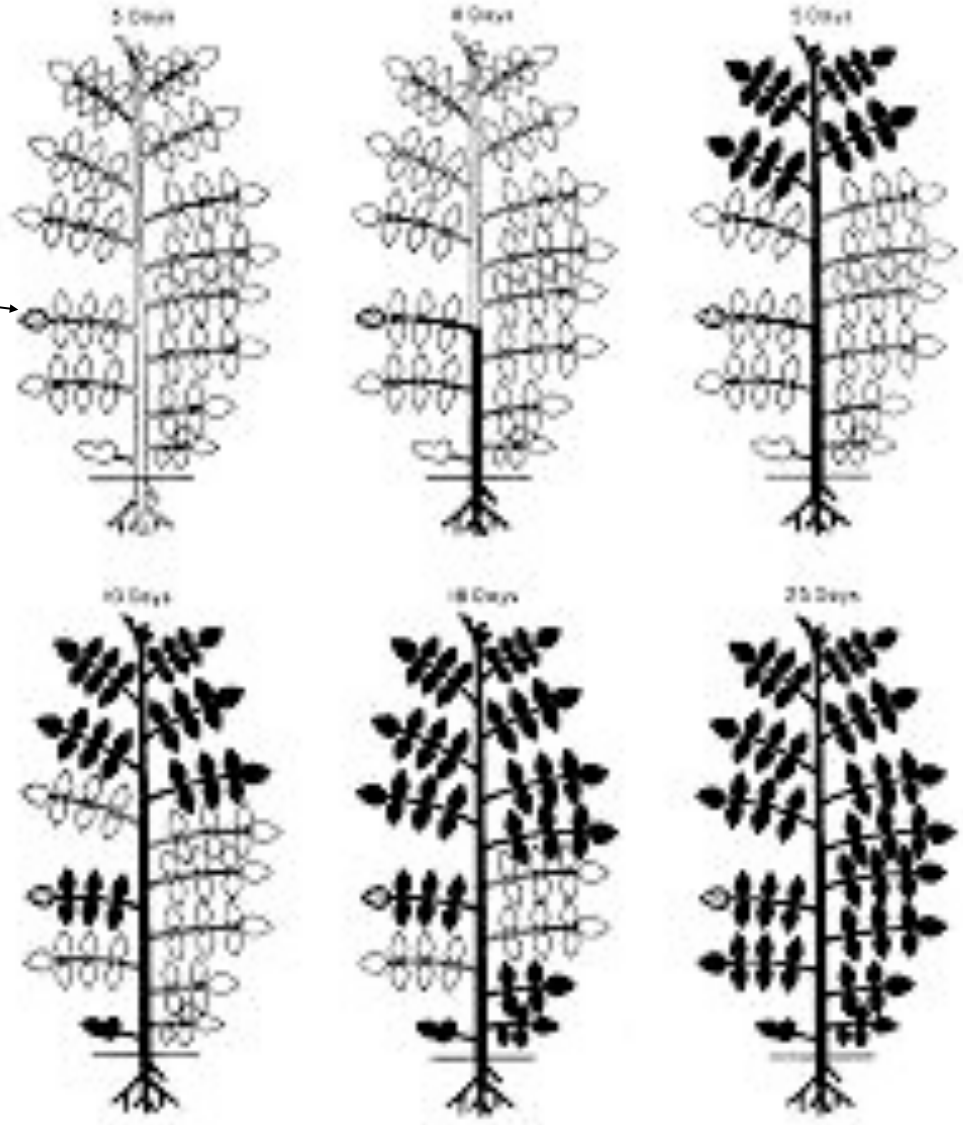
Computer-generated images of viruses

Infection process



Virus moves within plant from cell to cell and via vascular bundles, becoming **systemic**

First infected leaf



Ways in which viruses can spread:

Planting material/ cuttings

Pollen

Seed

Vectors of viruses

Aphids

Plant and leaf hoppers

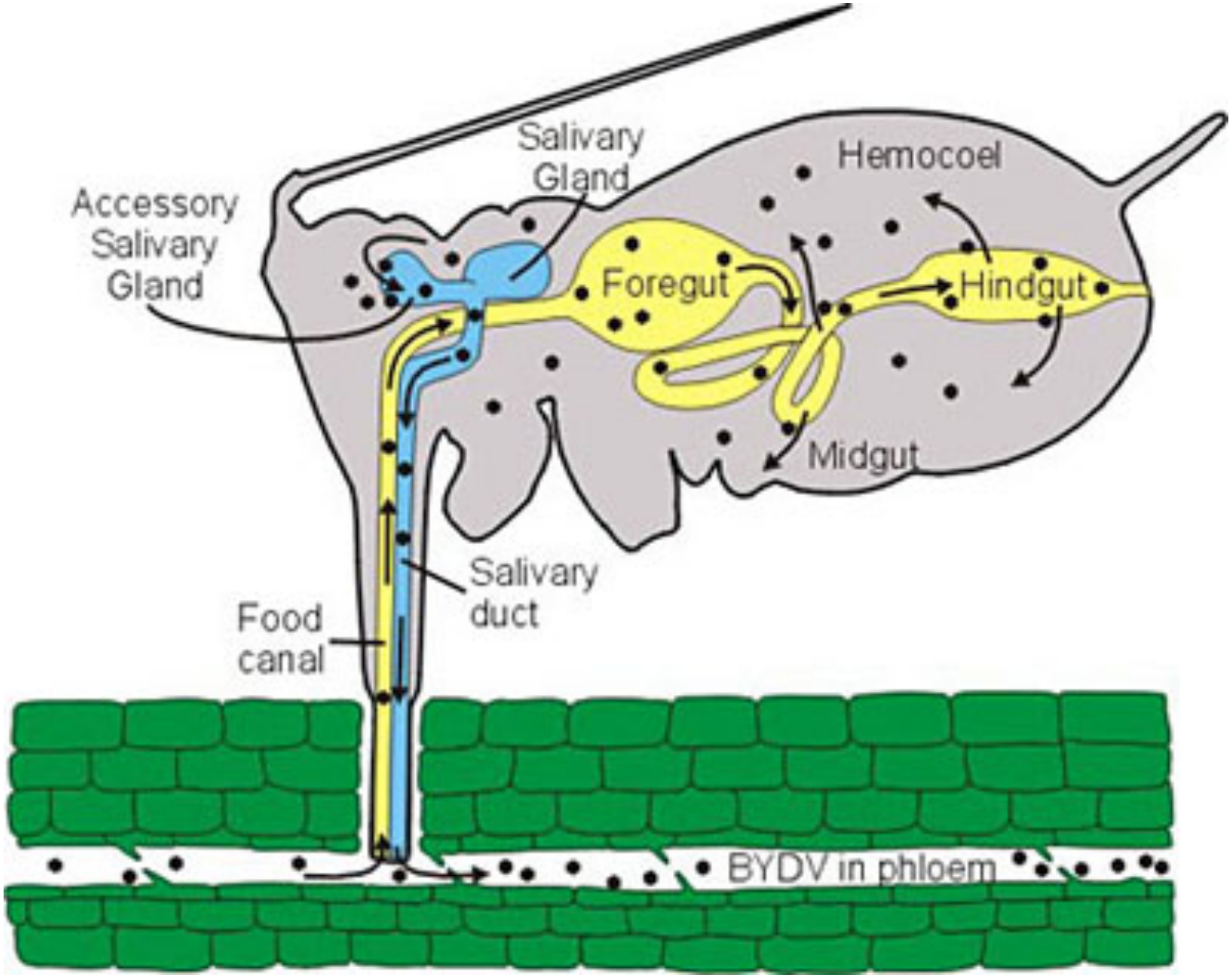
Thrips

Whiteflies

Mealybugs

Mites

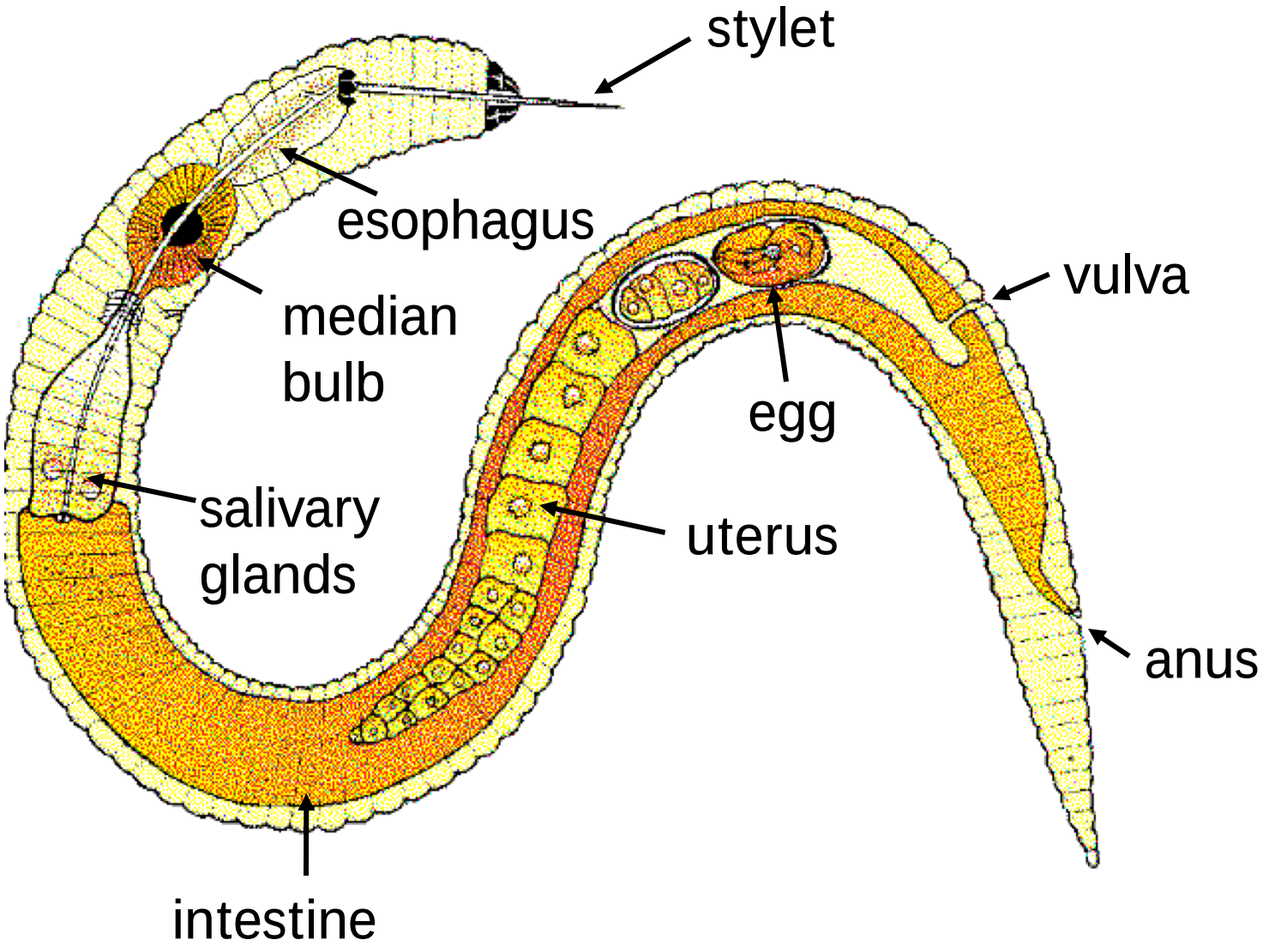
Nematodes


Salivary
Gland
Hemocoel
Accessory
Salivary
Gland
Foregut
Hindgut
Midgut
Salivary
duct
Food
canal
BYDV in phloem

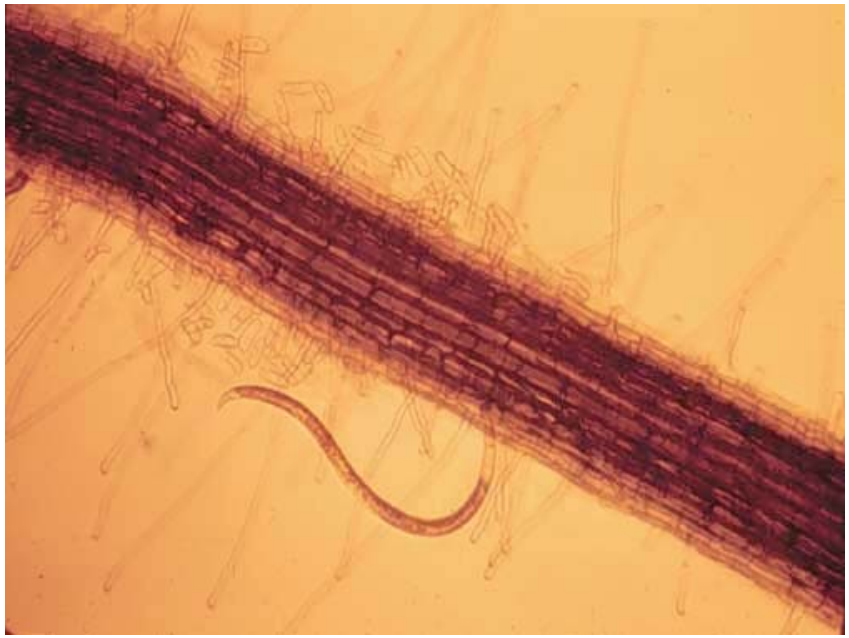
Nematodes

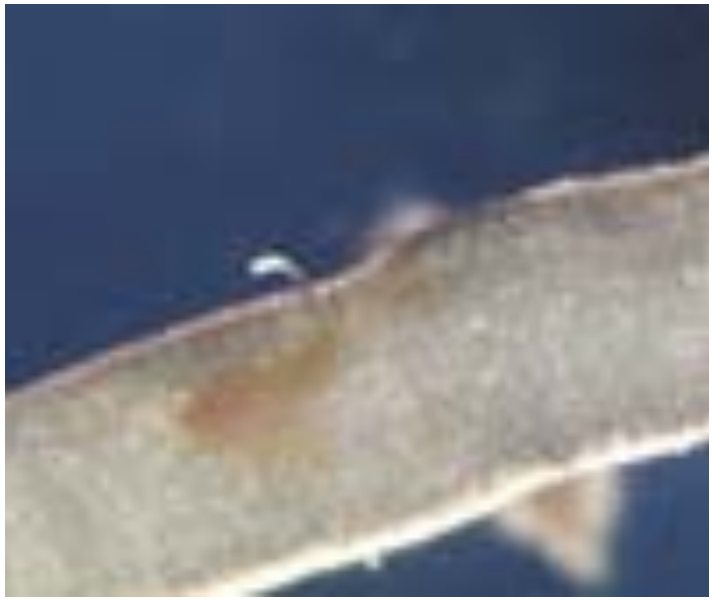
- Microscopic roundworms in soil
- Reproduce by laying eggs
- Plant parasitic nematodes have stylet to puncture plant roots
- Some nematodes feed on the outside of the root, others live inside roots
- Nematodes can swim short distances, and are spread by soil, water and equipment

Plant-parasitic nematode



Some nematodes feed on outside of roots, others penetrate and live inside roots

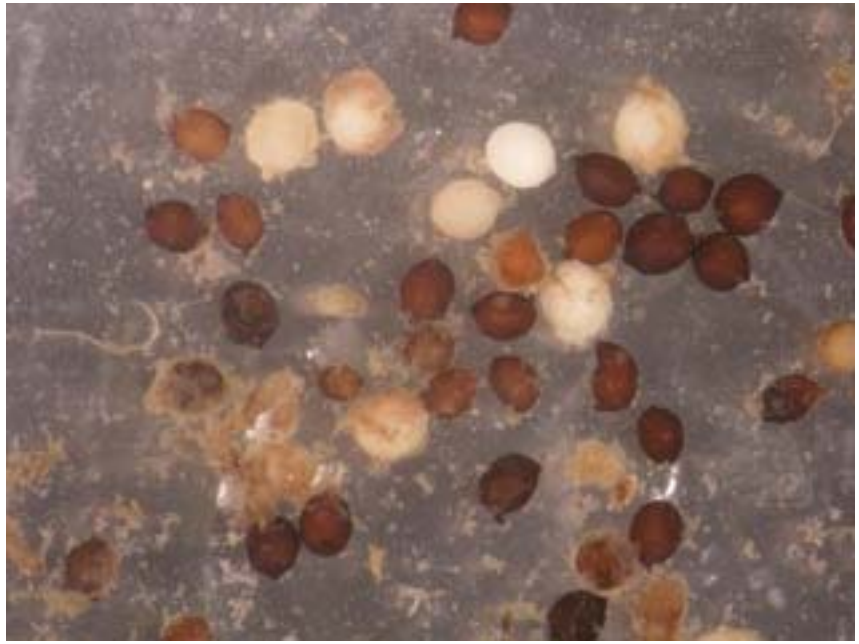


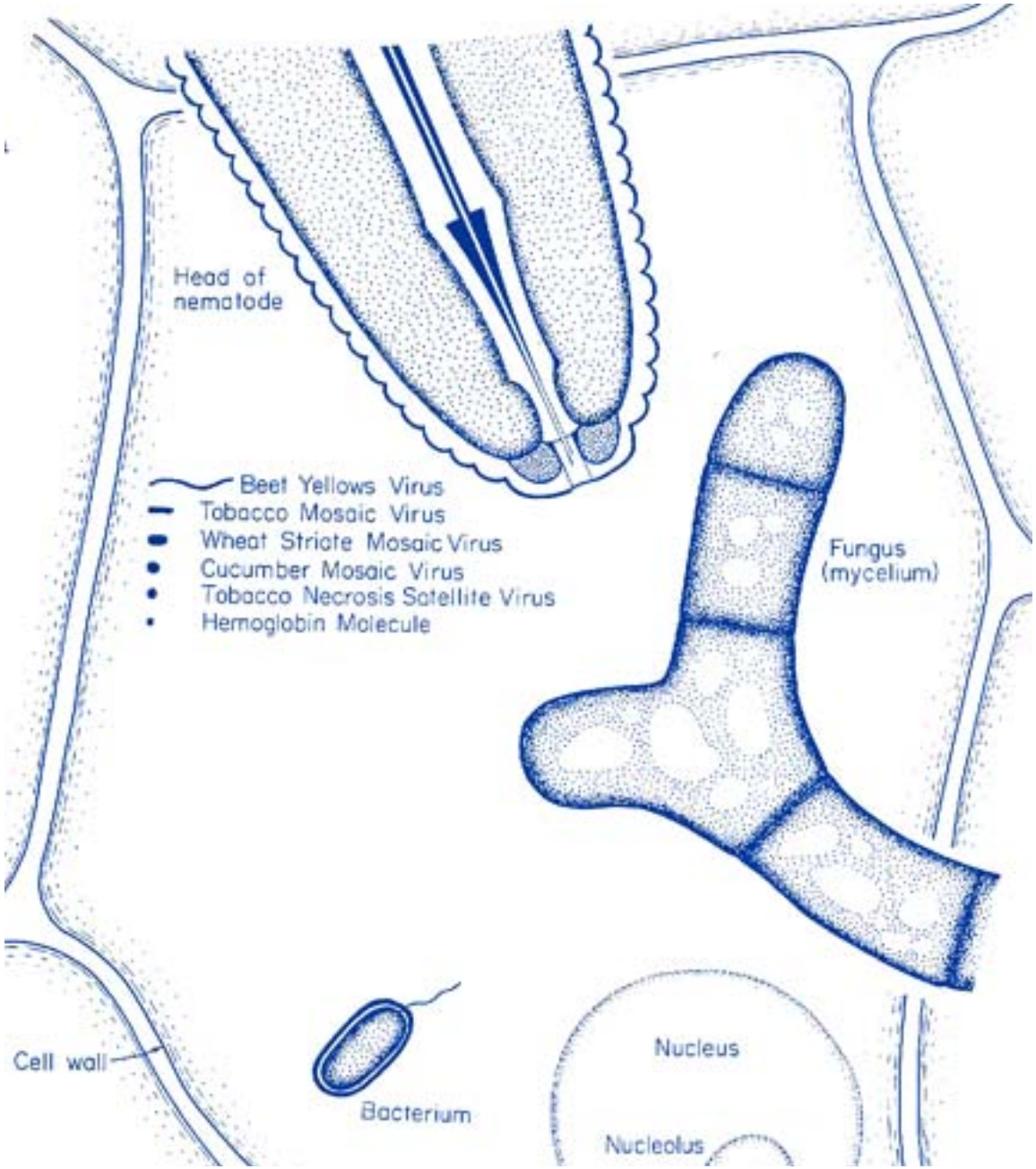


Lesion where nematode is feeding on root

Nematode cysts

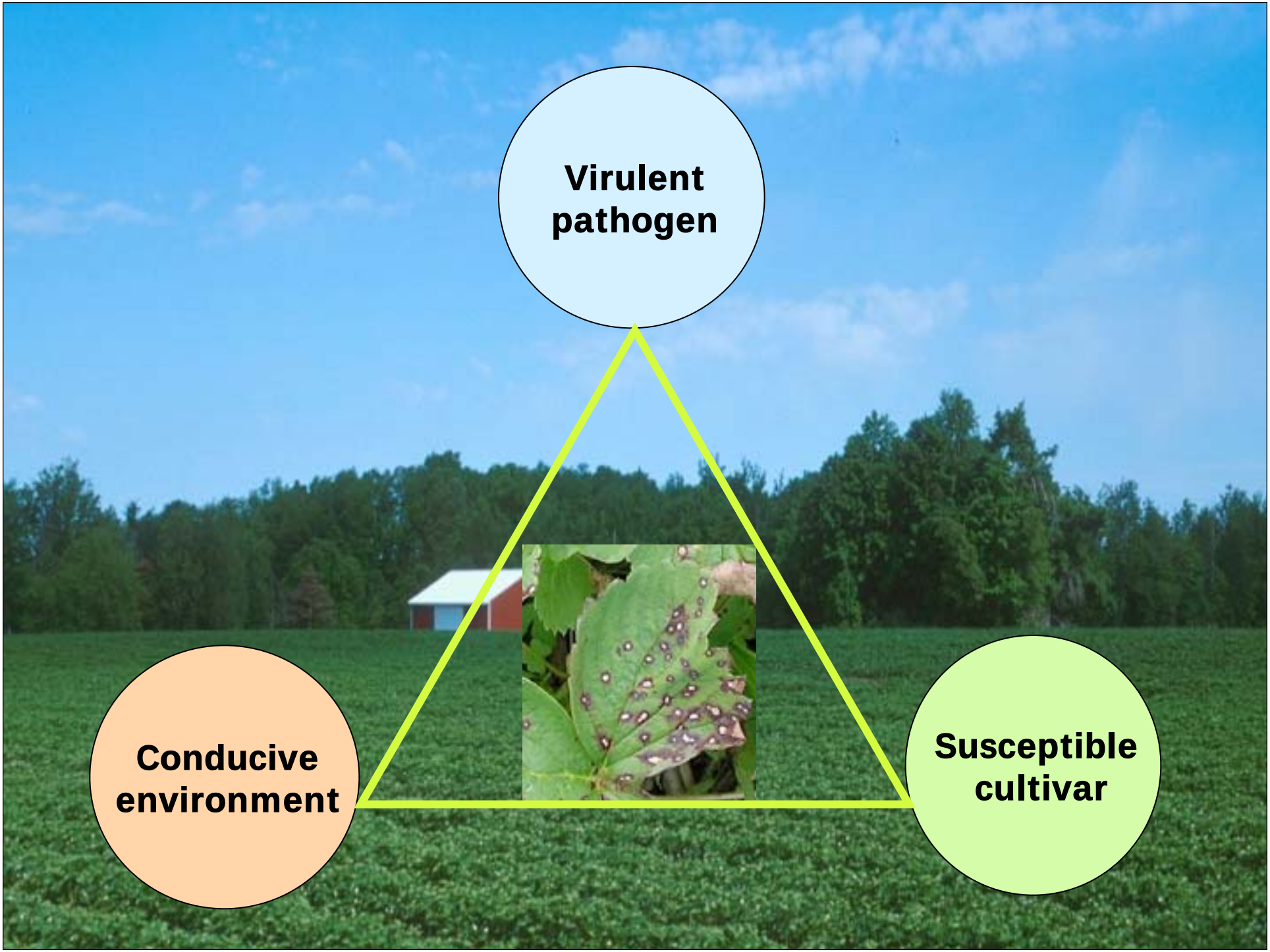
Nematode egg with juvenile inside



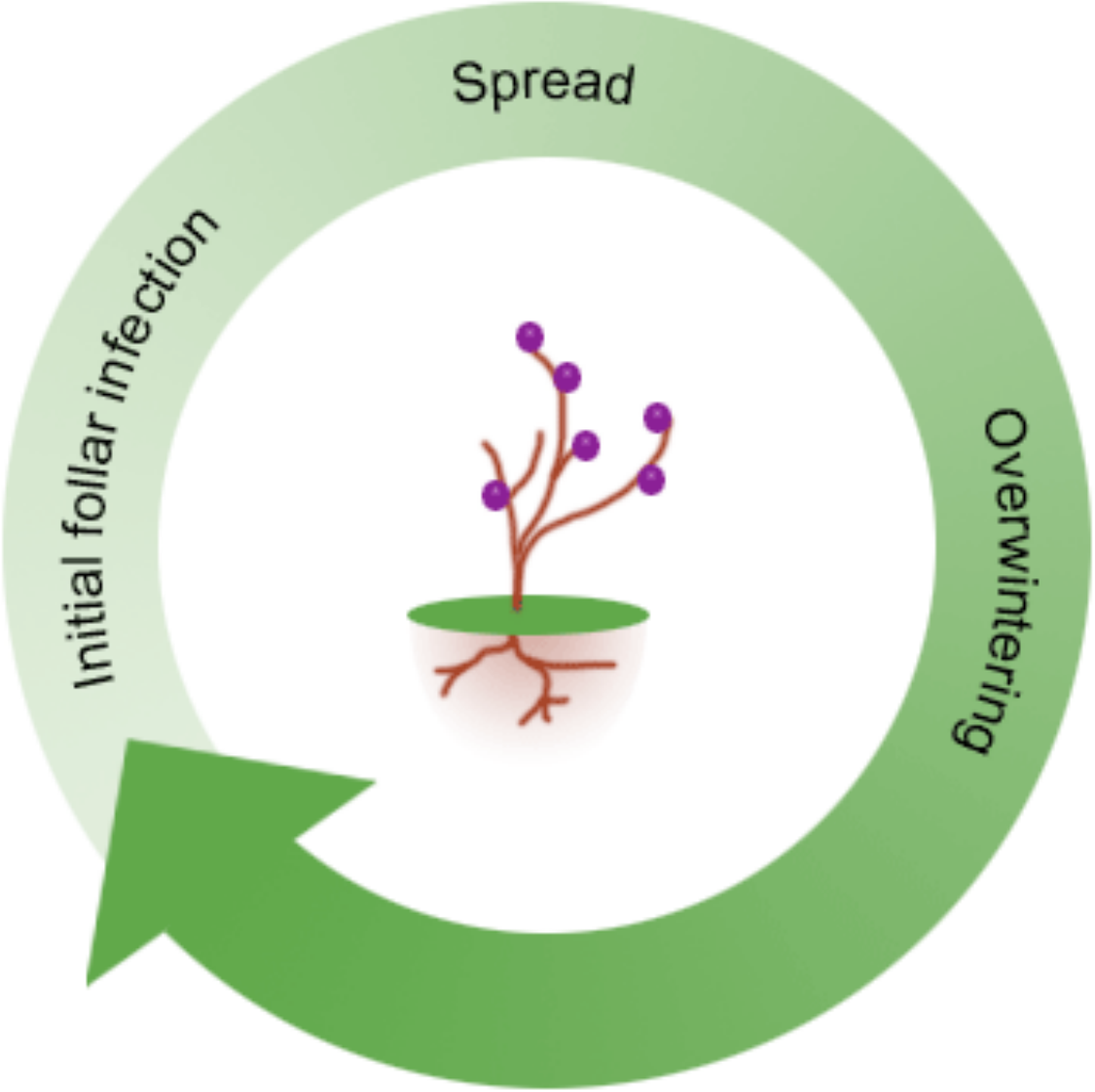


Comparative size of plant pathogens in relation to a plant cell

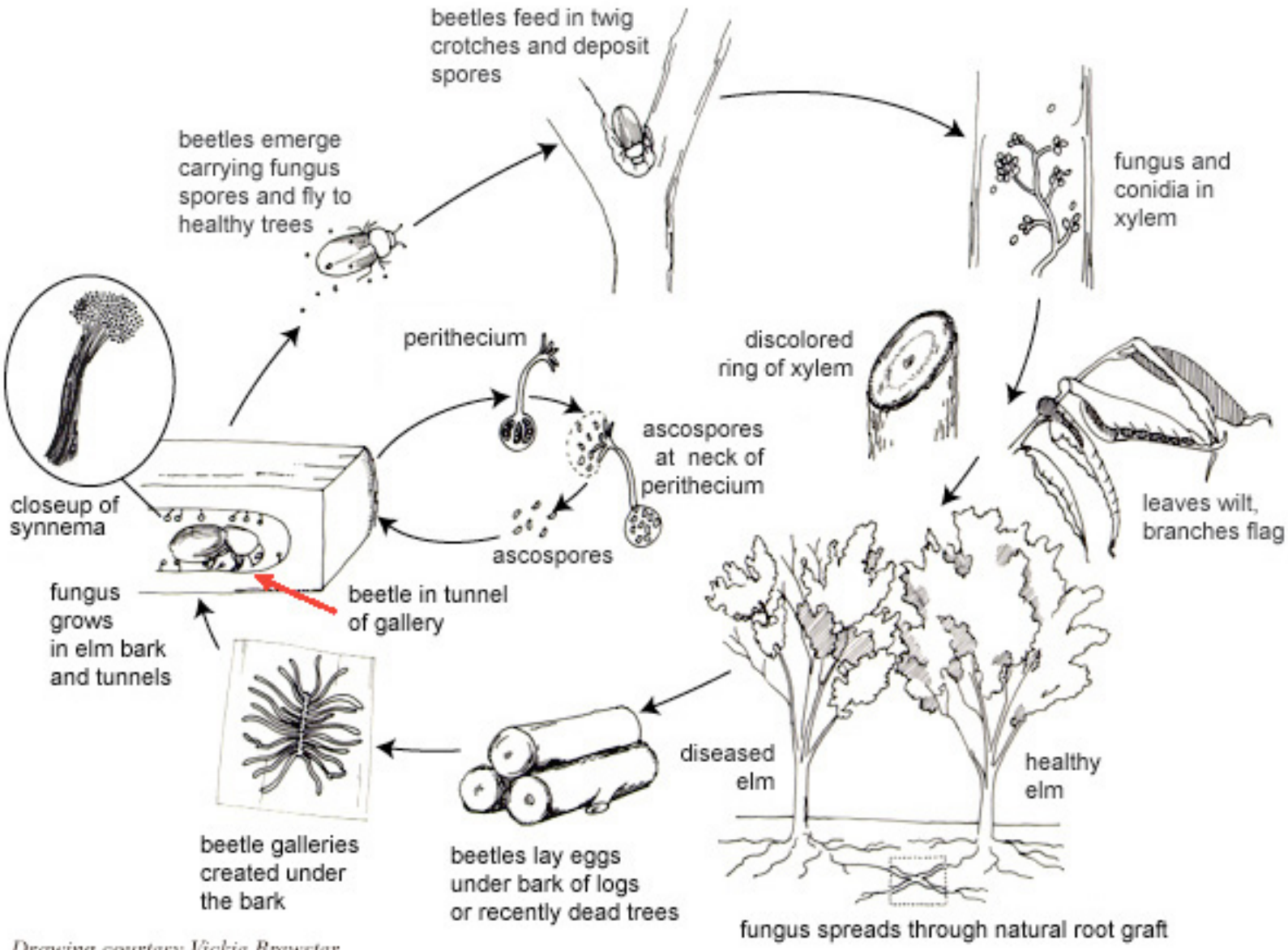
Disease development


Virulent pathogen
Conducive environment
Susceptible cultivar

General disease cycle



Dutch elm disease disease cycle

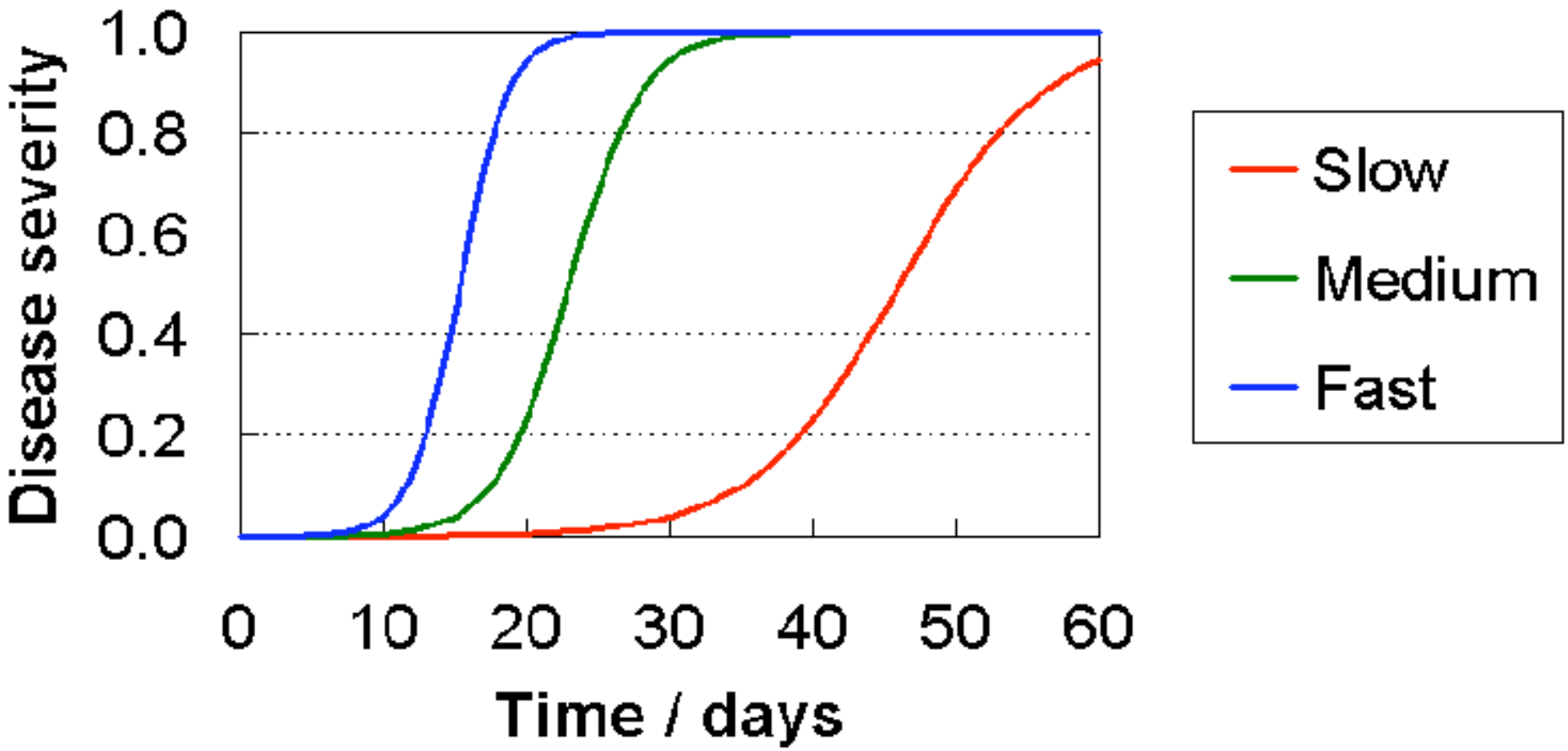


Drawing courtesy Vickie Brewster

More plant disease facts…

- Each pathogen has a unique disease cycle
- Pathogen activity is mostly dictated by the weather (especially moisture)
- Pathogens are often specific to their host
- Cultivars differ in disease susceptibility
- Most pathogens are too small to see with the naked eye, so monitoring is usually by disease symptoms

Disease epidemiology: disease progress curves



Abiotic diseases

- Nutrient deficiencies/toxicities
- Water (too much, too little)
- Temperature (too high, too low)
- Chemical injury (herbicides, etc.)
- Physical injury (hail, wind, lighting)

How can you tell them apart?

Infectious diseases	Abiotic disorders
Scattered in field, a diseased plant may be next to a healthy plant	Uniform over field, certain rows, or along field edge
Varieties differ in their susceptibility	May affect all varieties and even weeds
Gradual increase, may get worse over time (progressive)	Sudden onset, possibly after weather event or herbicide spray-no progression of disease
Fungal growth may be visible	No signs of any pathogen
May be more severe in wet years	After pesticide applications or adverse weather conditions
Send sample to diagnostic lab for identification of pathogen	Send plant sample for nutrient or pesticide residue analysis

A correct diagnosis is essential for effective disease control

Send the sample to a diagnostic lab

AND HOW WERE YOU PLANNING ON PAYING FOR THIS VISIT?