

# Bacterial Diseases of Fruit Trees

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# The Diseases

- Fire blight
  - *Erwinia amylovora*
  - Common name after the scorched appearance of leaves
  - Pome fruits and relatives only
  - Focus of this talk
- Bacterial blight
  - *Pseudomonas syringae*
  - Mostly stone fruits
  - Discuss this as an exception
- Management
  - Treatments are often similar for both diseases
  - IPM approach in the landscape will almost certainly be different



# The organism

## Bacteria

- Visible: no?
- Body: single celled
- Nucleus: small ring
- Gene transfer: plasmids
- Cell walls: peptidoglycan
- Reproduction: division
- Dispersal: cysts, spores?  
(not Erwinia!)

## Fungi

- Visible: yes?
- Body: multicellular
- Nucleus: multinucleate?
- Gene transfer: sex
- Cell walls: chitin
- Reproduction:  
fragmentation, spores
- Dispersal: spores

# The Environment

- Adapted to attacking flowers and new growth
- Active in spring, during bloom
- Really a problem on:
  - Pear & Asian pear
  - Quince
- Other hosts:
  - Apple
  - Loquat
  - Pyracantha
  - Cotoneaster
  - Toyon
  - Photinia
  - Sorbus



Image: Stock

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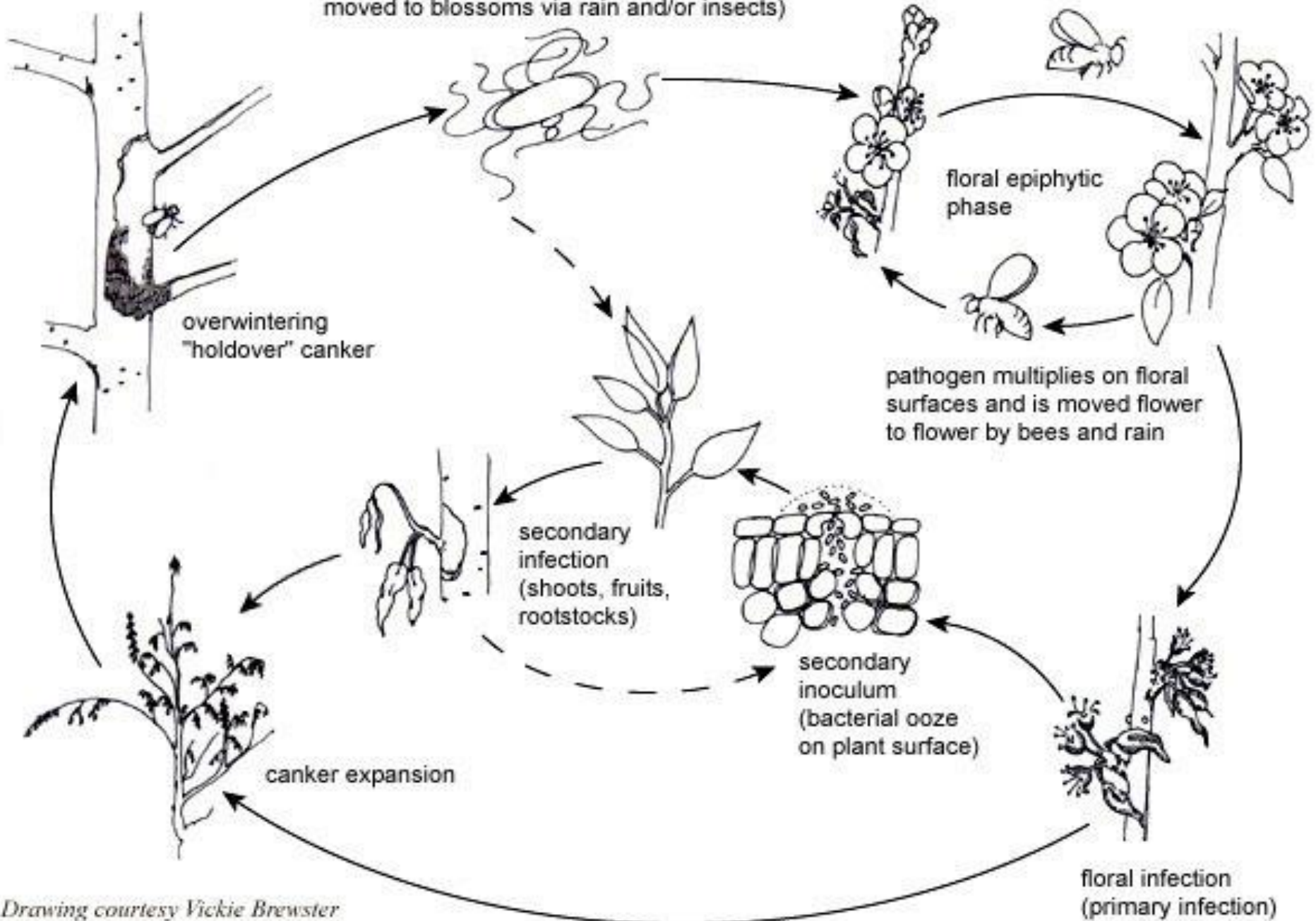
Image: Ed Perry, UCCE Stanislaus

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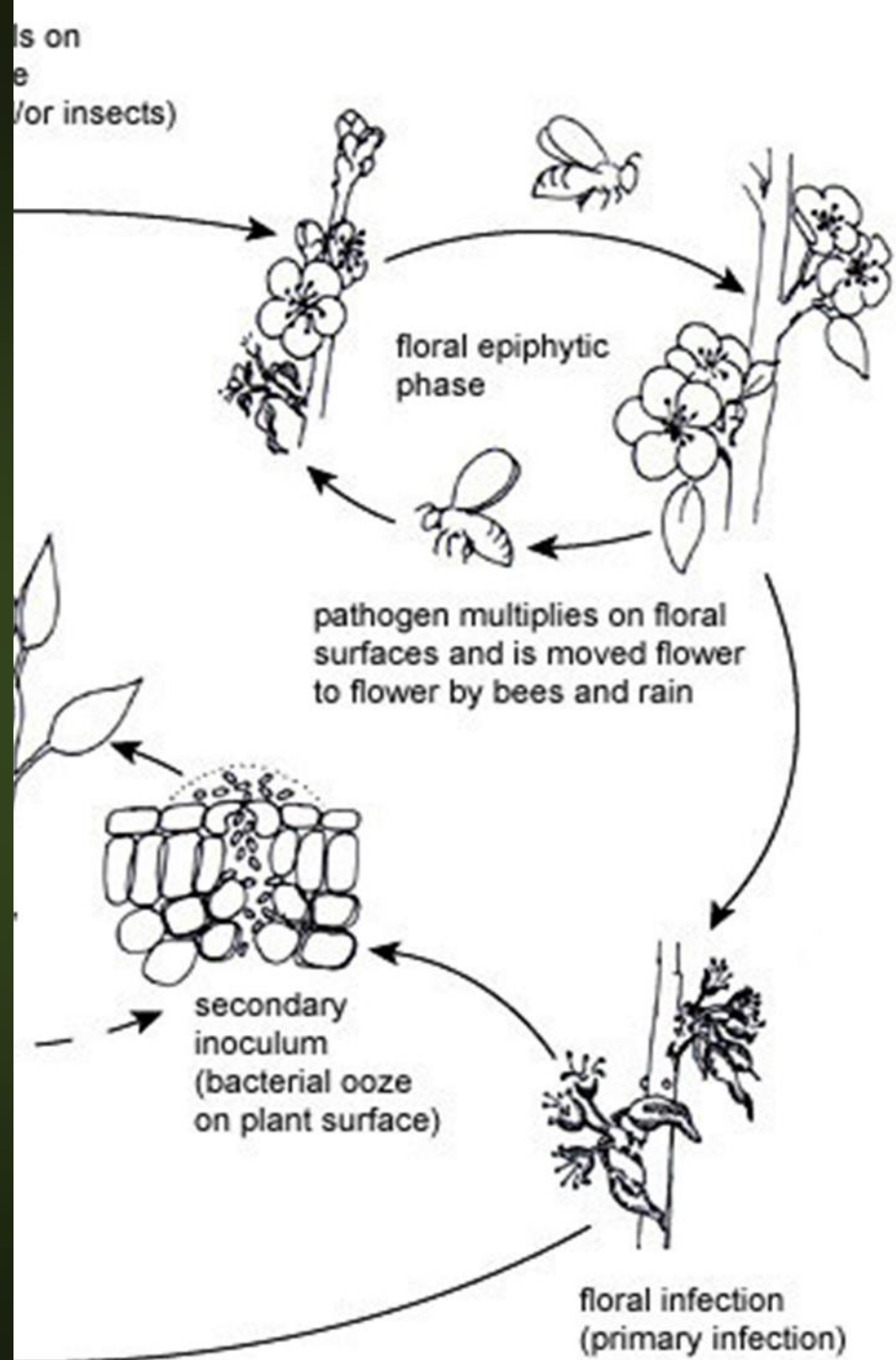
primary inoculum (pathogen cells on surfaces of holdover cankers are moved to blossoms via rain and/or insects)



Drawing courtesy Vickie Brewster

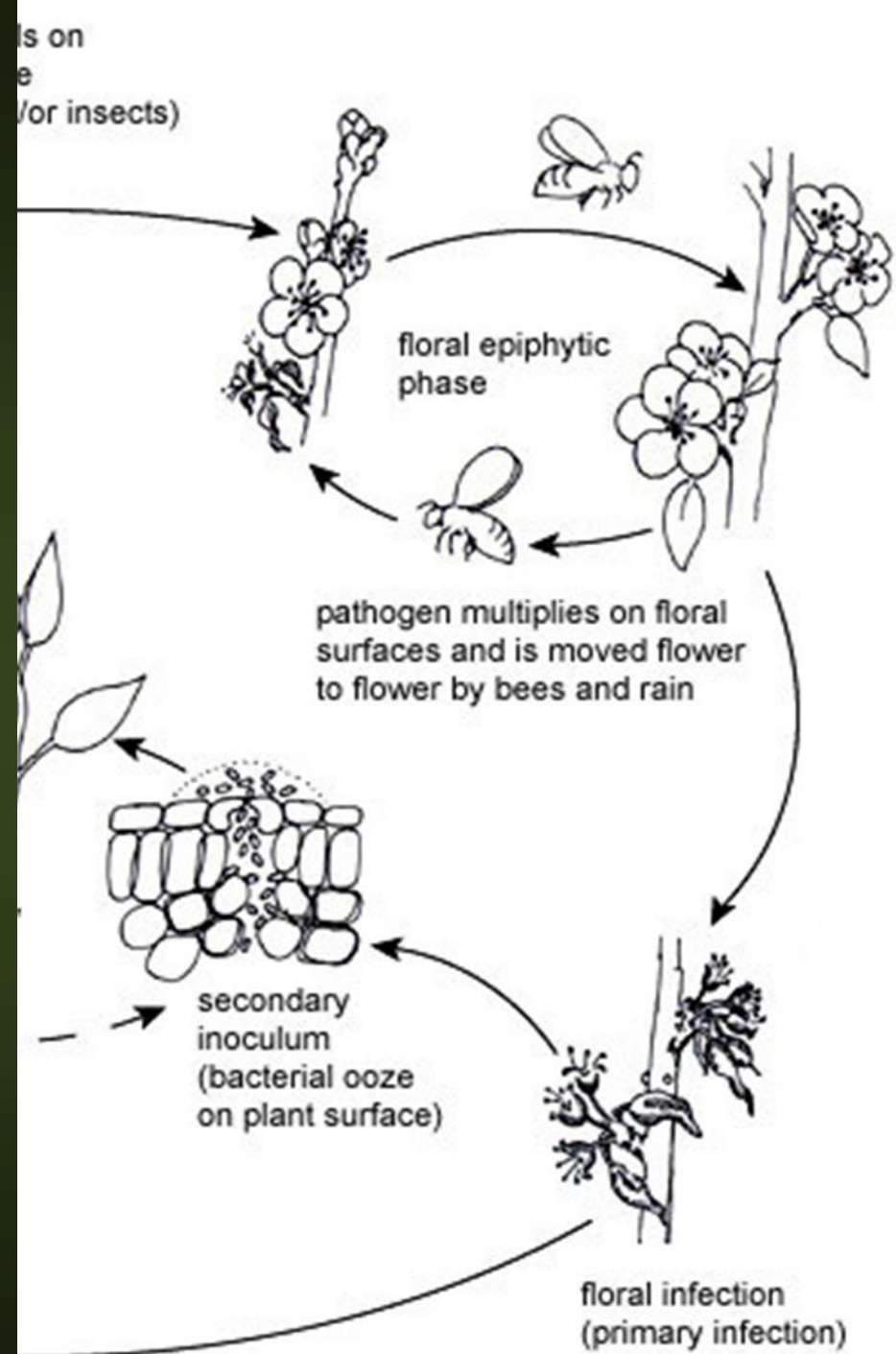
# Conditions for contagion

- Several days of warm temperatures during bloom
  - Temp mediates
    - Bee flights
    - Bacterial reproduction
  - BOTH increase when it's warm
  - Extensive spread to new trees
  - 50-60°F: meh
  - 60-75°F: warning
  - 75-90°F: BOOM



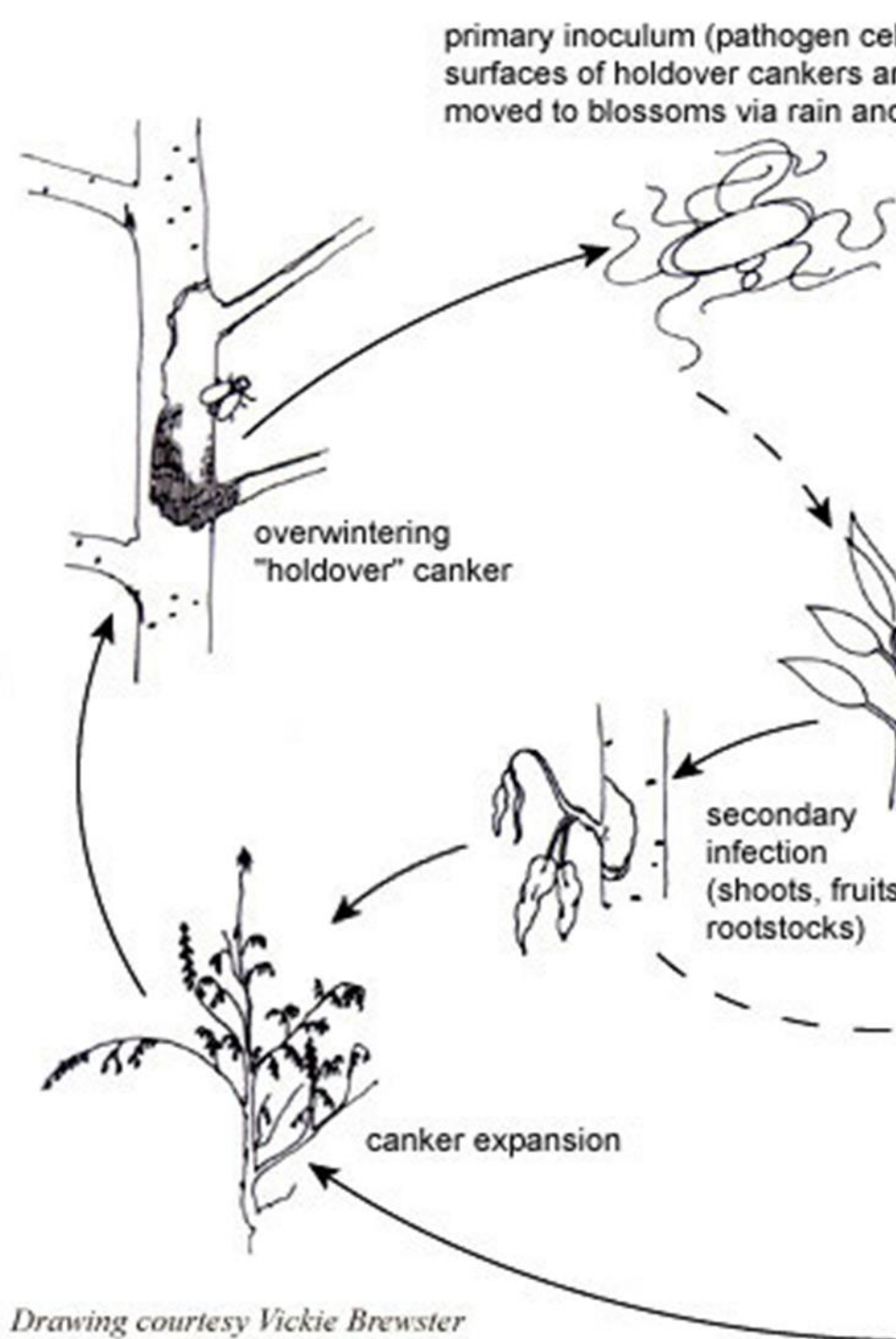
# Conditions for contagion

- Pathogen survives on stigmas
  - Nutrient rich
  - Point of contact for bees
- Three weeks for twig death to occur



# Conditions for contagion

- Prolonged rains during leaf flush
  - Spread of cankers to new sites within the same tree
    - Some inter-tree movement may occur in storms
    - This is why pruning cankers out is important
    - Neglected trees get worse



*Drawing courtesy Vickie Brewster*



# Symptoms

- Dead flowers
  - Sometimes baby fruit
  - Almost always black (brown in apples)
- Blackened leaves still attached
  - Infected through petiole
- Bacterial oozing
- Red streaking in phloem
- These can be challenging to find on some hosts
  - ELISA field tests



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← sample  
← sample  
← sample  
← sample  
← sample

Ea Lot 151138

Ea Lot 151138

Ea Lot 151138

BIOREBA  
BIOREBA  
BIOREBA  
BIOREBA  
BIOREBA





Bioss  
B  
Ea

Ea Lot 190639

Ea Lot 190639

Ea Lot 190639

BIOREBA  
BIOREBA  
BIOREBA  
BIOREBA  
Ea Lot 151138  
Ea Lot 151138  
Ea Lot 151138

# IPM

- Planning
  - Some landscapes have fire blight problems built in
  - Never mix ornamental pears with other fire blight hosts
    - Cotoneaster
    - Toyon
    - Pyracantha
  - Choose resistant varieties
    - UC IPM
    - Commercial grower sites (e.g: Dave Wilson Nurseries)





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# IPM

- Pruning
  - Spring:
    - Less time to spread
    - Clearer delineation of extent
    - Possible reinfection
  - Fall:
    - Lower contamination risk
    - Bigger cuts required
  - Disinfection of tools





# IPM

- Stuff UC IPM doesn't tell you
- No fertilizer
- Flower thinning
  - But this gets done with Bordeaux mixture ...
- Blowtorch
- Resistant rootstocks (?)
  - Won't keep your tree looking good
  - Will help prevent spread into the trunk

# IPM

- Sprays
  - Copper
    - Repeat every 2-3 days while humidity is high
    - 5-20 applications / year?
  - Bordeaux mixture?
    - Mix it yourself!
    - Burns stigmas



# IPM

- Antibiotics
  - Kasugamycin (new)
  - Oxytetracycline
  - Streptomycin
  - Spray every 2-5 days
    - Up to ~ 80% effective
  - Affect all epiphytic bacteria
  - Remember plasmids?
  - Resistance management





# IPM

- Biological bactericides
  - *Bacillus subtilis*
    - Rhapsody
    - Serenade
  - *Streptomyces lydicus*
    - Actinovate
  - *Pseudomonas fluorescens*
    - Blight ban
  - Others
  - Application frequency (2-5 days)
  - Landscape efficacy?



# IPM

- SAR's
  - Acibenzinol S-methyl
  - Mimics salicylic acid in plant
  - Primes plant immune system
  - Smaller response than antibiotic
  - Lasts longer (1 week)
  - Efficacy approaches antibiotics
- Phosphonates
  - AgriFos
  - Reliant
  - Aliette
  - Not a stand alone treatment
  - Some studies suggest near zero efficacy



# IPM

- Concern about the long-term viability of pear orchards in Lake County
- We aren't orchards
  - Monoculture
  - Relevance of orchard-derived research?
  - They can get 80% control using IPM programs



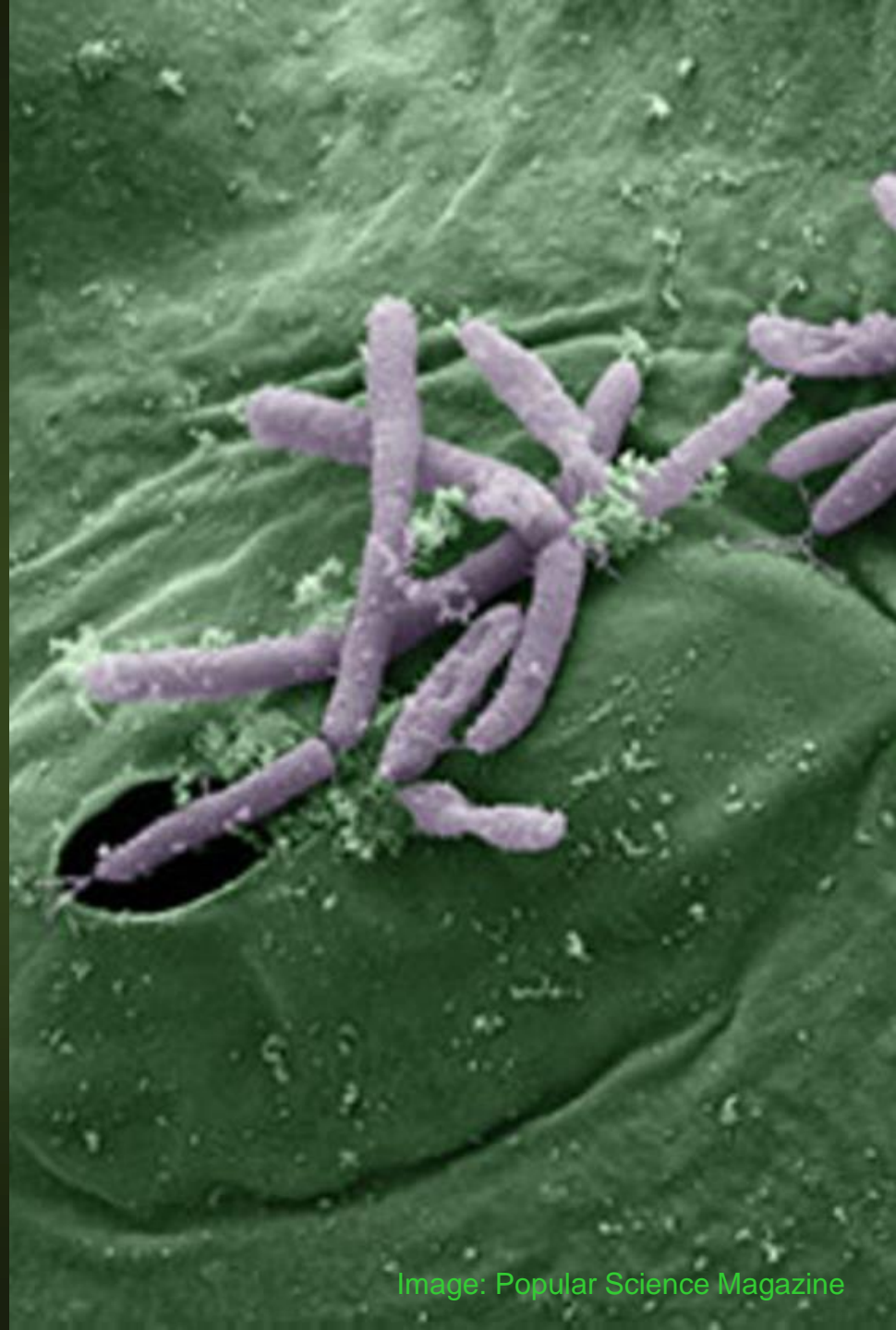
# Bacterial blight

- Doesn't move on bees
- Freeze specialist, entering frost damaged tissue after thaw
  - Late frosts
- Looks like abiotic frost damage
  - Not as uniform
  - More host specific
- Ice nucleator
  - Via hydrophilic & hydrophobic proteins
  - Snomax is so effective it's used by ski resorts



# Bacterial Blight Management

- Similar to fireblight
  - Copper kills bacteria
  - Prune out damaged twigs
- Keep plants hydrated
- Larger host list
- Less common in Marin
- Some forms are epiphytes, not pathogens
  - Pseudomonas “Ice minus”
    - Frostban (GMO)



# Landscape Summary

- Blight Mgmt fundamentals:
  - Planning
    - Global warming
  - Pruning
- If damage to foundation plants is unacceptable
  - Remove alternate hosts and/or replant with resistant varieties
- If you wait to prune, infections may move into the trunk
  - How do you prune this out?
- Sprays work best as prophylactics
  - Cost?
  - Efficacy?
  - Do SAR compounds retain efficacy in the landscape?



# Resources

- UC IPM website: <http://ipm.ucanr.edu/>
- Washington State University Extension: <http://treefruit.wsu.edu/crop-protection/disease-management/fire-blight/>
- Making Bordeaux (copper lime sulfate):  
<http://ipm.ucanr.edu/PMG/PESTNOTES/pn7481.html>
- Presentation will be on-line at: <http://ucanr.edu/MarinIPM>
- Steven Swain: [svswain@ucanr.edu](mailto:svswain@ucanr.edu)  
415 473 4226

