



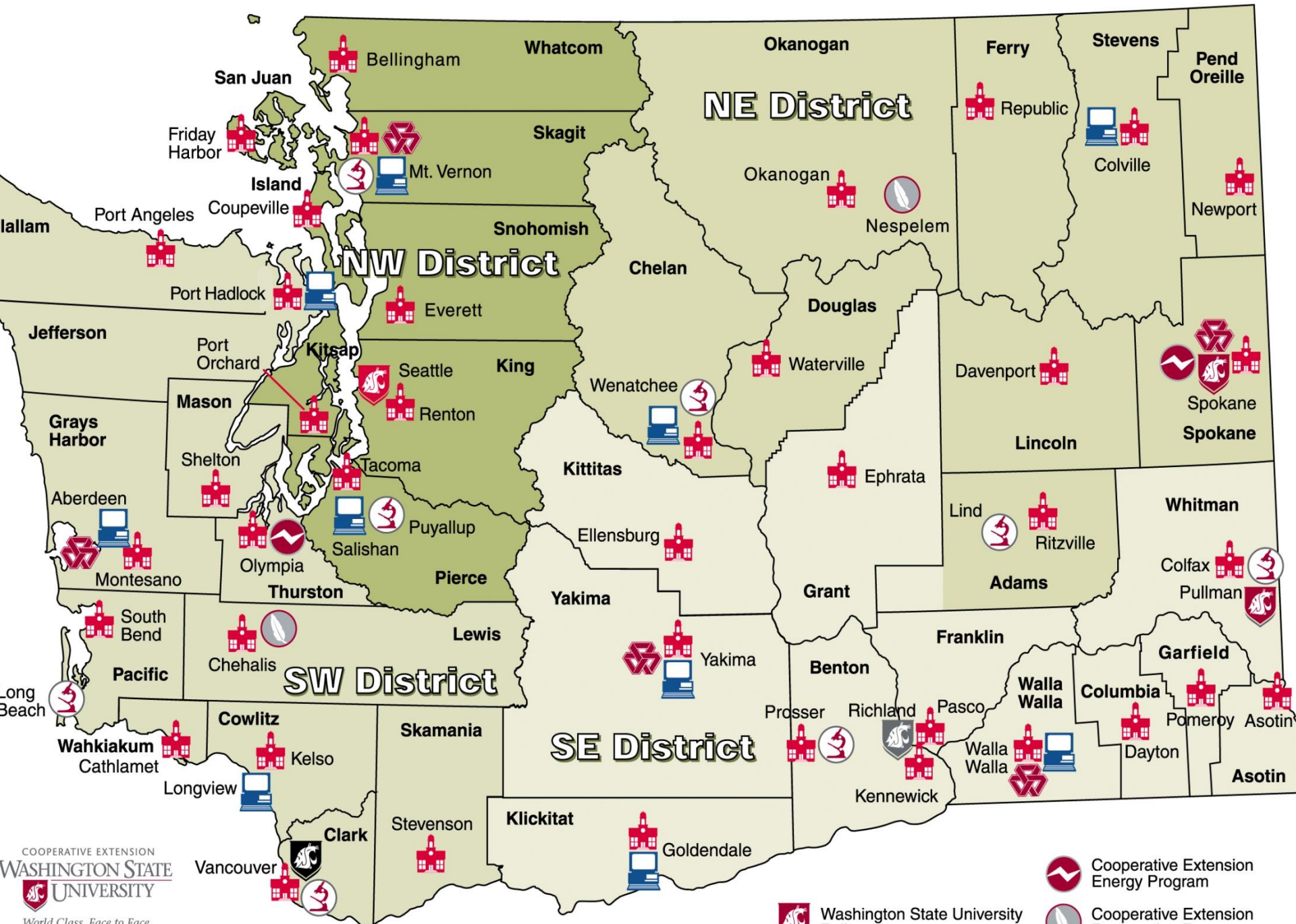


Welcome



Washington  
State  
University





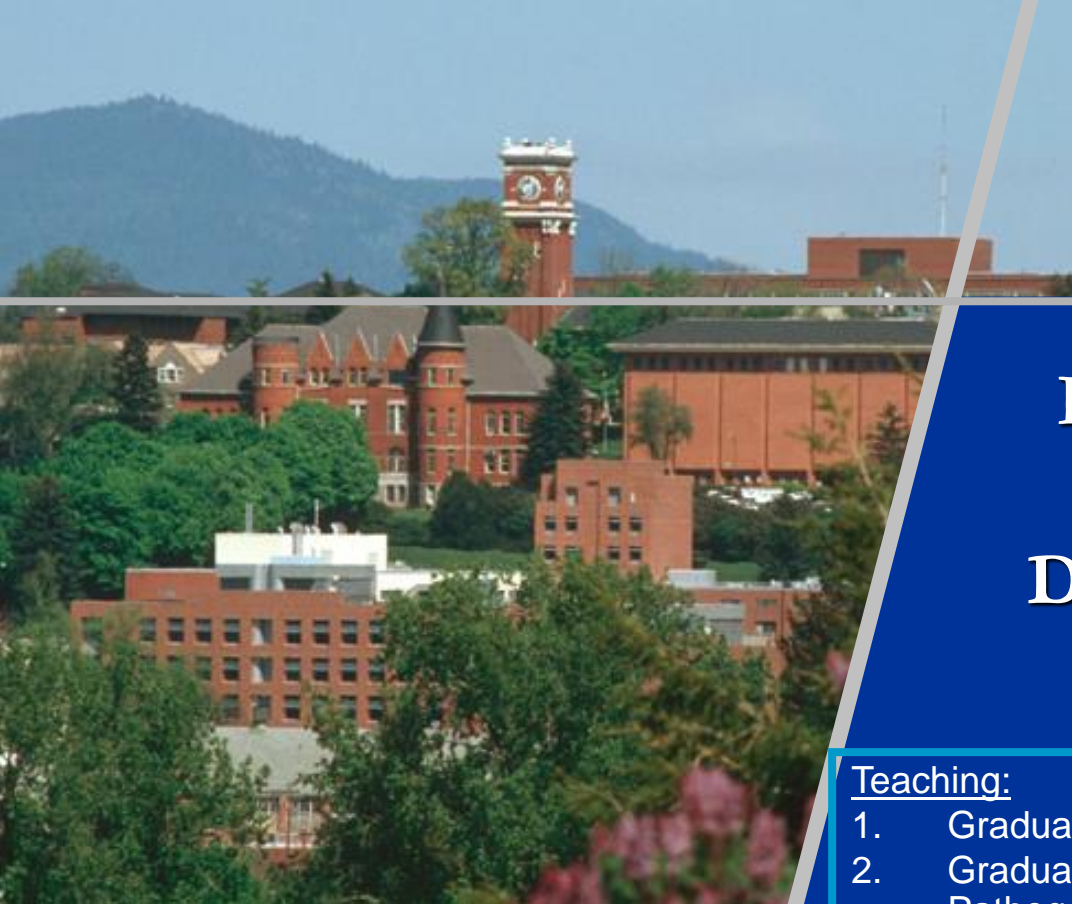


WSU's main campus in Pullman, WA









**Hanu R. Pappu, Ph.D.**  
**Professor**  
**Dept. of Plant Pathology**  
**WSU-Pullman**

Teaching:

1. Graduate course in Plant Virology
2. Graduate course in Molecular Genetics of Plant-Pathogen Interactions
3. Senior undergrad course in General Plant Pathology
4. Junior undergrad course in Ag Food Systems
5. Maymester course on ag biotechnology

Research:

Molecular basis of plant-virus interactions, characterization and control of viral diseases of crops

Commodities: Vegetables, Legumes, and Ornamentals













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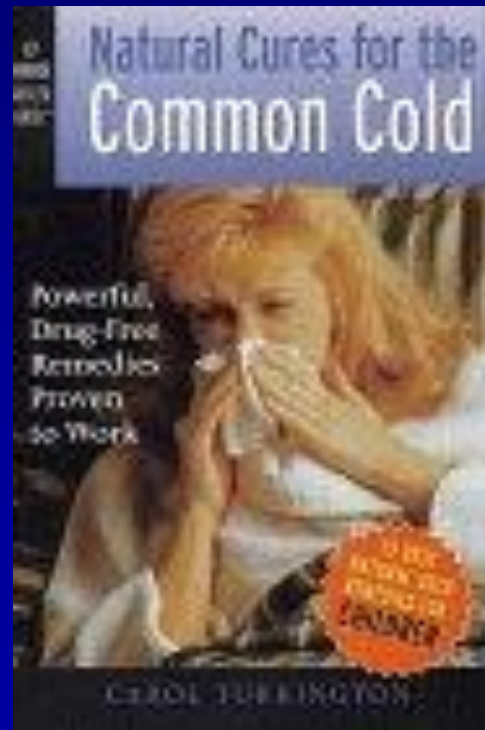
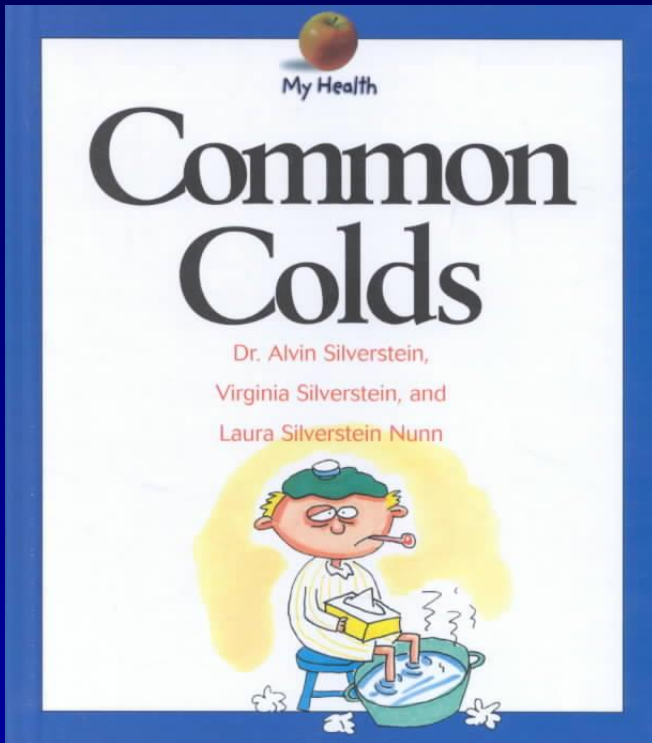


# *Outline*

- Symptoms associated with virus infections
- Virus testing program at WSU
- How to reduce the virus incidence



# What are viruses?





# Viruses as Plant Pathogens

## Virus:

- 1. submicroscopic: nm, Å (can not see them with a naked eye; not visible under an ordinary microscope)
- 2. infectious
- 3. replicate **ONLY** in living cells
  
- 1000+ viruses reported infecting plants

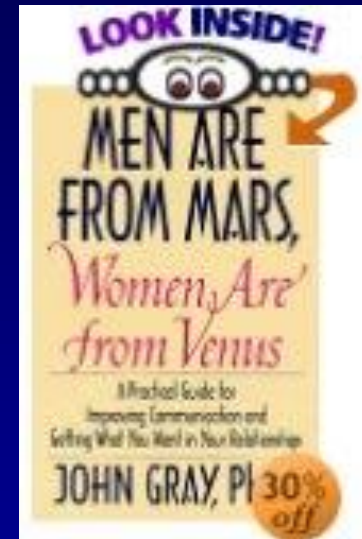


# What do viruses want...

**“Fungi and Bacteria are from Mars**

**Viruses are from Venus”**

**With apologies to John Gray**



**Men are from GM,  
Women are from Ford**

**Tom and Ray Magliozzi,  
Car Talk, NPR**

**“If you want to  
understand a virus,  
you have to think like  
a virus”**

**Dr. Phil Berger**



Color-breaking in tulips  
'Tulip mania' in Europe  
This condition is caused  
by virus infection



**Jan Davidsz de Heem,  
1645  
Vase of Flowers**

# Viruses affect us, animals, and plants

## Virus:

- 1. submicroscopic: nm, Å (can not see them with a naked eye; not visible under an ordinary microscope)
  - 2. infectious
  - 3. multiply **ONLY** in living cells
- 
- 1000+ viruses reported infecting plants





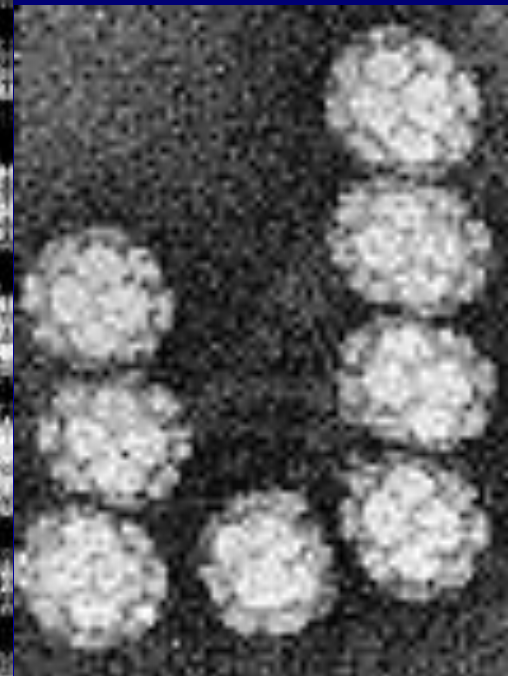
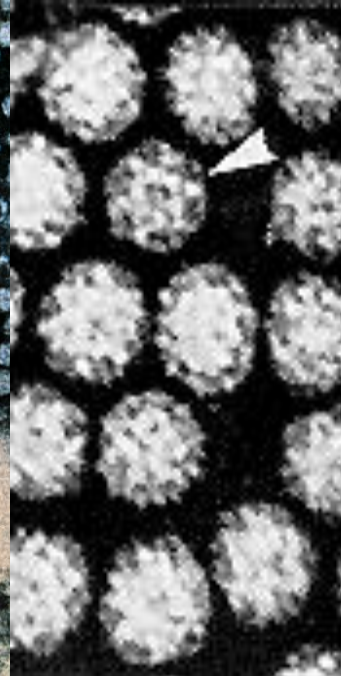
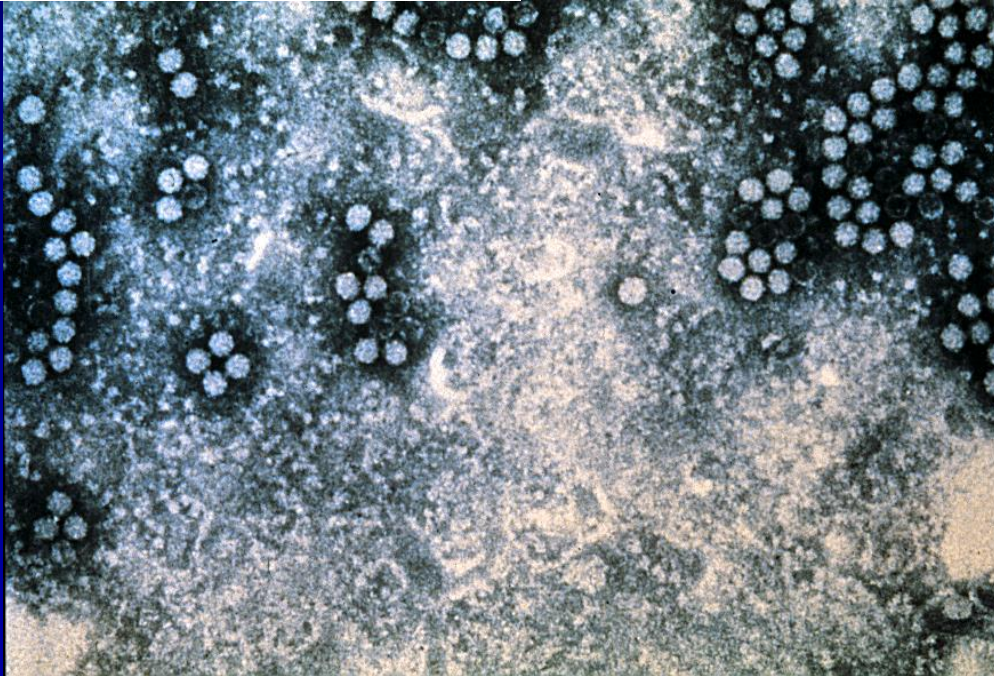
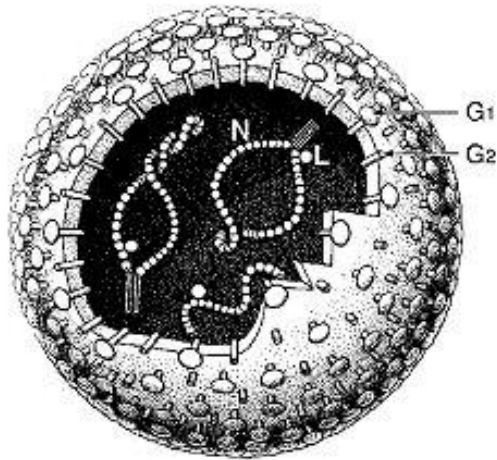
# Viruses: How do they look?



- Too small to see with a naked eye or even by a microscope
- Only by an electron microscope, at least 50,000 magnification



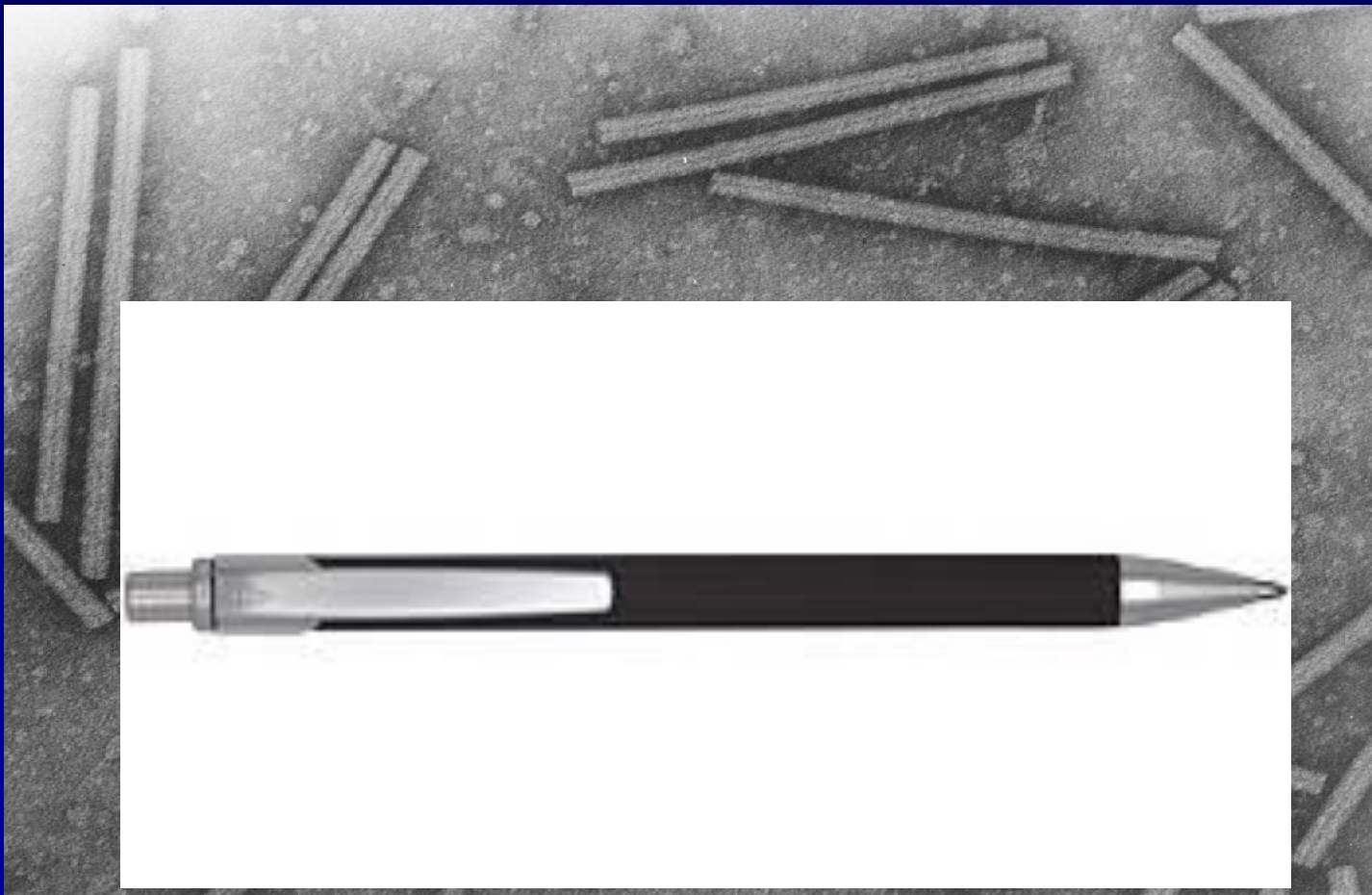
# Shapes of Viruses





# *Shapes of viruses:*

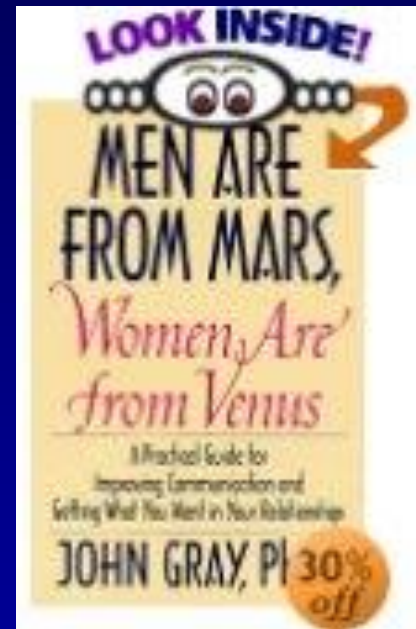
**Consists of 'inner' nucleic acid (RNA) surrounded by an 'outer' protein coat (similar to a we use)**



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# Typical symptoms caused by virus infections

- The most common type of symptoms is **MOSAIC** (=alternating islands of dark green and light green patches)



# *Tomato spotted wilt virus in tobacco*





# *Tomato spotted wilt virus in peanut*



*Commonly seen viruses in  
gardens  
(there are dozens of them!)*

- Tomato spotted wilt virus
- Impatiens necrotic spot virus
- Cucumber mosaic virus
- Dahlia mosaic virus
- Tobacco streak virus
- Tobacco rattle virus



Mosaic by Dahlia mosaic virus  
(similar symptoms are also caused by  
Cucumber mosaic virus)

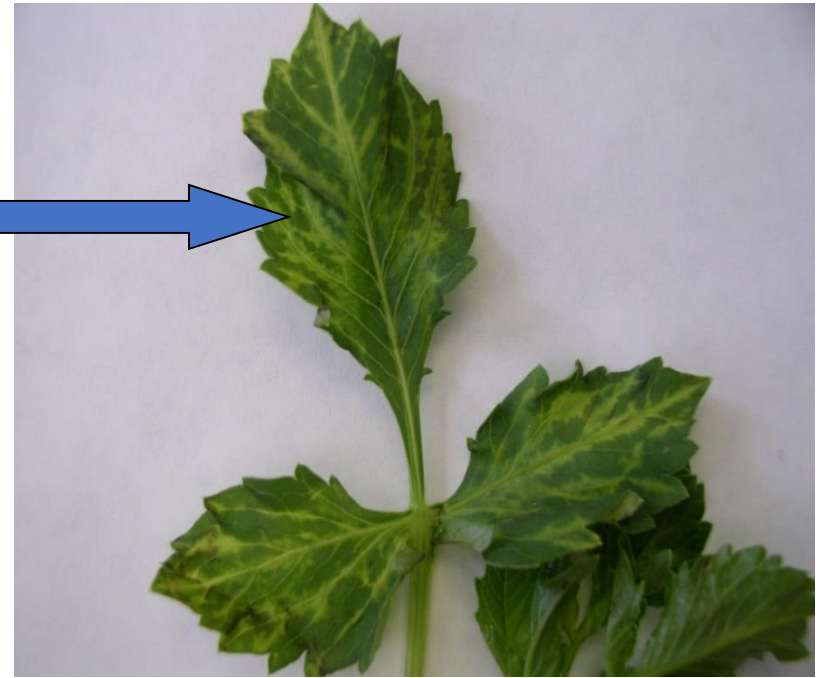


*Chlorosis (=yellowing)  
by Dahlia mosaic virus*





*Veinal chlorosis*  
(yellowing or loss of 'green' along the veins)  
*Dahlia mosaic virus*  
(moderate on left; severe on right)



*Systemic chlorosis: entire plant is  
symptomatic  
Dahlia mosaic virus*





Severe stunting,  
chlorosis,  
mottling

Dahlia mosaic  
virus



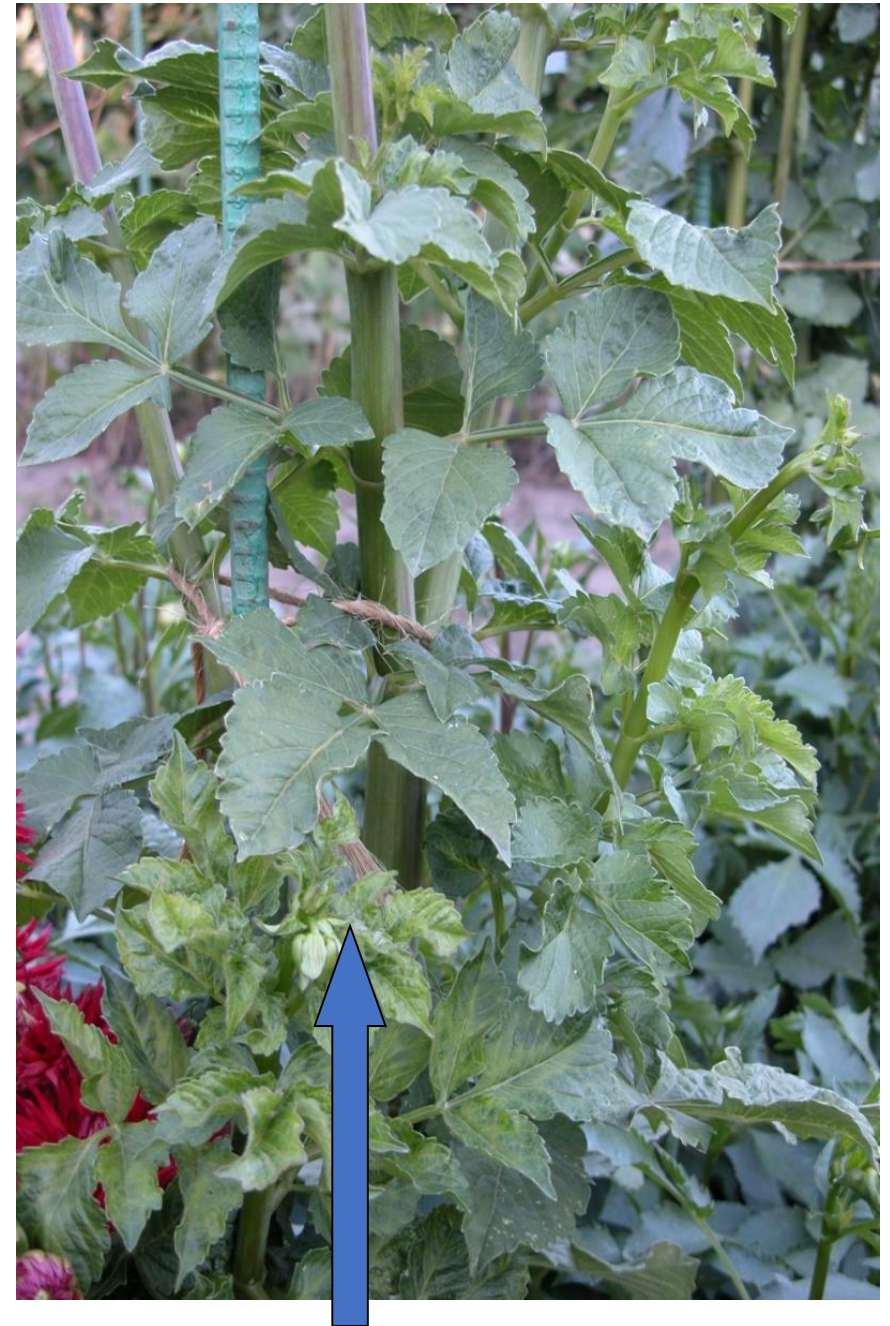


Severe stunting,  
chlorosis,  
mottling by  
Dahlia mosaic  
virus (right).  
Healthy plant on  
the left.



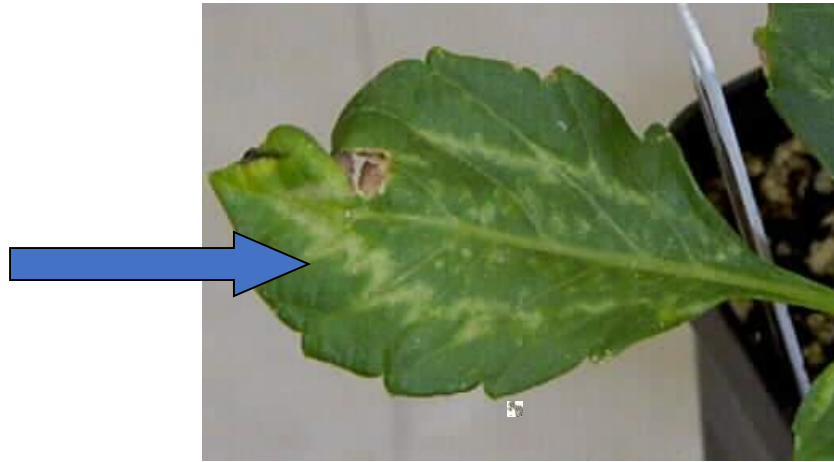


# Stunting of new growth: Cucumber mosaic virus





# 'Fanleaf' symptom by Tomato spotted wilt virus





# 'Fanleaf' symptom by Tomato spotted wilt virus



# Concentric ringspots Impatiens necrotic spot virus





*Ring spots/Netting : Tomato spotted wilt virus*

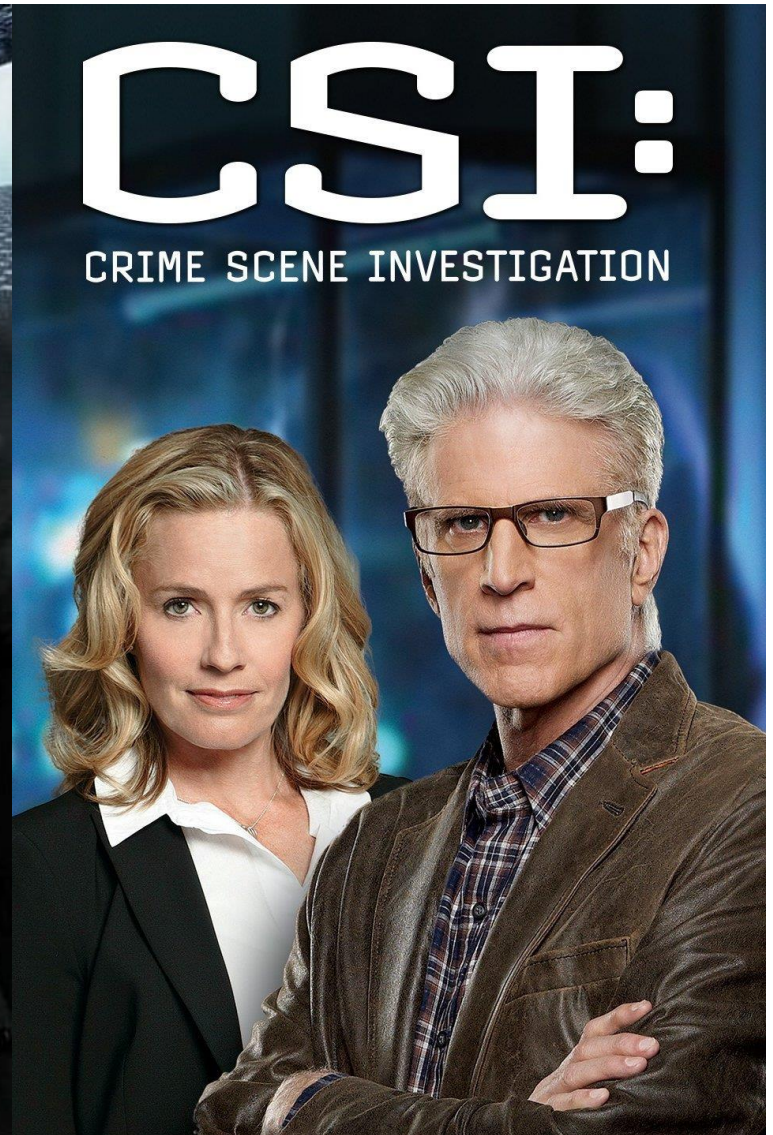


*Ring spots/Netting :  
Tomato spotted wilt virus*





# Virus Testing



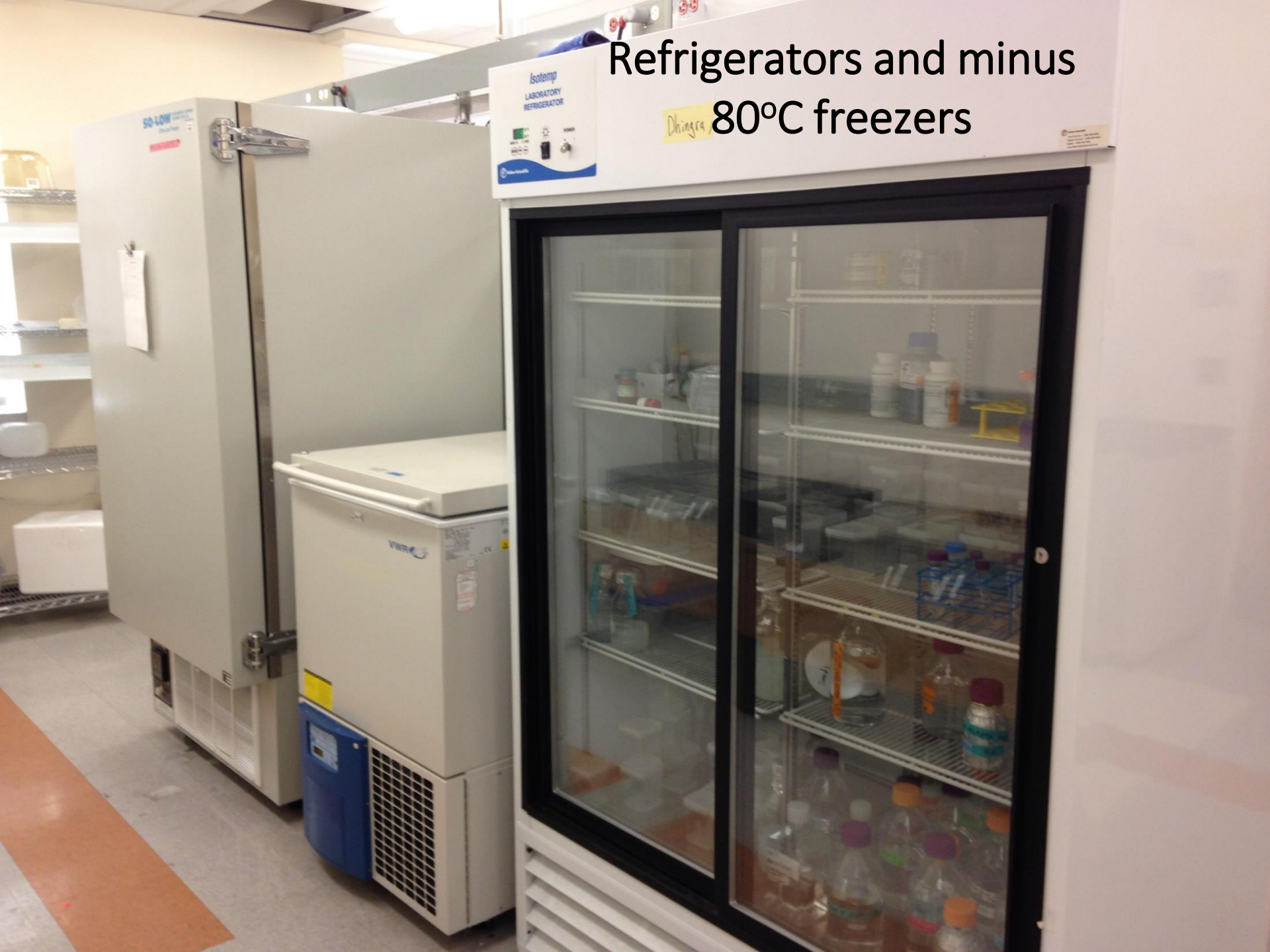


Walk-in cold  
room (4°C)

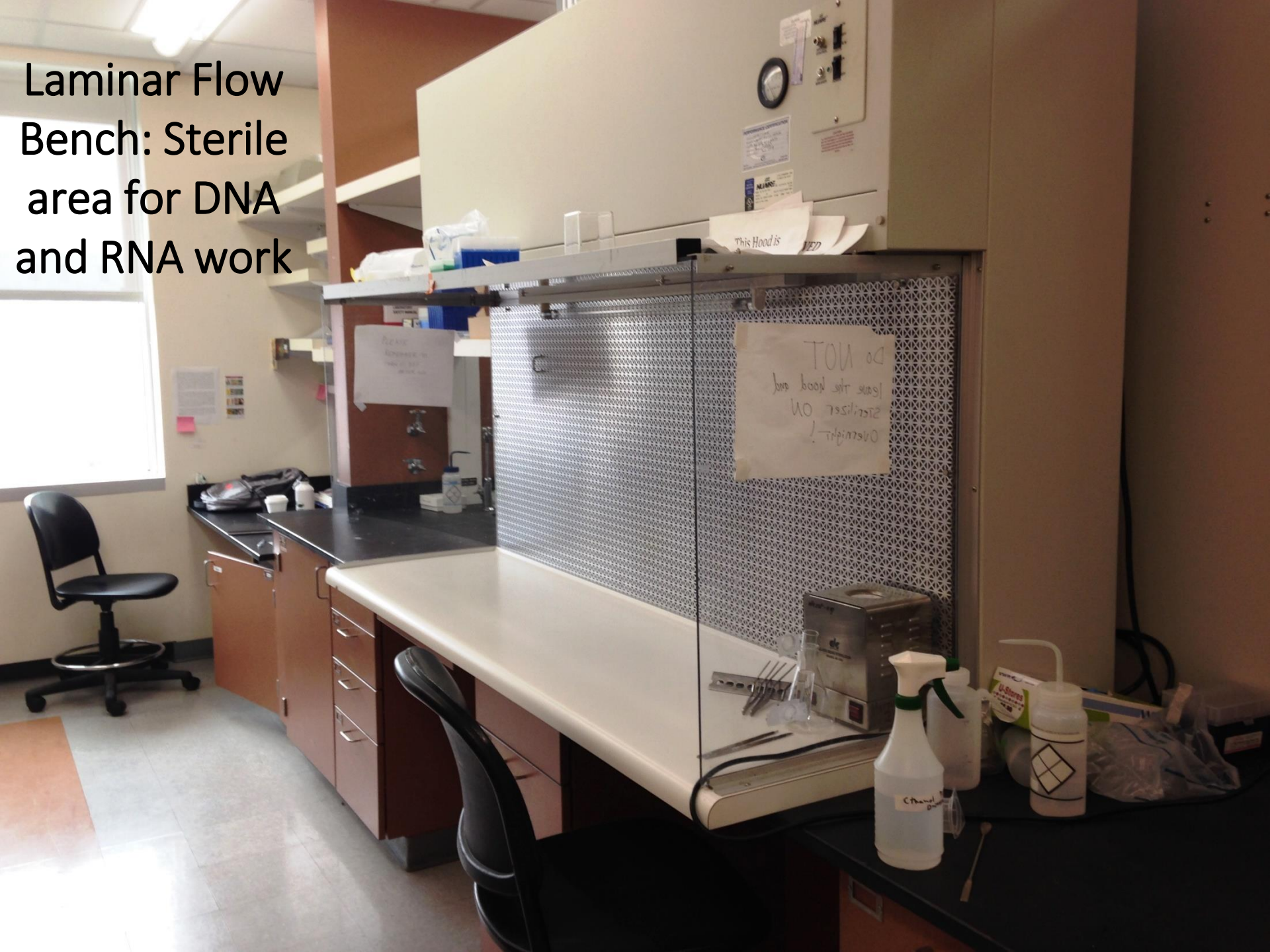




# Refrigerators and minus 80°C freezers



Laminar Flow Bench: Sterile area for DNA and RNA work







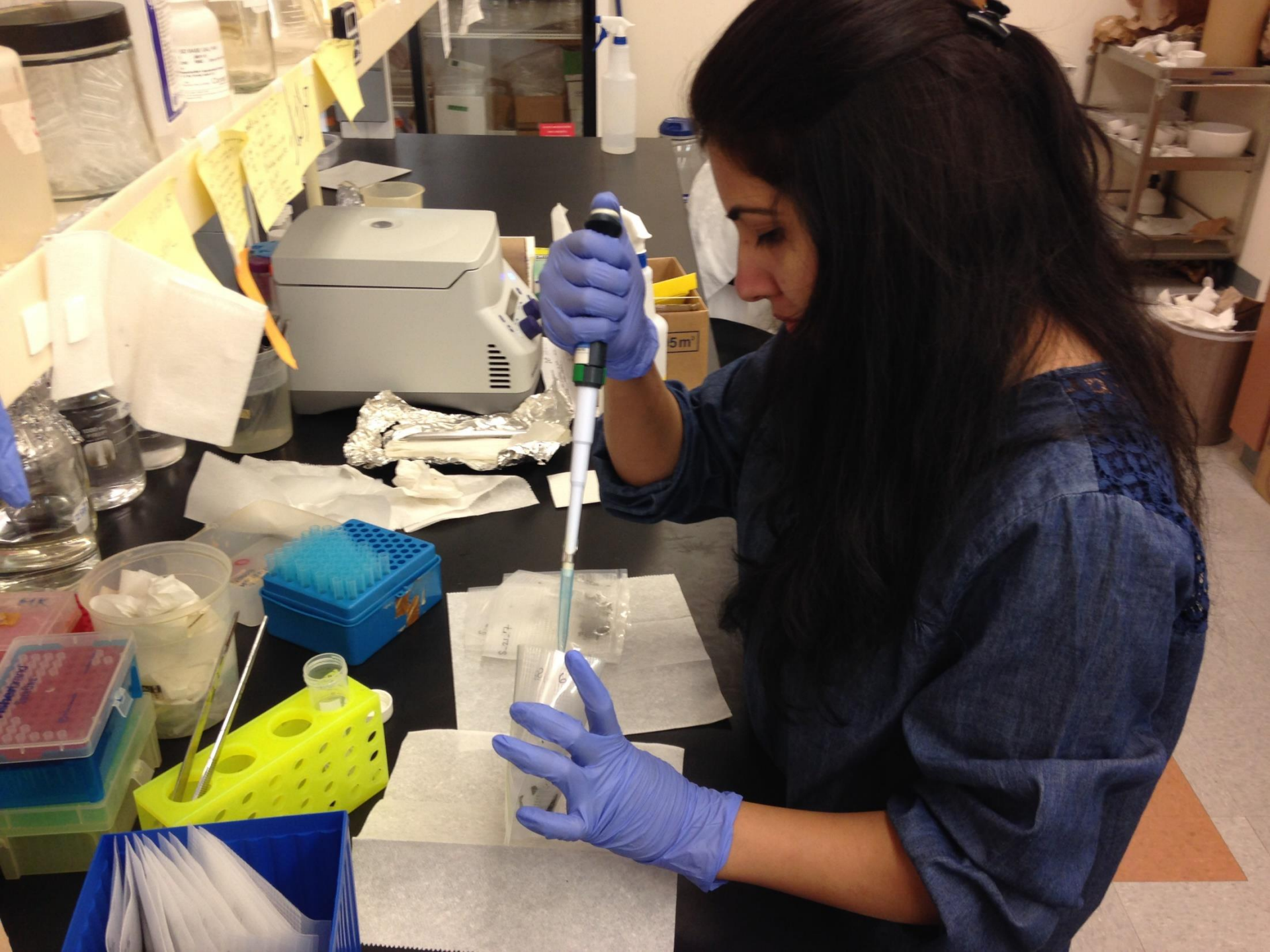
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Video  
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Licensed to Grind





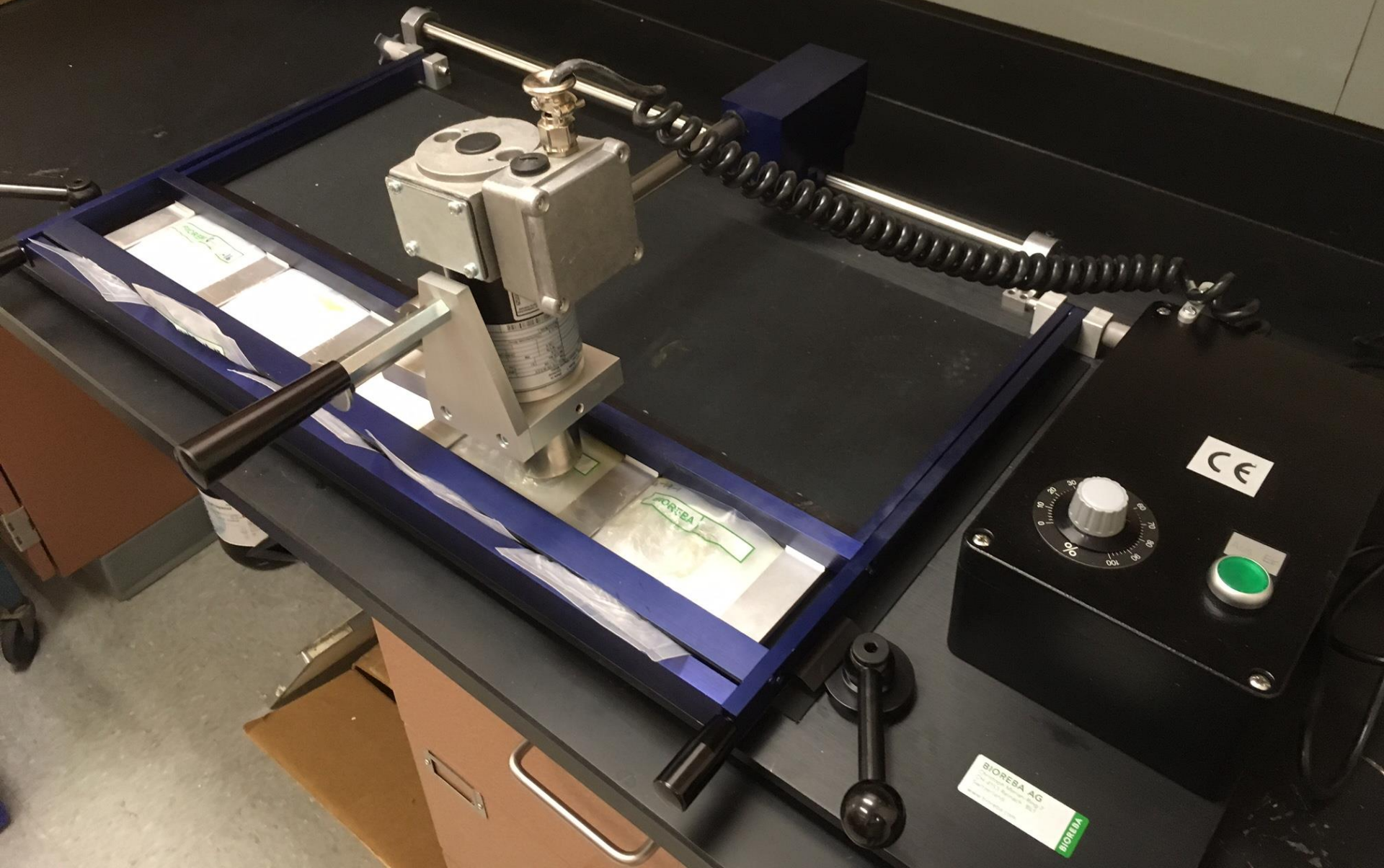




Video  
Madhu1



Composites of 25 samples  
can be processed at a time





**Thank you,  
Mr. Jim Chuey !!!**

