

Graduate Course: Viruses and Viral Diseases of Plants



GENERAL INFORMATION

COURSE: **PIP 511 Viruses and Viral Diseases of Plants. Spring 2017.
3 Credits**

Lectures: Tuesday and Thursday 1:25-2:45 PM

Location: 343 Johnson Hall, WSU campus, Pullman, WA

Instructor: Dr. Hanu Pappu, 335-3752; 353 Johnson Hall, WSU, Pullman
E-mail: hrp@wsu.edu
Web page: <http://plantpath.wsu.edu/people/faculty/pappu/>
Office hours by appointment

Text: Hull, R. 2013. Plant Virology, 5th ed. Academic Press, NY.

OBJECTIVES OF THE COURSE

1. To appreciate the breadth of viruses infecting plants and their economic impact.
 2. To know and apply principles of identification, physical/chemical/genetic characteristics and virus taxonomy to problems of diagnosis, etiology, epidemiology and control of plant diseases.
 3. To be able to understand and use virological literature and databases.
 4. To be able to critique research publications and summarize and articulate orally and in writing.
 5. To ask appropriate questions of trained plant pathologists who may possess the needed knowledge and skills.
 6. To know and converse with others the key questions and concepts in virology today.
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Grading

Classroom participation:	20%
Oral presentations	20%
*Assignments	60%

***Critical reading and writing assignments:**

Each week one or two papers from the primary literature will be given for critical reading and writing. You will have one week to submit your critique (no more than two type-written pages). Details on how to prepare the critique are given below. These are due in ONE WEEK (if given during Tuesday lecture; it is due the following Tuesday by 5 pm)

There will be no closed-book exams.

Attendance

To get the maximum benefit from the course, your attendance AND active participation are critical. If you have to skip a class for reasons beyond your control, email me before the class.

‘Decisions are made by those who show up’

President Josiah Bartlett (Martin Sheen); *West Wing* (NBC)

Assessment and creating an effective learning environment

Your progress and learning outcomes will be assessed through various learning instruments and throughout the duration of the course, and individualized feedback will be provided on a regular basis. Emphasis will be on assessing your progress in improving and enhancing your critical thinking and writing skills as we, together, will embark on this semester-long journey to dig deeper into the heart and soul of viruses to figure out why they do what they do...

It is not a vacation anymore, honey. It is a quest! It is a quest for fun!!

Clark Griswold (Chevy Chase), *National Lampoon’s Vacation*

There will be a significant amount of required reading involved and to be able to contribute to discussions, you are encouraged to stay current with all the assigned reading material.

‘How do you eat a whale? One piece at a time’

Sen. Frank Underwood (Kevin Spacey), *House of Cards* (Netflix)

Critical reading and writing

This will be on primary literature: either classical or contemporary papers

NO more than two type-written pages; Use one inch margins on all sides

Use Times New Roman font size 12; Single-spaced

No line numbers; number the pages; First line: your first name and last name

Send it by email as a Word or Pdf attachment

Subject line of the e-mail: PIP 511: Critical Writing Assignment submission

Keep it succinct, avoid using long sentences; pay attention to spelling and grammar.

‘Appu: What are your favorite dish, book and a movie?’

Manjula: Fried Green Tomatoes’

The Simpsons

Required elements in the critical writing assignments

“Baseball is 50% pitching, 50% batting, and oh yeah, 50% fielding” Ananheuser Busch commercial

Introduction (10% of the space): What was the paper about and why the study was undertaken? What was/were the hypotheses? If none stated, what would be YOUR hypotheses for this work?

Methodology (20% of the space): Briefly describe what methods were used and WHY they were used. Suggest you have any better/more efficient methods that they could have used. If none, say so.

Results (30% of the space): Summarize what they found. Do you agree with the conclusions made? Did the data support the conclusions? Why do you think so? If not, why not?

Your summary (20% of the space): Provide your evaluation of the work presented: its originality, contribution to the field of virology, and impact and future direction of this work

Take home message (20% of the space): What have you learned from this study: give an instance where you might use it in the future.

Oral presentations

Depending on the size of the class, one or two students will be required to give an oral presentation (no more than ten minutes) of a given assignment each week – WITHOUT using PowerPoint. Black/white board use is allowed.

“*Mom, I belong to the Twitter generation. I use 140 characters or less*”. Bart Simpson.

Written Assignments on ‘hows’ and ‘whys’ of virology facts and concepts

“*Just the Facts, Ma’am*” Joe Friday (Dan Aykroyd), Dragnet

These will be based on fundamental discoveries/findings/facts or principles pertaining to various principles of plant virology. NO more than one type-written page; single-spaced; one-inch margins on all sides; 12 font; Subject line of the e-mail: PIP 511: Assignment submission.

Example I:

Fact: Tobacco mosaic virus was the first virus to be shown to contain protein and nucleic acid.
Assignment: Describe the approach(es) that the researchers used at that time to come to this conclusion or make this claim. Feel free to suggest alternate methods/techniques – how you would do with the tools and techniques that are available now.

Example II:

Fact: A few viruses replicate in their insect vectors.
Assignment: What experimental approaches would you use to come to this conclusion?

“*Facts are meaningless. You could use facts to prove anything that’s even remotely true.*”
Homer Simpson. *The Simpsons*

Plagiarism Policy.

Please make sure you understand what is plagiarism and familiarize yourself with the WSU Plagiarism Policy at these web sites: <http://libraries.wsu.edu/library-instruction/plagiarism/>; <https://gradschool.wsu.edu/plagiarism/>

Each of you must work on your own assignments and no group effort is allowed. Penalty for plagiarism: First instance – you will get a warning; second time: you will be given zero points on that assignment. Third instance: F grade in the course.

Please check to see if you can find any instances of plagiarism in this short story I wrote:

I am taking Dr. Pappu's Virology class. After giving us back our first assignment, he went on and on about plagiarism. I almost started texting 'KMN' to my buddies. After the class, I was walking on the main street and 'came to a fork and I took it'. I ended up in Daily Grind with my friends to hang out. 'It was a dark and stormy night'. One guy came to our table to take our orders. I was looking at a painting hung on the wall – what looked like the St. John's Church in Richmond, VA. I said with a soft yet firm voice, 'Give me an Americano or give me a Latte'. He nodded and with a deep voice and a unique accent, said 'I will be baak' and walked away. His stride exuded confidence and his posture assured me that he knew what he was doing. His tone and voice triggered several emotions in me: respect, fear and admiration – all in about equal parts. I stared at the TV on the wall and Cramer on CNBC was saying that DJIA and NASDAQ hit new highs that day. 'It is the best of times and it's the worst of times' – I muttered to myself. I remember it like it was yesterday – but it was 'four score and seven years ago', 'I had a dream'. A dream that one day we will get rid this world of all diseases – human, animal, plant – everything. I started going through my emails and got a reminder from the Registrar's office- 'Ask not what the Professor can do for you, ask yourself if you have paid the tuition'. I told my buddies that I have to get going. I have a big virology assignment due tomorrow. Then again, I told myself, 'there is nothing to fear but fear itself'.

Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center.

Academic integrity is the cornerstone of the university. You assume full responsibility for the content and integrity of the academic work you submit. You may collaborate with classmates on assignments, with the instructor's permission. However the guiding principle of academic integrity shall be that your submitted work, examinations, reports, and projects must be your own work. Any student who violates the University's standard of conduct relating to academic integrity will be referred to the Office of Student Conduct and may fail the assignment or the course. You can learn more about Academic Integrity using the URL listed in the Academic Regulations section. Please use these resources to ensure that you don't inadvertently violate WSU's standard of conduct.

LECTURE OUTLINE

TOPIC	Textbook chapters/pages
General overview of the course. Historical perspectives. What is a virus? <i>“To understand a virus, you have to think like a virus”</i> Dr. Phil Berger, USDA-APHIS	pages 1-12
Classification and taxonomy. Groups of plant viruses. Biochemical components. Morphology. <i>“Men Bacteria and Fungi are from Mars; Women Viruses are from Venus”</i> . With apologies to John Gray	chapt. 2; chapt. 4
Types of plant virus diseases and symptomatology. Physiology of virus-infected plants: Acute vs chronic infection. <i>“Pain is a state of mind”</i> Mal Cobb (Marion Cotillard), <i>The Inception</i>	chapt. 3, pages 411-463
The structure of plant viruses <i>“Less is more”</i> . Ludwig Mies van der Rohe	chapt. 5
Assembly of plant viruses. The infection process. How viruses enter host cells. The early events. <i>“Rome TMV was not built in a day”</i>	chapt. 5; pages 225-232
What do viruses want? Viral genes and gene products. Logic behind the genes that viruses chose to have. <i>“Choose your people more wisely, Mr. Cobb”</i> Mr. Saito (Ken Watanabe), <i>The Inception</i>	chapt. 5
Replication and translation of viruses: General overview of nucleic acid replication and translation strategies as they apply to plant virus single-stranded (+) RNA genomes. <i>“All viruses are not created equal”</i> With apologies to the Founding Fathers	pages 293-333 pages 171-174; 189-221; 253-289
Single-stranded (+)RNA viruses. Detailed examples: Tobamoviruses Potyviruses Closteroviruses <i>“Remove all assumptions and start with a single strand”</i> . Dr. Angela Saxton, <i>Deception Point</i> , Dan Brown	pages 225-244

- Single-stranded (-)RNA and dsRNA viruses: pages 183-189; 244-246; 333-339
 Detailed examples: Rhabdoviruses and reoviruses
 Tosposviruses and tenuiviruses
“In RNA We Trust”
- Single-stranded DNA and double-stranded DNA viruses: pages 174-183; 246-253; 339-352
 Detailed examples: Geminiviruses and nanoviruses
 Caulimoviruses
“It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material.”
 Watson and Crick. *Nature*, 171:737. April 25, 1953.”
- Satellite viruses, satellite RNAs, and viroids. chapt. 14
“They may take away my coat protein; they may take away my polymerase, but they can never ever take away my replication!” With apologies to Sir William Wallace (Mel Gibson), *Braveheart*
- Variability of plant viruses and strains. Evolution of plant viruses. pages 352-371; chapt. 17
“The only thing that is constant is change” Heraclitus
- Serology. The fundamentals of immunological methods for detection and characterization. Serological methods. chapt 15
- DNA-based methods for virus detection and characterization chapt 15
“There are many ways to see simple things”
 Maurie Thauvel, *The Da Vinci Code*, Dan Brown chapt. 11,12
- Transmission of plant viruses:
 Seed, pollen, soil, water and vegetative materials.
 Vector transmission by organisms other than arthropods.
- Arthropod transmission - types and characteristics; mechanisms and accessory factors. chapt. 12
“Vectors are out there! They can't be bargained with! They can't be reasoned with! They don't feel pity, or remorse, or fear...” with apologies to Kyle Reese (Michael Biehn).
The Terminator
- Epidemiology. The spread of plant viruses within fields.
 The spread of plant viruses between fields. Ecology of plant viruses. Host range and survival.
“The needs of many outweigh the needs of one” Spock (Leonard Nemo), *Star Trek II: The Wrath of Khan*

Practical Virology

Case studies: Viruses of grapes, potato and tree fruits, and their management

"There is a difference between knowing the path and walking the path" Morpheus (Laurence Fishburne), *The Matrix*

Control of plant virus diseases.

chapt. 16

Examples of IPM: successful and not so successful...

"Most forecasters are no more accurate than a dart-throwing chimp" *Superforecasting: The Art and Science of Prediction*. Philip Tetlock and Dan Gardner

Disease control – Organic Ag production systems

"Mars will come to fear my botany powers."

Mark Watney (Matt Damon), *The Martian*

Case studies: Threats to food security: Ongoing virus outbreaks in different parts of the world – WWJD [What Would (Steve) Jobs Do?]

"Listen to me Millhouse: We still have hunger; there is still heart disease! All these do-gooder scientists are a bunch of losers!! That's why this world depends on Schwarzeneggers, Stallones, and to a lesser extent on van Dammes and Jackie Chans!!!" Bart Simpson, *The Simpsons*

PTGS, RNAi, and silencing suppressors

pages 707-743

Gene silencing as defense

Virus suppressor as counter-defense

Suppressing the suppressor?

Leveling the playing field?



Next Generation Sequencing, Bioinformatics and Virus Discovery

"In the future there will be two types of jobs: people who tell computers what to do, and people who are told by computers what to do" Marc Andreessen, Silicon Valley VC. In: *Chaos Monkeys: Obscene Fortune and Random Failure in Silicon Valley*. Antonio Garcia Martinez.



Future of Plant Virology: Virus as your friend, Synthetic Biology, Viruses as production factories

"I don't care about the future. I think about the future of the future". Dr. Robert Doring, *Timeline*, Micheal Crichton.

CRISPR, genome editing, and Gene Drives

"Tell me what you drive; I will tell you who you are"
Dominic Toretto (Vin Diesel), *Fast and Furious*

Course evaluation: You will have an opportunity to provide your feedback anonymously both on-line and in paper format twice during the semester: half-way through and at the end of the semester - What worked, what did not work... The instructor "should have, could have, would have..."

"My optometrist said I have excellent hindsight but very poor foresight.

LensCrafters said they will have my glasses ready in about hour and half." Jay Leno

End of the semester party!!! At my house. Details will follow.

"I don't understand these alumni: Why do they keep coming back even after the way we treated them in the first place?"

Dr. Dick Solomon (John Lithgow), *'Third Rock from the Sun'*, NBC.

Recommended Additional Texts:

Wilson C.R. 2014. Applied Plant Virology. CABI

Hadidi, A, Khetarpal, RK, Koganezawa, H 1998. Plant Virus Disease Control. APS Press, St. Paul. 684 pp.

Lobenstein and Katis (eds). Control of Plant Virus Diseases, 2014. Advances in Virus Research. Vol. 90. 530 pp.

Internet Resources: will be provided as needed

Lisa: "Dad, Springfield is getting its first cyber café!"

Homer: "Oh yeah? That internet thing is still around?"

The Simpsons

Papers from primary literature and review articles:

Will be given out as needed.



Mike Luckovich, Atlanta Journal Constitution