

Detection of Infection: Viruses in Ornamental and Crop Plants.

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ABSTRACT:

Williston High School is a small school in a geographically large, rural county. We rely heavily on agriculture for our economic base and peanuts are large part of this. Being able to detect a potential virus that may harm this valuable crop would present itself to my students as a “good” reason to do this kind of investigation and link the relevance of science to real life. Plants grown in the lab and around campus will be used in investigations that support the various frameworks of biology throughout the year. The project will culminate as we do the unit on microbiology and pathogenic organisms. The mature plants will be used to test for the presence of Tomato Spotted Wilt Virus (TSWV). We expect there will be positive and negative results from our investigation because this virus is vectored by thrips and they are a common arthropod in subtropical climates.

MISSION STATEMENT:

Development of this unit of study and incorporation of the various lab activities will accomplish several objectives. Students will become interested in science and excited about the knowledge scientific investigation can give them. Students will also be made aware of the newest technologies in scientific investigation and gain an understanding of the emerging industries that utilize these technologies. Students will understand the link between pathogenic organisms and other living things.

DESCRIPTION of TEACHING UNIT:

As school begins, AP Biology classes will plant various species of ornamental and crop plants (including peanuts) in the lab as well as in the agriculture green house and garden plot. This will be a part of the unit taught at the beginning of the year on scientific investigation and best laboratory practices. (SC.912.N 1-11)

As the plants continue to grow, they will be cared for as one section of the on-going lab investigation. This will introduce the unit on living things and help emphasize the characteristics associated with plants. These plants will be used to discuss the processes of living things (ie photosynthesis, cellular respiration, transpiration and the hydrologic cycle). . (SC.912.L.14-7)

Plants will continue to receive care and this will evolve into the lesson on keeping a scientific notebook and good record keeping techniques. (SC.912.N.1-11) Enrichment activities from this information can be compiled and may include making charts and graphs indicating various plant types and growth variations and soils etc.

As the plants reach maturity they will then be incorporated into the unit on microorganisms and specifically pathogenic organisms.

Viruses will be examined and described as pathogenic organisms. The "life" cycle of viruses will be addressed and that will lead into a description of antigen-antibody interactions.

This lesson could be referenced also as the scope and sequence of the curriculum continues and the study of invertebrates is addressed, arthropods in particular. This could lead into a discussion of the ramifications of insect vectors in the human population as well as the plant population.

The lab using the *Agdia ImmunoStrip Test* will be done as leaves and roots are collected from the campus-wide sources. This particular test is simple and affordable and can be done without an elaborate lab set-up which is perfect for a lab in this rural school.

This project lends itself to being a stepping stone to introduce other lab procedures that require the knowledge of DNA and genetics and that will be incorporated into those units.

AP Biology students at Williston High School will:

- Understand the process of scientific investigation
- Understand the characteristics of living things
- Understand the molecular processes of living things
- Understand the life cycle of a virus
- Be able to perform, understand and explain the science that is the platform for the working of the *Agdia ImmunoStrip Test* to identify the Tomato Spotted Wilt Virus .
- Gain an understanding of the technology that is currently being used in laboratories and industry to provide answers to questions that are important to society as a whole.

#### PRINCIPAL INSTRUCTOR EXPERTISE

Mary Russ, the principal instructor, is a graduate of the University of Florida with a Bachelors degree in Biology. She has taught at Williston High School in Levy County for 34 years where she is the Chairman of the Science Department and a member of the Literacy Team and a Curriculum Facilitator. Her teaching assignments have included Biology, Marine Science I and II, Anatomy and Physiology, and Environmental Science. She has participated in many professional development opportunities that span the scope of Marine Science and coral reefs to water quality monitoring in Florida waters. She has worked in conjunction with the School Board of Levy County and Dr. Richard Wahrer to develop and implement summer, residential camps in the Cedar Key area on Marine Science and Limnology. She is a member of the 2009 ICORE program.

LITERATURE CITED

Goldberg, NP (2000). Tomato Spotted Wilt Virus. Retrieved June 25, 2009, from New Mexico State University Web site: <http://aces.nmsu.edu/pubs>

University of Florida. (2009). *Investigating Tomato Spotted Wilt Virus: Can We Stop It?* (1st ed.) [Brochure]. Gainesville, FL: Julie Bokor.

BUDGET:

3 sets of *Agdia ImmunoStrip Test* kits @ 105.00 each .....\* 315.00

This will provide 75 each of the following:

1. sample bag with extract buffer
2. ImmunoStrips

10 lab stations: 5 students per station

Allows testing for 6 plants per group or 3 different plants per group testing roots and leaves. Different lab groups could test different plants and information could be entered in a large data collection chart.

\* The difference between the grant allocation and the actual cost of the lab will be compensated for by grants from the Levy County Schools Foundation NICE grant awards and the Williston Woman's Club Classroom grants or possible funding will be from the science budget at Williston High School.

## ***Theme: Emerging Pathogens***

<b>Lesson Title</b>	<b>Presence of Vector Borne Pathogens in Ornamental and Crop Plants</b>
<b>Grade Span</b>	<b>10-12</b>
<b>Content Emphasis</b>	<b>Science: Biology</b>
<b>Targeted Benchmark(s)</b>	SC.912.L.14.2: SC.912.L.14.1; SC.912.L.14.3: SC.912.N.1.1: SC.912.I.14.6
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<b>Lesson Preparation</b>	
<p><u>Learning goals:</u>            Understand the process of the scientific investigation.             Understand the characteristics of macrophytes.             Understand the processes of living things.             Understand the life cycle of a virus.             Understand the transfer of pathogens by vectors.             Be able to perform, understand and explain the science that is the platform for the working of the <i>Agdia ImmunoStrip Test</i> to identify the Tomato Spotted Wilt Virus. (Antigen/antibody interactions).</p>	
<p><b><u>Estimated time:</u></b>            Series of lessons from September 14, 2009 through January of 2010.</p> <p><b><u>Materials/Resources:</u></b>            Peanut seeds (treated and untreated)            Tomato seeds            Zinnia seeds            Impatiens, tomato plants and other assorted plants.            Soil, water, miracle grow fertilizer.            Agdia ImmunoStrip Test strips.            Pots for planting.</p> <p><b><u>Teacher Preparation:</u></b>            Purchase the <i>Agdia ImmunoStrip Test Strips</i>            Locate and acquire peanut seeds.            Locate and acquire various, assorted ornamental plants            Locate and acquire tomato plants and seeds.            Secure garden plot, greenhouse space and prepare potted plant area in classroom.            Lessons on plant growth, viruses, antigen and antibodies.</p>	

### Lesson Procedure and Evaluation

#### **Introduction:**

We will begin the lesson with a KWL on plants and growth. I will steer the discussion toward plant diseases and insects.

Throughout the course of the first semester we will investigate the following topics and discuss them at length. Students will be tested on this knowledge.

As the information is covered we will relate this knowledge to the growth, development and subsequent infection of the plants (maybe). [Have arranged to procure plants that are positively infected with TSWV to illustrate a positive test.]

- Proper scientific method ( Each group will make their hypotheses based on the background information they are presented)
- Characteristics of living things.
- Plant growth
- Insects
- Viruses
- Virus life cycles
- Vector borne pathogens.
- Antibody – antigen interactions

As the plants grow and mature they will be monitored, measured and all data will be recorded.

As the plants mature they will be evaluated for presence of virus. Tests will be performed to test for the presence of TSWV by using the Agdia ImmunoTest Strips.

Students will be expected to keep a record book and record all data. They will be expected to write up their findings and make corrections, if needed, to their predictions and evaluate the outcome of the investigation.

#### **Application:**

Students will be able to understand that there are many ways pathogens can be transmitted.

Students will be able to understand that pathogens can infect plants as well as animals.

Students will be able to understand that the relationship between pathogen infections and their hosts are related to the interaction between antibodies and antigens.