Teacher Resource for:
Dosage Compensation via Transposable Element Mediated Rewiring of a Regulatory Network.

Using This Teacher Resource

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GENERAL USE OF Science in the Classroom

Student Learning Goals:
Current views of science education emphasize that “one fundamental goal for K-12 science education is a scientifically literate person who can understand the nature of scientific knowledge.” (From A Framework for K-12 Science Education, National Research Council, 2012).

The U.S. National Academy of Sciences defines science as: “Any new finding requires independent testing before it is accepted as scientific knowledge; a scientist is therefore required to honestly and openly report results so that they can readily be repeated, challenged, and built upon by other scientists. Proceeding in this way over centuries, the community effort that we call science has developed an increasingly accurate understanding of how the world works. To do so, it has had to reject all dogmatic claims based on authority, insisting instead that there be reproducible evidence for any scientific claim.”

A very important student learning goal, central to any understanding of “the nature of scientific knowledge,” is to give each student an appreciation of how science is done.

This includes knowing why:
- Scientists must be independent thinkers, who are free to dissent from what the majority believes.
- Science can deal only with issues for which testable evidence can be obtained.
- All scientific understandings are built on previous work
- It is to be expected that one scientist’s conclusions will sometimes contradict the conclusions of other scientists.
- Science is a never-ending venture, as the results from one study always lead to more questions to investigate.
Using This Resource

Learning Lens:

The Learning Lens tool can be found on the right sidebar of each resource and is the source of annotations. Clicking on any of the headings will result in corresponding text of the research article being highlighted. A second click on the highlighted text will produce a text box containing more information about that particular piece of text. Below is an example of the Glossary function of the Learning Lens in use.

An example of the resource with the Glossary, Previous Work, Author's Experiments, News and Policy Links, and References and Notes tools turned on. The Glossary tool is in use.
Learning Notes:

Learning Notes accompany each figure and are designed to help students deconstruct the methods and data analysis contained within each figure.

References:

The Reference section of each resource is annotated with a short statement about how or why each reference relates to the current research study.
Suggestions for Classroom Use:

Four alternative ways to use the SitC reading, questions, and activities:

1. Assign to small groups to complete during class.
2. Assign different sections of the article to small groups to complete during class. Use class presentations or jigsaw to teach the entire class what is in the article.
3. Assign to individual students to complete during class or as homework.
4. Assign as an extra credit project.

Interactive student engagement ideas for use after reading the article:

1. Have students write answers to discussion questions (for example, those linked to the standards or those linked to the diagrams).
2. Go over the abstract, as well as information about the purpose and structure of an abstract, and have students write their own abstracts for the articles in language that could be best understood by their peers.
3. Have students edit the current version of the article, or parts of the article, to a simpler reading level.
4. Have students, working alone or in small groups, use the annotated list of references to explain how the scientists who wrote this article built on the published work of at least one independent group of scientists in making their discoveries. In the process, did they produce data that supports the findings of the earlier publication that they have cited in the text? In what way does this article support the statement that scientific knowledge is built up as a "community effort"?
5. Use the article and discussion questions linked to the standards and the diagrams for a teacher-led classroom discussion. The discussion can focus on the nature of science and scientific research, as well as on the science in the article itself.
6. Have students give a classroom presentation about the article, parts of the article, or their answers to discussion questions.
ARTICLE-SPECIFIC MATERIALS

Student Learning Goals:

*Connections to the nature of science from the article*

- When conducting research, it is important to ask the same question in multiple different ways

*The importance of this scientific research*

- Enhances understanding of chromosomes and evolution

*The actual science involved*

The nature of previously overlooked transposable elements are genetically examined in the fruit fly.
**Connect to Learning Standards:**

*Next Generation Science Standards 8 Practices for Scientists and Engineers:*

http://www.nap.edu/openbook.php?record_id=13165&page=42

Practice 2: Developing and using models

Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

**AP Biology Enduring Understanding**


Enduring Understanding C.3: (page 69): The processing of genetic information is imperfect and is a source of genetic variation.

**Common Core English Language Arts Standards:**

RST.11-12.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.

http://www.corestandards.org/ELA-Literacy/RST/11-12/
Resources for Interactive Engagement:

Discussion Questions

Next Generation Science Standards 8 Practices for Scientists and Engineers:
Practice 2: Developing and using models

Does the model the authors built work like they had envisioned?

What can we learn from this model?

If this model works, what is the next step?

AP Biology Enduring Understanding
Enduring Understanding C.3: (page 69):
The processing of genetic information is imperfect and is a source of genetic variation.

How is genetic information changed in this study?

Common Core English Language Arts Standards:
RST.11-12.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.

A key term in this paper is “transposable elements.” What does this term mean in this paper? Why is it used?
Activities connecting to the data shown in the Article

The Activities are linked to in the red tool bar running along the bottom of the page. Activities linked to this particular resource contain raw data from the authors that the students will be able to work with directly.