Georgia Tech
College of Sciences

TiLT:
Transparency in Learning and Teaching

CoS TEAM Teaching Event

Georgia Tech
College of Sciences

TiLT Project Goals and Activities

- Advance equitable teaching and learning practices that reduce systemic inequities in higher education by:
  1. *Promoting students' conscious understanding of how they learn*
  2. Enabling faculty to gather, share and benefit from current data about students' learning by coordinating their efforts across disciplines, institutions and countries

https://www.tilthighered.com/

Transparent Teaching Methods

- Require effective written *and* oral communication
- Focus on the *how* and *why*
- Use common language – make sure students know what you mean
- Are explicit
- Include *how* what you want students to do will help them learn (connect to course outcomes)

Adapted from: Carruth, Laura (2024). TILT: *Using Transparent Methods to Promote Student Learning and Success*. [Workshop presentation]. CTL Workshop, Atlanta, GA

Georgia Tech
College of Sciences

Transparent Teaching Methods

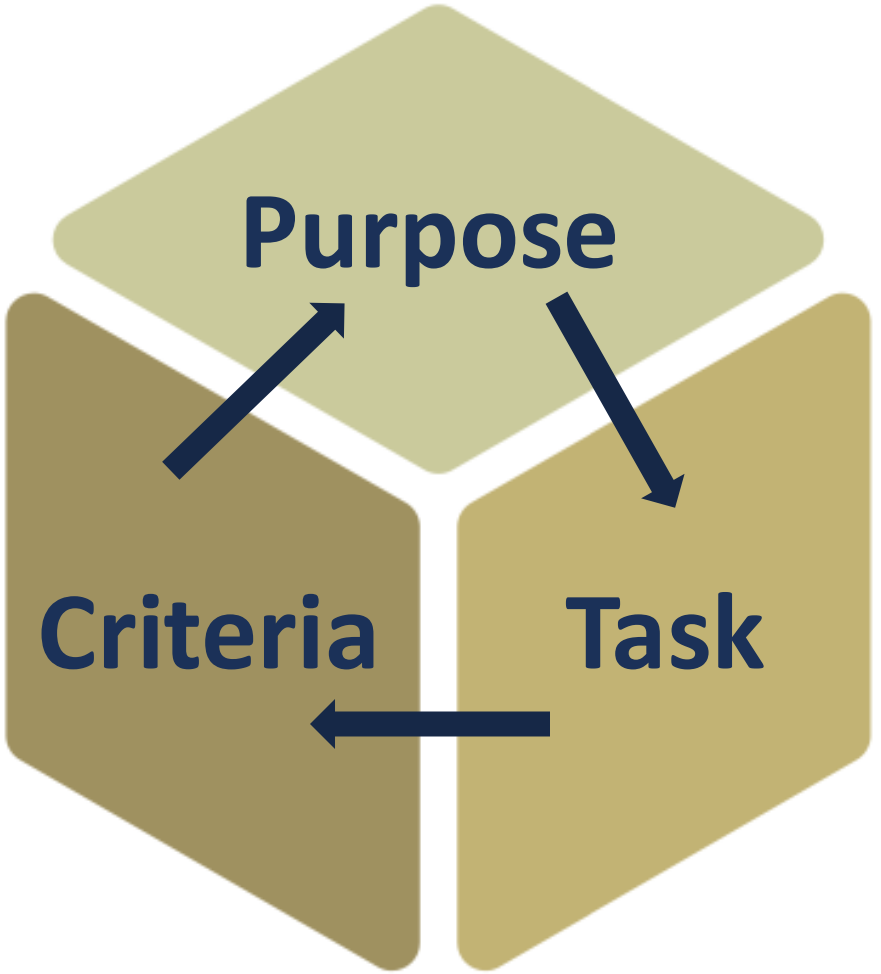
- Examples
  - Discuss assignments' learning goals and design rationale before students begin
  - Invite students to participate in class planning, agenda construction
  - Gauge understanding during class via peer work that requires application of concepts
  - Explicitly connect "how people learn" data with course activities when students struggle at difficult transition points
  - Engage students in applying the grading criteria that you'll use on their work
  - Debrief graded tests and assignments in class
  - Offer running commentary on class discussions to indicate what modes of thought or disciplinary methods are in use

https://www.tilthighered.com/transparent-methods

Georgia Tech
College of Sciences

Facets of TiLT

- Purpose
  - Relevance to students' lives
  - Connection to learning outcomes
- Task
  - Clearly define what to do and how to do it
- Criteria
  - Checklist or rubric
  - Examples of high- and low quality work



Example 1

- What is the purpose?
- What is the task?
- What is/are the criteria?

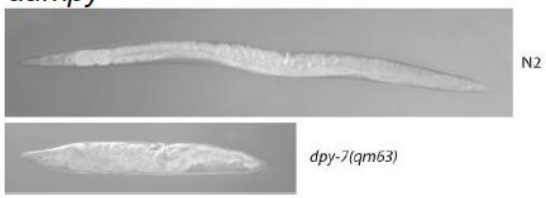
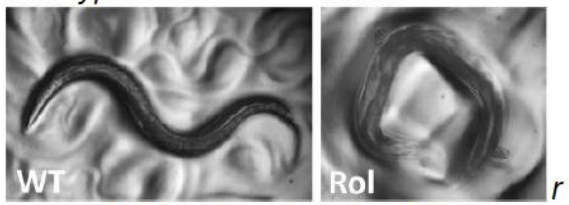
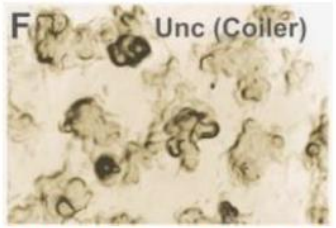
How could this assignment be made more transparent?

BIOL 111L
Used by permission of Kasey Christopher, Duquesne University

C. elegans Mutant Phenotypes Assignment
Name_____

For each mutant, complete the following:

1. How does this mutant differ from the wild type worms you've been observing?
2. Hypothesize: what developmental defect (molecular, structural, physiological) could underlie the phenotype? (It does not matter if you're correct as long as it's a plausible explanation!)
3. Find (& cite) a peer-reviewed study that explains the root cause of the phenotype.

dumpy  Page, A.P. and Johnstone, I.L. The cuticle (March 19, 2007), WormBook, ed. The C. elegans Research Community, WormBook, doi/10.1895/wormbook.1.138.1, http://www.wormbook.org.	*wild type* *roller*  Corsi A.K., Wightman B., and Chalfie M. A Transparent window into biology: A primer on Caenorhabditis elegans (June 18, 2015), WormBook, ed. The C. elegans Research Community, WormBook, doi/10.1895/wormbook.1.177.1, http://www.wormbook.org.
Uncoordinated  Félix, M.-A. Oscheius tipulae (August 16, 2006), WormBook, ed. The C. elegans Research Community, WormBook, doi/10.1895/wormbook.1.119.1, http://www.wormbook.org.	*bag of worms*  Kornfeld, K. (1997). Vulval development in Caenorhabditis elegans. Trends in Genetics 13, 55-61.

BIOL 111L
Revised C. elegans Mutant Phenotypes Assignment
Used by permission of Kasey Christopher, Duquesne University

Purpose:
The purpose of the exercise is twofold: first, to simulate the process developmental biologists go through in the laboratory when observing a novel mutant, and second, to help you think about downstream physiological effects of loss of function of various genes.

Skills:
This assignment will help you practice the following **skills**:
- Observing and describing a mutant phenotype as compared to wild-type organisms
- Formulating a hypothesis to explain a biological phenomenon
- Critical thinking and experimental interpretation
- Finding, citing, and summarizing research from a peer-reviewed scientific journal

Knowledge:
This assignment will help you gain the following **knowledge**:
- Familiarity with the appearance and physiology of the *C. elegans* nematode
- Understanding of the functional roles of a variety of organs and tissues of the *C. elegans* nematode
- Understanding of the links between embryonic development and adult phenotypes

Task: This exercise asks you to think about a series of *C. elegans* mutants. All of these mutants survive to adulthood, but display phenotypes that are based on underlying developmental defects. For each mutant, examine the images and watch the associated video (linked on Blackboard). Then, answer the following questions for each mutant:

1. Describe the phenotype of the mutant. How does it differ from wild type worms?
2. Hypothesize: How do you think this phenotype arises? (What process or structure might be defective in the mutant? What type of gene/protein function might be missing?) It does not matter if you're correct as long as it's a plausible explanation.
3. Find a peer-reviewed primary journal article that explains the true cause of the phenotype (see resources under Criteria for further information). Cite the paper, and describe what the root cause of this phenotype is. Some questions to consider: what is the normal function of the mutated gene? What happens when that gene is mutated? Why does the loss of function create the observed phenotype?

Criteria for Success: As scientists, we should strive for specificity and accuracy. As such, I encourage you to avoid vague descriptions or unclear hypotheses. Note that in the example given below, the student clearly describes the appearance of the worm's movements and how they contrast with wild type, rather than simply stating that it moves aberrantly. Furthermore, her hypothesis (though ultimately incorrect) provides a direct physiological mechanism by which the phenotype could arise. Finally, she identifies the actual underlying cause and cites the related peer-reviewed primary journal article. Note also the citation style used; this is the example you should follow in your own assignment.

Example 1 – TiLTed

TILT Higher Ed
Transparency in Learning and Teaching

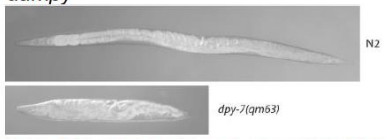
APPENDIX

Example answer for *unc-22* mutant (https://www.youtube.com/watch?v=o6g2ZAmCrlo):
1. Instead of normal sinusoidal movement, the *twitcher* mutant worm shows uncoordinated movements in which it constantly twitches its head back and forth.
2. I hypothesize that there is a defect in the nervous system of the *twitcher* worm, which doesn't allow it to properly control its muscle movements.
3. *unc-22* encodes a protein called twitchin, which is required for the normal function of muscle tissue in *C. elegans*. Twitchin interacts directly with the myosin motor protein and therefore is critical for contractile motions of the muscle. In the absence of twitchin (when the *unc-22* gene is mutated), muscle contraction is uncoordinated and therefore the animal twitches.

Source: Moerman, D.G., Benian, G.M, Barstead, R.J., Schriefer, L., Waterston, R.H. 1998. Identification and intracellular localization of the *unc-22* gene product of *Caenorhabditis elegans*. Genes Dev. 2:93-105.

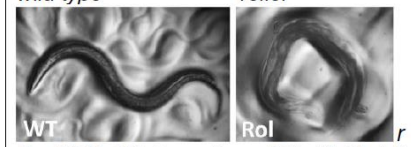
Mutants

dumpy



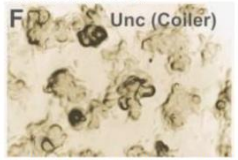
Page, A.P. and Johnstone, I.L. The cuticle (March 19, 2007), WormBook, ed. The C. elegans Research Community, WormBook, doi/10.1895/wormbook.1.138.1, http://www.wormbook.org.

wild type *roller*



Corsi A.K., Wightman B., and Chalfie M. A Transparent window into biology: A primer on Caenorhabditis elegans (June 18, 2015), WormBook, ed. The C. elegans Research Community, WormBook, doi/10.1895/wormbook.1.177.1, http://www.wormbook.org.

Uncoordinated



Félix, M.-A. Oscheius tipulae (August 16, 2006), WormBook, ed. The C. elegans Research Community, WormBook, doi/10.1895/wormbook.1.119.1, http://www.wormbook.org.

bag of worms

Kornfeld, K. (1997). Vulval development in Caenorhabditis elegans. Trends in Genetics 13, 55-61.

Read this scientific journal article. I do not expect you to understand it all - I don't understand all of a journal article the first time I read it, either! One point of this project is to see how much more you can understand each time you read.

As you read, keep in mind:

- The abstract is intended to give you a summary of the paper.
- Sections 2.2, 2.3, and 2.4 will mention lots of instrumentation you may not be familiar with - that's okay. You don't need to understand those techniques to do this reflection.
- Section 3 is very dense with lots of graphs. There is information here that should look familiar, though. Keep in mind that the point is not for you to understand this whole paper in one reading! Section 3.7 is a lot of detail on thermodynamics. Don't stress over this section.

As you read, reflect on these questions:

1. What chemical concepts discussed in the article can you relate to material we've studied in CHEM 1212K?
2. Which of the U.N. Sustainable Development Goals do you think the research discussed could help address?
3. The basic principles of the scientific method are consistent though some break it down into five primary steps while others separate parts of some steps to make an eight step cycle. Review the general premises of the scientific method from any source you like and consider what aspects you can identify in this journal article.

this journal article.

Example 2
CHEM 1212K

Your reflection paper should address the following:

1. Identify **one** chemical concept discussed in the article that you can relate to material we've studied in CHEM 1212K. Describe the concept and one application we examined in class and identify the specific portion of the article to which it appears. How is the concept being applied to the research?
2. Identify **one** of the U.N. Sustainable Development Goals that you think the research could help address? Identify the SDG by name and explain how the research relates.
3. Identify **one** aspect of the scientific method as it relates to the research. Be specific.

You are encouraged to talk to your classmates about the journal article and the reflection questions; however, you must submit your own reflection paper written in your own words. You may use resources, but you must make sure to cite them appropriately. The TurnItIn feature in Canvas is activated for this assignment, and you should be careful not to plagiarize the journal article, any resources you use, or classmates.

The reflection paper should be written in essay format (as opposed to bulleted or numbered responses) and conform to general grammatical guidelines. You will not be evaluated on writing, per se, but there is a component of the rubric that assesses whether you followed these formatting guidelines. There is no word count or page number minimum, and you will instead be evaluated on completeness of responses. However, I do not anticipate that this will require more than a standard page or so of writing (12-point, double spaced, etc.).

Be sure to review the rubric for this assignment before completing the reflection.

CHEM 1212K Literature and Sustainable Development Goals Project

Due Dates:

There are four parts to the assignment, each with its own due date:

- Part I – Friday, May 31st at 11:59pm
- Part II – Friday, June 21st at 11:59pm
- Part III – Friday, July 12th at 11:59pm
- Part IV – Friday, July 19th at 11:59pm

Purpose:

One of my goals in this course is to help you develop skills and mindsets that will help you succeed not only in CHEM 1212K but also in future science and engineering courses as well as your professional life beyond school. With this project, I:

- Provide the opportunity to demonstrate your ability to analyze, interpret, and criticize qualitative observations and quantitative measurements (Institute Learning Goal D).
- Introduce you to and strive to build your confidence in reading and comprehending peer-reviewed scientific literature.
- Hope to champion the Georgia Tech strategic focus area "Connect Globally." Specifically, I strive to highlight *global collaborative efforts that advance the U.N. Sustainable Development Goals.*

Skills

By completing all four parts of the assignment, students will have the opportunity to practice:

- *Connecting* the approaches and justifications for the research to the U.N. SDGs
- *Relating* CHEM 1212K content to water pollution and remediation as presented in an open-access, peer-reviewed journal article
- *Identifying* and *analyzing* the contributions of a diverse group of scientists
- *Analyzing* the application of the scientific method in peer-reviewed research
- *Comprehending* peer-reviewed scientific literature

Knowledge

By completing all four parts of the assignment, students will gain knowledge about:

- CHEM 1212K concepts ranging from laboratory techniques to kinetics, thermodynamics, oxidation-reduction processes, acid-base equilibria, and more
- How foundational chemistry concepts can be applied in solving real-world problems
- The 17 U.N. Sustainable Development Goals
- How scientific research is communicated to broader audiences

Task:

For the first three parts of the assignment (I suggest doing these in the order listed):

1. Review the 17 U.N. Sustainable Development Goals (see Task Note 1)
2. Review the pathway(s) of the scientific method in section 1.4 of *Interactive General Chemistry* (accessible via Achieve) or section 1.1 of the open-access chemistry textbook *OpenStax* (see Task Note 2)
3. Read this peer-reviewed research article from the journal *Water* (see Task Note 3)
4. Write a reflection paper devoting one or two paragraphs to each question (see Task Note 4):
    a. What is **one** chemical concept discussed in the article that you can relate to material we've studied in CHEM 1212K.
        i. Describe the concept and one application we examined in class and identify the specific portion of the article to which it appears.
        ii. How is the concept being applied to the research?
    b. What is **one** of the U.N. Sustainable Development Goals that you think the research could help address?
        i. Identify the SDG by name and number and explain how the research relates.
    c. What is **one** aspect of the scientific method that is evident in the paper?
        i. Be specific in this part. For example, rather than just writing that the paper includes a hypothesis, outline (in your own words) exactly what hypothesis the authors posed.

Criteria for Success:

The reflection paper should:

- Be written in essay format (as opposed to bulleted or numbered responses)
- Conform to general grammatical guidelines
    - You will not be evaluated on writing, per se, but there is a component of the rubric that assesses whether you followed these formatting guidelines.
- Cite all sources used (including the article itself if you quote from it or use figures or data) with in-text citations. This link explains how to do APA style in-text citations (two types). You may use any style (MLA, *etc.*) you like.
- Not be generated using AI programs such as ChatGPT
    - I am not opposed to the use of such programs and think they have great utility in some applications such as editing your writing. In this case, however, I am not assessing the quality of writing and want to focus on your original ideas. These two factors are the basis of this criterion.
- Contain complete responses to each question prompt
    - There is no word count or page number minimum, and you will instead be evaluated on completeness of responses.
    - I do not anticipate that this will require more than a standard page or so of writing (12-point, double spaced, etc.)
- Be written *after* reviewing the rubric for assessment and example assignment

Task Note 1:

1. Hover over each box and click on “More Information”
2. The infographic on the “Overview” tab is helpful
3. Also look at the “Targets and Indicators” for a better idea of what each goal entails

Task Note 2:

- Different resources label parts of the scientific method differently, and that’s okay. I am more concerned with the big picture than differences in labels or sub-parts.

Task Note 3:

- The abstract is intended to give you a summary of the paper.
- Sections 2.2, 2.3, and 2.4 will mention lots of instrumentation you may not be familiar with - that's okay. You don't need to understand those techniques to do this reflection.
- Section 3 is very dense with lots of graphs. T
    - There is information here that should look familiar, though. Keep in mind that the point is not for you to understand this whole paper in one reading!
    - Section 3.7 is a lot of detail on thermodynamics. Don't stress over this section.

Task Note 4:

- You are welcomed to discuss the article with your classmates; however, everyone must submit their own paper in their own writing.

Georgia Tech
College of Sciences

Tools For TiLTing

- Transparent Assignment Design Template for Teachers
- Checklist for Designing Transparent Assignments
- Bloom's Taxonomy Assignment Cues

https://www.tilthighered.com/transparent-methods