



TEACHING PRACTICES

Hard-to-Teach Biology Concepts, Revised 2nd Edition: Designing Instruction Aligned to the NGSS. By Susan Koba and Anne Tweed. 2014. NSTA Press. (ISBN 978-1-938946-48-6). 336 pp. Paperback. \$35.95 (discount-priced for NSTA members at \$28.76).

This could be the next new book in your professional development library. It may be lots of fun to explore professionally, particularly with a colleague or two. Imagine making a bigger difference, especially for students who arrive at your class with preconceptions and misconceptions, limited prior knowledge and limiting experiences, struggling to understand abstract content, diagrams, graphical and mathematical models, and preferring their explanations and ideas to science-based explanations and ideas. These students may make biology “hard-to-teach,” and “with the advent of state standards, adoption of NGSS, and high-stakes assessments, biology teachers are finding it difficult to teach in ways that worked for them in the past.”

The book begins with convincing rationales for using Koba and Tweed’s Instructional Planning Framework tool to build NGSS-aligned lessons to engage learners. In “Part I, The Toolbox: A Framework, Strategies and Connections,” the authors showcase the “how-to” of using the design process to implement their Framework: how to identify disciplinary core ideas (DCI), crosscutting concepts (CCC), and science and engineering practices (SEP); how to deconstruct the DCI into learning targets, storyline, and success criteria, including the nature of science; and how to get kids to think about their own thinking (metacognitive goals and strategies).

Using a “Proteins and Genes” unit from the first edition of the book, their insightful “implementation” chapter is full of instructional tools on metacognitive approaches, misconceptions, preconceptions, sense-making strategies, and demonstrating understanding. Here, this single book morphs into a phenomenal library of approaches, multiple strategies, and NGSS practices that makes their approach supportive of increased science literacy and making meaning through inquiry. Whether you’re a novice or veteran teacher, insight is provided for increased classroom effectiveness.

Pick and choose specific elements within the Framework or try the whole model for those hard-to-teach topics that have resulted in less-than-desired student outcomes in past years. Whatever approach, you will be aligning with the NGSS and making those conceptual shifts “from current practices to new ways of doing things.” Your students can be “learning through development of explanations based on reasoning and critical discussions” with your precise “focus on student outcomes.”

In “Part II, Toolbox Implementation: The Framework and Strategies in Practice,” there are four additional sample unit lessons written in an informative personal conversational style. You find the authors and contributors “thinking out loud” to you as they formulate their lesson(s). “A lesson is

actually a sequence of learning aligned to one of the learning targets (DCI, SEP, and CCC)” that may occur over a shorter or lengthier period of time.

Two of the four units really resonated with me: “Ecosystems: Interactions, Energy, and Dynamics: An Issue-Based Approach” and “The Role of Adaptation in Biological Evolution.” The former, about honeybee colony collapse disorder, a citizen science project, appeals to those both curious and concerned about the effect of pollinator loss on our food sources while the latter can “help a student understand the difference between a belief system and the nature of science.” There is also a model on “Matter and Energy in Organisms and Ecosystems” and one on “Variations of Traits.”

Exploring all five units provides an incremental depth of understanding of the Framework. Since each contributor has a different presentation style within the Framework, some units may present with more appeal. However, comprehensive exploration of the links associated with each resource makes this edition a journey to refreshing, creative, and effective distinction in your classroom.

On top of that, what is often covert practice is made overt. One clear example is being cognizant of “pruning” – identifying what not to include in a lesson. That is where the lament – this class is boring – can be intentionally avoided.

Koba and Tweed’s research-based model is focused on explaining phenomena, utilizing practices, applying knowledge, building coherent storylines, appreciating the connectedness of topics, valuing argumentation, reaching consensus, and having students taking responsibility for their own learning while working cooperatively with others. That kind of classroom is inspirational to construct.

You can apply their research and “shift” to supporting conceptual change as a process “where students access their own thinking, and as needed, alter their existing understanding to

generate scientific explanations for the science phenomena being studied.”

The authors sum up my understanding of ABT readership with this: “We are all in different places in the professional science-teaching continuum. Regardless of where we are there is always room to learn more and to enhance our instruction.”



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STEM CELLS

Inevitable Collision. By Tory Williams. 2015. Mary Ann Liebert, Inc. (ISBN 978-1-934854-38-9). 208 pp. Hardcover. \$21.95.

Inevitable Collision by Tory Williams outlines the true story of how a promising young man, “TJ,” suffers a spinal cord injury in an automobile accident and goes on to become the first patient clinically treated with a cell therapy derived from human embryonic stem cells. Moreover, TJ becomes an advocate for stem cell research and works toward raising awareness and funds to further his cause.

The book is suited to readers at the high school, undergraduate, and graduate levels, for both science majors and nonmajors. As the text provides numerous layers of complexity (outlined below) without an in-depth discussion of

the science, the instructor can choose to focus on one or several of the relevant topics broached. Some of the relevant discussion points include the following: What are stem cells? Where do stem cells come from? Are there different types of stem cells? Should stem cell research be funded? If so, what types of research merit funding? What are the ethical, legal, social, and political issues surrounding stem cell research? Are there economic benefits associated with stem cell research?

Human embryonic stem cells are of great interest because they can potentially form any cell type in the body – muscle, bone, nervous system cells, etc. But the tricky part is figuring out how to coax human embryonic stem cells to make the cell type of interest, without contamination with unwanted cell types. Of course, research and treatments with human embryonic stem cells can be controversial for moral and ethical reasons.

Regardless of whether or not one supports research with human embryonic stem cells, the book tells an important story regarding the impact of stem cells and stem cell research on developing clinical interventions to treat neurological injuries (and disease). The writer illustrates an important moment in medical history by cataloguing the events leading to the first clinical trial involving cells transplanted into humans that were produced from human embryonic stem cells. The reader gains insight into the difficult task of organizing and running a clinical trial and the unfathomable decisions patients face regarding whether they might have the opportunity or not to join the trial or, if given the option to join, whether they should join, not knowing whether the treatment will positively or negatively affect their health and future well-being.

The book has many layers of complexity, making it suitable for a wide range of audiences. As stated previously, the overarching theme is the story of TJ and his challenges and achievements as he adjusts to his spinal cord injury and subsequent new way of life. The book provides a behind-the-scenes look at the politics of funding research involving human embryonic stem cells and the business aspects of this emerging technology. There are high financial stakes surrounding stem cell research. For example, when the federal government refused to fund human embryonic stem cell research beyond existing cells lines (most or all of which were known to be inappropriate for clinical therapies), many states funded stem cell research through private investors (e.g., California, Connecticut, and Massachusetts). In turn, this financial infrastructure fueled the expansion of biotechnology companies and biotechnology jobs, resulting in an overall positive impact on

the economic growth for the participating states. The book highlights novel mechanisms to support research, including through for-profit and non-profit entities, via public or private funds, and by leveraging investments and creating unique collaborations (e.g., between the state of Alabama and researchers at the California Institute for Regenerative Medicine). The book provides a great example of how to accomplish your goals through the power of networking.

Intermingled with the main story line are the author’s personal anecdotes, which I found to be distracting from the main message. The author is, additionally, overly patronizing of research scientists, making them out to be superheroes rather than the regular people with intriguing talents that they (we) really are (scientists put their pants on one leg at a time too). A somewhat misguided view is presented that only those involved with the author’s research funding programs are truly committed researchers. This narrow view contributes to a major conflict between different funding agencies, research programs, and colleagues that, in the end, causes the severance of friendships and collaborative research efforts toward clinical therapies with stem cells. Indeed, the book illustrates how research is not always collaborative. Rather, research can create the perfect storm of jealousy and lead to the loss of money, friends, allies, and jobs.

In summary, this is a highly recommended book for a broad range of audiences. It tells many stories within the story, to educate the reader regarding the economic and health benefits of stem cell-based therapies, their application in regenerative medicine, and the social aspects of stem cell research. The book is sure to spark several fascinating discussions with varying viewpoints.



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