AAI Education Committee Highlight: Teaching Tools

In 2016, the AAI Education Committee initiated a new session focused on improving immunology education: the Immunology Teaching Interest Group (ITIG). The ITIG is an informal group comprised of past speakers and attendees of the ITIG sessions, including current immunology educators spanning a range of institutions and levels. It serves as a resource for novel teaching tools and practices that can be implemented in courses to enhance immunology education. The session has grown from an audience of 20 in 2016 to more than 100 participants in 2019 (the last time the session was held in person due to the cancellation of IMMUNOLOGY2020™). Because of the great interest in this topic, the AAI Newsletter *features "Teaching Tools" articles highlighting ITIG presentations.*

Avoiding the "Can't See the Forest for the Trees" Problem in Teaching Immunology

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Chatham University offers an elective immunology course, BIO419, for undergraduate biology majors and biomedical (MS and MA) graduate students. The average class has 40 students meeting twice a week without a lab. The first half of the course covers basic immunology, while the second half covers clinical immunology. The required textbook is Parham's *The Immune System (Fourth edition);* readings are supplemented with videos, class activities, and case studies.

Due to the complexity of vocabulary and molecular processes, students of immunology often lose "the forest for the trees" when studying how these details contribute to the dynamic, interrelated functions of the immune system. Research points to the necessity for learners, especially in STEM disciplines, to be able to sort through ideas and construct cohesive models of specific phenomena for authentic learning to occur.[1] For students to construct models, it is necessary for them to understand "big picture" events of immune responses. The methods that I have used to stimulate this type of learning have evolved over the 14 years that I have taught this course.

Overview

I have found great value in spending initial class meetings on an overview of immune responses. This mainly occurs through assigned book chapter readings, student self-reflection, and in-class discussion supplemented with open-access videos.

Define Critical Concepts with Images

"Critical concepts" are defined and tied to specific textbook figures and highlighted on the course management system. Students discuss critical concepts in groups and complete reinforcing activities. An example of a critical concept is the distinction between primary and secondary immune responses. The students graph antibody concentration data, identify the distinctions between the primary and secondary immune responses, and discuss the reasons for the differences. Students develop a "library" of critical concepts and can begin to link concepts together.

Analogies and Role Playing

Since immunology concepts are new to students, there is considerable benefit in providing memorable analogies for immunologic processes, like icing on a cake for opsonization. A final valuable tool that requires students to synthesize information is group role-playing. Groups of five to eight students develop an activity related to an assigned concept and use props that they develop to model key events. For example, T cell development has been role-

played by students dressed as double negative progenitors who interact with other students acting as cortical epithelial cells expressing either MHC Class I or Class II, and the students move to a different location in the classroom depending on the MHC with which they interact. CD4, CD8, and TCRs are represented by cardboard cutouts held by the students. Presenting groups also develop an engaging supplemental activity or game to reinforce concepts.

I have observed that students are more engaged when these approaches are used, compared to years when the course was taught solely by lecture, although the average course grades are not markedly different. While some activities seem overly simplistic, their benefit cannot be overstated since they form a bank of concepts that students can use to build more complex models of the immune response.

Reference

[1] Hallström, J., Schönborn, K.J. Models and Modelling for Authentic STEM Education: Reinforcing the Argument. *IJ STEM Ed* 6, 22 (2019). *https://doi.org/10.1186/s40594-019-0178-z*