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 200 participants today. Because of the great interest in this topic, the AAI Newsletter *features "Teaching Tools" articles highlighting ITIG presentations.*

Using Learning Management Systems to Help Students Apply Immunologic Concepts

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The application of immunological concepts is a major challenge for students. Many students memorize the details but fail to critically process the information into a comprehensive understanding of how the immune system works. This challenge may be even more true during a pandemic, when many students are learning remotely and are isolated from natural discussions and interactions with faculty and other students.

To address this concern, we developed a "test-based learning" approach to engage medical students and reinforce important concepts in our required Infectious Disease and Immunology course. We converted our interactive lecture-based cases that used Tophat responses to a case-based format using the quiz option in our learning management software (LMS). In our LMS, we uploaded individual patient presentations, each with five to six questions addressing lab result interpretation, identifying the immunological mechanism of the disease, and/or how treatments influence the immune response.

Before the pandemic, we had rooms with 52 students per faculty member, and they were broken up into groups of four who worked together. After the pandemic hit, students could work collaboratively through Microsoft Teams to help each other and/or reach out to faculty who were present on Teams to answer questions during a defined class period. This quiz-based approach to learning provides the opportunity for students to apply the information presented in lecture to clinical case-based questions either remotely in small groups or in person with a faculty member. This flexibility was critical to maintain our educational standards during the pandemic, which limited in-person learning.

We found that case-based learning in groups and/or individually provided many advantages for both students and faculty. For example, students must apply details that they learn from lecture, which tends to identify any misconceptions before exams. All of our exams are case based, in a format similar to board questions, so applying the fundamentals

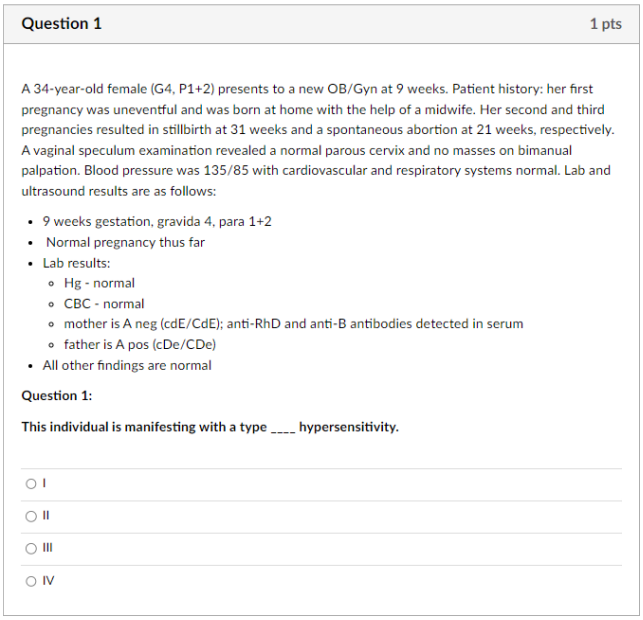
Hypersensitivity Cases

TABLE 18.3 The Characteristics of the Four Types of Hypersensitivity Reactions

Descriptive	Name	Cause	Time Course	Characteristic Cells Involved
Type I	Immediate hypersensitivity	Antibody (IgE) on sensitized cells' membranes binds antigen, causing degranulation	Seconds to minutes	Mast cells, basophils, and eosinophils
Type II	Cytotoxic hypersensitivity	Antibodies and complement lyse target cells	Minutes to hours	Red blood cells
Type III	Immune complex–mediated hypersensitivity	Nonphagocytized complexes of antibodies and antigens trigger mast cell degranulation	Several hours	Neutrophils
Type IV	Delayed hypersensitivity	T cells attack the body's cells	Several days	Activated T cells

GRADED - ONE PERSON PER GROUP IS ALLOWED TO ACCESS	UNGRADED - FOR VIEWING AND DISCUSSION PURPOSES ONLY
Hypersensitivity Case 1	Hypersensitivity Case 1 - Not Graded
Hypersensitivity Case 2	Hypersensitivity Case 2 - Not Graded
Hypersensitivity Case 3	Hypersensitivity Case 3 - Not Graded
Hypersensitivity Case 4	Hypersensitivity Case 4 - Not Graded
Hypersensitivity Case 5	Hypersensitivity Case 5 - Not Graded
Hypersensitivity Case 6	Hypersensitivity Case 6 - Not Graded

Web page containing a series of hypersensitivity case examples for students to study.



Question 1 1 pts

A 34-year-old female (G4, P1+2) presents to a new OB/Gyn at 9 weeks. Patient history: her first pregnancy was uneventful and was born at home with the help of a midwife. Her second and third pregnancies resulted in stillbirth at 31 weeks and a spontaneous abortion at 21 weeks, respectively. A vaginal speculum examination revealed a normal parous cervix and no masses on bimanual palpation. Blood pressure was 135/85 with cardiovascular and respiratory systems normal. Lab and ultrasound results are as follows:

- 9 weeks gestation, gravida 4, para 1+2
- Normal pregnancy thus far
- Lab results:
  - Hg - normal
  - CBC - normal
  - mother is A neg (cdE/CdE); anti-RhD and anti-B antibodies detected in serum
  - father is A pos (cDe/CDe)
- All other findings are normal

Question 1:

This individual is manifesting with a type ____ hypersensitivity.

- I
- II
- III
- IV

One question from the quiz based on hypersensivity cases.

of immunology to cases before the exams is helpful. Another advantage is that in a small group setting, students can learn among peers. These interactions not only increase student confidence, but also invoke an important sense of community. Additionally, this approach provides the opportunity for faculty to answer questions as they arise, which allows misconceptions to be corrected immediately. Finally, this format allows the faculty to quickly review student responses and identify areas of weakness among the class. If the majority of the students miss a question, the faculty can address this quickly in the next lecture to the entire class.

Another major advantage of this approach is its adaptability. Even though we have used quiz-based learning in the context of medical school education, this format can easily be modified for fundamental immunology teaching to undergraduates and/or graduate students. Also, this approach can be used as a graded assignment or as an ungraded "knowledge check" for students to assess their understanding of the material as they study. As mentioned above, this format is flexible in that it can be done independently or in groups. More importantly, in a pandemic, this format can be used in person or remotely. Lastly, this format is not specific to one LMS program, as we have used it with both CANVAS and BLACKBOARD LMS.

Our goal as immunology educators is to help students understand immunology rather than simply memorize cell types and CD numbers. The inclusion of these cases on our LMS has been extremely helpful for our students and faculty, both before and during the pandemic. If you would like additional information, please contact me at *mswans@midwestern.edu*.