Off the Beat

Metaphor in Immunology

Chemistry students are familiar with atoms that "like" to bond. Physics students encounter magnetic poles that "repel" or "attract." Science education (and science writing, for that matter) depends on metaphor to illustrate complicated concepts.

Even metaphor's critics find the practice inescapable. Susan Sontag, while claiming in *Illness as Metaphor* (Farrar, Straus and Giroux, 1978) that medical metaphors are dangerous to patient and researcher alike, introduces her essay by saying that "Illness is the night-side of life." Illness metaphors, she observes, act as a wall between sickness and reality. By making an illness into something it isn't, she says, metaphors mislead and are self-defeating.

The role of metaphor in science is well recognized and for the most part unquestioned by its perpetrators. In *The Structure of Scientific Revolutions* (University of Chicago, 1970), Thomas S. Kuhn notes, "Scientists work from models acquired through education and through subsequent exposure to the literature, often without quite knowing or needing to know what characteristics have given these models the status of community paradigms."

Immunologist Fred Karush of the University of Pennsylvania has questioned metaphor's role in his field, one of the more complicated disciplines of medicine. At a recent conference on the history of immunology, he said that metaphorical language has been the "primary vehicle" for explaining the basic concepts of immunology and in so doing has been both helpful and harmful.

Immunology, perhaps because of its complexity, lends itself to metaphors. And the bulk of the metaphors utilized in the popular press are military in nature: A foreign organism invades, perhaps camouflaged as something else. The body, if its advance warning system detects the enemy, puts up a line of defense. Antibodies attack. A lot of killing goes on. Researchers look for magic bullets or guided missiles. The metaphors make it sound as though we each provide a battleground for our own internal Star Wars.

Immunologists themselves employ metaphors, though, says Karush, "immunologists are more peacefully inclined." There are such "metaphorical fossils" as the lock-and-key analogy used to illustrate the specificity of the interaction between antibodies and antigens. Other metaphors popular among immunologists imbue immune system components with the ability to think, recognize and act — tolerance, surveillance, foreigness, helper T cells, rejection. Karush counts as many as three or four dozen. "It may . . . be argued," he says, "that the only way we can name and characterize a new phenomenon or idea is by reference to concepts with which we are already familiar, that is, by the use of analogy and metaphor."

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But on the other hand, he says, metaphors can limit thinking. In his ambivalence about the role of metaphors, Karush sides with both Aristotle and George Eliot. He cites Aristotle's observation: "The greatest thing by far is to be a master of metaphor. It is the one thing that cannot be learned from others. It is the mark of genius." But he notes George Eliot's question to the philosopher, in her novel *Mill on the Floss*: If Aristotle had lived in modern times, she asks, would he not have lamented "that intelligence so rarely shows itself in speech without metaphor — that we can so seldom declare what a thing is, except by saying it is something else?"

Take killer T cells. "The killer T cell creates a picture of shooting or bombing, and people begin to use it as though that is the reality. It makes it more difficult to describe the process," says Karush. Killer T cells are not actually out there committing murder — what actually happens is that the cells secrete chemicals that burst nearby cells.

Avidity, says Karush, illustrates both sides of the issue. When the word was originally introduced in 1903, it represented the reaction between blood sera and toxins — sera differed in their "avidness," or ability to bind, to the toxins. The key actor was later found to be antibodies in the sera that reacted with the toxins.

The term was, over the years, measured by different chemical means, making comparisons of avidity impossible. It became essentially useless until 1951, when Niels K. Jerne of the Basel Institute in Switzerland made a point of using it in connection with a specific chemical test measuring the strength of binding between a toxin and an antibody. But recidivism has taken hold, Karush observes — once again avidity has slipped back into service as a term broadly applied, indicating that binding is taking place but not quantifying the degree or strength of the binding.

Metaphor does have its role, he says. For example, Jerne's Nobel Prize-winning network hypothesis "has provided an expanded theoretical framework that has given direction to much of the current activity in cellular immunology," Karush says. According to the hypothesis, a network of reactions occurs in an immune response. Following the production of antibodies to a foreign organism, antibodies to those antibodies are made.

Several research groups have used the hypothesis to develop anti-idiotype vaccines, a new approach to vaccination. A foreign object such as a virus or tumor cell, which may cause problems if injected into the body, is administered to an animal that produces antibodies to it. These antibodies are essentially a mold of the original object; antibodies to the mold look something like the object itself, and these anti-idiotypes can be used for immunization rather than the initial virus or tumor cell (SN: 7/26/86, p.58, 4/12/86, p.231, 4/6/85, p.213).

"The difference between being a victim of metaphor and using it is whether you go beyond it in experimental analysis," Karush says. A metaphor can be a general organizing principle for an otherwise-unwieldy scheme. Take away metaphor from science teaching or reporting and you're left with mostly dry data. Then again, take away certain metaphors such as avidity from science research and researchers might think more precisely.

—*J. Silberner*