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The Science and Ethics of Animal Models in Biomedical and Behavioral Research: Justified Suffering or the Emperor’s New Paradigm


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Ever since the Animal Welfare Act (AWA) was amended in 1985 to require that a committee of scientists, veterinarians, and unaffiliated and community members review and approve animal research proposals prior to their implementation, I have been a member of an Institutional Animal Care and Use Committee (IACUC). The vast majority of the more than 1,000 proposals that I have reviewed during that time have involved the use of some sort of animal “model”—that is, the researchers proposed to study some significant human biomedical health issue by focusing upon aspects of animal physiology or psychology. It was assumed by each researcher that the characteristic was sufficiently similar to the human situation that study would reveal something unknown and applicable to the understanding or treatment of the problem.

The proposed experiments have ranged from studying the effects of infection by a bacterium or parasite, melanoma, treatment of head trauma, and neurological mechanisms of memory, to the purported production of childhood schizophrenia in young rats. The justifications for animal use and the validity of the models are typically written with an air of confidence and surety, and have a recognizable form that goes as follows: (1) In 1859, Darwin published the tome establishing human–animal physiological continuity; (2) In 1865, the physiologist and father of experimental medicine, Claude Bernard, asserted the usefulness of that continuity.

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for studying ills of the body, and the success of this position is now self-evident; (3) In 1985, the renowned behavioral scientist Neal Miller extended the argument of usefulness to pathologies of the mind and behavior; and (4) In 1986, the philosopher Carl Cohen claimed, in sweeping prose, that the animal research enterprise was on firm ethical ground, and that researchers should, in fact, increase their use of animals. Cohen asserted that notions such as animal rights and animal inherent value were absurd or silly and that the benefits of animal research for human health were enormous when set against the animal costs.

What is an IACUC member supposed to do in the face of this parade of assurances? We can certainly agree that on this seemingly rock-solid foundation, important discoveries have been made and sometimes missed, research careers have succeeded and failed, tens of thousands of graduate degrees have been conferred, a billion-dollar animal research support industry has emerged, and countless animals have been cared for, intellectually challenged, consumed, observed, infected, dissected, deprived, injured, and killed, sometimes suffering in great pain.

These two very important volumes assert that this four-step justificatory mantra will no longer do. LaFollette and Shanks focus on the broad field of biomedicine, and Shapiro’s steady gaze is leveled on research in the field of psychology. Both volumes tell us that a great deal has been happening that has gone unnoticed by much of the research community as they have learned and recited this four-part mantra.

ANIMAL MODELS IN BIOMEDICAL RESEARCH

The Kuhnian Paradigm

Some of the developments presented in these books are not that new. As LaFollette and Shanks, philosophers at East Tennessee State University, point out, the physicist and philosopher of science Thomas Kuhn sent up one of the first warnings. In his seminal work *The Structure of Scientific Revolutions*, Kuhn challenged the positivistic conception of science as a steady incremental process that reliably produced facts “corresponding” to the reality of nature. Instead, Kuhn revealed the existence of “paradigms” that guide and direct research and are judged on the basis of “coherence” of the data produced. He suggested that the paradigms created research puzzles that were meant to be solved by accepted procedures in a process called “normal” science. He showed that for the sake of the preservation of the paradigm, anomalous research findings were often ignored and discarded. LaFollette and Shanks argue that the patterns of useful and useless animal experiments must be faced and not ignored. The moral costs are too high to let them recede into the category of mere anomaly. Instead, these disparities show that the simplistic concept of continuity implied by 19th century evolutionary theory and Claude
Bernard’s confidence in the ubiquity of disease processes cannot withstand the findings of modern evolutionary theory.

The Logic of Models

As previously suggested, the usefulness of an animal model is frequently expressed in rather glib and indefinite ways. LaFollette and Shanks unpack the notion of the model using a careful logical analysis. They show, for example, that the common claim by researchers that a given animal model is likely to be of great help in understanding a particular biomedical process in a human (i.e., a “strong model”) is a serious claim requiring demanding levels of support and not just an armchair declaration. For example, it must be shown not only that the properties of the animal model assumed to be involved in causing a particular phenomenon must also be present in the subject of the model, there also must not be serious interference from disanalogies. The authors identify three sources of disanalogy: intrinsic, systemic, and intervention. Intrinsic disanalogies refer to the situation where evolution leaves the biological components of the animal and human structurally different. For example, rats do not have gall bladders. In the case of systemic disanalogy, the structural components of a physiological system are equivalent, but the way the parts interact with one another is different. Finally, intervention disanalogy refers to the differences in the condition under study that are produced by the experimental situation itself. For example, in the rodent model of head injury, the skull of the rat typically is opened, exposing the brain directly to the source of injury. This is quite different from the way a head injury would occur in a human in the real world. In the face of these requirements, few animal models deserve the confidence engendered by the paradigm.

Importantly, LaFollette and Shanks subject to careful scrutiny the work of Carl Cohen, who in 1986 wrote an article in *The New England Journal of Medicine* entitled “The Case for the Use of Animals in Biomedical Research.” That article is seen by some as the sine qua non of ethical justification. The analysis by LaFollette and Shanks will deprive those scientists who have based their justification on Cohen’s analysis of some of the arrogant certainty that his arguments seemed to provide.

ANIMAL MODELS IN PSYCHOLOGICAL RESEARCH

As a Diplomate in clinical psychology, an animal research ethicist, and Executive Director of Psychologists for the Ethical Treatment of Animals, Shapiro is well-suited to examine the issues concerning animal models of human psychopathology. His is an important analysis for both historical and current reasons. From the historical perspective, Peter Singer’s *Animal Liberation* specifically identified animal research in psychology as particularly trivial and cruel. In addition, psychology
is one of the most preferred university majors, as well as attracting thousands upon thousands of nonmajors to its curriculum. Therefore, many students are exposed to the findings and methods of psychological research every semester.

Like LaFollette and Shanks, Shapiro scrutinizes the various meanings of the concept of an animal model. He shows that models can be heuristic even if they contain many causal disanalogies. In other words, a model may enter into and facilitate the overall process of a scientist conceptualizing or coming to understand a psychological disorder. However, Shapiro’s review finds that heuristic models rarely serve that purpose. Instead, they often become the focus of research themselves, where myriad minor parametric variations are manipulated but add little or nothing to the understanding of the process originally being modeled.

Creating Criteria

Specifically, Shapiro looks at the animal models developed to study the eating disorders of anorexia and bulimia. These were chosen because they focus on unquestionably important pathological conditions, and the models have not been the target of previous controversies. His profound analysis shows that modelers interested in these conditions often begin by creating simplistic criteria of these complicated conditions. For example, Shapiro states that “any condition, mechanism, or intervention that enhances/reduces food intake is a model/treatment of obesity and bulimia, and inversely for anorexia” (p. 119). With this move, the social, cultural, and personal complexity of these conditions is compacted into a simple algorithm amenable to an endless number of animal experiments.

At one point, Shapiro presents a clinical narrative of a “typical” bulimic patient as that person would be encountered in the consulting room. The patient’s history, predicament, and concerns are presented with clinical sophistication and sensitivity. This picture remains in the mind of the reader as the animal model of sham eating is presented. Here a surgically implanted device extracts the ingesta from a rat’s stomach before it is absorbed in an attempt to model the “eating without calories” feature of bulimic patients. We are reminded that rats cannot vomit. The contrast is stunning.

To his credit, Shapiro does not end his analysis with these images. He is after more than a rhetorical victory. Instead, Shapiro describes a study in which he located a sample of clinicians who identified themselves as eating disorder specialists and directly asked them about the impact on their practice of the existing animal models. The questions were designed carefully and the results are enlightening. Suffice it to say that the majority of clinicians were either unaware of the models or unaffected by the concepts derived from them. Shapiro presents additional data that reflect on the actual use of concepts derived from animal models for the understanding and treatment of human psychopathology. Behavioral scientist Neal Miller’s influential claim is dealt a clear blow that lands squarely above the waist.
CONCLUSION

As an IACUC member, I am given direction by these books. For example, perhaps, as implied by LaFollette and Shanks, the justificatory mantra could be taken off automatic action by asking investigators to enumerate and weigh the impact of the disanalogies of their model. Similarly, the inclusion of a Shapiro-type invasiveness scale is a procedural and ethical must. More challenging is the reconsideration of the ethical model of decision making that Shapiro presents. Crudely applied utilitarianism has led to considerable abuse. There are new directions suggested in these excellent books. For those concerned students and researchers who explore them, these books will repay the effort of reading many times over.