

Letters to the Editor

Population Growth Curves

Dr. Madhu N. Mahadeva's article, "The Relationship of Human Behavior to Population Growth Curves" (*ABT* 43:3) should be considered "must" reading. At a time when evidence from many disciplines points to an impending crisis, clear statements comparing our present with appropriate future values can help us locate and weigh paths to potential futures. I hope that Mahadeva will expand on his ideas for a larger audience—including our representatives in Washington.

Projections of the future are often filled with gloom. The path I see—and it is reflected in the post-inflation-era values of the article—is a very hopeful and attractive one if we can, as a world community, turn from the now-destructive values we have cherished, including the exaggerated materialism characteristic of both capitalism and communism at present. If it is true, as I think it is, that within limits set by physical laws and human potential, reality follows ideas, rather than the opposite, Mahadeva's emphasis on values transformation can contribute significantly to efforts to develop a sane, viable culture.

I am sorry to see one flaw in this fine and thought-provoking article, the very frequent one of implying that matter circumvents the entropy law as it assumes characteristics of living. In reference to this, I would like to call your readers' attention to an excellent book, Jeremy Rifkin's *Entropy, A New World Order*.

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Mahadeva Responds

I very much appreciate Dr. Freeman's commendatory remarks on my article and his calling attention to Jeremy Rifkin's excellent book, published last year. (Had the book been available before my article was written, I certainly would have referred to it in the article, for it is so relevant.) I also agree with the view that living matter is not an exception to the Second Law of Thermodynamics. In fact, I should have said, "It appears that nonliving matter attained the trick of homeostasis and became living matter, giving the illusion of circumventing the Second Law of Thermodynamics."

Mayer and Berra on Evolution

In a Letter to the Editor (*ABT* 43:4), William V. Mayer commented on an article by Tim M. Berra that described the work of Charles Darwin (*ABT* 42:8). I would like to extend Mayer's comments. Darwin gave us two major theories—the kinematic "theory of descent with modification" (DM) and the dynamic "theory of natural selection" (NS). As with all theories, each of these theories is structured around a set of ideas, the postulates of the theory. (See Lewis 1980 for lists of these postulates taken from the *Origin of Species*.) Darwin's greatness lay in bringing together the right sets of ideas and then, as noted by Berra, following out their logical consequences in thousands of directions.

In this century, the theory of natural selection has undergone modifications derived from gene theory

and population genetics (see Lewis 1980 for postulates), but natural selection remains as the major concept in this theory. All three theories are very active today in guiding research in biology. The modern form of NS, the synthetic theory (SYN), does not destroy its parent theory rather SYN operates in those places where variations can be related to specific genes.

The "theory of evolution" is a misnomer. Really, evolution is a system of the three major theories and hundreds of subtheories (Caplan 1978, Tuomi and Haukioja 1979, and Lewis 1980) with each of the many theories having its own postulates. Taxonomic and phylogenetic theories are usually subtheories of DM. The theory of sexual selection is the best known subtheory of NS. And mimicry theories that embody specific genes are subtheories of SYN.

Any teacher who gives her/his students the postulates of the three major theories and the postulates of the subtheories s/he teaches will find that the teaching of evolution is easier, and learning by the student is faster. The facts fall into an orderly and logical array around the postulates. Some of the kinds of questions that can be asked about each theory are given in a paper on the teaching of DM (Lewis, Drum, and Fitch 1977).

Once one has the postulates of DM, NS, and SYN at hand, and then compares them with the postulates of the creationists' so-called theories

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an important point can be made that bacteria can enter through the natural stomatal openings. Inoculate all leaflets of one or two leaves.

4. Using the same procedure, inoculate control plants with distilled water only.

5. Use a wooden pot marker to record the date, treatment, and student initials, and return to the growing area.

Third Week:

1. Examine the newly inoculated plants for symptoms of tomato speck. Compare these symptoms with the original plants. Compare inoculated leaves with those not inoculated.

2. Discuss how Koch's Postulates have been demonstrated (and what remains to be done to satisfy the fourth requirement.)

Variations on the Basic Exercise

The steps outlined above can be broadened slightly to produce a more systematic approach to the demonstration. Leaves from a healthy plant could also be sampled

for the presence of the pathogen and a "blank" or control sample carried through. Healthy plants could be inoculated with non-pathogenic bacteria or with contaminants from the agar plates (although we have experienced surprisingly infrequent contamination).

The most obvious addition to the exercise is to re-isolate the pathogen from the newly infected tomato and compare it with the initial isolate, thereby satisfying the fourth postulate.

I have found, however, that the more basic steps detailed above are of sufficient length to adequately demonstrate the principles in question within a reasonable framework of time.

Conclusion

Working with tomatoes infected with *Pseudomonas tomato*, I have provided a laboratory exercise which can easily and in a reasonable period of time demonstrate the workings of Koch's Postulates. The exercise also provides an opportunity to practice aseptic techniques used in microbiological laboratories.

I would be happy to provide a bacterial culture to anyone who would like to try the procedure.

Acknowledgment—I would like to express my sincere appreciation to Dr. Randall C. Rowe, Associate Professor of Plant Pathology at the Ohio Agricultural Research and Development Center, for suggesting tomato speck as an appropriate disease for this exercise, for providing the original pathogen, and for his review of this paper.

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or "models," one sees immediately why creationism cannot be part of science. The fundamental postulate of all creationists' "models" is a supernatural creative force. For more than 300 years, scientists have agreed that assumptions about the supernatural were not admissible as scientific postulates. All the postulates of the three major theories in evolution are assumptions about nature. The attempts to bring the supernatural back into science stem from a failure to understand the limited realm of science, and to sense vast realms of human experience outside of science. The proper teach-

ing of science as systems of theories—hypothetico-deductive systems—could help remove some of this failure.

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