activities. The scientific establishment, educators, and legal action groups, in turn, have become better organized for explaining the difference between science and non-science in school curricula.

More subtly, according to Larson, judges have responded to popular opinion in finding anti-evolution and creation-science statutes repugnant to "the modern mind." Judges have shown deference toward greater public acceptance of the methods and social meanings of science in the United States. In so doing, it might be added, they have acknowledged a vital connection between scientific inquiry and the civic and social purposes of education in a democratic society. They have protected that connection against groups demanding a similar legitimacy for their own preferred systems of belief. In the political calculus that underlies "public science," the principle of majority rule has shifted the balance of power in controlling school curricula since the 1920's. Several strands of historical change help to explain this shift, notably demographic movements, political realignments, and higher levels of scientific education in the populace. Creationists, for their part, have shown an awareness of the shift as they have attempted to present traditional doctrines in scientific garb and, as a minority, to claim that without "equal time" their rights are being infringed upon, an argument that so far the courts have rejected.

What the author finds most interesting, and describes well, is the resourcefulness of the proponents on both sides as they have countered each other's strategies repeatedly in legislative chambers and courts of law. Since the contention is not likely to cease, this book merits attention for its many insights into the dilemmas of science education in a democratic society.

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The Character of Science

Changing Order. Replication and Induction in Scientific Practice. H. M. COLLINS. Sage, Beverly Hills, Calif., 1985. viii, 187 pp. $25; paper, $12.50.

The most difficult task of the scientist is to suspend judgment about what is true and what is not. This is precisely the task Harry Collins asks us to attempt in reading his important little book. The request is not made lightly. Public trust in science can only be maintained, Collins argues, if the public knows that facts do not speak for themselves, that disagreement among scientific experts is inevitable, that science is a human activity. In order to see the human character of science, we need to view the institution as though we were outsiders. *Changing Order* attempts to give us the necessary perspective.

Unfortunately, one must start this adventure with a heavy dose of philosophy. Fortunately, Collins's sense of humor makes the dose tolerable. He has us contemplate Wittgenstein's views of rules by playing a game called "Awkward Student." A joke about an Indian elephant illustrates the central questions of artificial intelligence. We approach the problem of replication as mice who have commissioned the Earth as a computer. The message is heavy, but the reading is just light enough to get most of us through to chapter 3. Once there, we are likely to stay the course.

Chapters 3, 4, and 5 report case studies that forcefully illustrate Collins's central points. They are rich in the details of scientific practice and make good reading. The dramatic saga of a TEA laser (transversely excited atmospheric-pressure CO_2 laser) calls into question the common picture of nature as "orderly and cooperatively passive," yielding truth in response to experiment. Instead, the case shows, the production of facts is the only available indicator of when an experiment has worked. Collins draws the conclusion that knowledge is not produced algorithmically.

The lack of independent criteria for "successful" experimentation results in what Collins calls "experimenter's regress." The criterion for successful procedure is fact, and the criterion for fact is successful procedure. "Experimental work can only be used as a test [of the validity of a knowledge claim] if some way is found to break into the circle," Collins writes, and illustrates the point with the controversy over gravitational radiation. The specific criterion that breaks into the circle will vary from case to case, but the development of consensus around the successful criterion is always a social process, not a mere exercise in logic. The third case, experiments in the paranormal, again shows "why and how the test of replication fails to work efficiently in disputed areas" (the only areas, Collins claims, where replication is ever used as a test).

The cases establish the plausibility of Collins's general claims, which are presented in chapter 5. A postscript spells out their implications for the politics of science. The algorithmic model of science encourages the view that method alone produces scientific knowledge. A mantle of infallibility becomes the basis for public trust and support for science. This view, Collins argues, is dangerous, since every instance of public disagreement over "the scientific facts" erodes the aura of infallibility. As an alternative, Collins proposes the enculturational model, the model the book explicates and illustrates. In this view, the locus of knowledge is not method but the community of expert practitioners. Scientists are seen as the best available consultants on a variety of matters rather than as infallible authorities.

The first model allows the citizen only two responses to science: awe or rejection. The second allows for a different kind of respect and forces the public to recognize the lack of purely technical solutions to political, moral, and technological decisions. The latter view is thus safer, according to Collins. To ask too much of science is to risk a widespread disillusionment our times can ill afford.

The argument is worth considering. *Changing Order* presents the case for the enculturational model as effectively as other, longer and less concrete, volumes that share its viewpoint. For both reasons, the book is worth the effort of thought experiment it requires.

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Surface Science

Many-Body Phenomena at Surfaces. DAVID LANGRETH and HARRY SUHL, Eds. Academic Press, Orlando, Fla., 1984. xiv, 578 pp., illus. $39.50. From a workshop, Santa Barbara, Calif., July 1983.

The quest to understand the many-body problem has long been a driving force in physics. This problem refers not to the racy possibilities one might imagine but to phenomena associated with the behavior of many interacting particles; for example, the book under review is concerned with the behavior of electrons and ions in solids. Although we have precise knowledge of the elementary Coulomb force between any pair of particles, the behavior of many particles is complex, often exhibiting novel behavior in the limit of large numbers. This is particularly so for the ultra-slippery