born children but not to speak to them in order to see whether they would speak their parents' language or some older language such as Hebrew or Greek. "But he labored in vain; for the children could not live without clappings of the hands, and gestures, and gladness of countenance, and blandishments" (*1*, p. 113). Thus we see an early example of serendipity and Frederick must be credited with the discovery of the importance of tender loving care in the rearing of children almost seven centuries before its alleged discovery. Herodotus reported a similar experiment performed by the pharaoh Psammetichus, with vastly different results. The children grew up speaking Phrygian (*2*). (It is unlikely that Frederick ever read Herodotus.)

Dante placed the godless Frederick in Hell, but he also praised his ability as a poet.

RICHARD E. JUDAY
Department of Chemistry,
University of Montana, Missoula

References

1. G. G. Coulton, *Medieval Panorama* (Meridian, New York, 1938), p. 447.
2. Herodotus, *The Histories*, A. de Selincourt, Transl. (Penguin, Baltimore, Md., 1954), p. 103.

Just to put the record straight—and to give credit to two long-dead but gallant youths—the cover picture on the 27 September issue is not that of Frederick II of Hohenstaufen and his son Conrad. Instead it is a picture of Conrad the Young, or Conradin, Frederick's grandson, with his friend and boon companion, Frederick of Baden. In the Manesse Manuscript, over the picture, is the legend "King Conrad the Young." Conradin, born 2 years after the death of Frederick, was the last legitimate heir of the Hohenstaufens, and perished grievously at the age of 16, along with Frederick of Baden, at the order of Charles of Anjou (*1*). In the painting, Conradin is flying a gyrfalcon, the falcon reserved for royalty. Frederick of Baden, on the left, is serving as squire.

Still, it is excellent that you have called attention to that fascinating imperial scientist, Frederick II of Hohenstaufen, and to the royal sport of falconry, which itself has many elements of interest to the behavioral scientist. The falcon presents an intriguing problem in behavior modification, one with which falconers have struggled for at least two millennia. Generally speaking, birds, like other animals from completely undomesticated species, are far more satisfactorily trained if they can be acquired early, preferably in infancy. This is extremely difficult with all hawks, which, as far as I know, never breed in captivity. Thus, the hawk, as a fledgling, must be snatched from the nest, and falcons' nests are generally built in inaccessible places. Even if one captures the fledgling, one must still devise a method of rearing which will keep the animal domesticated, but at the same time develop its strength and predatory skills. Two such goals are normally incompatible, in a wide-ranging animal like a hawk. The more satisfactory method is generally considered to be that of capturing a young adult bird. The problem then is that the falconer must deal with an extremely "wild" hawk, very difficult to tame.

Obviously, the first goal in training a falcon, whether by Oriental, English, or Continental methods, is to get the hawk to return to the falconer after it has seized its prey. Most falconers have used a twofold method. First they begin training by producing a stage of marked dependency in the falcon—either by stimulus reduction, such as the Persian use of "seeling" (sewing together the eyelids of the falcon), or—according to the commoner English practice—by a sort of shock treatment in which the animal is continuously exposed to stimulation for 60 hours or more, and kept in the dark for extended periods, a kind of brainwashing. Frederick was clearly influenced by the Persians, as expected from his general interest in the Orient (*2*). The English practice is as hard on the falconer as on the falcon, since he must sit up with the hawk and stimulate it constantly to prevent its falling asleep. Latham, the 17th-century English authority, describes in detail the other part of the method. This is the use of positive reinforcement. The falconer is informed that as soon as he begins to train the hawk he must talk to her and feed her from the hand so that hand and voice become associated with feeding. Thus, soon, the falcon so trained will be "better pleased both with them (the prey) and with yourself, loving your voice and you the better for their sakes." Latham explicitly recognized the primacy of food as a reinforcement when he says that it is food only "that guides her and rules her; it is curb and bridle that holds and keeps her in subjection to man" (*3*).

There is a growing group of falconers in America today, such as the members of the American Falconry Association, who find their best guides for behavior-shaping are still the treatises of Latham, of Frederick of Hohenstaufen, or of the Persian royal authority on falconry, Taymur Mirza, who, like Frederick, wrote in the 13th century (*4*).

SUSAN W. GRAY
Department of Psychology,
George Peabody College for Teachers,
Nashville, Tennessee 37203

References

1. T. Carlyle, *Frederick the Great* (Clarendon Press, Oxford, London, 1916).
2. Frederick II of Hohenstaufen, *The Art of Falconry*, C. A. Wood and F. M. Fyfe, Trans. and Eds. (Stanford Univ. Press, Stanford, Calif., 1943).
3. S. Latham, *Faulconry, or the Faulcon's Lure and Cure* (Thomas Rooks, London, 1658).
4. T. Mirza, *The Baz-Nama-Yi-Nasiri: A Persian Treatise on Falconry*, D. C. Phillott, Transl. (Bernard Quaritch, London, 1908).

Galileo's Insight: A Modern Guide

The Catholic Church's announcement of Galileo's probable rehabilitation and Father Ernan McMullin's comments ("Galileo: The case may be reexamined," 2 Aug., p. 449) ought to be considered with Pope Paul's more recent banning of artificial birth control. Galileo's name does not require rehabilitation. His *Dialogue* and other Copernican works were removed from the *Index of Prohibited Books* in 1822 when the College of Cardinals declared it permissible to teach Copernican theory in Catholic countries (*1*). By recanting and fulfilling his sentence Galileo rehabilitated himself in the eyes of the Church (*2*). Father McMullin praised him for theological concepts that Pope Paul VI seemingly chose to ignore when he considered the problem of birth control.

An abridged version of Galileo's sentence is in Wolf (*1*). The sentence is of a type that can be canceled by the Bishop without any legal proceeding according to the *Malleus Maleficarum*, a manual of procedure widely used in 17th-century ecclesiastical and secular trials of heretics (*2*). It is possible that the College of Cardinals may have rehabilitated Galileo when they permitted his theories to be taught in 1822.

Acceptance of Galileo's theological ideas is more important today than correcting the record of his trial because they touch on current problems. I find them useful in discussing evolution with

fundamentalist students. Galileo showed that truly scientific concepts could not be heretical. He said:

> We bring new discoveries not to confuse minds, but to enlighten them, not to destroy science, but to put it on a sound foundation . . . The Bible speaks as the people of the time looked upon matters . . . In science man must begin not with the authority of the Bible, but with observations and proof. . . . The Bible cannot be at variance with the facts because God cannot contradict himself. It were risking the authority of the Bible, if when once facts are proved, the Bible were not interpreted to fit all these facts, rather than that man should go counter to the facts and proofs of nature (*3*).

In other words this is God's world. Fully applied I believe this doctrine would do much to resolve the conflicts between theology and science.

Pope Leo XIII used these principles in 1893. But Pope Paul VI does not mention them among the guidelines he would recommend to those who oppose his ban on artificial birth control. If the Pope were to consider the question of birth control in this light he might, in Father McMullin's words, "clarify points of faith and confusion" that seem to be splitting the Catholic world.

Catholic institutions would more easily gain the confidence of non-Catholic scholars if they were to follow the example of one Jesuit university, Xavier, at Cagayan de Oro, Philippines, which has put the names of Galileo and Copernicus with others in gold letters high on its new science building. There can be no doubt that Galileo is honored there for the sake of the ideas he was compelled to recant.

HOWARD MCCULLY
4 Hermosa Place,
Menlo Park, California 94025

References

1. A. Wolf, *A History of Science, Technology, and Philosophy in the 16th and 17th Centuries* (Harper, New York, 1959), vol. 1, p. 35.
2. H. Kramer and J. Sprenger, *Malleus Maleficarum*, M. Summers, Transl. (Associated Booksellers, Bridgeport, Conn., 1951).
3. M. Ornstein, *The Role of Scientific Societies in the Seventeenth Century* (Univ. of Chicago Press, Chicago, 1938), pp. 3 and 28.

Australia: Too Many Ph.D.'s

Singer's editorial, "Matching education to jobs in developing nations" (7 June, p. 1067), is directly relevant to a situation that has developed in Australia. An unawareness of the need to match the training of physical scientists to the job opportunities available in this country has led to a glut of doctoral graduates—a glut attested to by the number of Australian Ph.D.'s who continue to live in the United States for longer periods than they originally intended (*1*).

A decade ago Australian universities could not fill all their staff vacancies in the physical sciences, and the student working toward a higher degree had little doubt that he would obtain a research and teaching appointment when he graduated. Today the picture is totally different. The excellence and international standing of our universities attract a large number of foreign scientists to permanent positions here. Meanwhile the Australian graduate (who follows the traditional pattern of spending his early postdoctoral years outside Australia) is frequently unsuccessful when he returns home and attempts to get a job. Australian industry employs very few doctoral graduates and neither government-sponsored research organizations nor the colleges of technology can accommodate all those who are seeking employment. Thus it is not surprising, in view of the restricted opportunities, that the expatriate considers himself stranded overseas with little chance of returning to Australia.

An opinion frequently expressed by university teachers is that their responsibility lies in giving the student the best possible training. In the Australian context this generally means training him for basic research. At the same time, sometimes, he develops a distaste for applied science. Many of us working in universities welcome graduate students to assist our research. It speeds our own productivity, but it also means that more and more new Ph.D.'s, qualified in areas irrelevant to the nation's needs, find themselves seeking specialized jobs which are already scarce.

Undoubtedly Australian industry must find a place within its structure for basic research, but there is a necessity also for "coordination between academic curricula and economic development" (to quote Singer), fostered by the desire of the universities to engage in work that is important to the national economy. We may then have some relevance between supply and demand.

RODNEY L. S. WILLIX
11 Milson Street,
South Perth, Western Australia

Reference

1. I. D. Rae, *Proc. Roy. Aust. Chem. Inst.* **35**, 201 (1968).