

from or entering into a joint venture with ESRC might seem to have two other alternatives. The first would be to use existing government-operated facilities. By the early 1980's, there will be at least four synchrotron radiation centers in operation in the United States with x-ray capability. The second alternative would be, especially for a large concern, to build its own storage ring; the cost is not that outrageous.

Hecht argues that neither alternative is

a viable one. In the first case, existing government policy has seemed to discourage proprietary research (see box), and in any event it is hard to see how a secure, production environment could be maintained at a public facility. In the second case, storage ring technology is exotic, to say the least, and the number of people in the world who can build one is limited; ESRC expects to employ a sizable fraction of those who can.

Actually, there is a third alternative:

not to use synchrotron radiation at all. A quick survey of researchers active in just one potential application, x-ray lithography, found none who would unequivocally say yes or no to the question: Is it cheaper to use synchrotron radiation? Hecht, Schwartz, Winick, and their associates are betting that the coming years will reveal the development of a compelling need to use the wonder radiation and that their company will be the beneficiary.—ARTHUR L. ROBINSON

### *Speaking of Science*

## **The Fatted Calf (II): The Concrete Truth About Beef**

Cattle raising often seems to be more art than science. Serendipity provides as many improvements in cattle-fattening techniques as does applied scientific research. A case in point is the recent discovery that the addition of cement kiln dust to cattle feed decreases the amount of feed required by the animals and improves the quality of their meat. Meanwhile, continuing tests on another serendipitous discovery, a plastic vaginal insert, have confirmed that it has much the same effect.

The effect of the dust was first observed more than a year ago by three Georgia cattle ranchers. They were liming their pastures with dust from a cement kiln and, on impulse, dumped some of the dust into their cattle feed. The cattle ate the feed readily and gained more weight than expected. The astonished ranchers reported their observations to William E. Wheeler and Robert R. Oltjen of the U.S. Department of Agriculture's Beltsville Agricultural Research Center. Wheeler and Oltjen were skeptical, but they obtained 14 steers and fed half of them a diet containing 3.5 percent cement kiln dust. To the investigators' surprise, after the animals had been fed the dust diet for 112 days, they gained 28 percent more weight than animals fed a control diet; they also consumed 21 percent less feed. Analyses showed that the extra weight was all meat and that the animals were apparently quite healthy. Their meat was also of a higher quality than that of the controls.

Wheeler and Oltjen observed much the same phenomenon with a second group of 32 steers. Similar results were also obtained in a study with 60 lambs. Even laboratory rats showed a 23 percent increase in weight when fed a diet containing 1 percent cement kiln dust.

The dust itself is a complex, calcium-rich mixture of minerals that is entrained when hot air is pulled out of the cement kiln; it does not contain the alkalis and hardeners necessary for cement to set. About 30 percent of its effect, Wheeler says, results from a simple buffering action in the gastrointestinal tract. The other 70 percent, he speculates, might arise because the dust contains some element that has not yet been recognized to be an essential nutrient for cattle. Another possibility is that the intense heat of the kiln causes the minerals in the dust to behave in some manner that is beneficial to the cattle. Still another possibility is that the small size of the particles allows them to be absorbed from the gastrointestinal tract more easily than conventional mineral supplements.

The vaginal insert, known as the Hei-Gro device, has

been tested in more than 250,000 head of cattle since its introduction some 2 years ago (*Science*, 6 February 1976, p. 453). Users have consistently found that the device produces a 13 to 22 percent faster growth rate among foraging heifers and a 5 to 10 percent faster rate in feedlots. The net effect is a \$15 to \$20 reduction in the cost of feeding each heifer, according to Wade Dickinson, president of Agrophysics Inc., the device's manufacturer. Studies have shown, he says, that the effects of the device are primarily hormonal. The device is not strictly a contraceptive, but it suppresses estrus and minimizes sexual activity. In the absence of sexual agitation, the heifers grow faster and use less feed.

While testing the device, Dickinson and his colleagues made a second interesting discovery. Both steers and heifers gain weight more quickly if males and females are kept sufficiently far apart so that they cannot smell each other—a distance of at least 15 meters. This fact appears to have been grasped intuitively by some cattle ranchers, but there seems to be no written description of this practice. Dickinson first noticed the effect when erratic results were obtained in some feedlot tests. Close examination showed that when heifers fitted with the device were upwind of steers, their weight gain was greater than that of similarly fitted heifers that were downwind. Erratic results were also obtained when heifers fitted with the device shared a pasture with steers. Similar but somewhat smaller effects were observed for heifers that were not fitted with the device. It appears that pheromones from the steers cause estrus in the heifers to be expressed more intensely, and the resulting sexual agitation causes them to require more feed. This stimulation negates the effect of the device.

In many feedlots the sexes are already separated, so this discovery will probably not have a great impact. An increasing number of ranchers and feedlot operators use the Hei-Gro device because it substantially increases the profit on heifers. It would not be greatly surprising, moreover, if some cement kiln dust is already finding its way into cattle feed. Some 30 million kilograms of dust are collected daily at cement kilns in the United States; so it is readily available. According to a spokesman for the Food and Drug Administration, there are no laws restricting its use in cattle feed, although the ranchers could face legal action if dust residues appeared in meat. A rapid explanation of the phenomenon should thus prove beneficial to both ranchers and consumers.—THOMAS H. MAUGH II