LETTERS

Uranium Enrichment

The decision to shut down the Oak Ridge Gaseous Diffusion Enrichment Plant and the Portsmouth Gas Centrifuge Enrichment Plant (News and Comment, 21 June, p. 1407) is a sign of an era gone by. The Oak Ridge plant was initially built for weapons materials and production and subsequently for civilian nuclear power reactor fuel. Light water power reactors use only slightly enriched uranium-235 (3 percent) and, therefore, require less capacity for separative work. Gas centrifuge separation requires less energy than gaseous diffusion, and it has also been terminated. I am therefore surprised that a decision has been made to go ahead with the development and deployment of laser isotope enrichment, which is an advanced and expensive technology. This is especially so when one considers that it was originally conceived to extract 0.2 percent U-235 from the depleted tailings of the gaseous diffusion plant and for separating plutonium-239 from its higher isotopes.

The whole idea of expanding enrichment for civilian power reactor fuel is misguided. If we do not have a method of converting the U-238 (or thorium-232) to fissile Pu-239 (or U-233), then in several decades of the growth of nuclear power we will have burned up the recoverable natural fissile U-235 in the world, and we will no longer have an economical source of nuclear fuel. The so-called "enrichment" plants are essentially "depletion" plants. It takes 6 tons of natural uranium resource to produce 1 ton of 3 percent U-235 enriched fuel for the light water reactors. The remaining 5 tons are thrown away as waste or are stored for possible future conversion. It has been well recognized that we have to "breed" fissile fuel from the fertile natural uranium or thorium ores. However, the liquid metal fast breeder has proved not to breed very fast, and since last year, with the demise of the Clinch River Breeder Reactor, we essentially have had no breeder demonstration program.

There is, however, a worthwhile method of producing fissile fuel from fertile material, one that was used at the dawn of the nuclear age by E. O. Lawrence and G. T. Seaborg and involves the use of spallation neutrons. In the modern version, a proton linear accelerator (linac) is used to produce protons at energies in the range of 1 to 2 gigaelectron volts, and the protons are made to impinge on a heavy metal target, such as uranium or thorium, thus creating a cascade of spallation neutrons. The neutrons are then absorbed in uranium and thorium in another region of the target, which results in fissile Pu-239 or U-233. The entire target assembly is subcritical. With this system (called the spallator or accelerator breeder), spent fuel elements can be enriched in fissile material for burning in conventional light water and gas cooled reactors. This is a true enriching device and not a means of extracting and depleting natural fissile U-235, as is isotope separation. Nine light water reactors (1000 megawatts electric) can be supplied with nuclear fuel by means of one 600 megawatt beam linac spallator (*1*). Some development is needed, but the essential technology is available to construct such a facility. More attention should be paid to this positive fuel-producing technique.

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Morphological Correlations

"Digestive adaptations for fueling the cost of endothermy" by William H. Karasov and Jared M. Diamond (Reports, 12 Apr., p. 202) and "Geometrical differences among homologous neurons in mammals" by Dale Purves and Jeff W. Lichtman (Research Article, 19 Apr., p. 298) recall prior morphological correlations (*1*) summarized by Munro (*2*).

In mammals basal metabolic rates per unit of body weight decrease with growth and with increases of adult size among species. The liver and the gastrointestinal tract occupy decreasing portions of total mass. The regression exponent relating basal energy metabolism to body weight, $W^{0.73}$, approximates the exponent for the weight of the small intestine. Endothermic demands are more intense in small animals with greater surface area relative to volume. Caloric and protein intake per unit of body weight also declines with increasing body size. By attributing the higher rates of food processing and greater intestinal surface area of mammals (compared with reptiles of similar size) to exigencies of endothermy, Karasov and Diamond add evolutionary significance to these observations.

Whereas basal energy requirements and protein turnover are five times greater (relative to body weight) in the rat than in man, skeletal muscle, heart, and blood constitute relatively constant proportions of body weight. The findings of Purves and Lichtman, that weight and dendritic complexity of the neurons that make up the cervical sympathetic ganglia progress with animal size, may imply that this component of the nervous system developed in closer relation to circulation and locomotion than to alimentary function.

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References

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2. H. N. Munro, in *Mammalian Protein Metabolism*, H. N. Munro, Ed. (Academic Press, New York, 1969), pp. 150–183.

A Glimpse of the Future?

Martha E. Williams (Articles, 26 Apr., p. 445) gives a welcome overview of the growing importance of electronic library-type databases, which allow virtually anyone in any location or field of work to stay informed.

Along with the increasing use of remote access online databases is an equally important trend—the building of asynchronous communication networks that allow people with similar interests to communicate, free of the constraints of time and space. This is made possible through computer teleconferencing, a technology that facilitates much of the discussion and information exchange that would normally take place in face-to-face meetings without the usual travel costs or scheduling inconveniences.

Computer teleconferencing for the first time allows great numbers of people to participate in meaningful dialogues. For example, I foresee a time when selecting letters for publication in *Science* will no longer be necessary. Those who wish to respond to an article will be able to join an ongoing conference, ask questions, contribute their own ideas, or possibly refer authors to others who have been doing related work. Our workplaces and meeting places will be wherever we connect our computers to the phone line. Our thoughts and actions, moreover, will be affected not only by the vast electronic libraries at our keyboard tips but by the ever-changing ideas of those with whom we network.

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