

fact, studies demonstrating that the morphological and biomechanical properties of tissues are unaffected by the freeze-thaw process contradict this hypothesis (2).

Comparisons between freezing and vitrification are often misleading, whereas either technique can fail spectacularly or succeed brilliantly, depending on the exact protocol used for preservation. Protocol development involves the adjustment of a multitude of process parameters, and the optimal processing requirements are tissue-specific. As reported by Kaiser, researchers at Organ Recovery Systems have achieved an important milestone in successfully vitrifying rabbit veins. However, their claim that "vitrification works better than freezing" is based on the relative performances of a fine-tuned vitrification protocol and an unoptimized freezing protocol (3), an inappropriate comparison.

For large organs, heat and mass transfer limitations become a significant obstacle to vitrification, which requires high cryoprotectant concentrations and rapid rates of temperature change. In contrast, freezing techniques use relatively dilute cryoprotectant solutions and low cooling rates. Moreover, the preservation process is assisted by ice formation: Ice sequesters water molecules, causing a gradual and relatively uniform concentration of cryoprotectants, even in large specimens. Paradoxically, when tissue is frozen, its biological components are actually vitrified in an amorphous matrix that envelops the crystals.

The behavior of tissue during freezing is more complex than during vitrification, and optimization of freezing procedures may therefore be more challenging. Nonetheless, optimization of freezing protocols for cells has benefited greatly from the development of mathematical models of the process. Recent efforts to model tissue freezing may thus ultimately improve our ability to optimize freezing procedures for organs (4).

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Antiaging Technology and Pseudoscience

CONSTANCE HOLDEN ACCURATELY DESCRIBES the range of opinions in the field of aging research concerning the possible efficacy of future life-extension technologies and

the lack of any antiaging medicines today (Bodybuilding: The Bionic Human, "The quest to reverse time's toll," 8 Feb., p. 1032). However, it is crucial to be aware that the term "antiaging" means different things to different people and that in spite of its misuse by some, the term can be and has been used by reputable scientists conducting research designed to understand and eventually modify the rate of aging (1). There are thousands of legitimate scientific publications devoted to the study of aging, and we enthusiastically support such research, as successful efforts to delay the onset of age-related chronic diseases and frailty have the potential to yield

"We want to make sure that the public is aware of both the scientific and the nonscientific use of the term 'antiaging medicine.'"

dramatic improvements in the health of older persons. This legitimate effort must be clearly distinguished from the antiaging quackery that has made its way into the contemporary lay literature. For example, two so-called scientific "journals" (*Journal of Longevity* and *The International Journal of Anti-Aging Medicine*) that appear on the surface to be traditional refereed publications are in fact little more than advertisements for a pseudoscientific antiaging industry. By contrast, the similarly titled *Journal of Anti-Aging Medicine* is a refereed scientific journal. We want to make sure that the public is aware of both the scientific and the nonscientific use of the term "antiaging medicine."

Those currently selling what they term "antiaging medicines" are promoting the use of products that may in some cases diminish the risk of certain diseases but that have not been shown even modestly to reduce the acceleration of mortality with age in the general population and that in some instances may be harmful (2). This misuse of the term "antiaging medicine" has led many scientists (including some of the undersigned) to shy away from using the term at all, for fear of guilt by association. The term "longevity science and medicine" was recently introduced by a group of scientists now working in the field (3), but the fear remains that this term will be coopted by the pseudoscientific antiaging industry as well. As such, we urge the scientific and lay population to be sure that they understand that there are currently no scientifically

proven antiaging medicines, but that legitimate and important scientific efforts are under way to develop them.

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Nasal Reconstruction in Ancient India

THE SPECIAL ISSUE ON THE BIONIC HUMAN (8 Feb.) was fascinating. However, the timeline ("Historical highlights in bionics and related medicine," p. 996) contained one error, dating nasal reconstruction with tissue flaps to 1597 A.D.

In ancient India, nasal amputation was a common form of punishment for adulterers, creating a broad need for nasal reconstruction. In a remarkably detailed and rational book written at the time of Vedic medicine, perhaps 1000 B.C., the Sushruta Samhita, nasal reconstruction using tissue flaps either obtained from the face or forearm is described (1). The first use of a mechanical tissue stapler is also described, intestinal injuries being repaired with the heads of black ants.

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URRs and Nobel Prizes

KENNETH ROGERS DESCRIBES THE ROLE OF university research reactors (URRs) and the current funding difficulties they are experiencing (Policy Forum, "The past and future of university research reactors," 22 March, p.

2217). In explaining contributions URRs have made to fields beyond nuclear science and engineering, he states, "The 1994 Nobel Prizes in physics were awarded to two individuals for work carried out at URRs." The 1994 Nobel Prize in Physics was shared by Bertram Brockhouse and Clifford Shull for their pioneering role in the development of neutron spectroscopy and diffraction. This research was done at the National Research Experimental (NRX) and National Research Universal (NRU) reactors at the Chalk River Nuclear Laboratories and the Graphite Reactor at Oak Ridge National Laboratory, respectively. Brockhouse and Shull subsequently took up faculty appointments at universi-

ties operating URRs (McMaster University and MIT, respectively); however, it was their earlier groundbreaking studies in Chalk River and Oak Ridge that were the basis for the Nobel Prize. Further details regarding the contributions made by Brockhouse and Shull and the facilities they used, as well as some autobiographical information, may be found on the excellent Nobel Prize Web site (www.nobel.se/physics/laureates/1994/index.html).

The Department of Energy user facility currently under construction, to which Rogers refers in the final paragraph, is the Spallation Neutron Source ("National" having been dropped when the project was approved in 1998).

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Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 6 months or issues of general interest. They can be submitted by e-mail (science_letters@aaas.org), the Web (www.letter2science.org), or regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.

Response

THE SENTENCE THAT MASON QUOTES WAS intended to illustrate the high scientific caliber (Nobel laureates) and the general area (physics) of the work carried out over the major portions of their scientific careers by several users of URRs. Shull and

Brockhouse were awarded the Nobel Prize approximately 10 years after their retirements. Although the research that they did earlier in their careers at government laboratory reactors undoubtedly influenced the work that they and many others carried out at URRs, their Nobel Prize was awarded after they had spent 31 and 22 years, respectively, at universities with URRs.

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CORRECTIONS AND CLARIFICATIONS

NEWS OF THE WEEK: "Early cowboys herded cattle in Africa" by Erik Stokstad (12 April, p. 236). The zebu was domesticated 7500 to 8000 years ago, not 6000 years ago, as stated in the article.

NEWS OF THE WEEK: "Money, mission, management top Zerhouni's Agenda" by J. Kaiser (5 April, p. 24). The article mischaracterizes the request by President Bush for a specific amount of money for cancer research. Such a request is not unprecedented, although past budget requests have not been embedded in proposed bill language.

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