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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References

1. B. Rubinsky *et al.*, *Cryobiology* **27**, 85 (1990).
2. S .P. Arnoczky *et al.*, *J. Orthopaed. Res.* **6**, 1 (1988).
3. Y. C. Song *et al.*, *Nature Biotechnol.* **18**, 296 (2000).
4. D. Irimia, J. O. M. Karlsson, *Biophys. J.*, in press.

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 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."

"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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References

1. A short list of examples can be found at www.src.uchicago.edu/~gavr1/antiaging-publications.html.
2. General Accounting Office, Anti-aging products pose potential for physical and economic harm, Special Committee on Aging, GAO-01-1129, September 2001 (http://aging.senate.gov/hr73gao.pdf).
3. Workshop Report: Is There an Anti-aging Medicine?, International Longevity Center, Canyon Ranch Series, New York, 2001 (www.ilcusa.org/_lib/pdf/pr20011101.pdf).

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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References

1. P. S. Sankaran, *Sushruta's Contribution to Surgery* (Indological Book House, Varanasi, India, 1976).

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.