Muscle-Powered Mechanical Blood Pumps

THE EVOLUTION OF MECHANICAL BLOOD pumps has been every bit as tortuous as McCarthy and Smith suggest in their Viewpoint "Mechanical Circulatory Support—a Long and Winding Road" (Bodybuilding: The Bionic Human, 8 Feb., p. 998), and there will certainly be plenty of twists and turns in the road ahead. With rapid advances in the field of tissue engineering and the shift in emphasis toward miniature axial-flow pumps, current technology portends the emergence of several new species of assist devices, but which variety will come to dominate remains a matter of speculation. McCarthy and Smith contend that "[t]he future most likely includes two scenarios: small, magnetically suspended blood pumps that are completely implanted and powered through transcutaneous energy sources; and the 'synergistic' combination of these pumps with new biological therapies." However, there is also a third scenario: namely, the use of biomechanical blood pumps powered by electrically stimulated skeletal muscle.

Although transplantation techniques aimed at harnessing muscle power for cardiac assist have now been largely abandoned because of mechanical inefficiencies and problems with ischemia, lessons learned from these disappointing trials have recently spawned a promising new approach. Rather than repositioning the latissimus dorsi (LD) to pump blood directly, methods are now being devised to use this powerful muscle to better advantage as an endogenous power source by preserving its blood supply and natural anatomic motion. Indeed, studies have shown that "trained" LD left in situ can generate work at levels comparable to the heart's main pumping chamber without fatigue and may therefore be used—at least in principle—to power a mechanical blood pump (*1*, *2*). To this end, an implantable device designed to tap this perpetual wellspring of biological energy is currently being developed under the auspices of the National Institutes of Health (*3*) and is already undergoing animal implant trials.

Fueled by the same metabolic processes that drive the heart itself, muscle-powered blood pumps could potentially breathe new life into the field of chronic circulatory support by breaching an important barrier—lack of a safe, unobtrusive power source—that has long prevented current devices from becoming a viable, cost-effective means to treat congestive heart failure.

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References
1. D. Trumble *et al.*, *Am. J. Physiol.* **273**, C588 (1997).
2. J. Jarvis, *J. Physiol.* **470**, 157 (1993).
3. NIH 1 RO1 HL59896-01A1.

Response

TRUMBLE AND MAGOVERN ARE CORRECT IN pointing out the potential of using electrically stimulated skeletal muscle for circulatory support. Prior clinical attempts using cardiomyoplasty, pacemaker-stimulated latissimus dorsi muscle that was wrapped around the heart, demonstrated improvement in some patients. However, generally it was not a reliable and vigorous response, and clinically it has been abandoned.

The new skeletal muscle pumps are still early in development, and in our Viewpoint we concentrated primarily on mechanical devices, in particular, ones that have migrated from use in animals to use in humans.

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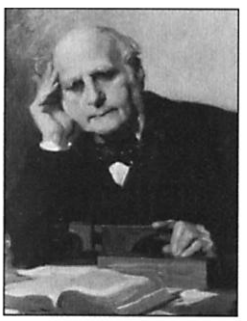
Did Sir Francis Galton Have a Sense of Humor?

IN HIS REVIEW OF NICHOLAS WRIGHT GILLham's book, *A Life of Sir Francis Galton* (Books *et al.*, 19 April, p. 472), W. F. Bynum states that "Galton firmly kept any lightness out of his published writings." There is at least one example that undermines this conclusion. In *Natural Inheritance*, Galton discussed the measurement of variability, for which he introduced the quantile function, an idea that I believe is more fundamental and far-reaching than correlation.

Galton wrote, "It is difficult to understand why statisticians commonly limit their inquiries to Averages and do not revel in more comprehensive views. Their souls seem as dull to the charm of variety as that of the native of one of our flat English counties, whose retrospect of Switzerland was that, if its mountains could be thrown into its lakes, two nuisances would be got rid of at once" (*1*, p. 62).


Sir Francis Galton

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Reference
1. F. Galton, *Natural Inheritance* (Macmillan, London, 1889)

Human Embryos: Potential Humans?

CARL FELDBAUM'S POLICY FORUM "SOME history should be repeated" (*Science*'s Compass, 8 Feb., p. 975) demonstrates several common conceptual errors in the debate on cloning [or somatic cell nuclear transfer (SCNT)].

To say that an embryo has the "potential" to become a human being is dangerous. A sperm has the potential to become a human being, as does an oocyte. The human zygote, however, is more than merely "potentially" a human being. If a human embryo only has the potential to become a human being, then when precisely does the embryo become a human being? There is no more pivotal point in the biologic growth and development of a human than the moment of fertilization when 23 chromosomes from the mother join with 23 chromosomes from the father to form a new, genetically unique individual. Similarly, in cloning, what stages of development impart "more" humanity to an embryo than the moment that the SCNT transfer stimulates an oocyte to divide?

Perhaps more dangerous is the concept

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