EMERGING TECHNOLOGIES

discussion of the dilemmas of the definition of death and the implications of the "yuk" factor. Moreover, xenotransplantation provides one extreme measure of hope for those whose current condition offers no possibility of a clear and real benefit to individuals in need of transplants. While this may be a good, there needs to be a careful calculation of the benefits to the individual over against the risks to the community. At present, the calculation needs the need to restrict the community by refraining from performing xenotransplantations. However, it is not always be possible to ensure that there are no negative consequences or risks associated with xenotransplantation or any other medical intervention. Medicine is not a fool-proof science, and we must be particularly cautious when there is a significant risk to the public's health. With every procedure, there may be variables which cannot be controlled. While this does not give physicians and scientists a license to be careless, we do well to recognize that there must be a clear and absolute guarantee of safety. In such a case, the risks associated with xenotransplantation may be acceptable. While we cannot guarantee that such arrangements will safeguard human well-being in every possible situation, we should nevertheless strive for the very highest and best biosecurity possible.

In the desire to foster the progress and development of medical science and to save human life, we need to realize the importance of asking moral questions. Just because we have the ability to do something does not mean that there is a technological imperative which demands that we do it; just because we can do something does not mean that we ought to do it. We need to look carefully at the technology itself, the motives for its use and development, the nature of what is involved in using this technology, and the likely consequences which may follow from its application. Only can we properly employ that technology to better human health and well-being.

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Modern biotechnology has been spectacularly successful. Advances in the area of fertility have resulted in the birth of "test-tube" babies, and surrogacy has made post-menopausal childbearing possible. The field of genetic research is seeing dramatic growth in the understanding of the links between genetics and disease, both in terms of predisposition for and actual incidence of disease. Such understanding is paving the way for gene replacement, gene modification and cloning. We are also able to transplant human hearts, lungs, kidneys, livers, corneas, and skin into patients whose own organs are failing. The emerging technology of xenotransplantation involves the transplantation of live cells, tissues, or organs from an animal into persons suffering from various diseases.

Although human-to-human transplantation (allotransplantation) has become a regular, accepted treatment protocol and the success rate of such transplants has grown considerably both in terms of the recipient's quality of life and life expectancy, xenotransplantation is becoming an increasingly popular prospect due to the shortage of human organs. In the United Kingdom at the close of the century, over 5,000 people were waiting for kidney transplants. In the United States, there are currently over 400,000 people waiting for organ transplants. If we were able to extend the waiting lists to reflect the universal need for organs, we would find an astoundingly large number of people awaiting transplants.

Although it may still strike many as an almost unimaginable venture, xenotransplantation is not a completely new notion. Inert heart valves from pigs are already being used in heart valve replacement operations. Tissue for human bones and skin is being grown and developed from pigs. There have been many relatively successful transplants of healthy pancreatic islets from pigs into persons with diabetes whose own islet cells are not functioning properly. There are also experiments in process which involve the implantation of brain cells from pigs into people suffering from Alzheimer's disease.

Among many there is an uneasy feeling that with xenotransplantation, human beings are going a step too far. Such persons assert that xenotransplantation crosses fundamental species lines drawn by nature itself or God. Instead of respecting and following nature or God's design, we are now interfering with nature and "playing God." Although xenotransplantation may indeed raise unique ethical issues, the problem with this latter argument is that medicine may be said to be playing

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