Greetings from IUPUI

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> "Imagine swallowing a pill that could help heal a spinal injury or restore degenerating eyesight. Imagine applying a 'smart bandage' to regenerate an amputated finger or the tissue of an unsightly wound, rather than undergoing reconstructive surgery."

If necessity was the mother of invention for the Industrial Age, imagination is the mother of invention for the Age of the Life Sciences.

David Stocum's imagination was stimulated by the ability of amphibians to regenerate limbs, a process of metamorphosis understood by modern science to be a change in an animal's form or structure through cell growth and differentiation. In bygone times, a discussion of metamorphosis would more likely have taken place among alchemists or scholars of classical antiquity and gothic literature rather than biologists and chemists. Now, such studies can no longer be considered akin to mythology, fiction, or even science fiction. It is science, pure and simple.

David Stocum is the founder of the IU Center for Regenerative Biology and Medicine, based in the Purdue School of Science at IUPUI. The center was established by grants from the Indiana 21st Century Research and Technology Fund, the Partnerships in Innovation Program of the National Science Foundation, Eli Lilly & Company, and university matching funds.

The W. M. Keck Foundation has just awarded the center $1.6 million for research that will help it and collaborators from the Institute for Genomic Biology at the University of Illinois at Urbana-Champaign study amphibians' powers to regenerate complex structures that humans cannot. Once the mechanisms are known in molecular terms, the next step is to translate the discovery into therapies.

In Errol Morris' 1992 film, A Brief History of Time, he profiled the renowned theoretical physicist, Stephen Hawking. Considered one of the most gifted scientists of his generation, Hawking holds the academic chair occupied 300 years ago by Isaac Newton at the University of Cambridge in England. Discussing his film with an interviewer, Morris said, "Much of Stephen [Hawking']s work is so advanced that it may strike some people as verging on pure fiction, but it's important to remember that science isn't witchcraft . . . Science is our most spectacular attempt to try and understand the world around us."

The notion of regenerating nerves and limbs may likewise strike people as verging on fiction. It is, in truth, a science that may one day help people like Stephen Hawking. I am not referring to the ability Hawking has to make intuitive leaps of the imagination and come to new discoveries about how the universe works. I am referring to Hawking's inability to make his own muscles work.

Hawking lives with Lou Gehrig's Disease, a disease that attacks the motor neurons, the nerve cells in the brain and spinal cord that control the body's voluntary muscles. When the motor neurons begin to die, the muscles weaken and shrink. Victims gradually become paralyzed. While doctors have known about the disease since 1874, the inability to pinpoint the cause has hindered efforts to find an effective treatment.

Scientists associated with our Center for Regenerative Biology and Medicine think that certain growth factors produced by the body to stimulate nerve cells to grow and multiply may be useful for treating Lou Gehrig's disease. These substances might one day be produced in the laboratory using biotechnology. Doctors envision that it might be possible to develop drugs that will not only stop motor neurons from dying, but replace them and reverse the course of the disease.

Understanding the stem cell properties that trigger the regeneration of nerve cells, bones, muscle tissues, skin, and vital organs has enormous implications for treating Lou Gehrig's, Parkinson's, and other chronic degenerative diseases; for orthopedic reconstruction; for treatment of severe burns; and for protein wasting diseases associated with cancer and AIDS. Ellen Chernoff, director of the Center for Regenerative Biology and Medicine, is developing research on spinal cord regeneration that may one day help victims of traumatic spine and brain injuries.

While the prospect of medical breakthroughs like these cannot help but be compelling to the general public, we must remember not to underappreciate the fact that the scientific principles that contribute to an understanding of the course of a disease often derive from pure, or basic, science research with no practical application in view. Randy Tobias, former CEO of Eli Lilly and Company and now U.S. Global AIDS Coordinator, once said:

> "We must not lose sight of the fact that there remain two very different ends of scientific inquiry. One is pragmatic in intent. The other open-ended. One is focused on discovery—finding an unknown; the other on innovation—meeting a need. While it is a fact that most of our technology comes out of the latter need-focused research, all of the intellectual tools, the knowledge base that allows us to create that technology comes out of the former kind of inquiry."

It has been said that Stephen Hawking's own great scientific gift has been his ability to reconcile the study of cosmology (the very large) with the study of particle physics (the very small) and thus attempt to understand the universe. Next year's medical miracle may well derive from a small scientific insight that sheds new light on the larger picture of accumulated research. What may appear to yield little of practical value in the short term may be the breakthrough of a lifetime in the long term.

Somewhere in between is someone's leap of faith—or imagination.

Charles R. Bantz
Chancellor

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