

OCTOBER 24, 2002

Stem Cells 101: Of Mice and Journalists

Lab-coated and latex-gloved, the journalists are learning how to isolate mouse embryos and culture embryonic stem cells.

University of Chicago graduate student Erica Smith notices the queasy looks as she demonstrates how to mouth-pipette the blastocysts—embryos 3.5 days after fertilization—from the uteruses of pregnant female mice. "Don't worry," she says. "There's a filter so you don't end up drinking what you're pipetting."

Working reporters and graduate students from Northwestern University's Medill School of Journalism are participating in a "Stem Cells for Journalists" day at the University of Chicago, supported by a science education grant from HHMI. The lectures, discussions and hands-on laboratory experiences were organized by Jose Quintans, master of the University of Chicago's Biological Sciences Collegiate Division and HHMI program director, and Patrick Medina, HHMI program manager, to help educate the educators of the public, preparing them to write or broadcast the stem-cell story more accurately and thoughtfully.

To prepare them for their lab, HHMI investigator Harinder Singh gives the journalists an overview of stem cell biology and its applications. "Stem cells have the power to revolutionize medicine," says Singh, describing their multifaceted promise, including developing new drugs, understanding the mechanisms of human development and gene control, and generating cells and tissues for therapeutic use in a variety of crippling and life-threatening human conditions such as muscular dystrophy, spinal cord injury, heart disease and diabetes.

Singh explains the difference between pluripotent or embryonic stem cells, multipotent stem cells derived from adult tissues such as bone marrow, and totipotent stem cells—found only in the zygote or fertilized egg—that give rise to the organism itself. "Stem cell biology is not new, but it is still in its infancy," he tells the journalists. "There are a lot of questions yet to be answered. What is the underlying molecular basis of developmental cell plasticity? Do various kinds of stem cells share a conserved set of regulatory genes? How does age affect adult stem cells? Is there a danger of transmitting genetic problems?"

In the lab, HHMI investigator Bruce Lahn and his colleague John D. Crispino, who study the development of blood cells, guide the journalists through the processes of isolation and culture of mouse blastocysts and differentiation of embryonic stem cells. They learn words like transfection, the introduction of genetically manipulated DNA into a stem cell.

"How in the world do you manipulate DNA?" asks *National Geographic's* Alan Mairson. "We aren't doing it physically," graduate student Steve Droho explains. "There's no miniature scissors or tweezers. We do it biochemically, with enzymes."

The journalists try their hands at injecting embryonic stem cells into blastocysts one millionth of a millimeter in diameter. "I don't have the coordination to play video games, let alone do this," grumbles Ron Csillag, a Religious News Service reporter from Toronto, as blastocyst after blastocyst bounces free of his probing injection pipette. They also peer through microscopes at individual stem cells differentiating into cell aggregates known as embryoid bodies and from there into colonies of red blood cells.

"Why do you use mice?" asks Giovanna Breu of *People* magazine. Crispino explains: Mouse cell types are virtually identical to human; the genes that regulate development are the same; the blastocysts are relatively the same size, and yet the cell lines can be grown rapidly.

Catherine Verfaillie, director of the University of Minnesota Stem Cell Research Institute, briefs the journalists on a hot topic in stem-cell research: the unexpected potential of stem cells taken from the bone marrow of adults to self-renew and differentiate into different kinds of cells and tissues. Verfaillie was senior author on a newsmaking paper on the apparent plasticity of adult bone marrow stem cells, published in the June 20, 2002 issue of the journal *Nature*. She predicts that multipotent adult progenitor cells (MAPCs) will be useful in drug discovery, systemic cell therapy for genetic disorders and tissue regeneration.

Verfaillie's findings have been cited by some as a reason to stop embryonic stem cell research, but, says the researcher, "they haven't talked to me about it." She advocates continuing MAPC and embryonic stem cell research. "There are too many unanswered questions," she says. "Adult cells may be a better source for certain tissues and embryonic cells for other tissues."

A spirited discussion ensues among the researchers, bioethicists and the visiting journalists. "Does anything that you're doing keep you up at night thinking, 'we're heading into strange territory; what may come of all this?'" Mairson asks. "Anything can be applied in a harmful way," Singh responds. "Is that a reason not to pursue new knowledge that could also save lives and improve the quality of life?"

"Scientists are accountable to society as a whole," suggests Janet Parker, a faculty member at the Chicago Theological Seminary. "They need to consider the larger common good." Lahn agrees and disagrees. "Of course scientists must consider the moral implications of what we do," he says, "but we cannot

please everybody. Ultimately I must make my own moral judgment, and I don't want to close doors because a few people find what I am doing distasteful."