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Stem Cell Challenges and Opportunities Discussed at AAAS Meeting

The United States government's decision last year to lift restrictions on federally-funded stem cell research has helped the nation's stem-cell researchers concentrate on science, but limitations remain – even under the new policy, according to George Daley, a Howard Hughes Medical Institute investigator at Children's Hospital Boston.

Daley's presentation at the AAAS Annual Meeting in San Diego, Calif., on February 20, 2010 described the current climate facing stem cell researchers in the United States. He also discussed his current viewpoint on whether induced pluripotent stem cells (iPS) -- which are derived from adult cells -- will have the same potential therapeutic utility as human embryonic stem cells.

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- **George Q. Daley**

Human embryonic stem cells have the remarkable capacity to mature into all of the 200 kinds of cells that make up the human body: skin, bone, nerve, blood, heart, and so on. By this nature, the cells hold great promise for treating devastating diseases like Alzheimer's, Parkinson's, cancer, and diabetes. However, some consider human embryonic stem cell research controversial because, in some cases, the new stem cell lines are derived from frozen human embryos that have been donated for research. New strategies have been recently developed that circumvent this issue by genetically

reprogramming adult cells.

On March 9, 2009, President Obama lifted the ban that had previously restricted the use of federal funds for embryonic stem cell research on cell lines that had been created after August 9, 2001. “Over a thousand lines have been derived since August 9, 2001, many with attributes beneficial to medical research,” says Daley, whose own lab has derived 18 new stem cell lines. Until the change in policy, these lines could only be studied with private funds. Obama called upon the National Institutes of Health to set up rigorous guidelines to ensure that new stem cells lines were derived by ethical practices.

Although less restrictive, the new policy does have its own challenges. Only one of the “pre-April 9, 2001-lines” that had been approved and used for federally-funded research during the last decade are currently approved under the new guidelines. That’s impeding research, says Daley. “Ten years of research are under some doubt because of the inability to continue to work on the Bush lines. We need the scientists who derived the older lines to step up and get their lines approved under the new system.”

Daley’s talk also highlighted the differences between embryonic stem cells and iPS cells, which were first created from adult human cells in 2007. The iPS strategy is an important tool because it can be used to create disease-specific stem cell lines that, like embryonic stem cells, can develop into many cell types. Daley and other scientists are using iPS technology to reprogram cells from patients with diseases such as Lou Gehrig’s disease (amyotrophic lateral sclerosis), Huntington’s disease, and diabetes. With these “disease-specific” iPS cells in hand, researchers can learn more about how such diseases develop and hopefully identify new therapeutic strategies.

Despite the promise of iPS cells, scientists are still struggling to understand whether their developmental potential is equivalent to that of embryonic stem cells. Some studies have suggested that iPS cells have more fragile genomes or are more prone to DNA abnormalities than embryonic stem cells. This fragility could make them unsafe to use therapeutically. The bottom line, says Daley, is that research on both types of stem cells must continue, because it’s too early to predict where the safest and most effective cell-based therapies will come from.

“It’s a remarkably fast paced and exciting field,” says Daley. “We’ve had a decade of diversions and distractions, and we as a scientific community are relieved to have a more rational scientific policy, which allows us to focus almost exclusively on the science.”