

ANIMAL ACTION REPORT

A publication of the
National Anti-Vivisection Society

Advancing science without harming animals

Summer 2005



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Several members of the NAVS team were dispatched to the 2005 Intel ISEF (International Science and Engineering Fair) to monitor the use of animals in the participants' projects at this event, where more than 1,400 students came from all over the world to compete for prizes ranging from membership in professional organizations to four-year paid scholarships. We also attended the competition to award the 4th Annual Humane Science Award (see page 3).

As our team explored the vast exhibit space, all agreed that it was an awe-inspiring experience. The scope and quality of the projects, ranging from water quality testing to theoretical space science, dazzled the mind. In order to exhibit at the Intel ISEF,

students must excel at local and regional competitions, which earn them the right to display their projects and defend their research before teams of judges in more than a dozen categories.

As impressive as we found the competition—and the competitors—we continue to take issue with Intel ISEF as one of the few remaining science fairs to permit students to conduct invasive experiments on vertebrate animals. This year, more than two dozen projects used live vertebrate animals, resulting in the death of more than 500 animals. Worse, these represent only a small fraction of the total projects that were developed for local science fairs throughout the country and around the world—so it's safe to assume that a great many more



The NAVS team at the 2005 Intel ISEF was impressed with the scope and sophistication of the students' projects, but disappointed to see that those using vertebrate animals were on the rise.

animals lost their lives for the purpose of conducting high school science fair projects. Most disturbing of all is the fact that for the first time in more than a decade, the number of invasive animal experiments was on the rise.

As readers of the *Animal Action Report* will recall, NAVS had been invited to participate in the process of developing new rules regarding the use of animals in Intel ISEF student projects. These new rules, while not as far-reaching as we would have hoped,

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Alan Ho-Yin Gee, first place winner of the NAVS Humane Science Award, poses with his project.

demonstrate at least some incremental changes that benefit animals used for education and research.

The new rules prohibit invasive experiments from being performed on vertebrate animals outside the laboratory. However, within the laboratory there is a growing emphasis on research on animals for student science fair projects. In designing and conducting a project for a science fair, students are required to do original research, and not merely base their project on work they are doing with a principal researcher. Yet many students gain access to professional laboratories through internships and sponsored work-study programs. Once working at the laboratory, they can design a project that is an offshoot of existing research, or at least use the laboratory's facilities to house and care for any animals used in their own project.

These projects must undergo review from the laboratory's or university's institutional animal care and use committee, or a scientific review committee under the Intel ISEF rules. Students are required to justify why animals must be used and describe how the animals will be used and in what numbers.

Looking out for the animals *Continued from page 1*

Alternatives to the use of vertebrate animals must also be explored and discussed in the student's research plan, including the three "R's" of replacement, reduction and refinement of the use of animals.

While many of the animal projects were based in the laboratory, there were others that were noninvasive and performed in the home or in school. In one such project, in the category of Behavioral Science, a student used mice to study the effects of sleep deprivation, citing the lack of sleep as a problem among teenagers. Yet, in the very next aisle was another study on sleep deprivation that actually used teenagers as test subjects. While neither project was particularly sophisticated in its methodology, only one student understood that sleep deprivation as a human issue required the use of human test subjects. The other student was focused on designing a science fair project without regard to the most effective and accurate methodology involved.

In accounting for animal use at Intel ISEF, an entire category—invertebrates—was completely neglected. This is because Intel ISEF, and indeed the federal Animal Welfare Act, does not regulate the use of invertebrate animals. Yet thousands of insects, fish and crustaceans are used for science projects each year. One project used 72 crayfish to test the effects of antidepressants. Puffer fish, electric fish and zebra fish were all used in a wide range of lethal experiments. Bees and other insects were used to test their anti-bacterial properties, which generally resulted in the death of the creatures involved. In fact, the number of invertebrate animals was so extreme that NAVS will begin tracking their use at future fairs as part of our oversight to the overall use of animals.

In reviewing the use of animals for science fair projects, NAVS also looks for benign non-invasive behavioral projects, or projects that promote animal welfare through mini-

mally invasive, non-harmful testing (i.e., scraping the cells from the cheeks of a horse). The number of such projects this year was small, but one deserves a special mention. An environmental project entitled "Electronic Rangers: Assistance for Visually Impaired Canines" addressed the problem of loss of eyesight in companion animal dogs by devising a pyroelectric infrared detector to help dogs sense objects around them. While the device has a long way to go in its development, the time and energy spent by this student in developing this project—which will have such a positive impact on a dog's life—is commendable.

The NAVS team makes it a point to interview students about the particulars of their projects. As in previous years, we were told by students that experimentation on animals is necessary for the development and understanding of human health science and that it is necessary to sacrifice mice and rats before moving up a pre-determined ladder of experimentation that extends to primates before humans enter the equation. One student, when questioned about the necessity of testing human drugs on animals first, conceded that micro dosing humans made more sense. But that was only after he was reminded of the numerous drugs that have been marketed to humans because they tested safe on animals, yet proved to be harmful, as well as the many potentially beneficial drugs that have been bypassed for development because they harmed animals.

In the end, the 2005 Intel ISEF turned out to be a mixed bag of exciting and innovative projects, along with cruel and invasive experiments. For NAVS, this prestigious science fair remains an important opportunity to educate students, scientists and administrators of scientific institutions that there are better ways to achieve advancement in the sciences. It is also an effective way to encourage these future scientists to include humane considerations in their work. 🐾

A Salute to Humane Science

NAVS presents our 4th Annual Humane Science Award at the Intel International Science and Engineering Fair.



For the fourth year in a row, NAVS was privileged to present our Humane Science Award at the 2005 Intel ISEF (International Science and Engineering Fair)—one of the few remaining science fairs that continues to permit invasive experiments on vertebrate animals. The Humane Science Award was created to recognize and draw attention to the innovative scientific investigation that is being done without the use of animals, as well as to offer incentive to students to seek out projects that do not harm animals. NAVS is the only animal advocacy group that has been invited to present an award at this prestigious event.

This year, the winning projects covered the disciplines of Biochemistry, Medicine and Health, and Microbiology. We extend our congratulations to the winners, who represent some of the very best and brightest young scientific minds today. Most importantly, though, these students, by integrating compassion for other creatures with creativity, ingenuity and diligence, reflect our hope for the next generation of scientists.

First prize—\$5,000

Alan Ho-Yin Gee, *Metastable Conformations in the Secondary Structure of the Poly(A) Signal in Human Immunodeficiency Virus Type-1*

Second prize—\$2,000

Jijun Chow, *Use of Homology Modeling and Molecular Docking to Map Retinoid Binding Sites on Protein Kinase C*

Third prize—\$1,000

Jeff Silpe, *Evaluations of MMP and TIMP Expression in Human Pediatric Brain Tumors*

The NAVS judging team included Dr. June Bradlaw, Chair of the Scientific Advisory Board for the International Foundation for Ethical Research, and Dr. Ray Greek, NAVS' science advisor and noted author.

The importance of rewarding humane science projects cannot be overemphasized.

The winners of the NAVS Humane Science Award share the stage with the NAVS judging team. From left: **Dr. Ray Greek**, NAVS Science Advisor; **Alan Ho-Vin Gee**, first place winner; **Peggy Cunniff**, NAVS Executive Director; **Jijun Chow**, second place winner; **Marcia Kramer**, NAVS Director of Legal/Legislative Affairs; **Jeff Silpe**, third place winner; **Dr. June Bradlaw**, Chair of the Science Advisory Board for the International Foundation for Ethical Research.

The number of students who enter the sciences without even being aware of new technologies and developments that make animal testing obsolete is far too high. This makes it all the more critical that we reach future researchers with our message that humane science and progressive science are one and the same. These students will be entering some of the most prestigious colleges and universities in the country—many of them to prepare for careers in research. That is why now is the time to set their minds—and hearts—in the right direction and to engage their interest in non-animal methodologies. 🐾

On Line with Animal Law

Animallaw.com marks five years of keeping activists in the legal loop.

Five years ago, NAVS developed Animallaw.com as a free legislative search tool that tracks legislation for all 50 states and the federal government on issues regarding animals. As it turns out, that was just the beginning. Today, thanks to the efforts of a committed staff of paralegals and law students, Animallaw.com also provides links directly to state and federal resources, as well as additional information for all types of activism.

Now a joint project of the National Anti-Vivisection Society and the International Institute for Animal Law, Animallaw.com includes these features:

- Current state and federal legislation
- Up-to-date state and federal laws
- Model laws on important animal issues
- Bibliography of animal law resources

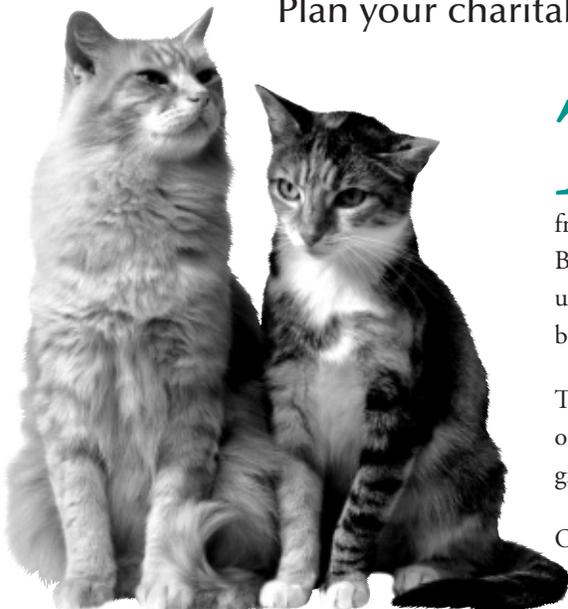
This unique website enables you to compare and analyze the best and worst of laws concerning animals. For example, if you are looking for laws regarding dissection, a key word search will show you all of the laws regarding dissection in all 50 states. Change your criteria to search for current legislation to see which states will be the next to pass student choice protections. Check out the bibliography for any relevant articles. Then go to the model law section to find language that you can present to your legislator to introduce a student choice proposal in your state's legislature.

We invite all animal advocates, especially those who are interested in the burgeoning field of animal law, to find a wealth of information at www.Animallaw.com. 🐾



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To quote William Shakespeare, “Summer’s eve hath all too short a date.” We all wish the breezy, care-free days of summer would go on forever. But that is not to be. Like the seasons, all of us on earth are part of the endless cycle of birth, death and rebirth.

There is a way for our spirit to live on beyond our earthbound days—through charitable giving as part of your estate planning.

Our free booklet, *The Legacy of Compassion*, provides important information on how

you can use charitable giving through estate planning as a meaningful way to support your favorite charities. To obtain your copy, simply call us at **800-888-NAVS** (800-888-6287).

A significant portion of the donations that make our work here at NAVS possible comes from caring animal advocates who have had the wisdom and foresight to plan their charitable giving beyond their own lifetimes through estate planning. If you wish to remember NAVS in your will, we recommend that you consult your attorney, financial advisor or estate planner. 🐾

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Looking for a book to add to your summer reading list? We've got one...but you'll want to take it to the mall rather than the beach. It's the new 12th edition of *Personal Care for People Who Care*, your comprehensive, updated guide to cruelty-free shopping. This new edition, with its bold new design and practical, informative contents, will help you put compassion on the top of your shopping list. You'll find hundreds of listings of companies that do and do not test their cosmetics, personal care and household products on animals...and much, much more to help you shop with your conscience, and help end animal testing with every purchase!

You can order your own copy of *Personal Care for People Who Care* online at www.navs.org, or use the donor form on page 7. Total cost is \$13.50 (which includes first class postage and handling).

Members of NAVS receive one free copy of *Personal Care for People Who Care*. If you haven't already become a member of NAVS, you may join online at www.navs.org or by calling us at **800-888-NAVS** (800-888-6287) with your donation of \$40 or more. 🐾

This handy guide is **FREE** to members of NAVS. If you haven't already joined NAVS, you may do so with your donation of \$40 or more.



The National Anti-Vivisection Society
Advancing science without harming animals

National Headquarters
53 W. Jackson Blvd., Suite 1552
Chicago, IL 60604

Tel: 312-427-6065

800-888-NAVS
(800-888-6287)

Fax: 312-427-6524

Email: navs@navs.org

Visit us on the web: www.navs.org

The National Anti-Vivisection Society is a national, not-for-profit organization incorporated in the State of Illinois. Annual membership includes a year's subscription to the Animal Action Report and a copy of *Personal Care for People Who Care*. Life Partner: \$1,000; Life Benefactor: \$500; Life Sponsor: \$100; Individual Membership: \$40; Senior Membership: \$15; Student Membership: \$15. All donations are tax-deductible to the fullest extent allowed by law. A copy of NAVS' annual financial report is available upon request.

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Science Advisors
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The National Anti-Vivisection Society promotes greater compassion, respect and justice for animals through educational programs based on respected ethical and scientific theory and supported by extensive documentation of the cruelty and waste of vivisection. NAVS' educational programs are directed at increasing public awareness about vivisection, identifying humane solutions to human problems, developing alternatives to the use of animals, and working with like-minded individuals to effect changes which help to end the suffering of innocent animals.

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Stem Cell Research and Its Impact on Animal Research

By Ray Greek, MD—NAVS Science Advisor

The issue of stem cell research has raised serious ethical questions, making it one of the most controversial science topics being discussed today. In the following article, Dr. Ray Greek, our science advisor, explains the scientific issues involved and helps us understand how stem cell research will impact the use of animals in science. Concerns raised by proponents and critics of stem cell research deserve thoughtful and informed discussion. The following article is neither an endorsement nor a condemnation of this research; rather, it is designed to serve as an introduction to this complex topic and a springboard to further discussion. Please e-mail us at navs@navs.org with your questions or comments.

With all the controversy surrounding stem cell research, and the extensive media coverage this subject has garnered, it seems an opportune time to explore this very “hot” topic, and to contemplate what it means for the future of human-based as well as animal-based medical research.

Recent breakthroughs involving stem cell research have made this discussion even more pertinent. You may have read about Woo-Suk Hwang, a scientist in South Korea, who made headlines with his creation of the first human embryonic stem-cell lines using DNA from the patient who was to benefit from the stem cells. Around the same time, a scientist in Chicago, Yuri Verlinsky, was creating stem cells for specific patients without using new stem cell lines.

These discoveries have become yet another flashpoint for the ethical and scientific controversy surrounding stem cells, which first became an issue in 1998 when a scientist at the University of Wisconsin, Jamie Thomas, grew stem cells, called *lines*, in culture medium. Prior to this discovery, the only way to obtain stem cells was to procure them from a source, such as an aborted fetus or discarded cells from *in vitro* fertilization (IVF) clinics, every time one wanted to study them. Thomas found a way to grow the stem cells so they need only be derived from their original source one time.

Where science and ethics intersect

Scientists generally agree that stem cell research using human stem cells will, in the

long run, result in cures for human disease. It is also an excellent example of human-based research, which animal advocates tout—and rightly so—as a better way to perform medical research, since it does not need to involve animals (indeed should not) and it will result in cures for humans and animals suffering from disease.

In an enlightened society, funds would be pulled from animal-based research and used in human-based (in this case stem cell) research, thus decreasing the number of animals used in all of biomedical research. From strictly a scientific perspective, stem cell research represents a win-win situation for animal advocates.

Were it not for the ethical issues surrounding stem cells, such research would easily fall into the same category as *in vitro* research using human cells (which it is), clinical research, epidemiology, and other ethically acceptable and useful research techniques that rely on humans and human tissue. The crux of the ethical argument is this: Some in society feel that life, which is deserving of respect, begins at conception, and, as such, any cells that could become fully human should not be used in research. These people believe that every effort should be made to ensure that such life comes to completion—in this case, birth.

Others disagree with this premise, saying that since the stem cells are not sentient, they do not deserve rights and therefore research with them is morally acceptable. There are many permutations on this central ethical theme. You, the reader, must make your own decision...one that appropriately reflects your beliefs.

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Stem Cell Research, *cont'd.*

The types of ethical questions raised about stem cell research are not unique to this burgeoning area of science. Many contemporary issues have involved both science and ethics, such as the splitting of the atom, which brought about the ability to build an atomic bomb. There were and are definite ethical issues surrounding the splitting of the atom, but there are also very separate and distinct scientific aspects to it that have no ethical component *per se*.

How to make uranium or heavy water is purely a scientific issue. What to do with it is an ethical issue. At the same time, people making ethical decisions need to be aware of the science involved, so it's important to understand the science behind stem cell research, which I'll now explain.

What is a stem cell?

Stem cells are the body's master cells. They that can grow into virtually any of the body's cell types. Stem cells are unlike any

specific adult cell; however, they have the ability to become any adult cell. Stem cells can proliferate indefinitely in culture, so potentially they provide an unlimited source of clinically important adult cells. Therefore, stem cells are an effective treatment for replacing cells lost to diseases like cancer, diabetes, Parkinson's and Alzheimer's and for preventing birth defects.

Why can stem cells be used in this way? Let's take a look at how stem cells come into being.

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STATE CHARITABLE REGISTRATIONS

The address and telephone number of the National Anti-Vivisection Society may be found on page 5. You may obtain a copy of NAVS' annual financial report by writing to us. In addition, residents of the following states can receive copies as follows. In Arizona: A copy of the official registration may be obtained from the Secretary of State, State of Arizona, State Capitol, 1700 West Washington 7th Floor, Phoenix, AZ 85007-2808 or by calling toll-free 800-458-5842. In California: A copy of the official financial statement may be obtained from the Attorney General's Registry of Charitable Trusts, Department of Justice, P.O. Box 903447, Sacramento, CA 94203-4470 or by calling 916-445-2021. In Los Angeles: Information card on file with Los Angeles Police Commission. In Florida: A COPY OF THE OFFICIAL REGISTRATION (#SC-03423) AND FINANCIAL INFORMATION MAY BE OBTAINED FROM THE DIVISION OF CONSUMER SERVICES BY CALLING TOLL-FREE 1-800-435-7352, WITHIN THE STATE. In Kansas: Kansas registration number is available upon request. A copy of the financial report is on file with the Kansas Secretary of State's Office, Capitol - 2nd Floor, Topeka, KS 66612. In Maryland: Upon request, Maryland residents may obtain a copy of the current financial statement of the charity from the Secretary of State's Office, State House, Annapolis, MD 21401 or from the charity directly. In Michigan: The charity's Michigan registration number is available upon request. In New Jersey: INFORMATION FILED WITH THE ATTORNEY GENERAL CONCERNING THIS CHARITABLE SOLICITATION MAY BE OBTAINED FROM THE ATTORNEY GENERAL OF THE STATE OF NEW JERSEY BY CALLING 201-504-6215. In New York: Upon request the latest annual report may be obtained from the charity directly by sending a self-addressed stamped envelope to the charity's address or by writing to the Office of Charities Registration, Department of State, 162 Washington Avenue, Albany, NY 12231. In North Carolina: A COPY OF THE LICENSE TO SOLICIT CHARITABLE CONTRIBUTIONS AS A CHARITABLE ORGANIZATION OR SPONSOR AND FINANCIAL INFORMATION OR A COPY OF THE LICENSE AND FINANCIAL INFORMATION OF THE SOLICITOR MAY BE OBTAINED FROM THE DEPARTMENT OF HUMAN SERVICES, SOLICITATION LICENSING BRANCH, BY CALLING (919) 733-4510. In Pennsylvania: A copy of the official registration and financial information may be obtained from the Pennsylvania Department of State by calling toll-free within Pennsylvania, 800-732-0999. In Virginia: A financial statement is available from the Commonwealth of Virginia, Division of Consumer Affairs, P.O. Box 1163, Richmond, VA 23209 or by calling 804-786-1343. In Washington: Financial information is available from the Secretary of State, State of Washington, Olympia, WA 98504-9000. In West Virginia: Residents may obtain a summary of the registration and financial documents from the Secretary of State, State Capitol, Charleston, WV 25305. In Wisconsin: A copy of the charity's financial statement disclosing assets, liabilities, fund balances, revenue, and expenses for the preceding fiscal year will be provided upon request by writing to the charity's name and address. REGISTRATION DOES NOT IMPLY ENDORSEMENT, APPROVAL, OR RECOMMENDATION BY THE STATE.

Stem Cell Research

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When a single cell called a sperm combines with a single cell called an egg, another single cell is formed. This cell is called a *zygote* and can be the beginning of a living organism such as a human, dog, cat or gorilla, depending on the origin of the previous two single cells.

After formed, the *zygote* can then divide into two new cells. The two new cells then divide into four cells, then eight, then 16, then 32 and so forth. About five days after the *zygote* forms, the cells become what is called a *blastocyst*. The *blastocyst* is a hollow ball of about 100 cells. The inner cells of the *blastocyst* are the embryonic stem cells. It is during the *blastocyst* stage that cells are removed and grown in culture—what are commonly referred to as stem cells.

The embryo continues to grow. The cells multiply into the thousands, then millions. When the clump of cells is sufficient, it is implanted into the mother's uterus where it will grow and become a bigger embryo, then a fetus, and finally—if all goes according to plan—a baby.

Two definitions are important at this point. The term *embryo* is defined, in humans, as: The developing organism from the time of fertilization until the end of the eighth week of gestation, when it becomes known as a *fetus*. Fetus is defined as: A developing human from usually two months after conception to birth. Stem cells usually come from embryos, not fetuses.

Based on our knowledge as of this writing, there are three classes of stem cells: *totipotent*, *multipotent*, and *pluripotent*. Each class of cells are capable of different things, as the figure here shows:

The *zygote* gives rise to totipotent stem cells, and they are capable of making any cells in the body, including the embryo itself. This is how a body is made from a small number of cells. Any one of the cells can make a heart cell, skeletal muscle cell, nervous system cells and so forth—or even a twin.

Stem cells derived from totipotent stem cells are called pluripotent stem cells, and they can give rise to any cell in the body except the cells needed to make the entire embryo. This deserves repeating: *Pluripotent stem cells can make every cell type that totipotent stem cells can except those needed to make the actual embryo.* This is a big difference.

Pluripotent stem cells are isolated from human embryos in the *blastocyst* stage. These cells can be used to create pluripotent stem cell lines. These lines are stem cell cultures that can be grown indefinitely in the laboratory and hence used in research and treatment.

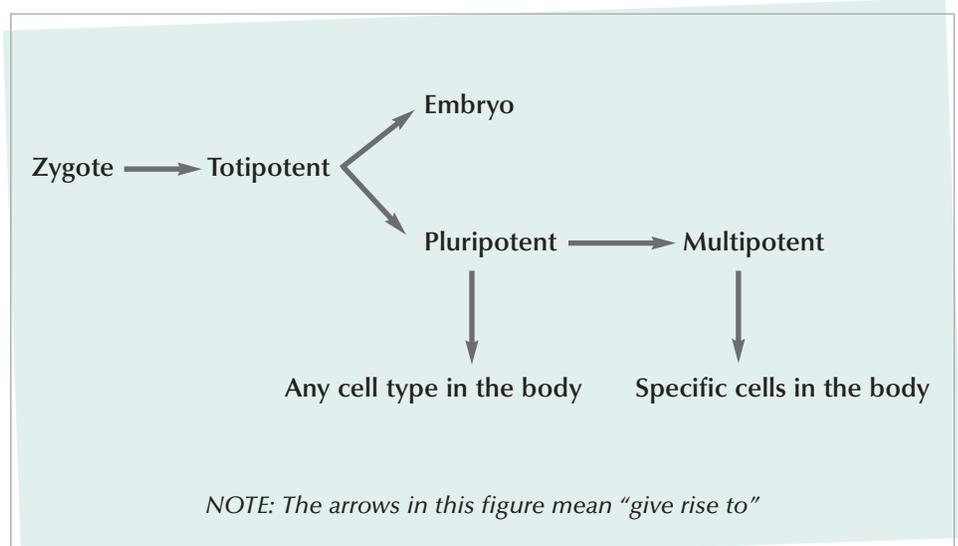
Multipotent stem cells are the least flexible stem cell. (These cells are often called adult stem cells.) Multipotent stem cells can give rise to many, but not as many, cells as the pluripotent stem cells. For example, stem cells found in the bone marrow are capable of developing into a variety of blood cells,

but not other cells. (It should be noted here that some people advocate using multipotent stem cells from adults or from the umbilical cord for research and treatment. Discussing the details of this opinion is beyond the scope of this article; suffice it to say that these stem cells are not as flexible as the pluripotent stem cells. As a result, researchers cannot use them to extract the full potential of the pluripotent stem cells.)

Human pluripotent stem cells can be derived from human fetal tissue following elective abortion. They can also come from human embryos that are created through *in vitro* fertilization (IVF) but no longer needed by couples being treated for infertility.

These “extra” embryos are a normal result of the IVF procedure. When a couple wishes to use IVF in an attempt to become pregnant, the clinic will take multiple eggs and fertilize all of them. Typically about eight embryos will be formed. One or two will be implanted, and the rest will be placed in the freezer to be used in subsequent attempts should the first implantation fail. If the couple becomes pregnant on the first try, six or seven fertilized eggs could be left in the freezer with little or no chance of ever being placed into a woman's uterus.

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Stem Cell Research

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One of three things will happen to these cells:

1. They will be used in stem cell research.
2. They will be donated to another couple wishing to become pregnant.
3. They will be discarded.

The third option—being discarded—is what usually happens. This is an important but often overlooked point in this emotional debate. Most stem cells taken from such *in vitro* fertilization clinics for research would otherwise be thrown away.

A related issue that crops up in discussions about stem cell research is *cloning*. Cloning is the process of making an identical copy of a biological entity, e.g., a cell, a gene, a human or a frog. *Therapeutic* cloning is the process of making stem cells from the DNA of the human in whom those stem cells will eventually be placed—for example, a person suffering from cancer. This would solve the rejection problem now associated with stem cell and transplant therapy.

Human *reproductive* cloning is the process whereby a human being's DNA is cloned and placed into an egg, which is then implanted into a female for gestation and birthing. This has not happened and is unlikely to happen any time soon. There are huge obstacles, both ethically and scientifically, to reproducing a human via reproductive cloning.

The power and potential of stem cell research

The benefits of stem cells are myriad. Physicians can transplant stem cells into children suffering from leukemia, as opposed to using such traditional leukemia therapies like chemotherapy, radiation and bone marrow transplants. Recent human studies showed that leukemia patients who receive stem cell transplants had a 25 per-



cent survival advantage over those with the traditional modes.

Already, people with autoimmune diseases—multiple sclerosis, scleroderma, juvenile arthritis, systemic lupus erythematosus and vasculitis/cryoglobulinemia—have been successfully treated using stem cell therapy. Around two-thirds of these patients stabilize or improve. Stem cell transplantation combined with chemotherapy has been particularly successful in treatment of persistent systemic lupus erythematosus.

Patients suffering from a wide range of cell-based diseases, such as juvenile onset

Removing frozen cell samples from liquid nitrogen cryostorage

diabetes, Alzheimer's and Parkinson's disease, can also benefit. Replacing faulty cells with healthy ones offers hope for treatment and possibly cures. Likewise, injecting healthy cells to replace damaged or diseased cells could, in theory, rejuvenate failing organs. Children with sickle cell anemia, immunodeficiency syndromes and inherited enzyme deficiencies can also benefit from transplantation of stem cells.

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Return Services Requested

Here is your latest issue of NAVS ANIMAL ACTION REPORT

Stem Cell Research

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Research on stem cells will benefit humans and animals in ways many and diverse. Animal-based research can be replaced by stem cell-based research, and animals individually can benefit from the therapies developed from the use of stem cells.

Implications for animal-based research

These exciting developments in the area of stem cell research not only demonstrate the progress that has been made in stem cell research, but also the unlimited opportunities this methodology offers in every field of medicine—all of which makes animal-based methodologies seem even more archaic.

Ironically, this relatively new field of human-based research will actually increase animal-based research. Anytime a new area of research is introduced or popularized, the number of animals used in that endeavor will in all likelihood increase. In this case, animal-derived stem cells will be studied in animals. Clearly, the number of ways animals can be used will increase, and the total number of animals used in research will probably increase.

This is unfortunate, since the real breakthroughs will come from research on human stem cells, not animal stem cells. Therefore the resources committed to animal-based research are wasted. But such waste will inevitably occur. The reality of today's world of scientific research is that people who conduct experiments on animals will use stem cell research as an excuse to obtain more money to perform more experiments on animals.

This is exactly the opposite of what should happen. Instead of funding animal-based research, we should be funding human-based research, as it is more likely to bring

cures to the sick and suffering. Moreover, as this concept pertains to stem cells, it means we should be funding research to identify the chemical and molecular pathways that allow stem cells to differentiate into other cells. We should also be looking for effective ways to combine gene therapy and stem cell therapy. And finally, we should be using human-derived stem cells to treat humans.

Stem cell therapy offers cures to diseases that today we are far from understanding, much less treating. Research on stem cells will benefit humans and animals in ways many and diverse. Animal-based research can be replaced by stem cell-based research, and animals individually can benefit from the therapies developed from the use of stem cells.

The above scientific explanations do not supplant the societal need for an ethics-based discussion of stem cell research and treatments. There are many issues here that have no relation to science *per se*, and all viewpoints should be heard. But the ethical discussion should be scientifically informed, so people are not arguing over common misconceptions, such as reproductive cloning or saying that harvesting stem cells from *in vitro* fertilization clinics is tantamount to killing a one-year-old baby. 🐾

If you would like to learn more about stem cell research, Dr. Greek recommends that you visit the following website:

<http://stemcells.nih.gov/info/basics/basics3.asp>