

Stem Cell Science

<http://filer.case.edu/jbb36/506> Discipline Project

Stem cell science, a broad subset of biomedical engineering, makes use of the unique self-renewing properties of the body's own stem cells to generate new therapies and treatments for medical disorders.

What are stem cells?

Stem cells have the potential to differentiate into any type of cell in the body, such as heart muscles, tissue, and nerves. Essentially, they act as the body's self-repair system. Scientists work to uncover the specific mechanisms that allow stem cells to self-renew and differentiate, as their regenerative properties hold the potential to treat many of the most devastating diseases, including cancers, diabetes, Parkinson's, Alzheimer's, arthritis, spinal cord injuries, stroke, burns, and heart disease.

Much of the current focus of stem cell research centers on regenerative medicine, which essentially uses stem cells to allow a patient's body to heal itself.

For example, stem cell transplants have successfully been used to treat leukemia in patients for whom traditional treatments such as chemotherapy have failed.

It is important to understand that two very broad categories of stem cells exist: embryonic and adult.

- *Embryonic stem cells* come directly from human embryos and have the ability to differentiate in a much less restricted manner than adult stem cells and therefore offer greater potential for scientific advancements. However, much controversy exists over their use, as it does result in the destruction of a human embryo. The United States currently prohibits the use of federal funding for embryonic stem cell research, although many states have passed laws or allocated funding that allow for the continuation of embryonic research in specific situations.
- *Adult stem cells* can be found in adults and children, making the name a bit of a misnomer. In fact, adult stem cells also include umbilical cord stem cells, which maintain many of the same properties as embryonic stem cells. Adult stem cells cannot differentiate as broadly as embryonic stem cells can, although this property also makes them easier to control in a laboratory setting.

Want to learn more? Visit <http://filer.case.edu/jbb36/506> Discipline Project/resources.html for additional resources.

We also have two great resources right here on campus:

- Department of Biomedical Engineering, Case Western Reserve University: <http://bme.case.edu/>
- Center for Stem Cell and Regenerative Medicine (CSCRM): www.thestemcellcenter.org

The National Institutes of Health (NIH) also offers great information, from basic stem cell facts for the public to detailed protocols for investigators. <http://stemcells.nih.gov/>

Key Journals ([https://filer.case.edu/jbb36/506 Discipline Project/journal.html](https://filer.case.edu/jbb36/506%20Discipline%20Project/journal.html))

While stem cell research will appear in nearly every biomedical engineering journal, as well as in most subspecialty medical journals, and even popular culture magazines and newspapers, the following are considered the leading scholarly journals in the field:

Stem Cells: The International Journal of Cell Differentiation and Proliferation

While directed toward a scientific audience with an in-depth knowledge of the field, *Stem Cells* is a useful resource for students interested in gaining an understanding of the types of research currently being done, as well as the key researchers currently publishing. Students can also gain familiarity with the basic scientific article genre, specifically with the structure, format, and types of information stem cell researchers expect to find in scientific articles.

Cell Stem Cell

Like *Stem Cell*, this journal is a great place for students to start gaining a sense of the types of research being published and the types of scientific articles they may one day need to write. *Cell Stem Cell* also publishes review and analysis articles, as well as four different types of "research reports describing novel results of unusual significance in all areas of stem cell research."

Science Magazine

While students may not find stem cell research in every topic, this is a good source for reviewing articles written for a slightly broader technical audience than the previous two journals.

Key Genres ([https://filer.case.edu/jbb36/506 Discipline Project/genres.html](https://filer.case.edu/jbb36/506%20Discipline%20Project/genres.html))

Scientific Articles

Scientific articles are one of the main channels researchers use to publicize new findings to each other. They generally contain a brief abstract, follow a highly structured format, and include a limited number of figures and tables. They serve to share information with fellow researchers and advance science. More practically, however, the "Materials and Methods" section allows researchers to recreate experiments, thus verifying the results. Additionally, the research published both indicates the types of research currently receiving funding and helps the publishing authors gain potential additional funding.

Grant Applications

To generate funding, stem cell researchers will necessarily write many grant applications over the course of their careers. Grants, even those offered by foundations or individual donors, are generally reviewed by fellow scientists.

Thus, while they necessarily use heavily technical language, they must also be concise and clear. Grant applications must prove the novelty of the proposed project, explain the significance of the expected results, and demonstrate that the necessary institutional support exists to complete the project.

Review Articles

Review articles summarize a broad body of information for a general scientific audience. While some journals accept review submissions, others commission review material articles. Reviews generally aim to take previously published material and place them in a context that will appeal to a more general readership than a scientific article. Rather than critiquing the work being reviewed, this genre of articles critically examine and connect various research methods or recent findings to provide an account of the state of the field.

Business communications, particularly emails, are important too! Much of the success of a research project depends on commercialization, thus researchers must understand how to "sell" their work and communicate effectively in a professional environment.