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BioResource now !

Our monthly newsletter features a variety of information, highlighting current domestic and international issues concerning bioresources.

Introduction to Resource Center No. 28

Human Embryonic Stem Cells

Hirofumi Suemori
Stem Cell Research Center, Institute for Frontier Medical Sciences, Kyoto University

Ongoing Column No.36

Easy creation of 3D models by using photos

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Other information on bioresources is available at

- NBRP http://www.nbrp.jp/
- SHIGEN http://www.shigen.nig.ac.jp/
- WGR http://www.shigen.nig.ac.jp/wgr/
- JGR http://www.shigen.nig.ac.jp/wgr/jgr/jgrUrlList.jsp

Announcements (Details are available at http://www.nbrp.jp/)

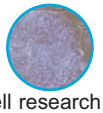
- BMB2008
  (Joint Meeting of the 31st Annual Meeting of the Molecular Biology Society of Japan & the 81st Annual Meeting of the Japanese Biochemical Society)
  "NBRP Symposium
  Date : December 9 (Tue) , 16:45–19:15
  Place: The 19th Site (Main Hall on the 1st Floor of Kobe International Conference Center)
  "NBRP Exhibition: Panel Exhibitions with Realia"
  Date : December 9 (Tue) - 12 (Fri) , 10:00 - 18:00
  Place: Exhibition Site 2 (The 3rd Hall of Kobe International Exhibition Hall)
- NBRP Symposium on "C. elegans"
  Date : November 5 (Wed) , 13:00–18:00
  Place: Yayoi Memorial Hall, Tokyo Women's Medica l University
- Symposium on NBRP BioResources and their uses and applications — Focusing on the Expansion of the NBRP and Activities at the University of Miyazaki —
  Date : November 28 (Fri), 10:00–15:30
  Place: Audio-visual room, 3rd floor of the University of Miyazaki Library
- The 2nd Workshop on Rat Resource Research
  Date: January 30 (Fri), 13:00–17:00, 2009
  Place: International Conference Hall I, Clock Tower Centennial Hall, Kyoto Univ.
- The 3rd International Biocuration Conference (IBC 2009)
  Date: April 16–19, 2009, in Berlin, Germany
  Details are available at http://projects.eml.org/Meeting2009

Introduction to Resource Center No.28

Human Embryonic Stem Cells

Hirofumi Suemori, Associate Professor,
Institute for Frontier Medical Sciences, Kyoto University

Past and present scenario of resource consolidation



The first report on the establishment of human embryonic stem (ES) cell lines facilitated further development of ES cell lines and initiated studies that used ES cells. Even in Japan, the initiation of human ES cell research was prompted not only by researchers but also by patients with intractable diseases and affiliates of these patients. In light of these developments, the ethical issues involved in human stem cell and ES cell researches were discussed and "The Guidelines for Derivation and Utilization of Human Embryonic Stem Cells" was released in Japan in 2001. In 2002, we initiated the research for establishment of human ES cell lines in accordance to the abovementioned guidelines. We used the ES cells that had been freeze-preserved for fertilization treatments and would have been disposed of without being used for any medical treatment; the cells were used after obtaining informed consent from the donors. The frozen stem cells were defrosted and cultured, and 3 blastocysts were obtained for the establishment of ES cell lines. The internal mass of the cells was isolated and cultured, and the ES cell lines were successfully established; thus, we now own 3 human ES cell lines. We analyzed the marker expressions, differentiation capabilities, and karyotypes of the cells to confirm whether these cells exhibited the properties of ES cells; then, we distributed these cells to various researchers in the country. We are currently planning to increase the number of cell lines to 10. However, the regulations in the guidelines are extremely stringent, and these regulations tend to overburden medical institutions as well as individual cell donors; therefore, it is difficult to obtain a sufficient number of embryos.

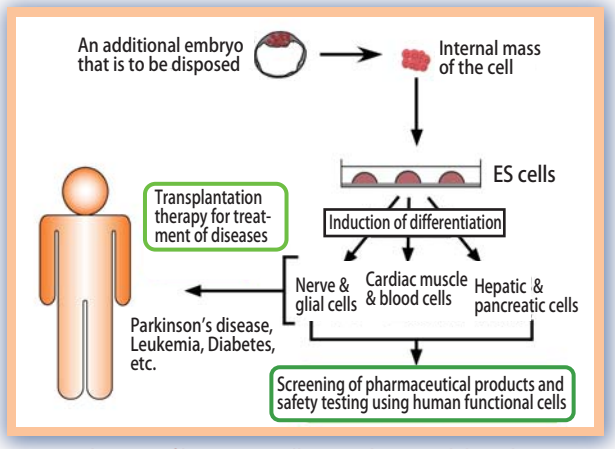


Fig. 1: Utilization of human ES cells in medicine and drug discovery
Various human functional cells developed from ES cells could be used in medicine and drug discovery.

Researches using resources

Needless to say, mainstream ES cell research is focused on using ES cells in medical transplantations. The medical application of ES cells can be divided into 3 stages. First, human ES cells are safely cultured in large quantities. Next, the cells necessary for the treatment are efficiently produced from the ES cells. Lastly, the safety and efficacy of the cells in actual treatment conditions is tested. Currently, ES cell research is primarily focused on establishment of methods for culturing the cells and inducing differentiation in the cultured cells, and few projects have shown apparent clinical applications.

In this situation, the treatment of Parkinson's disease by transplantation of dopamine-producing neurons is one of the projects that show a relatively high potential for medical application. Parkinson's disease is an intractable disease that is caused by the degeneration of dopamine-producing cells in the brain. The patients suffering from this disease develop symptoms such as muscle rigidity and attenuated motion. Although transplantation of dopamine-producing neurons has been considered as a possible therapy for Parkinson's disease, the primary obstacle was the difficulty in acquiring the cells necessary for transplantation. Sasai, et al. at RIKEN CDB established an extremely efficient method for inducing human ES cells to differentiate into neural cells, including dopamine-producing neurons, by using matrices derived from human amnion cells and synthetic media. They have already succeeded in the clinical trials using monkey ES cells on monkey models of Parkinson's disease; thus, it is expected that clinical applications in human beings may be realized relatively soon after the efficacy and safety of human ES cells have been evaluated.

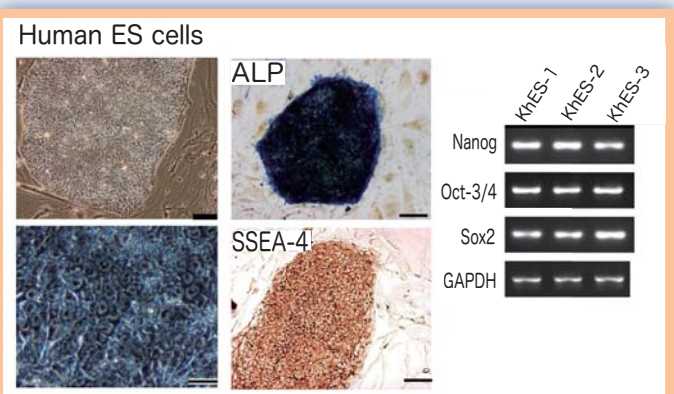


Fig. 2: Human ES Cells
Human ES cells form monolayer colonies on feeder cells. ES cells contain less cytoplasm and exhibit a characteristic morphology in which the nucleolus can be clearly observed inside the nucleus. Cell-surface antigens that are specific to undifferentiated human ES cells, such as alkali phosphatase and SSEA-4, and gene expressions of Oct and Nanog are examined to confirm the identity of the ES cells. In addition, the karyotype and differentiation capacities are tested, and the ES cells are then distributed and used for research.

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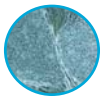
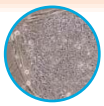


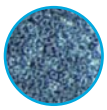
Drug development is another potential field of application for ES cells. Human cells are being increasingly used for efficacy and safety evaluations in pharmaceutical development processes. The selective production of the target cells from the ES cells will facilitate a constant and sufficient supply of quality-controlled human functional cells. In addition, the creation of cells that exhibit properties suitable to the objective of each drug development procedure will be made possible by pre-emptive genetic engineering of the ES cells. Since there is no obligation to evaluate the safety of the cells used in drug development, the practical applications of human ES cells may be realized relatively sooner in the field of drug development than in direct clinical therapy.

Moreover, ES cells can be used in researches on early embryogenesis in humans. ES cells are established by culturing the internal mass of cells in a blastocyst at the very early stages of embryogenesis. Therefore, these cells can be used as a model of early embryo cells. The analysis of human cell differentiation mechanisms in the early developmental stages has been restricted by the difficulties in sample acquisition. Human ES cells may be useful in such analyses.

Acquiring ES cells



Researchers who plan to conduct research using human ES cells are required to follow the procedure stated in the guidelines. First, the responsible official of the research group should draft a research proposal and request the head of the institution (or university) to confirm whether the plans are compatible with the guidelines. The head of the institution then asks the internal ethical committees for opinions. If the research plan is considered appropriate, the research proposal is submitted to the Minister of Education, Culture, Sports, Science and Technology (MEXT) for further confirmation, and the adequacy of the proposal is assessed by the expert committee. Even though this double-screening process by the research institute and the government is considered to be the feature of the research guidelines, it is an extremely complicated procedure without any parallel in the world. Very often, the process from research planning to authorization takes more than 1 year. This delay has resulted in a bottleneck in ES cell research. A smoother screening process is being formulated; however, the application process is inevitably overburdened, which is the primary factor that hinders the progress of research. Therefore, immediate improvements are required to be made to this process.



While distributing the cells, we conduct training programs on the methods of culturing and freeze-preserving ES cells. If the researchers are adept in basic cell-culturing techniques, the research program can be started in a relatively short period of time. In addition, we do not claim property rights for researches performed using the cells distributed by us; research achievements are attributed to the researchers and institutions. Therefore, our resources are accessible from the viewpoint of intellectual property right administration.

Please refer to the information regarding the cells that we established and the consent form for distributing the cells, both of which are available at the NBRP website (http://www.shigen.nig.ac.jp/escell/human/).

In addition, interested groups/individuals are also advised to inquire the Deputy Director Office for Bioethics and Biosafety, Life Science Division, Research Promotion Bureau, MEXT (ethics@mext.go.jp) for the research application after referencing the relevant MEXT website (http://www.mext.go.jp/a_menu/shinkou/seimei/main.htm)

Website of
NBRP Human ES Cells

A Request to Researchers

We have a request to researchers who use our bioresources for their research.

Please include information of the bioresources in Materials & Methods or Acknowledgement when you publish your research journals. In addition, please contact the facility who provided those bioresources to you.

NBRP has opened a registration website for research journals. You can easily submit the information of your journal at the address provided below.

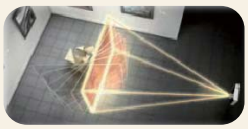
http://rrc.nbrp.jp/

Coming up in the next issue!
The special topic on resources in the next month's issue will be "Medaka."

10 minutes
Information Technology - 36 -

Easy creation of 3D models by using photos

"Photosynth" is a service application that was publicly released by Microsoft in August this year. This service allows users to easily create 3D models. Users only need to capture several continuous images. Once these images are uploaded to Photosynth, the software automatically creates a 3D model from them.



Let's install Photosynth!

A "Windows Live ID" is required to use Photosynth; therefore, new users will have to create a "Windows Live ID." Photosynth works on Internet Explorer 7 (IE7) and Firefox 2 browsers in computers running on Windows XP SP2 and Vista platforms. When you login for the first time, you will be required to register your username.

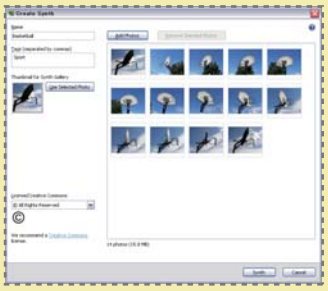


Fig. 1: Creating 3D space on Photosynth

Login to Photosynth (http://photosynth.net/Default.aspx) and click on "Create a Synth" to start Photosynth on your PC. Add the images to the application and click on "Synth" to create the 3D model.

※ When you use Photosynth for the first time, you will be asked to install a plug-in.

Let's use the software!

We used 14 photos in this demonstration; it took approximately 5 min to process the 3D model. Let's click on "View" to look at the final product.

One of the features of this software is that it allows users to interact with the model, unlike movies. A large number of views can be created depending on the combination of photos; thus, this software can be used to create a virtual tour of your research laboratory.

However, please choose your photos carefully because all files will be publicized.

Fig. 2: Screenshot of the completed 3D model created by Photosynth

(Tohru WATANABE, Center for Genetic Resource Information)

Editor's Note Consolidation of guidelines and screening systems for the use of human ES cells are extremely important; however, it is preposterous to use these regulations and administration systems to hinder the progress of research or burden the cell donors. Thus, the implementation of procedures that could ensure quicker processing would be highly appreciated. Dr. Suemori and affiliates endeavored to resolve the issues surrounding handling techniques and property rights so that the users can access ES cell resources without difficulty. ES cell research involves some delicate ethical issues in which the genuine worth of human beings is being questioned. Nevertheless, I believe that the faith of each individual will be the strongest force to promote the research (Y.Y.).

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