Addgene Rewards Plasmid Pioneers

By Melanie Herscovitch
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Addgene's Challenge Award winners were announced this week. The award recognizes laboratories using plasmids from Addgene's collection in creative ways to advance their research.

In the spirit of the NIH's Recovery Act Challenge Grants, Archon's X Prize, and other science competitions that focus on innovation and creativity, the Cambridge-based nonprofit organization, Addgene, announced the winners of its own Challenge Award. Part of the Addgene Innovation Awards program (http://www.addgene.org/awards), the **Addgene Challenge Award** was created to highlight labs that are using plasmids in both novel and creative ways to advance their research. The sole criterion for entering into the challenge was the use of a plasmid obtained from Addgene's collection. With more than 12,000 plasmids to choose from, applicants and winners represented very diverse fields, including everything from Chemical Engineering to Developmental Biology. However, the overarching theme in all of the winning submissions is the ingenuity in the use of plasmid(s) to express or finely tune the expression of gene(s). One often thinks of plasmids as a basic molecular tool, but for the winners of this award-plasmids were a central focus in the design of their projects.

One of the award winners, Aaron Gitler, at the University of Pennsylvania, has taken a unique approach in identifying important genes in neurodegenerative diseases. While yeast has long been used as a model system for studying gene function, the Gitler Lab has been using the organism to predict which genes may be important in disease. "The advantages of working with yeast are that they're very fast (to work with). And the protein folding pathways are conserved in yeast- making it a good system," explains Dr. Gitler.

The lab expressed the human ALS (amyotrophic lateral sclerosis, also called Lou Gehrig's disease) protein TDP-43 and performed a high-throughput screen in yeast to identify unique toxicity modifiers. One of the modifiers that were pulled out of the screen was the yeast counterpart to a human gene called Ataxin-2. Through collaborative efforts, it was then found that a polyQ (poly-glutamine) expansion of 24-34 repeats in the Ataxin-2 gene is linked with a higher risk of ALS in humans.

The lab hopes to continue working with yeast, as they've shown it to be a good model for understanding basic molecular and cellular mechanisms involved in neurodegeneration.

Another Challenge Award winner, the Jaenisch Lab at the Whitehead Institute, is a pioneer in developing unique strategies and techniques for studying embryonic stem cells (ESCs). One of the lab's current projects is to investigate the molecular links between X-inactivation and the pluripotent state. Dirk Hockemeyer, one of the lead scientists working on the project, explains that Zinc Finger Nucleases are being used to specifically target fluorescent reporter genes to each of the X chromosomes in female hESCs. This will result in an X-chromosome tagged hESC cell line for studying X-inactivation in live cells, the first of its kind. Future studies with the tagged X-chromosome will assay for conditions that promote the earlier developmental state characterized by two active X chromosomes in hESCs.

Another award winner was chosen based on their ground-breaking work on stem cells. Michael Roberts Laboratory from the University of Missouri is involved in understanding the differentiation process of trophoblasts. Trophoblasts represent the outer layer of blastocysts, which eventually gives rise to the placenta during development. Dr. Bhanu Telugu, a Research Scientist in Dr. Roberts' laboratory is interested in how these cells progress to a specific subtype of human trophoblast known as "extra-villous trophoblast (EVT)", whose defective invasion into the maternal uterus has been shown to cause several

pregnancy disorders, including preeclampsia. Dr. Telugu has been successful in establishing methodologies for directed differentiation of human embryonic stem cells (ESC) into EVT, in other words “birth” of these cells in vitro.

The Roberts Laboratory has also been a leader in the development of stem cell tools for regenerative studies using pig as a model species. Recently, it was one of three research groups that established induced pluripotent stem cells (iPSCs) from porcine embryonic fibroblasts.

“(The pig) is a valuable model in regenerative biology- its physiology is very similar to humans. This makes grafting studies in the pig a viable choice,” explains Dr. Roberts.

The lab continues to improve the efficiency of developing porcine iPSCs and is exploring the use of these cells for tissue grafts.

The final Challenge Award winner represents the ever-growing field of synthetic biology. As the need for alternative energy sources increases, work on biofuels has become a fast growing area of research for both industry and academia.

Alissa Kerner, a graduate student in the Lin Lab at the University of Michigan and a Challenge Award winner, is currently engineering two separate E. coli auxotroph strains in order to develop a tunable, synthetic consortium where the strains are dependent on one-another for growth. “I am manipulating the export of essential amino acids in order to create a programmable, forced symbiosis between the strains,” explains Alissa.

“This circuit can be transferred to a more complex production scheme where a highly desired biochemical molecule, such as a biofuel, can be produced,” says Alissa.

The Challenge Award was the third award distributed by Addgene through its Innovation Awards program in 2010. Winners of all of Addgene’s awards were chosen based on their commitment to scientific collaboration, one of the founding principles of the organization. Continuing to foster this core value, Addgene is proud to recognize all of its Innovation Award winners from 2010 (http://www.addgene.org/awards) and all labs that have contributed to its collection. In ushering in 2011, Addgene wishes the community a successful research year.

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Addgene is a non-profit organization dedicated to making it easier for scientists to share plasmids.

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