STEM Society Meeting, October 9, 2012

James Emery

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1 About the STEM Society and the STEM Society Website

STEM is an abbreviation for Science, Technology, Engineering and Mathematics. There are nearly 100 people on the mailing list, although a much

smaller group attends any one meeting. We meet on the second Tuesday of each month at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The meetings are open to all. The start time is 6PM. We make presentations, have discussions, and sometimes have scientific demonstrations. The topics range from General Relativity to scientific experiments for kids.

The set of meeting notes may be viewed by going down the list of notes appearing on the front page of the site. These notes contains links to documents, which may be viewed or downloaded by clicking the link. Other documents can be reached by clicking the heading "Documents and Downloads" that appears on the left side of the front page. Then click on "documents." The meeting notes may also be viewed in an archive file in the list of documents. Most of the documents are PDF files. They may be viewed or downloaded to the computer by clicking, provided Adobe Reader is present, or another program capable of reading PDF files. There are usually more documents available at the site than are listed under "Documents" because they are not in the documents.htm file.

The web site is:

`http://www.stem2.org/`

Direct to the documents list:

`http://www.stem2.org/je/documents.htm`

Direct to the archive file:

`http://www.stem2.org/je/archive.pdf`

2 The October Meeting Announcement

The October meeting of the STEM Society will take place on the second Tuesday of the month, October 9, 2012, at the Trailside Center at 99th and Holmes in Kansas City, Missouri. The starting time is 6PM.
A Suggested List of Possible Topics:

(1) Project Developments by David Frazee.

(2) Electronics: Measuring Inductance.

(3) Fourier Series, the DFT (Discrete Fourier Transform) and Matlab.

(4) Pulleys and the Relation to Conic Sections.

(5) Recent Developments in Biology: Creating Mouse Eggs From Scratch, Progeria and Aging.

(6) Book Reports.

(7) Generating and Analyzing Signals With Goldwave and Plaat.

(8) Ad Hoc Topics and Demonstrations by Attendees.

(9) Problems and Solutions.

STEM Society web site:

`http://www.stem2.org/`

3 News in Biology

3.1 Stem Cells into Mouse Eggs

Published Online October 4 2012, Science Express Index, Science DOI: 10.1126/science.1226889
Report: **Offspring from Oocytes Derived from in Vitro Primordial Germ CellLike Cells in Mice.**

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Abstract:

Reconstitution of female germ-cell development in vitro is a key challenge in reproductive biology and medicine. We show here that female (XX) embryonic stem cells and induced pluripotent stem cells in mice are induced into primordial germ cell-like cells (PGCLCs), which, when aggregated with female gonadal somatic cells as reconstituted ovaries, undergo X-reactivation, imprint erasure, cyst formation, and exhibit meiotic potential. Upon transplantation under mouse ovarian bursa, PGCLCs in the reconstituted ovaries mature into germinal vesicle-stage oocytes, which then contribute to fertile offspring after in vitro maturation and fertilization. Our culture system serves as a robust foundation for the investigation of key properties of female germ cells, including the acquisition of totipotency, and for the reconstitution of whole female germ-cell development in vitro. Received for publication 3 July 2012. Accepted for publication 18 September 2012.

3.2 Progeria and Ageing

From an NPR story, September 24, 2012:

"Researchers have found the first drug to treat progeria, an extremely rare genetic disease that causes children to age so rapidly that many die in their teens."

"The drug, called lonafarnib, is not a cure. But in a study published Monday of 28 children, it reversed changes in blood vessels that usually lead to heart attacks and strokes."

"This is a fantastic first step," says Leslie Gordon, medical director for the Progeria Research Foundation and the mother of a child with progeria.

"It has told us something pretty profound, namely that all of us are making little bits of this same toxic protein," Francis Collins says. "Kids with progeria are making a lot. We're making a little bit. And as our cells get older and older they start making more."

"The results appear in the **Proceedings of the National Academy of Sciences**, and they are encouraging. Overall, lonafarnib helped children gain weight and improve their bone structure. But more important, Gordon says, it has reversed changes in blood vessels associated with the heart attacks and strokes that usually kill kids with progeria."

So as some researchers focus on progeria itself, others will be looking for ways to use this new information to ward off a range of diseases associated with aging.

As for Sam, he's almost 16 now, working to become an Eagle Scout, and likes to play percussion in his school band.

http://www.npr.org/blogs/health/2012/09/25/161691083/experimental-drug-is-first-to-help-kids-with-premature-aging-disea

From Wikipedia:

"In normal conditions, the LMNA gene codes for a structural protein called prelamin A. There is a farnesyl functional group attached to the carboxyl-terminus of its structure. The farnesyl group allows prelamin A to attach temporarily to the nuclear rim. Once the protein is attached, the farnesyl group is removed, which permanently affixes the protein to the nuclear rim. Without its farnesyl group, prelamin A is referred to as lamin A. Lamin A, along with lamin B and lamin C, make up the nuclear lamina, which provides structural support to the nucleus. Before the late 20th century, research on progeria yielded very little information about the syndrome. In 2003, the cause of progeria was discovered to be a point mutation in position 1824 of the LMNA gene, in which cytosine is replaced with thymine. This mutation causes transcription of the LMNA gene to stop too early, which results in the creation of an abnormally short mRNA transcript. This mRNA strand, when translated, yields an abnormal variant of the prelamin A protein whose farnesyl group cannot be removed. Because its farnesyl group cannot be removed, this abnormal protein, referred to as progerin, cannot be affixed to the nuclear rim, and therefore does not become part of the nuclear lamina. Without lamin A, the nuclear lamina is unable to provide the nuclear envelope with adequate structural support, causing it to take on an abnormal shape. Since the support that the nuclear lamina normally provides is necessary for the organizing of chromatin during mitosis, weakening of the nuclear lamina limits the ability of the cell to divide. Progerin may also play a role in normal human aging, since its production is activated in senescent wildtype cells."

3.3 2012 Nobel Prizes in Medicine for Cloning and Induced Pluripotent Stem Cells.

"British scientist John Gurdon and Shinya Yamanaka of Japan shared the 2012 Nobel Prize in physiology or medicine Monday for experiments separated by almost 50 years that provide deep insight into how animals develop and offer hope for a new era of personalized medicine."

John Gurden of of the University of Cambridge in England cloned a frog in 1962, and produced Dolly the sheep. Shinya Yamanaka of Kyoto university developed the technique of making Induced Pluripotent Stem Cells from skin cells, which reduced the need for using embryonic stem cells in research. A pluripotent cell is capable of developing into any cell type.

4 A Visit by a Falcon, *Quoth the Raven: Nevermore*

Bill Reid brought a Gyrfalcon to the meeting and it presented a imposing sight indeed. A beautiful bird, the largest of the falcons, it brought various reactions, a little fear, and also a little compassion for the leashed hooded enslaved creature. According to Bill, it is worth an immense amount of money because of its genetics, this falcon is a spectacular hunter and killer, dives from 11000 ft at 230 miles an hour. Later with the hood removed, the bird which apparently can rotate its head like Linda Blair in the Exorcist, made a threatening head movement, generating the question: "What is that?" "Just triangulating," Bill replied.

5 James Emery: Pulley Belt Length, Circle Tangents, and Conic Sections

We presented calculations, figures, and programs, about the length of a pulley belt, circle tangents, and related it all to the famous **Ice Cream Proof** that a conic section is an ellipse. Projective geometry methods were used to compute a graphics figure for this proof.

See the following document titled: **Pulley Belt Length, Circle Tangents, and Conic Sections**:

`http://www.stem2.org/je/pulley.pdf`

6 James Emery: A Talk on Electrical Inductance

This included a definition of inductance using Faraday's and Ampere's laws, expressed in two of Maxwell's equations, and a discussion of measuring inductance by two methods.

(1) By using an oscilloscope and a function generator and using the fact that most electrical instruments have a resistive input impedance of 50 ohms, and that at high frequencies the amplitude across the inductor reaches a steady value. By using the frequency that gives one half this amplitude, the inductance may be computed.

(2) By looking for the series resonance point where a capacitor of known value is in series with the inductor and a resistor. Resonance occurs at a frequency where the inductive reactance equals the capacitive reactance. At this frequency the total impedance equals only the series resistance.

See the sections on inductance and measuring inductance in the document by James Emery called **Electrical Circuits**,

`http://www.stem2.org/je/ee.pdf`

And also see the document called **Electromagnetic Iheory**

`http://www.stem2.org/je/electromagnetictheory.pdf`

7 Kent Smith and Rod Shriwise: Audio Parkinson Disease Diagnoses

Kent and Rod demonstrated their project with audio displays with Goldwave and Plaat, and a flickering horizontal line on the oscilloscope.