

TECHNOLOGY SEMINAR - 03

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The last seminar (TS02) focused on *Thermodynamics* (Please see MIT course notes at <http://web.mit.edu/16.unified/www/FALL/thermodynamics/index.html>). *Light Energy* and its relationship to modern electronics were described.

This seminar will start with President-Elect Barack Obama's Radio Address of Saturday, 20 DEC 2008 where he describes his view of technology's importance to our national welfare (<http://www.youtube.com/watch?v=PMIXNrBxM0g>) and then study careers of some successful scientists who discovered medications in unlikely places.

President-Elect Obama stated in part:

*Whether it's the science to slow global warming; the technology to protect our troops and confront bioterror and weapons of mass destruction; the research to find life-saving cures; or the innovations to remake our industries and create twenty-first century jobs – today, more than ever before, science holds the key to our survival as a planet and our security and prosperity as a nation. **Its time we once again put science at the top of our agenda and worked to restore Americas place as the world leader in science and technology** [Emphasis added].*

Right now, in labs, classrooms and companies across America, our leading minds are hard at work chasing the next big idea, on the cusp of breakthroughs that could revolutionize our lives. But history tells us that they can't do it alone. From landing on the moon, to sequencing the human genome, to inventing the Internet, America has been the first to cross that new frontier because we had leaders who paved the way: leaders like President Kennedy, who inspired us to push the boundaries of the known world and achieve the impossible; leaders who not only invested in our scientists, but who respected the integrity of the scientific process.

Because the truth is that promoting science isn't just about providing resources – its about protecting free and open inquiry. It's about ensuring that facts and evidence are never twisted or obscured by politics or ideology. It's about listening to what our scientists have to say, even when it's inconvenient – especially when it's inconvenient. Because the highest purpose of science is the search for knowledge, truth and a greater understanding of the world around us. That will be my goal as President of the United States -
<http://www.foxnews.com/politics/2008/12/20/transcript-president-elect-barack-obamas-radio-address/>

If Mr. Obama were to visit your classroom, then what suggestions would you make for his science and technology agenda? How can your role in technology make a difference?

The remainder of this seminar will focus on the lives and achievements of two contemporary scientists who came from humble backgrounds, obtained excellent educations and went on to

make important discoveries in the fields of chemistry and medicine by starting with substances often overlooked by others.

While the seminar presentation will be necessarily short because of time restrictions, reference links will guide you to more information on their careers and technologies. In studying these materials, please compare and contrast their methodologies and consider how their approaches could help in your own investigations.

PERCY L. JULIAN
1899-1975

http://en.wikipedia.org/wiki/Percy_Lavon_Julian

Percy Julian's career is of special interest because he was both a scientist (Ph.D. Chemistry) and an engineer. His work spanned a spectrum from theoretical analysis of plant chemicals to construction of chemical manufacturing processes for complex organic chemicals and pharmaceuticals. He lived and worked in Chicago and its suburbs. Percy Julian High School (<http://www.pljulianhs.net/>) on Chicago's far South Side is named in memory of him.

Dr. Julian is to be respected not only because of what he overcame in the face of racial prejudice; but, because of what he achieved. As described in more detail on his WIKIPEDIA biography, Julian received more than 130 chemical patents. He was one of the first African Americans to receive a doctorate in chemistry. Also, he was the first African-American chemist inducted into the National Academy of Sciences (<http://www.nationalacademies.org/>), and the second African-American scientist inducted from any field. A biography of Dr. Julian's life and scientific achievements in the study of chemistry of plants and synthesizing *phytochemicals* (<http://en.wikipedia.org/wiki/Phytochemical>) appears on the Academy's website at <http://books.nap.edu/html/biomems/pjulian.pdf>. One of his many major achievements was synthesis from plant materials of human *hormones* (<http://en.wikipedia.org/wiki/Hormones>) such as:

- ◆ *steroids* (<http://en.wikipedia.org/wiki/Steroids>),
- ◆ *progesterone* (<http://en.wikipedia.org/wiki/Progesterone>), and
- ◆ *testosterone* (<http://en.wikipedia.org/wiki/Testosterone>).

Also, see Public Broadcasting System's *NOVA* website at <http://www.pbs.org/wgbh/nova/julian/> and listen to Dr. Julian's comments at <http://www.pbs.org/wgbh/nova/julian/spea-flash.html>.

SELMAN A. WAKSMAN
1888—1973

http://en.wikipedia.org/wiki/Selman_Waksman

While Dr. Julian was learning how to extract complex organic chemicals and pharmaceuticals from plants, such as the soybean, Dr. Selman A. Waksman was studying the microbiology of soils for pharmaceuticals – especially one that would cure an epidemic disease then called *consumption* –and now called *tuberculosis* (<http://en.wikipedia.org/wiki/Tuberculosis>). Tuberculosis is very contagious, extremely debilitating and often fatal.

Tuberculosis is caused by infection of *lungs* (<http://en.wikipedia.org/wiki/Lungs>) by *bacterium* (<http://en.wikipedia.org/wiki/Bacteria>) of the *Mycobacterium tuberculosis* species (http://en.wikipedia.org/wiki/Mycobacterium_tuberculosis) from the bacterium genus called *Mycobacterium* (<http://en.wikipedia.org/wiki/Mycobacterium>).

Dr. Waksman was born in Ukraine of Jewish parents and came to the United States when he was 22-years old. He earned a B.S. in Agriculture from Rutgers U. when he was 27 and then went on to do graduate work in *soil* (<http://en.wikipedia.org/wiki/Soil>) bacteriology, which is now part of the science of *Microbiology* (<http://en.wikipedia.org/wiki/Microbiology>). He earned his Ph.D. in Biochemistry when he was 30.

Dr. Waksman's hypothesis in his search for a cure was alarmingly simple; namely, there must be a soil *microbe* or *microorganism* (<http://en.wikipedia.org/wiki/Microorganism>) that digests *Mycobacterium tuberculosis* or Earth would be covered with them.

Dr. Waksman's search for a microorganism that would treat tuberculosis by attacking *mycobacterium* required thousands of soil experiments and is well described in Ryan, *The Forgotten Plague: How the Battle Against Tuberculosis Was Won - And Lost*, ISBN-13: 978-0316763813. It culminated in the discovery of *streptomycin* (<http://en.wikipedia.org/wiki/Streptomycin>), which was the first *antibiotic* (a term coined by Waksman and described at <http://en.wikipedia.org/wiki/Antibiotic>) that was effective against the disease. Waksman went on to make other discoveries in spite of being confronted with anti-Semitism that restricted his career before World War II.

Waksman was finally recognized for his contributions to science after World War II. He was awarded a Nobel Prize in 1952; the Japanese *Star of the Rising Sun*, the rank of *Commander* in the French *Legion of Honor* and the Dutch *Leeuwenhoek Medal*. See <http://waksman.rutgers.edu/Waks/Waksman/DrWaksman.html> and his Nobel biography at http://nobelprize.org/nobel_prizes/medicine/laureates/1952/waksman-bio.html for additional information.

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This Technology Seminar note is at <http://www.k9ape.com/publicservice/PSM/TS03.pdf>. The INTERNET version contains active URL links for your convenience.