THE WAGNER FREE INSTITUTE OF SCIENCE

Fall 2017
CHEMISTRY SERIES
The Science Behind Global Warming
Professor Kevin Cannon

This course will be held at the **Falls of Schuylkill Branch of the Free Library**, 3501 Midvale Avenue, Philadelphia, PA.

6 Mondays, October 16 – November 27, 2017

LECTURES ARE HELD FROM 6:30 to 7:45 PM

Course Description
This course explores the science that is associated with global warming, and examines the evidence pointing to ongoing global warming and the modeling techniques used to predict the warming trend. The course will examine the measurement of global temperature, the energy balances that affect global temperature, the chemistry and processes that affect the energy balances, and finally the human role in the cause and possible outcomes of the warming trend. The intention is to present relevant scientific information that will help participants make informed public policy choices.

Lectures

1. Monday, October 16, 2017 – Introduction: Is global warming real?
Currently, there is a 160 year record of measured (instrument-based) global temperatures. Measurements made throughout the 20th century show planetary warming, and this warming has undergone a sharp rise since the late 20th century. The existence of this warming trend has been challenged by some. Others, accepting the trend, minimize its significance. The first step to addressing the issue of climate change is to understand how we determine the Earth's temperature. Methods used to measure the Earth's temperature over the last 160 years will be examined.

Suggested reading: "What Weather Is the Fault of Climate Change?" Heidi Cullen, https://www.nytimes.com/2016/03/11/opinion/what-weather-is-the-fault-of-climate-change.html

2. Monday, October 23, 2017 – A History of the Earth's Changing Climate
To put the current warming trend in perspective, we need a historical climate record that precedes the 160 year instrument-based record. Techniques used determine global temperatures thousands, millions, and even billions of years are surveyed. Trends and variations in the Earth's temperature prior to the 18th century will also be examined to put the current warming trend in perspective.

NO CLASS – Monday, October 30, 2017

3. Monday, November 6, 2017 – The Earth's Energy Balance
Global warming (or cooling) is a result of an imbalance between the energy that the Earth absorbs and releases. The factors associated with this energy balance, along with their respective significance, will be detailed and reviewed. Special attention will be paid to the role of "greenhouse gases" in the energy balance, and why some gases have a greater impact on global warming than others.

4. Monday, November 13, 2017 – Carbon Dioxide and Global Warming

After surveying the greenhouse gases that can contribute to Earth's warming, the course will focus on carbon dioxide. Evidence exists for a direct relationship between the Earth's temperature and carbon dioxide levels in the atmosphere. After a presentation of this evidence, the carbon cycle will be examined to determine the factors that influence carbon dioxide concentration in the atmosphere. The effects of human activities (for example, energy production, deforestation, etc.) on the carbon cycle, and carbon dioxide's concentration in the Earth's atmosphere, will be detailed.

5. Monday, November 20, 2017 - The tipping point

A critical projection involves whether the Earth as we know it cannot recover. A survey of proposed tipping points and their expected outcomes will be discussed.

Suggested reading: "The Uninhabitable Earth: Famine, economic collapse, a sun that cooks us: What climate change could wreak — sooner than you think." David Wallace-Wells, http://nymag.com/daily/intelligencer/2017/07/climate-change-earth-too-hot-for-humans.html

6. Monday, November 27, 2017 - What does the future hold: Que Sera Sera?

Projections of future carbon dioxide levels and global temperatures have been developed for numerous human activity scenarios. These scenarios range from no proactive measures to "aggressive" measures to limit greenhouse gas emissions. Evaluation of these scenarios grounded in present technology will be surveyed to determine the likely impact humans might have on global warming.

December 4, 2017 - make-up class (if needed)

Suggested Reading

Henson, Robert. *The Thinking Person's Guide to Climate Change.* ISBN: 9781935704737

Bennett, Jeffrey. *A Global Warming Primer: Answering Your Questions About The Science, The Consequences, and The Solutions.* ISBN: 9781937548780

Mann, Michael E. *Dire Predictions: Understanding Climate Change* (2nd ed.) ISBN: 9781465433640

Howe, Joshua P. *Behind the Curve: Science and the Politics of Global Warming.* ISBN 9780295995601

Dr. Kevin Cannon is an Associate Professor of Chemistry at Penn State Abington College and a Research Associate at Temple University. He has done chemical work in bomb-detection, car paint, oil spill remediation and natural product synthesis. He has an ongoing interest in the history of science, particularly 18th and 19th century science which includes the development of the periodic table. He has been teaching for the Wagner since 2015.