KENT SCHOOL

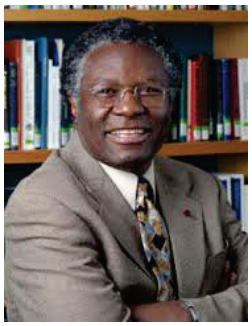
Summer Educational Experience at Kent (SEEK)

Science, Engineering, and Innovation

7-13 June 2014

Prospectus

Faculty



Calestous Juma

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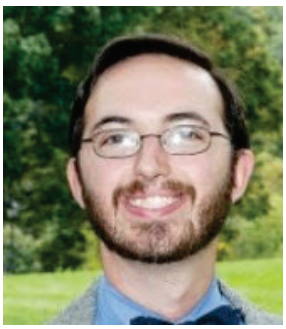
Jeremy Sokolnicki

Biotechnology and Synthetic Biology

Thomas Bouldin

Music & Creativity



Matthew Austin

Music & Physics

Edward Dunn

History

Julie Saxton

Innovation and Entrepreneurship

Introduction

In June 2014 Kent School hosts the Summer Educational Experience at Kent (SEEK) on **Science, Engineering, and Innovation**. It is one of several activities conducted as part of the pioneering Kent School Pre-Engineering Program.

Under the program, students learn how to leverage the power of engineering to solve global economic challenges as outlined in the report entitled *Grand Challenges for Engineering* by the US National Academy of Engineering. This session includes themes on: Music, Creativity and Engineering; Synthetic Biology and the Global Economy; Global Agriculture: The Sustainability Challenge; Global Health: The Antimicrobial Challenge; and Entrepreneurship. The program is implemented in partnership with the Science, Technology and Globalization Project at Harvard Kennedy School and led by its director and Kent School trustee, Professor Calestous Juma. During the 2014-15 Professor Juma will serve as Dr. Martin Luther King, Jr. Visiting Professor at the Massachusetts Institute of Technology (MIT). The program is directed by Mr. Pape Seye and involves seven Kent School teachers and staff. It includes field visits to provide students with practical exposure. Additional assistance is provided by firms such as Nokero and Little Sun, which donated photovoltaic lamps for demonstration.

Saturday June 7 | ***Laboratory Visits***

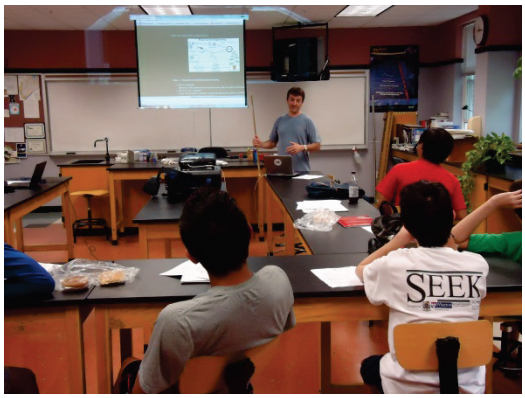
Students start by spending the weekend in the Boston area visiting laboratories at Harvard University's Wyss Institute for Biologically Inspired Engineering, the Harvard School of Engineering and Applied Sciences, and the Genetically Engineered Machine (iGEM) Foundation, an offshoot of MIT. The labs provide different perspectives including frontier biologically-inspired engineering, engineering designs by undergraduate students of relevance to development, and the basics of synthetic biology and their associated international competitions.

Monday June 9 | ***Music, Creativity and Engineering***

Music provides the cultural foundation for creativity. Students are introduced to the core principles of music as a basis for understanding the recombinant nature of creativity that underlies science, engineering and overall economic development. The introduction is supported by theory, history and practical activities. In addition, students are introduced to the mathematical, physical and engineering principles underlying musical innovation. More specifically, they learn about the physics of musical creation. They also discuss the social implications of innovation in music. Part of the time is spent on identifying future team projects that the students will work on as follow up to the program.

Tuesday June 10 | ***Synthetic Biology and the Global Economy***

The 20th century was dominated by innovations arising from the convergence of physics and engineering. The 21st century will see the addition of life sciences to physics and engineering as reflected in the rise of the field of synthetic biology. Students are introduced to the basic principles of physics and biology and their implications for economic transformation through innovation. They explore how synthetic biology can be used to address global grand challenges in fields such as agriculture and health. Students perform biotechnology experiments involving gene transfer to gain practical knowledge in one of the key foundations of synthetic biology.



Wednesday June 11 | ***Global Agriculture: The Sustainability Challenge***

One of the most pressing global challenges is meeting the rising need for food, feed and fiber while protecting the environment and addressing socio-economic inequities. Students explore the role of biotechnology and synthetic biology in addressing the challenges, with particular reference to climate change and depletion of water resources. The exploration is put in a historical context, which is provided by a visit to a Machinery and Mining Museum. Wider societal aspects of biotechnology are reviewed. Students continue to work on their biotechnology lab projects as well as explore future activities.

Thursday June 12 | ***Global Health: The Antimicrobial Resistance Challenge***

The rise of antimicrobial resistance is emerging as a major challenge to global health. Students examine the facts related to the challenge and explore how emerging tools of synthetic biology could be harnessed to address the problem. The issue is placed in a wider context of the global burden of disease and the challenges associated with persistent infectious and emerging non-infectious diseases, including cancer. They supplement the discussion with a visit to the Emergency Room of a local hospital. Students spend time in the lab working on a health-related project. They also finalize their follow-up project ideas.

Friday June 13 | ***Student Presentations and Closing Session***

Students end the program by presenting what they have learned and their ideas of follow-up activities, which include potential participation in the International Genetically Modified Machine (iGEM) competition in 2015 and beyond. This is put in the context of wider societal perspectives on entrepreneurship, risk management and public engagement pertaining to technological innovation. They unveil the design of their project web page that they researched and designed over the program period. The students receive their completion certificates.

SEEK

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