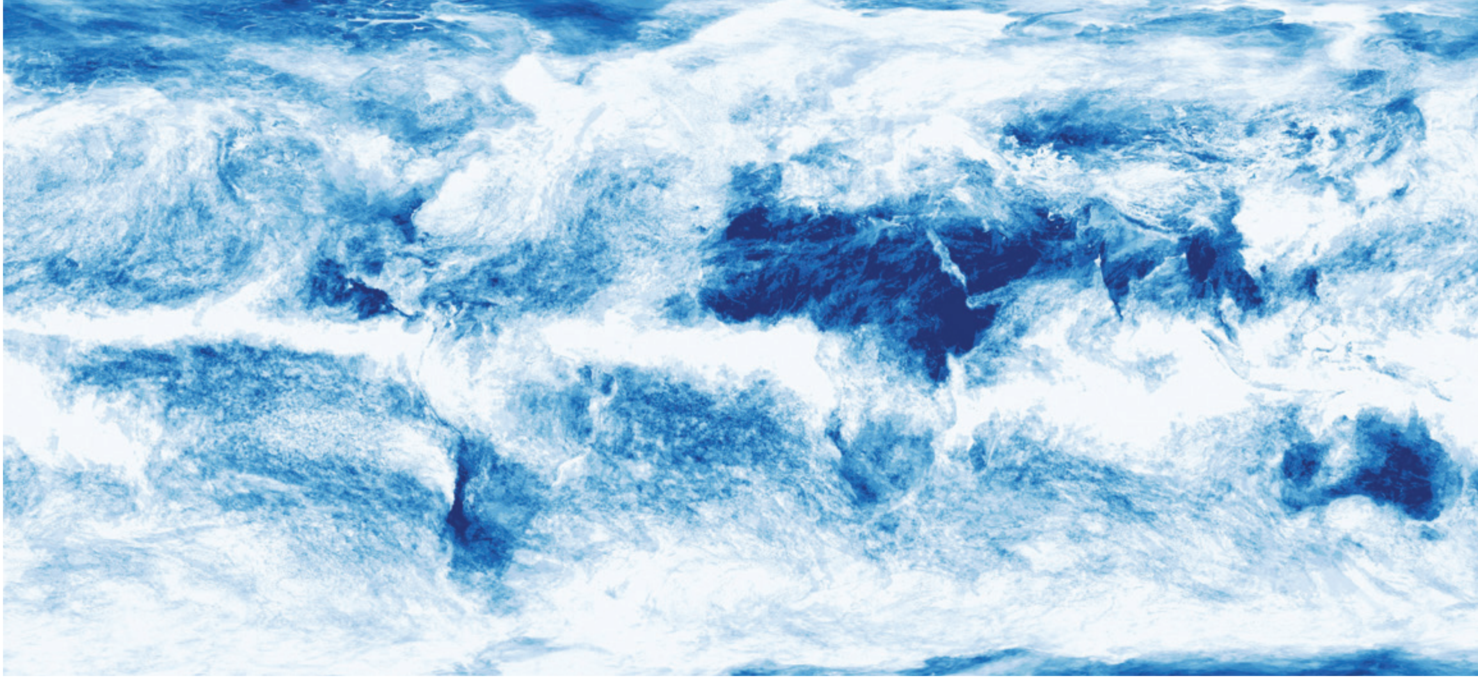

MODIS ATMOS. SCI. TEAM/RETO STOCKLI, NASA EARTH OBSERV.

**Clouds are key to understanding climate change, but more-realistic models of their formation are needed.**

climate physics combined with skills in numerical modelling. But the number of scientists involved in developing computer algorithms for improved climate models is tiny, says Christian Jakob, an atmosphere researcher at Monash University in Clayton, Australia.

Physicists agree that climate science is not a big attractor of physics students. "Very few, and rarely the best, choose to do a master thesis in climatology," says Thierry Fichefet, a physicist and climate modeller at the French-speaking Catholic University of Leuven in Belgium. "Talented physicists commonly go into more glamorous fields such as astronomy, cosmology or particle physics." According to the American Institute of Physics in College Park, Maryland, 49 PhDs were awarded in atmospheric chemistry and climatology in the United States in 2013, compared with 303 for astronomy and almost 2,000 each for physics and mathematics.

Many physicists applaud Bony's effort to raise interest in climate science, but whether physics students will heed her call remains to be seen. "We offer courses in climate science and our students do recognize the importance of the field," says Paul Linden, a fluid-dynamics researcher at the University of Cambridge, UK. However, he says, classical subjects with a long history such as cosmology, are just more attractive, particularly at his university. "Most physics students would rather study with someone like Stephen Hawking, who is a member of our faculty." ■

BIOTECHNOLOGY

# Synthetic biology called to order

*Meeting launches effort to develop standards for fast-moving field.*

**BY ERIKA CHECK HAYDEN**

Synthetic biologists have a vision. Researchers in this young field, who build 'devices' from engineered genes and other molecular components, imagine a future in which products such as drugs, chemicals, fuels and food are manufactured by microbes. These devices could even be wired up to create cellular computers, much as electronic transistors are wired up to make microprocessors (see *Nature* http://doi.org/3fz; 2013).

But if the dream is to be realized, those components need to perform more consistently and be more reproducible than they are now, especially as they move from the lab bench to the biofactory. Unlike silicon-based electronic devices, synthetic organisms assembled from genetic components do not always have predictable properties — at least not yet.

On 31 March, representatives from industry, academic institutions and government met at Stanford University in California to launch the Synthetic Biology Standards Consortium, an initiative led by the US National Institute of Standards and Technology (NIST) to address issues preventing the field from reaching its potential.

"It's the signal of a maturing industry," says Patrick Boyle, who oversees the organism-design pipeline at Ginkgo BioWorks, a synthetic-biology company in Boston, Massachusetts. "As we get better at synthetic biology, we want to make sure we are comparing apples to apples."

The standards push comes at a pivotal point for synthetic biology. Ginkgo BioWorks is one of several 'foundries' set up to mass produce organisms for various uses. Others include Amyris Biotechnologies and Zymergen, both in Emeryville, California, and publicly funded initiatives in the United Kingdom and the United States. Massive firms — and potential customers for these foundries — are showing interest in the field. The chemical manufacturers Dow and DuPont, the US defence-technology giant Lockheed Martin, the drug maker Novartis and the Dutch health and materials-sciences company DSM were all represented at the NIST meeting.

Participants divided into work groups to brainstorm what standards would make it easier for synthetic biologists to share methods, materials and information. The groups concentrated on a wide range of topics, including standards for automating methods, describing and assembling components and documenting the performance of engineered bacterial strains. One group considered how to demonstrate the safety of commercial synthetic-biology products. Another worked towards calibration methods for flow cytometry, a widely used technology for counting and sorting cells.

Each working group will now carry its ideas forward. NIST will provide support for these efforts, but where they go is up to the researchers. ▶

Like most life-sciences fields, synthetic biology faces issues with reproducibility (see *Nature* **515,** 7; 2014). It has proved difficult for labs to replicate strains engineered by others, which is hampering progress in industry and in academic research. One lab may not provide enough information about how a part was made for another to reproduce the work. Or researchers may toil to refine a process, only to find that the developer has already done that work without reporting it in the literature.

"It's just difficult to know all the information out there, because there isn't a set of standard ways to describe what we know about a biological resource," says Ryan Ritterson, a synthetic biologist at the University of California, San Francisco.

Synthetic biologists who work in industry pushed for standards that would simplify commercial decisions. For instance, organisms that make products well in the lab do not always work when grown to bigger scales. Boyle advocated the development of 'reference strains' whose behaviour has been characterized in different types of fermentation equipment and growth media. This is particularly important to companies that want to understand whether variations in manufacturing efficiency stem from the organisms or from external factors.

The NIST-led effort is not the first attempt at standardizing the tools and methods of synthetic biology. The Synthetic Biology Open Language project is an online consortium that is developing standard nomenclature, symbols and other tools to describe engineered systems. The BioBricks Foundation has designed a licence to facilitate the free exchange of biological parts. And several repositories make and distribute such parts.

But those efforts have addressed only some of the reproducibility issues in synthetic biology. Parts in some of the repositories do not always work or are mischaracterized. Not all companies want to use parts that are in the public domain, or contribute their components to these repositories. And the field has moved on since some of the standards were set; for instance, the standard method for assembling BioBricks can be slower than newer methods for making complex DNA assemblies.

Meeting participants said that they hoped that the NIST initiative's inclusion of researchers and companies would help it to overcome some of those problems. "We had people coming from different areas who all have different stakes in the outcome," Ritterson says, "and rather than dividing into factions and deciding what standards would work best in our applications, we had thoughtful conversations about the standards that would work best for the entire community." ■

Tom Kariuki will head a funding platform for African research that is due to be launched in June.

SVEN TORFINN

DEVELOPING NATIONS

# Africa aims for research autonomy

*Regional hub intends to manage international grants and develop science strategy.*

**BY LINDA NORDLING**

African scientists look set to gain greater control over research in their own countries, if an ambitious plan for a regional hub to award grants and develop research capacity bears fruit.

Three international funding bodies are giving seed cash of around US$4.5 million to establish the Alliance for Accelerating Excellence in Science in Africa (AESA). The London-based biomedical charity the Wellcome Trust also hopes to transfer the management of millions of dollars in its research funds to the alliance. AESA's other two backers are the UK Department for International Development and the Bill & Melinda Gates Foundation in Seattle, Washington. The idea is that AESA will be a platform for managing Africa-focused research programmes and a think tank to direct the continent's science.

"Science can and will transform Africa. But to get there, we must train critical numbers of excellent scientists in all corners of Africa. That is the mission of AESA," says Tom Kariuki, a Kenyan immunologist who was appointed as the alliance's director in March. It is due to be launched in June by African heads of state, and will operate out of the headquarters of the African Academy of Sciences in Nairobi.

## REMOTE CONTROL

For decades, African science capacity and research output have lagged behind those of the rest of the world. But they are now taking off in fields with clear impacts on African development, such as health and agriculture, in nations including Uganda, Kenya, Ghana and Nigeria (see *Nature* **474,** 556–559; 2011). One problem is that overseas funders still supply a large chunk of the research cash and decide where and how it is spent.

"Much of the research done in Africa is still predominately financed by global funders from Western Europe and the United States, and still managed from Western capitals from funders' head offices," says Kariuki (see 'Funding from abroad'). That has limited the impact of such research, in part because it matches priorities set outside Africa. Funding is in short supply for studying neglected tropical diseases, for example, and funding for HIV research is not always directed at the countries in the greatest need. African researchers can also struggle to keep