PÉTER HÁMORI © EUROPEAN COMMISSION

Neelie Kroes (center), the European Commissioner for Digital Agenda, opens the exhibition at the May conference in Budapest where six finalists for two billion-dollar projects were announced.

such sensors could alert the wearer to gas, or to pollen or other allergens in the environment. Further in the future, the sensors could interact via emotions, says Ionescu. (Although Switzerland is not a member of the European Union, it participates in EU research funding. In 2010 it was ranked by the EU as Europe's most innovative country, and three of the six FET pilots have coordinators there.)

But intelligent robots, sensors, and devices "will only be remotely feasible with a deep understanding of the computing principles of the brain," says EPFL neurology researcher Henry Markram, coordinator of the human brain FET pilot. "And we are very far from understanding the brain or any of its nearly 600 different diseases." The solution, he says, "is to integrate all the fragments of data and knowledge on the brain." Such a "21st-century approach," he adds, "had to wait for supercomputing to become useful in biology."

Graphene, the strong, lightweight, flexible carbon material whose discovery was recognized with last year's Nobel Prize in Physics, is the focus of another FET pilot project. "One of the defining features of research is that you never quite know what is around the corner," says coordinator Jari Kinaret of Chalmers University of Technology in Gothenburg, Sweden. Still, he adds, "we will create a science and technology roadmap for where graphene is going in the 10-year timeframe." Examples of graphene applications might be large foldable keyboards and screens for smart phones or lightweight nanocomposites for aircraft. "Graphene will result in products and jobs," says Kinaret. "You could say that the new investment opportunities will either be in Europe or elsewhere. The new jobs will either be in Europe or elsewhere. And we would like to see them here."

Investment versus risk

Over the next year, the six pilot finalists will be making their cases in hopes of being selected as a flagship. This period is not about getting new research results, but rather about showing scientific and technological excellence and social impact, defining project governance, and gaining additional financial commitments. "You have to have something that is visionary, but at the same time credible for funding bodies," says Ionescu. European Commission (EC) funding would start in 2013.

The EC has traditionally funded small- to medium-sized projects for three-year periods. "If you look in general at the results, there is a lot of fragmentation, because projects are all running independently," says Ionescu. The main idea of the FET flagships is to "federate this effort and have all the research serving a common goal of bridging science and technology to have the largest impact on society."

Says Kinaret, "I get the impression that funding will likely be 50-50 from the EC and other sources, but this could be 40-60 or 60-40, and it need not be constant" over the decade. In the case of graphene, and perhaps for other areas as well, Kinaret says, "none of the potential materials producers is willing to take the risk and start producing material before they know that the demand is going to be there. And none of the companies that develop applications are willing to say they are really going to put big money there unless there is a materials supply. It's a chicken and egg situation." Kinaret hopes that with the FET flagships, "federated funding may be a catalyst that allows us to get through these barriers."

Dario, who served on the EC advisory panel that formulated the new funding mechanism, says that with the FET flagships, "We want to bridge science with technology and try to address major social programs, and maybe create new industry, educate thousands of researchers, innovate, create new jobs. That is what we dream."

Toni Feder

Developing-world academy of sciences has new leader

The mathematical physicist looks to increase the number of PhD scientists in economically challenged countries.

Rwandan-born physicist Romain Murenzi began his tenure in April as executive director for TWAS, the Academy of Sciences for the Developing World (formerly the Third World Academy of Sciences). He succeeds Sudanese physicist Mohamed Hassan, who had led the organization since its inception in 1983.

Based in Trieste, Italy, TWAS shares office space with the Abdus Salam International Centre for Theoretical Physics and reserves committee positions for ICTP scientists. Both organizations were founded by Salam, the physics Nobel laureate from Pakistan, and fall under the auspices of the United Nations Educational, Scientific and Cultural Organization.

Murenzi's chief task is to promote science and technology (S&T) for sustainable development in five regions: Africa, Central and South Asia, East and Southeast Asia and the Pacific, Latin America and the Caribbean, and the Arab Middle East. He says he will focus on the goals in TWAS's existing strategic plan, which include increasing grants and prizes for young scientists, growing the organization's $15 million endowment, and shifting operations, including the selection of recipients for scholarships and grants, to the five regional offices.

No stranger to S&T policy, Murenzi has served as TWAS vice president for

the Africa region and as a policy scholar on sustainable development at the American Association for the Advancement of Science. From 2001 to 2009, he was Rwanda's minister of education, science, technology, and scientific research. During his tenure, Rwanda increased its R&D spending to 1.6% of GDP, compared with 0.3% for most other African countries and 2.8% for the US, and reserved 70% of its higher-education loans for students majoring in S&T-related disciplines.

Murenzi completed his bachelor's degree in mathematics in Burundi, where he also taught high school mathematics; his master's and PhD degrees in physics in Belgium; and his postdoctoral research in France. He served as chair of the physics department at Clark Atlanta University in the US. His academic research focused on continuous wavelet applications for multidimensional image and video processing.

PHYSICS TODAY spoke with Murenzi by telephone in May.

PHYSICS TODAY: What are your top priorities for TWAS and how will your experiences as an academic, a national science minister, and a policy scholar help you in your new role?

MURENZI: All my experiences contribute to my vision of strengthening science in developing countries. I have an understanding of the importance of science for development and not just science for science. [The question is,] how do you do science that will have an impact on the daily lives of people: food security, water, health, energy, climate change, global infectious diseases? Developing countries cannot tackle these science-based issues if they don't conduct science research. And for that to happen, they need to be able to train scientists at the highest level, in particular to have doctoral-degree scientists. So that's something that I'm going to be concentrating on. TWAS has developed a doctoral [scholarship] program in collaboration with [universities in] emerging countries like Brazil, China, India, and Malaysia for students from S&T-lagging countries. TWAS selects the candidates and pays for their travel costs. Right now, there are only 300 fellowships per year. If we can scale it up to 1000 or more per year, I think it could have a major global impact.

PT: What other initiatives will you focus on?

MURENZI: At the highest level of S&T policymaking, you need to create knowledge by producing PhDs and creating opportunities for postdoctoral training. You want [scientists] to know what's happening in the world, and you need to provide research funding for [them]. We have several programs for visiting scientist exchanges, funding research professors, all of which you can find on our website [http://www.twas.org].

TWAS

Murenzi

PT: Your predecessor, Mohamed Hassan, has stated the importance of TWAS's decentralizing, shifting more control to the regional offices, and serving as a funding agency for the least-developed countries. He especially wants to see TWAS's endowment grow to $25 million over the next decade. Are these also your priorities?

MURENZI: Yes. Decentralization is crucial, since our members are scattered around the world. So it makes sense to empower our five regional offices—in Nairobi, in Alexandria [Egypt], in Bangalore [India], in Beijing, and in Rio de Janeiro. I plan to visit each of them in the next couple of months.

With regards to making TWAS an NSF-type [agency], with our network of 1000-plus members throughout the world, we've been able to develop a really good selection method [for funding researchers]. If a particular [developed or emerging] country wants to help an S&T-lagging country, TWAS is positioned to help. We are planning a major fundraising campaign to scale up our grants and prizes.

PT: How will you go about raising the money?

MURENZI: The details of the campaign will be worked out at our next general meeting in November by our development committee and our future action committee. What I can say is that I think there are possibilities not only to raise the number of fellowships but also the number of [sponsoring] countries. For example, scholarships could go to students from lagging African countries to attend the African University for Science and Technology in Abuja, Nigeria, or Benin's Institute of Mathematics and Physics or some very good graduate programs in Kenya and South Africa. The cost would be relatively cheap. The same thing can also be done in Latin America. By keeping students within the region, we can then go after grants from the regional development banks, such as the African Development Bank or the Inter-American Development Bank.

PT: Do you see this intraregional postgraduate training plan as one way of stemming the high brain drain from developing countries?

MURENZI: Country leaders should understand that they need to put up an incentive and remove barriers in order for their citizens to return. There are people who study abroad and want to return, but the political climate deters them. If the political climate is not good, most people tend not to return, or if they return, they leave when things get bad. TWAS will also advocate for countries to have a national policy, a long-term plan for science, technology, and innovation. Doubling the number of PhDs alone can make a huge difference in raising the level of research in a small developing country.

PT: Given their rapid economic growth, do you think countries such as China and Brazil still belong in TWAS?

MURENZI: Those countries are emerging, but they are still developing. They've been able to develop world-class laboratories. And through TWAS, they've given opportunities to scientists and students from the lagging countries to go and study in their labs. So for me, I would not separate them. India, China, and Brazil are very good examples for the S&T-lagging countries of what can be done when a country is serious about S&T for development.

Jermey N. A. Matthews

Supercomputing has a future in clean energy

As national laboratories tout their high-performance computing for energy applications, the path to more powerful computers may be blocked by prohibitive electricity requirements.

As supercomputing surges toward the exascale—10^{18} floating-point operations per second (flops), or 1000 times as powerful as today's top-performing petaflop machines—the US Department of Energy and its national laboratories are promoting the use of high-performance computing (HPC) to power the development of clean-energy technologies.

Lawrence Livermore National Laboratory (LLNL), home to some of the world's most powerful supercomputers, cosponsored a conference in