Wales, known as a land of poets, artists, bards (and rugby), wants to be just as famous for its science. Benchmarking against the other parts of the United Kingdom—England, Northern Ireland, and Scotland—showed that although Wales has five percent of the U.K. population, it receives only about three percent of U.K. Research Council funding. Wales excels at attracting support for the arts, but could do better in science. This analysis prompted the government, in spring 2012, to release Science for Wales, a 60-page document with a five-year vision for Welsh science. The plan could support the Welsh economy by creating research jobs and businesses. A major goal is increasing the share of U.K. research funds to be proportional to the population by 2017.

Of course, research funding is not doled out based on population numbers, and must be earned. But Wales feels it deserves a bigger piece of the pie. “Scientific productivity is a point of pride for U.K. ministers, who say we produce more with less, and Welsh research has quite a few good examples of that,” says Peter Halligan, head of Strategic Futures at Higher Education Wales. “In several areas Wales does very well. In psychiatry and psychology we’re in the top 10 for citations per paper, but many people aren’t aware of that. Wales has made significant progress over the past decade and currently exceeds the world and European average for research impact despite producing proportionally fewer overall publications.” Computer science, social science, engineering, and neuroscience are other areas where Wales is punching above its weight, says Halligan. And with the Science for Wales agenda, the Welsh government is trying to do more to develop that potential.

Driving the new scientific plan is John Harries, who became the first Welsh chief scientific adviser in 2010. “We’ve got some real pinnacles of excellence in Wales,” said Harries in a 2012 BBC interview, “but we need to augment the quality of our work.” Science for Wales, he said, “can up our game and bring more research money to Wales.”

**The Centerpiece Of The Agenda**

At the center of the Science for Wales agenda is Sêr Cymru or Stars Wales, funded with £50 million—nearly $80 million. The Welsh government also wants to support science education, collaboration, and technology transfer, and quite simply, to be better at promoting Welsh science. Researchers are spreading the word about Wales as it launches an ambitious scientific plan. By Chris Tachibana

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**Upcoming Features**

- Diversity (online only)—June 7
- Postdocs—August 23
- Faculty: Collaborative Grants—September 13
Focus on Careers
Wales

will identify, encourage, and direct collaborative grants and projects in the priority research areas. First Minister of Wales Carwyn Jones says, “Here in Wales we certainly have a lot to be proud of, but we now need to build further on our science base to develop a dynamic and strong research community based on international excellence. That is what our Sêr Cymru program is about—attracting top scientific researchers and their teams to Wales.”

Installing preeminent researchers at Welsh universities could boost the Welsh science agenda, stimulating funding, publications, and further recruitment across the country. It’s a bold approach in times of general budget austerity, but the program faces an issue familiar to any university recruiter: established scientists are reluctant to relocate. Mid- to late-career professors often have families and strong connections to their institutes and their communities. In addition, finding high-profile candidates in some fields, like engineering or low-carbon research, can be difficult because the most well-known science awards rarely go to researchers in those areas.

“Sêr Cymru is a fantastic idea,” says Davey Jones, who chairs Soil and Environmental Science at Bangor University, “but it’s been difficult to find people. The energy and environment fields don’t have a lot of Nobel Prize winners like they do in life sciences and health.” Setting up the National Research Networks has also been challenging because they must balance inclusiveness with becoming too diffuse, distributing resources equitably with boosting areas of strengths, and casting a wide net for contributors while connecting the most relevant collaborators. Says Jones, “We need to concentrate our efforts on fields where we have expertise. If we focus on the things we’re already good at, we can make them better.” An example, he says, is the Welsh government’s recent investment in regional agro-environmental activities. These efforts have increased interaction between universities, policymakers, and regulators around sustainable management of agricultural ecosystems, says Jones. “The science we do in this area makes a difference. It’s directly made things better for farmers.”

As the new science agenda gets under way, educators want to make sure that the emphasis on three areas of science and the focus on senior researchers does not neglect students and junior faculty. Sêr Cymru fits well with the country’s current research and education strategy, says David Blaney, chief executive of the Higher Education Funding Council for Wales (HEFCW), the government arm that funds Wales’ universities and colleges. In fact, he says, by increasing agency efficiency, HEFCW was able to contribute £15 million to Sêr Cymru, “over and above” other research funding. Blaney says that although changes in government support for undergraduates recently reduced HEFCW funds, contributions to general research should remain steady at £71 million annually. In addition, he says, “We fund all areas for teachers—with additional funding for science because of expenses such as labs.” The government is working to promote science in the school curriculum, for example establishing a National Science Academy in 2010 to coordinate activities that encourage science education.

Other New Initiatives
Early- to mid-career researchers in Wales can find new opportunities for professional development and collaboration through Welsh Crucible. Participants in this program must show achievement in their field and commitment to a research career in Wales. The program is designed to support networking and collaboration, especially between scientists at different universities and in different fields. Lijie Li participated in the first round of Welsh Crucible in 2011. Li is a senior lecturer in the college of engineering at Swansea University who works on nanosensors and actuators that detect and respond to the environment. He says the program introduced him to researchers from other universities in Wales that he might not otherwise have met. The events, says Li, “allowed us to come together for opportunities to share ideas and discuss our research.”

Through Welsh Crucible, Li and his colleagues at Swansea University received seed funding for two collaborative projects with researchers at Cardiff University. The studies are small, says Li, but designed to gather preliminary data that could lead to additional funding. One project is focused on investigating ways to transfer mechanical movement into electrical energy, which could lead to environmentally friendly energy sources, for example for wearable devices. Li says Welsh Crucible has accomplished its goal of bringing Welsh researchers from multiple disciplines together, and his new collaborations are evidence. “I hope it will eventually expand to the rest of the U.K. and perhaps internationally,” he says.

Li’s office and laboratory are less than five miles from another major Welsh science project, the £400 million Swansea University Science and Innovation Campus. Leading the project is Pro Vice Chancellor Iwan Davies, who says the campus “represents a major scientific facility for Wales.” In addition to providing much-needed space and infrastructure at Swansea University, especially for engineering, Davies hopes the new campus “will attract the very best scholars to the university.”

The Welsh and U.K. governments and the Wales European Funding Office made substantial contributions to the first phase of the Science and Innovation Campus, projected to open in 2015. The oil company BP donated nearly 70 acres of land. The campus will incorporate a science park that will include the College of Engineering, continued>
Mental health. Recently, MRC scientists have made notable advances in areas such as Alzheimer’s disease, Huntington’s disease, schizophrenia, bipolar disorder, depression, and ADHD. An additional push for the life sciences industry comes from the Welsh government, which announced the Life Sciences Wales Investment Fund in May 2012. The government has pledged up to £100 million for the fund to stimulate life sciences research and development.

Opto-electronics (or photonics) is a £1 billion-per-year industry for Wales and an example of how a scientific strength can have a local and national economic impact, says Paul Rees, professor of optics:
technology and metrology, Glyndŵr University. North Wales has the largest cluster of opto-electronics companies in the United Kingdom, says Rees, and the industry, community, and universities have “a symbiotic relationship.” University-industry connections and the relevant skills of local residents have made the region attractive to companies and strengthened the opportunities for opto-electronics research. The Welsh Opto-Electronics Forum, an industry-led interest group that originated in North Wales, is working with both industry and universities to respond to national initiatives such as Sêr Cymru. Also in the area is OpTIC Glyndŵr, part of Glyndŵr University, which includes incubator space for high-technology companies. OpTIC Glyndŵr is a facilitator of exchange of expertise and academic-industrial partnerships, a door between academia and industry,” says Rees.

Combining Strengths

Conversations about how a small place like Wales, with three million people, can have an international scientific impact, often include the terms “collaborations,” “mergers,” and “critical mass.” The showcase example is frequently the Institute of Biological, Environmental and Rural Sciences (IBERS) at Aberystwyth University. The school has a strong record of international collaborations and partnerships with a wide range of institutions, including the University of California, Berkeley, and the University of Tokyo. This has helped to establish a strong research network, with opportunities for students and researchers to work with leading experts in their fields.

The School of Business and Economics, and space for industry. For example, Swansea Materials and Research Testing (SMaRT), a subsidiary of the university, will be located at the new campus. SMaRT performs tests on materials for clients such as Rolls Royce, Dyson, and Airbus.

“Wales is naturally attractive to many industries. It has a history of high-quality engineering using traditional raw materials—steel and coal—and is now working in more advanced materials like high-performance composites,” says Andrew R. Barron.

Barron has an endowed chair in chemistry at Rice University, an honorary chair in engineering at Swansea University, and is known for nonacademic research on vintage sports cars. His academic work covers the trio of focus areas in Science for Wales: materials engineering, life sciences, and environmental research. Barron interacted with Welsh industries and academic institutions as the first Prince of Wales Visiting Innovator in 2009. “At the time,” say Barron, “they were just getting relationships between companies and universities going. That has grown a lot in the last few years.” Sêr Cymru could drive job creation and better science education in Wales, predicts Barron, especially if there is growth in research and development as well as manufacturing.

The life sciences have high potential for expansion in Wales, especially since researchers have access to the data and tissue banks of the U.K. National Health Service. Barron, a featured speaker at the 2013 BioScience Wales conference, says that he used the National Health Service resources as a selling point when connecting a U.S. company that is developing a pancreatic cancer test with Welsh collaborators. Another international, life sciences facility in Wales is the Medical Research Council (MRC) Centre for Neuropsychiatric Genetics and Genomics. Housed at Cardiff University, the center capitalizes on Cardiff’s exceptional researchers and resources in neuroscience and mental health. Recently, MRC scientists have made notable advances in areas such as Alzheimer’s disease, Huntington’s disease, schizophrenia, bipolar disorder, depression, and ADHD. An additional push for the life sciences industry comes from the Welsh government, which announced the Life Sciences Wales Investment Fund in May 2012. The government has pledged up to £100 million for the fund to stimulate life sciences research and development.
Environmental and Rural Sciences (IBERS). With 350 staff, 150 scientists, and 1,200 undergraduates, IBERS is a merger of the Institutes of Rural Sciences and Biological Sciences at Aberystwyth University and the Institute for Grassland and Environmental Research from the U.K.’s Biotechnology and Biological Science Research Council, with a formal collaboration with the Bangor University College of Natural Sciences. Aberystwyth University brings strengths in plant sciences and Bangor University has expertise in soil science, agroforestry, and social sciences, says IBERS Director Wayne Powell.

“By bringing together institutes and departments that were working in isolation before, we’ve created a center that attracts people who wouldn’t normally think of coming to Wales,” says Powell. Joint faculty appointments and collaborative grant applications have helped make the geographically dispersed groups into a single institution, he says. With a broad mission covering animal sciences to biodiversity, IBERS can influence the areas of climate change, sustainable and renewable energy, food security, and others, says Powell. For example, IBERS is breeding grasses with high sugar content, suitable for grassland ecosystems in the United Kingdom and the United States. The economic and environmental benefits of using these grasses include efficient weight gain when ruminants are fed the high carbohydrate diet, with “fewer pollutants coming out their back end.” Waste from the grasses can be used for bioethanol production, sparing food sources such as maize. Powell says the high-tech grasses lead directly to products while supporting rural communities.

Expertise in energy and engineering is the foundation of the Low Carbon Research Institute (LCRI). This collaborative enterprise has representatives from six Welsh institutes and universities but is led and managed by Cardiff University, based on its strengths in energy research. Alan Guwy, head of the Sustainable Energy Research Centre, University of Glamorgan, leads research in hydrogen energy systems for the LCRI. This area of research covers hydrogen vehicles and fuel cells as well as biological production of hydrogen and use of its byproducts. “LCRI researchers have a history of working in the low carbon area. Now, in this consortium, we’re feeding off each other, developing new ideas, learning about funding opportunities, and meeting with funders and other academics around the world,” says Guwy. For instance, he explains, scientists at Glamorgan are working on biofermentation of hydrogen and methane from biowastes. Swansea University researchers contribute expertise in separation of wastes from valuable fermentation intermediates, and Bangor University collaborators focus on end products and testing.

The critical mass principle applies to Welsh universities, which have already gone through many mergers, name changes, and alliances, with more on the way. Researchers, administrators, and government officials alike agree that mergers are a good idea. The challenge is finding ways to combine forces in a way that strengthens the research and educational system, yet retains previous investments in infrastructure and preserves unique institutional cultures. Future mergers could result in the 11 Welsh universities coalescing into about eight. The universities understand the need to collaborate and coordinate. In 2009, Aberystwyth, Bangor, Cardiff, Swansea, and Glamorgan universities created the Saint David’s Day Group with a goal of reaching out to businesses, the government, and international contacts to help Wales out of the recession.

The central element of the Science for Wales agenda is under way, as universities search for Sêr Cymru research chairs and National Research Network directors. In the meantime, scientists in Wales are asked to consider hosting international conferences, serving on U.K. councils, and publicizing their research successes. It’s all part of getting the word out about science in Wales. At Aberystwyth University, Powell says, “It’s a good time to be considering Wales as a destination. We have a real opportunity now to combine scientific excellence and impact, all in a great environment to live.”

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