

# Central, East & South Europe

Countries in the region are pushing to adopt a broader research base, along with updated institutional organizations. But for the most part it is the physical sciences that remain strongest.

ARTICLE COUNT: **3,351**  
 FRACTIONAL COUNT (FC): **1,321**  
 WEIGHTED FRACTIONAL COUNT (WFC): **1,048**

One of the most striking findings about this region is the subject distribution of its research footprint.

Globally, subject areas for papers in the Nature Index are fairly evenly split among the life sciences, chemistry and physical sciences, with each commanding approximately one third of the share (with earth and environment papers making up 6% of the total). In Central, East and South Europe, however, there is nearly double the output in physical sciences. To some extent, this reflects history. Science in countries in the former USSR and Eastern Bloc was affected by communist ideology: fields held to showcase the best of the Soviet system, such as space science, were favoured, while others that contradicted ideology, such as genetics, were suppressed.

As the largest country in this region, with almost 143 million people, Russia produces the most high-quality science — and, as expected, is focused mainly on the physical sciences. Its world-leading centre for nuclear physics, the Joint Institute for Nuclear Research (JINR) — set up as a Soviet response to the European Organisation for Nuclear Research, also known as CERN in the 1950s) has seen its budget swell from US\$37 million in 2005 to more than \$100 million in 2010. The institute, renowned for its work on the synthesis of new superheavy elements, has built new facilities and upgraded its existing ones. In the index, the JINR contributes

to 3% of Russia’s physical sciences weighted fractional count (WFC), a measure of the relative contribution of an institution to each paper.

Russia’s 290-year-old Academy of Sciences (RAS) is the top institution in the region by article count (AC) and WFC. However, RAS is undergoing a painful overhaul. In 2013, president Vladimir Putin’s administration passed laws forcing the RAS to merge with its two sister academies, which focus on medical and agricultural research. It is also downsizing, with its 483 institutes facing staff cuts. The turmoil at RAS is not the only blight on the Russian research landscape. Earlier this year, NATO and NASA cut ties with Russia in response to the situation in the Ukraine, threatening the future of its international collaborations, which within the index, at least, are greater than the global average.

## REGIONAL REGENERATION

With the collapse of communism in the early 1990s came turmoil, followed by regeneration and change. In central Europe, former Eastern Bloc countries such as Poland, Hungary and the Czech Republic have since been reforming their infrastructures to make them more merit-based.

Poland is second in the region with a WFC of 216 (sandwiched globally between Brazil and Finland). The country, which joined the European Union (EU) in 2004, has been pursuing policies to modernise the traditional,

hierarchical structure of its research institutions. In 2010, new government moves to make the funding of Polish science more competitive included establishing a new funding agency, the National Science Centre, and reforming the existing National Centre for Research and Development. “This is the biggest achievement,” says Maciej Żylicz, president of the Foundation for Polish Science (FNP), an NGO that supports scientific research in Poland. About a decade ago, only 13% of government funding was in the form of competitive grants, he says. Today that figure is about 50%. “This is a big change, not only physically, but psychologically.”

Poland has also undertaken a number of initiatives to support the life sciences. One notable example is the International Institute of Molecular and Cell Biology (IIMCB) in Warsaw, founded following a 1995 agreement between the Polish government and UNESCO. “This international umbrella helped us to build a structure that is totally different from the structures of the institutes of the Polish Academy of Sciences or universities,” says Żylicz, who also heads the Department of Molecular Biology at the IIMCB.

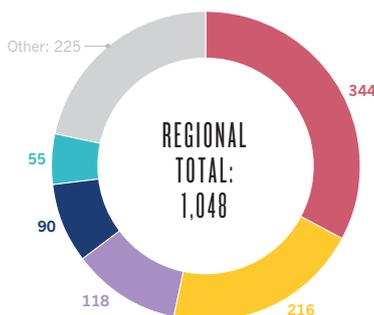
The IIMCB has an international advisory board, which helps select principle investigators. Scientists do not have tenure, but are evaluated every four years and dismissed if they are not up to scratch. “In normal Polish institutes, there is no way to fire professors,” says Żylicz.

## CENTRAL, EAST & SOUTH EUROPE ANALYSIS

■ Russia ■ Poland ■ Czech Republic ■ Greece ■ Hungary ■ Slovenia ■ Cyprus

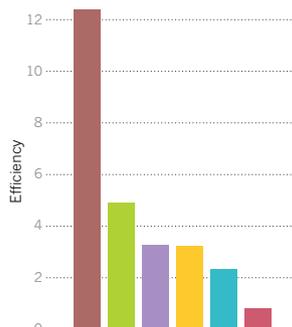
### Countries’ weighted fractional count (WFC)

Of the 22 countries in this region, Russia and Poland produce more than half of the high-quality science.



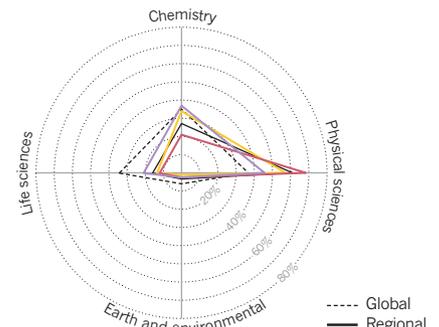
### Researcher efficiency

WFC per 1,000 researchers<sup>1</sup>.



### Research strengths

The whole region is heavily skewed towards the physical sciences<sup>2</sup>.



1. Source: UNESCO. 2. Subjects overlap, so the total for each country can be >100%.

Cyprus may have a population of 866,000 people and a WFC of only 10.9, but it tops the region in terms of its researcher efficiency, or WFC per 1,000 researchers, rivalling that of western European countries such as the United Kingdom and Germany. This might seem surprising given that, unlike these countries, Cyprus' research history is short: its first public university, the University of Cyprus, was only established in 1989; and its first research institute, the Cyprus Institute of Neurology and Genetics, opened in 1990. But, says Vassilis Tsakalos, Director General of the Research Promotion Foundation (RPF), an NGO that supports scientific and technological research, youth is a virtue. "It's a new system," he says. "The institutions were created with the latest ideas in mind. So they are very dynamic."

Although funding in Cyprus suffered as a result of the global financial crisis, scientists are hopeful that spending will now remain stable, says Tsakalos. The RPF gets most of its funding from the government, which spent about half a per cent of GDP on R&D per annum between 2010 and 2012. Recently, the Cypriot government appointed a committee to recommend on the governance of research and innovation.

**UNIVERSITY CHALLENGE**

Science in this region is dominated by national academies of science, which are conglomerates of tens or hundreds of smaller, dedicated research institutes. To allow for comparison, the index can focus on universities only, which for the top three countries include the University of Warsaw, Charles University in Prague and Lomonosov Moscow State University (MSU). The universities are all of comparable size: Warsaw has around 7,000 staff, and the same number of PhD and postdoc students; Charles University has more than 7,900 staff, including 4,500 academic and research staff; MSU has 10,000 faculty including 5,000 researchers.

Publications from all three are heavily dominated by the physical sciences (see 'Institutional subjects'). Yet while Warsaw is proportionally the most focused on physics, its WFC for this subject

is 21, whereas MSU produces the most physics output in absolute terms with a WFC of 24.

Warsaw is involved in several large international physics collaborations. One to which its researchers contribute particular expertise, says Warsaw's Rector Professor Marcin Palys, is the Compact Muon Solenoid (CMS) collaboration at CERN. Another strength is the university's highly regarded astronomical observatory, which in 2013 made a major contribution to a *Nature* paper that more precisely measured the distance to the Large Magellanic Cloud — an important cosmic yardstick. The paper created a stir internationally, earning the university one of its highest scores on altmetric.com, which tracks media outlets (see 'Online visibility').

Charles University, too, has been successful with international physics projects including the High Energy Stereoscopic System (HESS) Collaboration and the PHENIX Experiment at Brookhaven National Laboratory, as well as projects at CERN. "These collaborations have been very productive," says Jan Konvalinka, vice-rector of Charles University. MSU, likewise, has published extensively as part of the LHCb, CMS and ATLAS collaborations at CERN.

Of the three institutions, Charles University produces the largest fraction (18%) of output in the life sciences. Key to this success are the university's links with the European Molecular Biology Organisation and other EU initiatives, and offers of support to attract foreign scientists.

In terms of publications in *Nature* and *Science*, Charles University lags behind Warsaw and MSU with only 0.3% of its WFC from these journals. Konvalinka expects this to change. As well as investment in facilities, changes in the way the university and government rate papers should increase quality. Previously, the Czech government's science funding schemes valued only the quantity of papers produced, an issue that Konvalinka and several leading Czech scientists have criticized. "Now we need to see to it that not only the quantity of research papers but also the quality of original scientific contributions is increased substantially," says Konvalinka. ■

**HUNGARY**

*Academy of Sciences*



The beautiful Hungarian Academy of Sciences

Hungary, like many other countries in central and eastern Europe, has an Academy of Sciences (HAS) as its top institution. But unlike the academies of Russia, the Czech Republic or Poland, for example, HAS has a much stronger record in the life sciences, which comprise more than a third of its output. The academy has a long history in this area: the Biological Research Centre in Szeged and the Institute of Experimental Medicine in Budapest are regarded as leading institutions in the country. The latter contributed to almost half of the academy's WFC in the life sciences.

However, in terms of publications in *Nature and Science* HAS is far less productive than the academies of neighbouring countries. It is looking to change this and in 2009 launched its Momentum programme, with Ft2.5 billion (US\$10 million) of government funding, to encourage outstanding young Hungarian researchers to remain in or return to the country. HAS received a further boost in 2012, when the government increased its overall funding by 20% to Ft35 billion (US\$142 million). HAS expects this to translate into a significant increase in publications in the most prestigious journals over the longer term, an academy spokesperson told *Nature*.

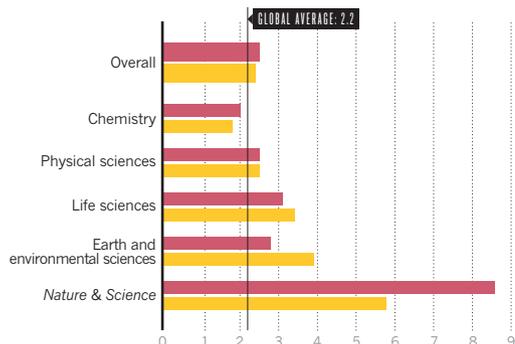
HUNGARIAN ACADEMY OF SCIENCES

■ Russia ■ Poland

■ Lomonosov Moscow State University (MSU) ■ University of Warsaw ■ Charles University in Prague

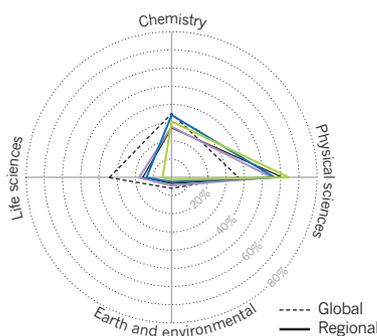
**Collaboration rate**

Dividing AC by FC gives a proxy for average number of collaborators per paper from outside the country.



**Institutional subjects**

Warsaw is most skewed towards physics, but MSU has higher actual output<sup>1</sup>.



**University of Warsaw's online visibility**

A paper involving the astronomical observatory helped refine an important cosmic yardstick<sup>2</sup>.



1. Some subjects overlap, so total can be >100%. 2. DOI: 10.1038/nature11878 data from altmetric.com, 22 September 2014.