

DOD PHOTO/ALAMY

DRC-Hubo, the humanoid robot that won its creators from KAIST a US robotics prize.

SOUTH KOREA

A big investor in research and development, South Korea is attracting top scientists in the hope of boosting basic science.

BY MARK ZASTROW

When computer scientist François Rameau made the decision to pursue his career abroad, he did it more quickly than most. After looking up the research output of the robotics and computer-vision laboratory at the Korea Advanced Institute of Science and Technology (KAIST) in Daejeon, South Korea, where he had been offered a position, he instantly rejected the three postdoctoral fellowships on offer back home in France. “I realized it’s probably one of the best in the world,” he says. “I went without hesitation.”

Rameau is now working on driverless cars — one of the hottest research fields in computer science. He has a five-year fellowship from the National Research Foundation (NRF) of Korea and additional funding from the German manufacturer Bosch. Since Rameau arrived, the lab’s reputation has continued to grow: in 2015, a group of his colleagues won the US Defense Advanced Research Projects Agency Robotics Challenge with DRC-Hubo, a humanoid robot that can drive a car, climb stairs and open doors.

Robotics is one of the many fields that have benefitted from South Korea’s focus on research and development (R&D) since the start of the century. In 2014, the country spent 4.3% of its gross domestic product (GDP) on R&D — the highest globally, and twice what it spent in 1999.

This investment has been partly spent on recruiting high-level international scientists to South Korean institutions. But these have often been joint appointments, under which the researchers work at the institutions for only a few months of the year. Although this approach

may have lent prestige, it is widely viewed to have failed to improve research quality. As a result, many universities are now moving towards offering more long term, full-time appointments.

The Institute for Basic Science (IBS), a network of university-based research centres established in 2011, does not offer joint appointments. “Foreign recruits have to resign from their previous position and move here,” says Doochul Kim, president of IBS, headquartered in Daejeon.

Efforts to attract talented scientists to South Korea are partly driven by concern over the country’s low birth rate, and fears of a looming shortfall in the number of students taking up university places. The government hopes to double the number of foreign students at South Korean universities to 200,000 by 2023. It has also created a visa for entrepreneurs and offers citizenship to those who studied in Korea and have since been in employment for two years.

Language can present hurdles for foreign researchers — calls for grant proposals are often only in Korean, for example. And there are few international schools outside of the capital. This is why, instead of living close to his lab at KAIST, Turkish chemist Cafer Yavuz, and his wife and son, live in Seoul. He makes the three-hour commute by bus to KAIST twice a week. “It’s a working solution, but it’s not ideal,” he says.

Rameau, who doesn’t have children, has no such worries. He is considering looking for an academic position in South Korea when his fellowship ends. He says those moving to the country might find that it takes a while to get their bearings. “Don’t judge too early,” he says. “You need to stay for more than six months to start to understand the state of mind of the people.” ■



KOREA INSTITUTE OF SCIENCE AND TECHNOLOGY

BYUNG GWON LEE
President of the Korea Institute of Science and Technology (KIST)

How easy is it to get a job at a South Korean institution?

The job market is getting tougher, but the country’s increasing globalization offers great opportunities for foreign scientists.

What advice do you have for scientists hoping to work in South Korea?

Without learning Korean, foreign scientists cannot compete for R&D funding. For those who find work, I strongly advise that they broaden their professional and personal network. Tight social and business circles can limit opportunities, but Koreans are warm-hearted, and Korean scientists in particular are open-minded to scientists from abroad.

What are the relative benefits of working for government institutes, universities or industry?

Industry is well funded, but focuses on the profit motive to the extent that your project is continuously under review and can be terminated quickly. Government institutions also provide good resources, but it can be difficult to find high-quality students to fill positions, which can make it difficult to make progress. Academic institutions have access to very good students, but funding is sometimes limited.

How does South Korea’s famously hierarchical work culture affect scientists?

Local researchers are very respectful towards principal investigators and senior researchers. Foreign researchers have a bit more freedom. They can freely walk out of the lab, whereas Koreans typically ask permission if they want to leave before the principal investigator.

What is the best thing about working in South Korea?

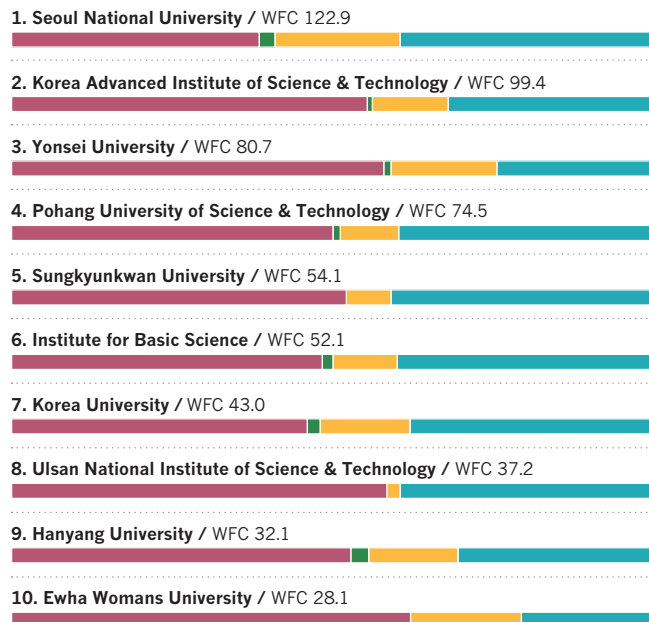
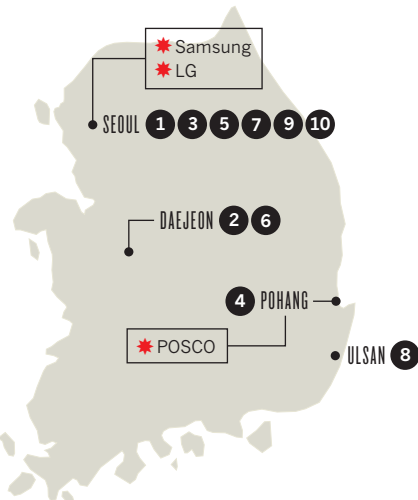
It’s the Koreans. They are highly educated, and have strong characters and great energy. **M.Z.**

This interview has been edited for length and clarity.

WHERE TO WORK

The top ten institutions in South Korea, based on research output included in the 2015 *Nature Index*, May 1 2015–April 30 2016, shown as weighted fractional count (WFC), a measure of the relative contribution of an author to an article weighted to correct for imbalances between subjects. Bars are divided according to the proportion that each subject area contributes to the overall score.

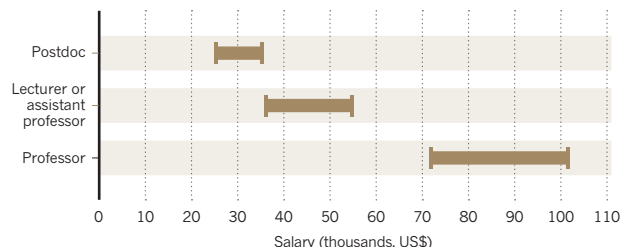
- Chemistry
- Earth and environmental sciences
- Life sciences
- Physics
- ★ Major industry employer



Overlaps in subject areas may cause some distortion to relative subject proportions.

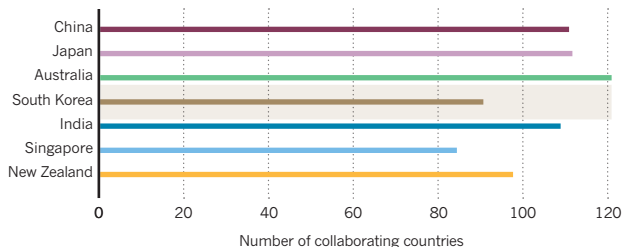
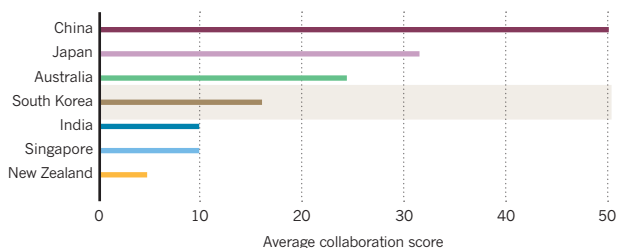
SALARIES

Compared with researchers elsewhere in the Asia-Pacific region, postdocs are relatively poorly paid and professors relatively well paid in South Korea, according to data collected in *Nature's* interviews.



COLLABORATIONS

South Korea's average collaboration score (top) — the sum of *Nature Index's* fractional count (the relative contribution of authors to an article) for international collaborations divided by the number of countries South Korea collaborates with.



RESEARCH FOCUS

The hunt for dark matter — which is thought to make up around 27% of the Universe — could come to an end in South Korea.

One possible component of dark matter is a theoretical particle called the axion. In 2017, physicists at the Center for Axion and Precision Physics Research (CAPP) in Daejeon expect to complete the development of a detector that could find this particle. CAPP director Yannis Semertzidis also hopes to build an experiment to detect the electric dipole moment of the proton, which if found could help to explain why there is more matter than antimatter in the Universe.

CAPP is one of 26 research centres that make up the Institute for Basic Science (IBS), a national institution founded in 2011 to bolster blue-sky research. The institute's task is to rebalance the country's scientific efforts to include more basic science alongside the previous focus on applied research, which was deemed to offer more immediate economic benefits. Other centres in the network focus on different fields, including laser science, gene editing and nanomedicine.

The IBS has plans to open further research centres that specialize in areas of mathematics, environmental science, theoretical and nuclear physics, optics, new materials and the use of nanotechnology in biomedicine. It plans to recruit scientists to serve as directors and associate directors of these, and offer fellowships for young scientists, in 2017.

OPPORTUNITIES & CONTACTS

- The Korean Government Scholarship Program offers scholarships to international graduates or undergraduates, consisting of one year of Korean instruction, followed by up to six years of study.
- The International R&D Academy at Korea Institute of Science and Technology trains scientists and engineers from developing countries and offers PhD programmes through the affiliated University of Science and Technology.
- The government-run Brain Korea 21 Program for Leading Universities and Students (BK21 PLUS) initiative funds professor and postdoc positions at various research universities. ■