

## Blazing a different path

The **JAPAN ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY (JAIST)** has created an environment for nurturing true intellectual rigour

**Since it was established in 1990**, the Japan Advanced Institute of Science and Technology (JAIST) has been a bold experiment in cultivating a supportive environment for its students and researchers. JAIST focuses purely on research and postgraduate education, so faculty are not tied up teaching undergraduate courses.

Furthermore, the institute is located in an affordable rural area, a 40 minute drive from Kanazawa city, and lower living costs allow students to focus on their studies and research.

JAIST president, Tetsuo Asano, points out that to pay rent many Japanese university students have to juggle the demands of part-time jobs with their studies, whereas most JAIST students take advantage of the inexpensive on-campus accommodation. "JAIST is open

24 hours a day, so they can pursue their research at any time they want," he says. Another difference is that courses are designed around topics that address social needs, rather than the pet topics of professors. "This allows us to provide courses that better meet the needs of students," says Asano.

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### **Interdisciplinary and international skills**

JAIST's education system is designed to build the skills needed to tackle



President of JAIST, Tetsuo Asano.

interdisciplinary research through fostering intellectual toughness — the ability to cope with emerging areas and the challenges of overlapping academic points of view. Asano adds that "JAIST seeks to empower students to leave their comfort zones, because they may well discover something more exciting outside them." Intellectual toughness, he points out, "is about being dissatisfied with where you are at and looking forward."

Intellectual toughness is fostered by letting students fully tailor their courses, enabling them to design

their studies to transcend the boundaries between specialties. Until three years ago, students were restricted to taking courses only from one of three schools. But Asano says this resulted in unnecessary barriers between schools. He decided to tear down these barriers and allow students to take courses from any school. Now, students can design courses based their own needs, says Asano. "Other universities don't offer that freedom of choice; we're the only one."

Classes are offered in both English and Japanese, and more than half of the students



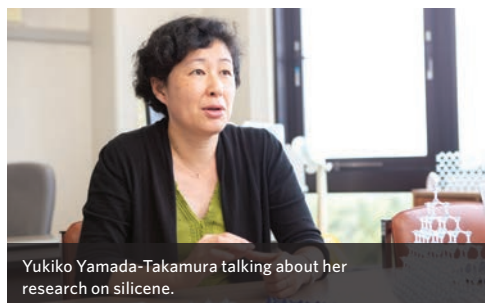
Hiroshi Mizuta in his laboratory.



Mizuta describes his work on graphene.



JAIST's main campus in rural Ishikawa.



Yukiko Yamada-Takamura talking about her research on silicene.



Two researchers at work in the lab of Yamada-Takamura's group.

at JAIST's main campus are from overseas, which is also virtually unheard of elsewhere in Japan. This has created a uniquely proactive study environment at JAIST. "In general, Japanese students are more reluctant to ask questions during lectures," notes Asano. "But most international students are active learners and ask many questions. Japanese students at JAIST have imbibed this approach to learning."

#### **An idyllic place to pursue research**

In addition to being an effective place to study, JAIST

provides a highly conducive environment for research. Some schemes entice productive researchers with big salaries, but Asano considers this somewhat misguided. He argues that most researchers care more about their research environment than inflated pay cheques. Hiroshi Mizuta, who is looking into graphene's potential as a highly sensitive skin gas sensor, agrees. Mizuta says that JAIST's set-up gives him more time for research and the support of management. "This is the most comfortable place for me to focus on my research. I'm very lucky."

Mizuta notes that the university houses an impressive range of equipment. "We have more than 200 pieces of state-of-the-art equipment," he says. The university's provision of financial support to keep the equipment in an optimum state is unusual for Japan, he says. "Most other universities lack technical staff — it's a big benefit." This support is vital to Mizuta who is also using an emerging technique — a helium-ion beam — to pattern graphene into structures smaller than 10 nanometres that could be used to make the thermal

equivalent of a transistor, a device that allows heat to flow in one direction, but not in the opposite direction.

Another researcher, Yukiko Yamada-Takamura, who is exploring the growth of inorganic thin films, came to JAIST in 2006 for a chance to do independent research. "Here at JAIST, young professors can be principal investigators and run their own research groups," she explains. "I thought it was a great opportunity and challenge to start my own group from scratch."

Her results have already been impressive. Through a collaboration with two other groups, in 2012 Yamada-Takamura discovered that silicene — the silicon equivalent of graphene — forms on a substrate of zirconium diboride. The paper on that discovery, which was one of the earliest reports of the fabrication of silicene sheets, has been cited more than 1,000 times, and highlighted in a news report in *Nature*.

Forming collaborations is effortless and dynamic at JAIST, she says. "You just walk and talk directly with your colleagues and then collaboration starts right away. It's very easy." Yamada-Takamura says she is delighted to have been able to collaborate with the groups that she worked with on the silicene paper "and that my collaborators and I were all at JAIST." ■

