where many ethnic Chinese researchers were employed, the researchers began to flood back to Hsinchu (see graph on p. 423). The park is now filled to overflowing, and a second park began operations in 1997 at Tainan in the south (see "A science giant rises out of the rice fields", overleaf).

Some of these returnees, such as Nicky Lu, a former researcher at IBM's Thomas J. Watson Research Center and now president of Etron Technology in the HSIP, have established start-ups back in Silicon Valley to push forward the frontiers of technology their companies are interested in (see "Nicky Lu — entrepreneur", overleaf). Thus, a dynamic two-way interaction between Silicon Valley and Hsinchu is being established.

Academia's rising star

The success of the electronics industry and booming Taiwan economy created an environment in which US-based Chinese scientists in basic research also began to return.

One example is Nobel prizewinner Yuan-tseh Lee, who came back to head the Academia Sinica, Taiwan's leading institution for basic research, in 1994. In turn, Lee has been instrumental in bringing back the brightest and best to the academy, which is now beginning to make its mark in molecular and structural biology, astronomy, biomedical science, surface science and Lee's own field of molecular and atomic science (see "Beating the odds", p. 422).

The academy, which consists of 25 institutes housing 818 researchers, has increased the number of its papers published in international peer-reviewed journals from 200 to 1,220 in the past decade. This gives a 14% share of the total papers in the Science Citation Index that Taiwan produced in 1998.

As well as strengthening the academy by implementing recruitment campaigns and external reviews of staff and institutes, Lee has established a technology transfer office. For the first time, scientists are seeing their ideas patented and developed by local industry.

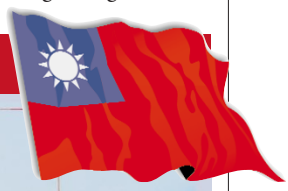
In the first 70 years of its existence, the academy failed to secure a single patent. But since 1998 it has filed 80 applications in the United States, of which ten have been approved and seven have been licensed to companies. The technology transfer office already has about US$7 million to show for its efforts, moving into the black after just three years. The office also helps with the licensing of research and holds exhibitions to showcase Academia Sinica research to potential buyers.

Microarrays or 'biochips' are one example of success. Konan Peck of the Academia Sinica's Institute of Biomedical Sciences has licensed his colorimetric detection technique for complementary DNA microarrays to three local start-ups — U-vision Biotech, Taiwan Genome Sciences and GeneMaster Biotechnology Corporation — and one US start-up, PhytoCeutica, which was established by Yung-chi Cheng at Yale University.

But the academy and its scientists are new to the game of technology transfer, and not accustomed to lengthy patenting processes, which can severely delay publication of research papers. One of the academy's most commercially promising results — a mutant mouse for studying spinal muscular atrophy — illustrates some of the frustrations researchers unused to the business world face when trying to capitalize on their research (see "The rodent route to celebrity", p. 425).

Overall, technology transfer remains underdeveloped. Chi-ming Liang, director

Building a progressive sci-tech island



In 1949, a rag-tag Chinese nationalist army (Kuomintang or KMT) fled the communist army of Mao Tse-tung and took refuge on the island of Taiwan — officially taking the name Republic of China. The KMT controlled the island until the election of Chen Shui-bian of the Democratic Progressive Party (DPP) in March this year. The mainland People's Republic of China maintains a "one China" principle, stating that Taiwan is just a renegade province. Although relations between the island and the mainland have always been tense, the election of a member of the DPP, which is known for making strong statements favouring Taiwanese independence, has irked mainland leaders.

The influx of ethnic Chinese from abroad, mostly but not exclusively returnees of Taiwan origin, has fuelled Taiwan's electronics boom, and many of the highest rungs of Taiwan's academia are populated by Chinese who have come, or returned, to Taiwan in the past decade. The government has dedicated itself to making Taiwan a "progressive sci-tech island". It has already shown ingenuity in establishing science parks and industrial institutes, which gave rise to the successful electronics industry. The government budget for science and technology for 2001 stands at NT$53.1 billion (US$1.7 billion), up 10.3% on 2000.

The government continues to promote both academic and industrial R&D. Public R&D spending has increased yearly by 8–10% for each of the past five years, and aggressive government policies have encouraged private research so that total R&D spending (government plus industry) has jumped from 1.0% to 2.0% of GDP since 1986. This puts Taiwan on par with the United Kingdom, France and Germany but still behind the United States, Japan and Korea. This has boosted academic science, though some see an "overly democratic" emphasis on even distribution of research funds as preventing development of some of the best talent. But Taiwan's international openness has created a fluidity in terms of capital, technological and human resources that has made it a vital node in the global economic, technological and scientific web. D.C.