TRIESTE
city
of
science

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NANOTECHNOLOGY In TRIESTE

Trieste is a city on the far east side of Italy. Built on the rugged hillside above its beautiful port and the dramatic Adriatic coastline, it is rather peculiarly wedged between the mountains and the sea. Gazing eastwards, it is possible to see the rocky green Karst, while on the other side the Adriatic Sea sways gently under the wind. Trieste is famous for it's marvelous seafood and Vienna-like coffee houses. But there is much more to enjoy in this marvelous mediterranean city that was once a part of the Austro-Hungarian Hapsburg Empire. Not many people know, even in Trieste, about an extraordinary new line of work that has developed in the city over the last few decades: scientific and technological research.

The number and prestige of the research facilities that have been set up in and around Trieste is nothing short of staggering. Here is a list of only the biggest of them: the Abdus Salam International Centre for Theoretical Physics (ICTP), established in 1964, whose success has not only given Trieste a valuable cultural dimension but also acted as a catalyst for many of the subsequent scientific developments; the AREA Science Park, with campuses at Padriciano and Basovizza where about 1,600 people work in over 70 research laboratories and high-tech companies; the International School for Advanced Studies (Scuola Internazionale Superiore di Studi Avanzati - SISSA); the International Centre for Genetic Engineering and Biotechnology (ICGEB); the ELETTRA Synchrotron Light Laboratory; the Trieste centers of the National Institute of Nuclear Physics

and the National Institute for the Physics of Matter; the National Research Council Institute of Crystallography and the Structure of Matter; the International Centre for Science and High Technology (ICS); the Third World Academy of Science (TWAS). A central role in this prestigious context is obviously played by the city's main institution of research - the University of Trieste, with its 12 faculties (including Medicine and Surgery, Engineering and Mathematical, Physical and Natural Sciences), its lecturers and researchers, post-graduate students and 27,000 undergraduate students.

As a result of this proliferation of scientific establishments, Trieste and its province can now boast a total of 4,700 people working in R&D, of whom 3,400 are researchers and technology experts - a huge proportion of the overall population.

The scientific disciplines studied in Trieste cover the leading edge of research: the physics of sub-nuclear particles and astronomy, the sciences of the atmosphere and the seas, biotechnology and biomedical technology, new materials, chemistry, environmental sciences, electronics, industrial automation, informatics and telecommunications. The laboratories and research centers produce new fundamental and basic knowledge, develop and perfect technological innovations and nurture new high-tech companies able not only to survive but also to prosper in international markets.

Special mention should be made of the high-level training for scientists from developing countries carried out by a number of research bodies, particularly those in the orbit of the United Nations, such as the ICTP, the ICGEB and the ICS. This is an innovative formula that has proved to be highly successful. The Centers give scholars from developing countries the chance to work on leading-edge subjects with top-level European and American scientists, leading to a direct personal transfer of knowledge and culture which benefits all concerned and is invaluable to the scholars who return to their countries to manage their own research institutions.

Recently, in Trieste there has also been established a new Center of Excellence for preparation, development and characterization of nanomaterials and surfaces

(CENMAT). CENMAT has been designed to act as a focus for current interdisciplinary nanoscale materials and device research. In bringing together world-class infrastructure and leading nanotechnology research activities, the Centre will attain the critical mass to compete with the best facilities abroad. Furthermore by acting as a bridge between the biomedical, physical, chemical and engineering sciences the Centre will cross the 'chip-to-cell interface': an essential step if Italy is to remain internationally competitive in biotechnology.

Of course, the Centre will pursue strong links with the commercial and broader nanotechnology community.

Some examples of the Center's scientific focus areas are given below:

Fabrication Research: Because of the large potential payroll for the Italian industrial base, and to gain a competitive edge, there is a need for the state-of-the-art fabrication and new processing routes. The Centre will house various leading fabrication tools and associated research programmes

Theory and Modeling: We are entering an exciting period of which the length scale of systems that can be accurately simulated is the same as the scale on which symptoms can be imaged and fabricated: such as simulations will be core to the Center's operations

Experiments on Chips and Tips: Complete scientific experiments as a process embedded on a chip and operating to atomic precision represent as profound a change for experimental sciences. A particular emphasis is placed on the optical spectroscopic characterization of nanomaterials a submicron level, through the joint use of Raman and/or fluorescence spectroscopy, Scanning near field optical microcopy (SNOM) and Atomic force microscopy (AFM).

Novel electronics: The principal emphasis of the Center's device work will be on the use of novel materials to engineer nanoscale electronic, optoelectronic and electro-mechanical devices for applications in electronics and sensing

Nanobiology: The development of chemical and biological sensors, and the ability to examine biological processes at a scale below that of visible light, will yield new real-time diagnosis and therapeutic regimes

Advanced catalysts: Cluster size effect on catalytic activities and alteration of the properties of metal clusters with increasing metal-support interaction are investigated with the aim of designing new catalysts of optimized catalytic properties