The London Centre for Nanotechnology

Located in the London neighborhoods of Bloomsbury and South Kensington, the London Centre for Nanotechnology is a UK-based multidisciplinary research center that operates at the forefront of science and technology. It is a joint venture between two of the world’s leading institutions, UCL and Imperial College London, uniting their strong capabilities in the disciplines that underpin nanotechnology: engineering, the physical sciences and biomedicine. The London Centre for Nanotechnology has a unique operating model that accesses and focuses the combined skills of the Departments of Chemistry, Physics, Materials, Medicine, Electrical and Electronic Engineering, Mechanical Engineering, Chemical Engineering, Biochemical Engineering and Earth Sciences across the two universities. It aims to provide the nanoscience and nanotechnology required to solve major problems in healthcare, information processing, energy and the environment.

Genesis & development of the LCN

The London Centre for Nanotechnology (LCN) was formed in response to the emergence of nanotechnology as a significant area of scientific progress in the early years of the new millennium, a development that coincided with the recapitalization of university science programs in the UK through the Scientific Research Investment Fund (SRIF) and recognition within UCL that nanoscience efforts in disparate faculties and departments needed to be consolidated in order to achieve critical mass. In 2002 UCL and Imperial College evaluated their capabilities in nanoscience and considered what they could achieve by joining forces. Construction of a purpose-built £14 million facility began in Bloomsbury the following year and the LCN building was officially opened in November 2006 (Figure 1). Housing a state-of-the-art clean room and more than £7 million of equipment, it provides a complete range of interdisciplinary tools for both bio- and non-bio-nanotechnology. There has also been a considerable additional investment in South Kensington – most notably, a £2.4 million grant from the Engineering and Physical Sciences Research Council (EPSRC), which enabled the procurement of a Titan scanning transmission-electron microscope – the first of its kind in the UK and one of only a few in the world.

The LCN has grown rapidly and now has a turnover in excess of £10 million. Operating funds derive from a range of private and public sector sources, including the UK research councils, the EU, private companies, such as STS/Sumitomo, and charities, such as the Gatsby and Wolfson Foundations. Despite these varied funding streams, the UK government remains the most significant source of income and the LCN has been successful at winning large numbers of grants and contracts, with values ranging from several thousand to several million pounds. This funding supports the research of close to 100 academic staff associated with the LCN on both of its sites.

Research areas

The vision for the LCN is for it to become Europe’s premier research center for applied nanotechnology in the areas of healthcare, information technology and environmental engineering, focusing on...
the delivery of research programs that
tackle real-life challenges, benefiting both
society and industry (Box 1).

■ Healthcare
The LCN mobilizes its unique cross-
disciplinary expertise to harness nanotech-
nology and provide new forms of healthcare
for the 21st century. Tools such as micropat-
terning and microfluidics (Figure 2) are being
used to address fundamental problems in
cellular biophysics and novel forms of micro-
scopy (Figure 3) are being developed to image
biomolecular interactions. In addition, a
range of diagnostic equipment is under
development, together with specialized
sensors and tools for drug discovery. The
most recent research award – a £1.6 million
Grand Challenge grant from the EPSRC
– provides a good example of the LCN’s
collaborative, multidisciplinary approach.
It will fund a world-leading consortium to
engineer and commercialize the next gen-
eration of multimarker HIV smart chips,
which will rapidly diagnose and monitor
HIV in resource-limited environments such
as district hospitals, GP surgeries and devel-
opping countries. This joint venture involves
scientists and clinicians at the UCL/MRC
Centre for Medical Molecular Virology and
the Royal Free and UCL Hospitals, and is
advised by the Health Protection Agency
and industrial partners.

■ Environment
Climate change is often cited as the single
biggest threat to society in the new mil-
lenium. The LCN uses expertise ranging
from biology to chemistry and materials
science to conduct research in novel pho-
tovoltaics, develop new materials for the
nuclear industry, investigate methods of
efficient hydrogen storage at room tem-
perature and explore ways of maximizing
current energy supplies.

Figure 1. The London Centre for
Nanotechnology in Bloomsbury.

Figure 2. Microfluidic device designed to sort DNA molecules.
The computing and communications needs of a growing, increasingly industrialized society become ever more complex. Current technology is being stretched to capacity and a variety of innovative solutions are being investigated by LCN staff, applying nanotechnology-driven paradigms such as quantum computing and spintronics.

### Business strategy
The LCN has an internal structure specifically designed to facilitate industrial collaboration. A dedicated Business Development Manager is employed to raise funds for the Centre and identify opportunities for commercially viable programs that can benefit the general public. The LCN’s business strategy exploits a portfolio of intellectual property clustered around the three main research themes. Through a spin-off company called Bio Nano Consulting, the LCN’s experts provide technical consultancy services to clients. Personnel include leading researchers across the life sciences and wider nanotechnology sectors who can assist with:

- Joint research projects;
- Contract research and development;
- Project management services;
- Open access to instrumentation, enabling analysis, characterization and fabrication on micro- and nanoscales.

### Expertise & facilities
The LCN delivers by exploiting its skills, expertise and equipment in:

- Theory and modeling: leading techniques and technologies to simulate, visualize and design nanoscale structures and devices in the biological and non-biological areas; first principles atomic/molecular level theory, systems modeling and other powerful computational tools;

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### Box 1. Thematic priorities at the London Centre for Nanotechnology.

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<th>Healthcare</th>
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<td>Fuel cells and electrodes</td>
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<td>Composite materials</td>
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<td>Ecoprocessing</td>
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<td>Novel manufacturing methods</td>
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<td>Fossil fuel exploration</td>
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<td>Novel biophysical detectors</td>
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<td>Hybrid devices and systems</td>
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<td>Large-scale electronics</td>
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<td>Microelectromechanical systems and vacuum devices</td>
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<td>Spintronics/superconductors</td>
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<td>Photonics</td>
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Nanocharacterization: the full range of optical-, electron-, ion- and scan probe-based technologies required to image and characterize nanostructures in both biological systems and material substrates such as silicon, III–V semiconductors, organics and diamond;

Nanofabrication: a large clean room space with the ability to fabricate nanostructures using semiconductors, metals and elastomers and functionalize them with biomolecules;

Systems: the range of techniques and technologies required to translate nanotechnology into workable products for industry; hybridization and integration techniques, error handling and rerouting algorithms, and methods to connect bio- and non-bio systems;

Summary
Bringing together world-class research, high-quality infrastructure and commercial best practices, the LCN ranks amongst the leading nanotechnology facilities in the world (Figure 4). Moreover, it is the only nanotechnology center located in the heart of a metropolis, providing superb access to corporate, investment and industrial partners and facilitating interactions with London’s extensive biomedical community and international partners. The LCN is at the forefront of training in nanotechnology and has a strong media presence aimed at educating the public and bringing transparency to this emerging science.
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