Professor Kim Fox, MD, FRCP, FESC, chair of clinical cardiology, and head of the National Heart and Lung Institute, London, England, and Professor Michael Schneider, MD, FMedSci, head of cardiovascular science, National Heart and Lung Institute, and director of the British Heart Foundation Centre of Research Excellence, Imperial College London, London, describe the structure of Imperial College London and its work to Barry Shurlock, MA, PhD.

A
fter a tussle lasting nearly 30 years, much of cardiovascular medicine and surgery in West London and its 42 professorial chairs are coming together under the umbrella of the Imperial College of Science, Technology, and Medicine, which is generally referred to as Imperial College London or Imperial, with plans for even more integration in the future.

“Imperial’s Faculty of Medicine is 50% of the Whole of Imperial College, and It Is One of the Largest Medical Schools in Europe”

Imperial College London is fast consolidating its position as one of the most important cardiovascular hubs in the world. At any one time, ≈200 PhD students are at work in its main cardiovascular academic unit, the National Heart and Lung Institute (NHLI), which fosters research and clinical practice of the highest quality at many sites under its umbrella.

Two key figures leading the research are Professor Kim Fox, MD, FRCP, FESC (see http://circ.ahajournals.org/content/119/5/f25), who holds the chair of clinical cardiology and Professor Michael D. Schneider, MD, FMedSci, (see http://circ.ahajournals.org/content/125/16/f91), British Heart Foundation Simon Marks Chair in Regenerative Cardiology. In September 2011, Professor Fox assumed direction of the NHLI on a 5-year term, and his predecessor, Professor Schneider, ceded the top job to focus on leading the cardiovascular science wing of the NHLI.

Professor Fox is the son of an army officer who might have read chemistry if his father had not persuaded him otherwise. He trained in Dundee, Scotland, which, although highly regarded, is one of the most far-flung of the British medical schools (only the Aberdeen School of Medicine, Aberdeen, Scotland, is further from London), but slowly, like Dick Whittington, he made his way to the capital, via Hull, a city in the northeast of England. After a long and distinguished career, including a spell as president of the European Society of Cardiology, Professor Fox now finds himself in charge of one of the largest cardiorespiratory research institutes in the world, within a top British university, with faculties of Natural Science and Engineering, as well as Medicine.

Outlining the status of the NHLI, which has 5 fellows of the Royal Society on its staff, Professor Fox says, “The Faculty of Medicine is 50% of the whole of Imperial College, and it is one of the largest medical schools in Europe. Imperial College is rated 8th in the world, with the Faculty of Medicine rated 3rd in the world, only behind..."
Oxford, England, and Harvard, Boston, MA, according to the Times Higher Education World University Rankings. The NHLI grant income/turnover is 25% of that of the whole Imperial College Medical School. The respiratory and cardiovascular parts of NHLI are roughly equal in size.”

Cardiorespiratory Basic Science Is Embedded Within the NHLI and Has Close Links With Other Departments in the Faculty of Medicine as Well as Other Faculties Such as Mathematics, Chemistry, Bioengineering, and Engineering

Imperial’s Faculty of Medicine encompasses several large hospitals on 5 different campuses in West London, each with constituent research institutes of various shapes and sizes. Recently, one of its hospitals even forged links with the Liverpool Heart and Chest Hospital, Liverpool, England, >200 miles away, in the north of the country.

Although geographically complex, the faculty in its entirety is structurally relatively simple. NHLI is made up of separate sections in cardiovascular and respiratory medicine, many with an international reputation, mostly attached to mother hospitals, which are part of the UK National Health Service and whose patients are often involved in the Institute’s research. Their medically qualified principal investigators often practice in the hospitals or have honorary appointments to gain access.

Cardiorespiratory basic science is embedded within the NHLI and has close links with other departments in the Faculty of Medicine as well as other facilities such as Mathematics, Chemistry, Bioengineering, and Engineering. Within this structure are a plethora of cardiovascular activities that the British Heart Foundation recently recognised as a Centre of Excellence (the others are at Edinburgh, Scotland, Oxford, England, and King’s College London, London). Directed by Professor Schneider, Imperial College London Centre of Excellence has been granted £8.9 million over 6 years. Other major sources of funds at Imperial College include the National Institute for Health Research, European Research Council, the UK Medical Research Council, the UK Engineering and Physical Sciences Research Councils, the Wellcome Trust, and the Paris-based Leducq Foundation, which promotes international collaborative research through its Transatlantic Networks of Excellence for Cardiovascular and Neurovascular Research.

The achievements of the Imperial College London cardiorespiratory community are a tribute to the effectiveness of a system that owes much to a relative freedom in research, coupled with a tradition of innovation, an openness to international ideas, and a critical mass of patients and specialists who come from its location in a capital city with a population of 10 million.

Asked to name key achievements of the National Heart and Lung Institute, Professor Fox cites the pioneering work of Sir Magdi Yacoub, FRS, FRCS (top left, see http://circ.ahajournals.org/content/113/12/45) at Harefield Hospital, especially heart-lung transplantation and the development of left ventricular assist devices; Jane Somerville, FRCP (top right, see http://circ.ahajournals.org/content/115/14/61), who established the subspecialty of grown-up congenital heart disease; the work of the late Philip Poole-Wilson, FRCP, FMedSci (2nd row, left, photo courtesy of Professor Fox, see http://circ.ahajournals.org/content/119/8/43) on heart failure, including the use of angiotensin converting enzyme inhibitors and β-blockers; his own work on angiotensin converting enzyme inhibitors and heart rate modulation for the treatment of coronary artery disease; the Anglo-Scandinavian Outcomes Trial led by Peter Sever and Neil Poulter; the 12-year stint that stent pioneer Ulrich Sigwart, MD (2nd row, right, see http://circ.ahajournals.org/content/113/1/F1) spent at the Royal Brompton Hospital, London, followed by the work of Carlo di Mario, PhD, FRCP (3rd row, left, at work reopening a chronic total occlusion during a recent live transmission for the Transcatheter Cardiovascular Therapeutics conference, photo courtesy of Professor di Mario, see http://circ.ahajournals.org/content/118/6/31); and the development of magnetic resonance imaging, initially started by Nobel Laureate Godfrey Hounsfield and Donald Longmore and then led by Dudley Pennell, FRCP (3rd row, right, see http://circ.ahajournals.org/content/113/11/41) and his team.
Imperial’s New International Centre for Translational and Experimental Medicine Was Opened on May 28, 2012

Much of Imperial’s basic biomedical research is planned to come together in the International Centre for Translational and Experimental Medicine, a brand-new 5-storey building with 3600 m² of floor space built on the Hammersmith Hospital campus and dedicated to cardiovascular basic science. Hammersmith Hospital (see p. fl44) is well known as the mother hospital of the Royal Postgraduate Medical School. It is close to the Medical Research Council Clinical Sciences Centre, which includes a molecular cardiology group, led by Professor Cook, and another on physiological genomics, led by Timothy Aitman, FMedSci. Also on the Hammersmith campus are the teams of Gianni Angelini, MD, FRCS, FETCS, FMedSci, a mechanical engineer by training, now a cardiac surgeon, with an interest in various aspects of coronary bypass surgery; and Jaspal Kooner, PhD FRCP, who is investigating premature coronary artery disease.

Three NHLI groups who account for a major part of basic science cardiovascular research at Imperial College London have already settled into the International Centre for Translational and Experimental Medicine.

The Heart Science group is headed by Professor Schneider, whose main interest is in developmental biology with a view to repairing the damaged heart. Other members of the group include Nadia Rosenthal, PhD, who is also founding director of the Australian Regenerative Medicine Institute at Monash University, Victoria, Australia. Also now resident is Dorian Haskard’s [FMedSci] Vascular Science Group, which investigates underlying mechanisms of inflammatory vascular diseases, particularly endogenous cytoprotective and homeostatic mechanisms, both in immune systems and vascular endothelial cells and macrophages.

Myocardial function is the main interest of Sian Harding, PhD, and her team (see http://circ.ahajournals.org/content/
123/3/f13), especially the effect on the adult myocyte of a variety of cardiovascular events and the reversal by gene or cell therapy. They use a wide range of advanced imaging techniques to gain understanding of myofilament physiology in the cardiovascular system to develop models and inform translational studies.

Commenting on some of the activities he directs within the BHF Centre of Excellence, Professor Schneider says, “We enjoy the cream of London’s medical sciences, all different, and we are especially concerned with the potential synergy that comes from interacting with the basic sciences, like chemistry, mathematics, systems biology, and engineering. We have a variety of themed groupings with similar interests or similar ‘scientific palettes.’ And we take talent from anywhere!

“Semihistorically, the NHLI had a large critical mass of principal investigators focused on advanced heart failure, such as the work of Sir Magdi Yacoub at Harefield Hospital, Dudley Pennell on magnetic resonance imaging, and Philip Poole-Wilson’s work on the pathophysiology of heart failure. This seminal research showed abnormal calcium handling in the failing cardiomyocyte.

“Now we are moving increasingly into cardiovascular genetics, cardiovascular development, and regenerative medicine, in addition to these other areas, recruiting leading scientists from all over the globe to work and interact with the considerable talents already available at Imperial.”

**Committed to Extensive Studies of Cardiovascular Epidemiology and Disease Prevention**

The NHLI has a strong and large presence at the Royal Brompton Hospital devoted to clinical and translational research based around the National Health Service National Institute for Health Research Biomedical Research Unit. Themes involving imaging, heart failure, coronary disease, the aorta, and valves as well as congenital heart disease (the Brompton adult congenital heart disease unit is probably the largest in the world) draw clinical scientists from all over Europe. They include Professor Pennell, Professor Martin Cowie, MD, Professor di Mario, Professor John Pepper, MD, and Professor Michael Gatzoulis, MD, PhD.

The NHLI is also committed to extensive studies of cardiovascular epidemiology and disease prevention. These studies are led by Professor Sever and located on the campus of St. Mary’s Hospital NHS Trust in the Paddington quarter of London. The group focuses on the cellular and physiological mechanisms of cardiovascular diseases and diabetes mellitus and conducts multinational clinical trials. Within the group, Professor Neil Poulter, MD, heads a unit that initiates clinical trials in the cardiovascular field. Their team has major interests in hypertension, cardiovascular effects of exogenous oestrogen and progesterone, and ethnic differences in cardiovascular disease, based largely on the Asian population of West London.

Professor David Wood, MD, also based on the St. Mary’s site, is particularly interested in the practice of cardiovascular medicine and has led the European Society of Cardiology survey European Action on Primary and Secondary Intervention to Reduce Events (EUROASPIRE) and its sequelae and the EUROACTION trials. These trials have resulted in the inception of many nurse-led multidisciplinary cardiovascular prevention programmes throughout Europe.

**The Institute for Cardiovascular Medicine and Science Is a Not-For-Profit Company in Partnership with the Liverpool Heart and Chest Hospital**

Onto this already complex stage, another player strode last year in September 2011, when the Royal Brompton and Harefield NHS Trust, which has a huge clinical workload, formed the Institute for Cardiovascular Medicine and Science, a not-for-profit company in partnership with the Liverpool Heart and Chest Hospital, Liverpool. Liverpool is the city famed as the home of the Beatles, and more soberly as the gateway from which so many Irish emigrants left for the United States in the last century.

Kim Fox, who has long advocated “supercentres,” explains: “We expect a number of benefits, for example, Stuart Cook [MRCP, PhD] has a large genetics study using magnetic resonance imaging phenotyping and will now be
able to include many patients from Liverpool. Imperial College will also be running an MSc course for nurses at Liverpool. This is an exciting opportunity, rare in Europe and perhaps unique. The 2 centres will be financially autonomous, but will bring clinical and research benefits from having 2 different set of patients, the Brompton’s coming from the relatively wealthy southeast, Liverpool’s coming from the much more socially deprived northwest [of the country]. Together, the 2 centres serve a population of ≈6 million and probably now form the largest cardiovascular grouping in Europe. Annual figures include 3400 coronary artery bypass operations, 5000 percutaneous coronary interventions, of which 1600 are primary, and 900 ablation procedures for atrial fibrillation. Liverpool cardiologists are now honorary senior lecturers at Imperial College and honorary consultants at the Brompton. The hospital approached us because Liverpool University was unable to provide the support and facilities available at Imperial particularly in cardiovascular basic science and medicine.”

Welding together all these resources—distinguished principal investigators, hospitals, and research institutes with international reputations and much else—into a coherent whole, whereby the essential talents from clinicians, biomedical researchers, and the basic sciences are made to work together, has long been the ambition of people like Professor Fox. He says, “What we are doing is to set up an interdepartmental, interhospital collaboration between researchers in the basic sciences, engineering, physics, and mathematics, and clinicians, so that people work together to the same goals, to advance patient care. We have a lot in common—the basic sciences and engineering can tell us a lot about the pumps, tubes, and fluid dynamics that we all depend on as cardiologists. So vascular science at NHLI works closely with Rob Krams [MD, PhD], who sits in Bioengineering.”

Within A Decade Much of the Cardiovascular Community of Imperial College London Will Probably Be Located on 1 Supersite

Under the microscope of modern management, the rich cardiovascular community of Imperial College London—at the last count it had 42 professorial chairs—is gradually being forged into an organism whose component parts increasingly interact with each other, and with other faculties in the university, so that within a decade much of it will probably be located on one supersite. Eyes are focused on a site close to the Hammersmith Hospital (see p. f144) in West London.

The extent and diversity of cardiovascular activities within Imperial College as a whole reflects the recent history of medical education and research in London. Major cities worldwide have struggled with the fact that modern medicine demands large critical masses of professionals, patients, and resources to keep pace with technology, and to attract the best staff, to gain major grants, and to provide a strong patient base for clinical trials.

The traditional setup with a medical school and hospital in one part of town and another institution elsewhere peopled by PhDs who ferry clever ideas across the science–medicine divide is underproductive. Also, large is better. The medical powers-that-be of London have long sought to amalgamate facilities (often reluctantly), and over the years 4 different groups of United Hospitals have been created. Three of them are still part of the federal structure of the University of London, but Imperial College has been independent since 2007. Geographically, the United Hospitals approximate to the points of the compass, with Imperial College having roots in West London. This is South Kensington, where the Great Exhibition of 1851 spurred Prince Albert, husband of Queen Victoria, to create Albertopolis, a complex of museums and institutes of the practical arts and sciences. Imperial College
was founded here by royal charter in 1907, although its medical campuses are now widely spread across a large part of West London, which traditionally only includes the north bank of the River Thames.

A curious fact about Imperial College is that it had no medical element until 1988, when it merged with St. Mary’s Hospital Medical School, where Sir Alexander Fleming worked on penicillin. A few years later, it took in other London-based institutions: in 1995, the NHLI, and 2 years later, the Royal Postgraduate Medical School, based at the Hammersmith Hospital, together with the Institute of Obstetrics and Gynaecology, and the Charing Cross and Westminster Medical School in 1997, which was formed from separate medical schools in 1984. Other key parts of the Imperial College cardiovascular complex are the Royal Brompton and Harefield NHS Trust, which includes the Harefield Heart Science Centre directed by Sir Magdi Yacoub and the National Institute for Health Research Cardiovascular Biomedical Research Unit. This was opened in November 2010 on the site of the Brompton and is one of 20 similar bodies funded in the United Kingdom by the National Health Service National Institute of Health Research.

The process of organising and reorganising a major institution is, of course, never complete and already an ambitious plan is under way to put all Imperial College cardiovascular and respiratory activities together on one site in West London.

We Will Never Split the NHLI
As regards the NHLI, its twin mission of investigating diseases of both heart and lung is largely historical, and it could be argued that separate bodies might have advantages. But Professor Fox champions the status quo. He says, “We will never split it. The NHLI is bigger than many medical schools, and because it specialises in both specialties this gives joint leverage in areas that are generic and cross the divide, like genetics. The heart and the lung are 2 ‘magnificent labs’ in which to test new ideas. Besides, research in all areas goes through peaks and troughs, and we get more stability with both—when respiratory research is perhaps in a trough, cardiovascular is not—fortunately both are up just now. And in comparison with other specialties—cancer or surgery, for example—we overpunch them all.”

“The ultimate aim is to bring together all the Brompton and cardiovascular and respiratory activities on one site in West London, together with the Hammersmith, St. Mary’s, and Charing Cross. Of course formidable difficulties exist. First, restitting of the hospitals, so dear to the British heart. Then there is the impact on the National Health Service as a whole. We are talking about a sizeable part of National Health Service London. Then there are the unbelievable costs. But I think it will happen, with a lot of pain, in ≈8 years.”

Barry Shurlock is a freelance medical journalist.