There are few buildings that stir the imagination more than the Medical Research Council’s Laboratory of Molecular Biology in Cambridge.

The building’s design, construction and working environment is entirely devoted to freedom of thought, personal interaction and shared enthusiasm that creates an ethos where people can research, discover and help shape our futures.

The new Laboratory of Molecular Biology, opened by The Queen in 2013, represents a brilliant history of achievements which includes 10 Nobel Prizes whilst at the same time promising a bright future for its 600 scientists, students and support staff.

Built at a cost of £212 million and as the flagship of the Cambridge Biomedical Campus, the building comprises two long laboratory blocks joined by a large atrium containing seminar rooms and has been likened to paired chromosomes. The glass cladding of the main structure has integrated automatic blinds within the triple glazing system and is dramatised by four exterior stainless-steel towers housing heavy plant and equipment.

The principle of form following function is evident, not only in the building's visual impact but also within its structure. When first entering the atrium, one is struck by its height compared with the number of laboratory floors.

There seem too few floors until one realises they include interstitial service voids — full-height service spaces containing pipes, ductwork and services between the laboratories. Interestingly the word interstitial has a meaning in chemistry relating to ions or atoms in a metal lattice, very apt for this structure.

The interstitial service voids make a significant difference to the operational aspects of the whole building by enabling the services to be located laterally between the floors. They can be modified and maintained without need of access or disruption to the laboratories and work areas below. Walking through the interstitial floors the amount of pipework, ductwork, and equipment is truly impressive, especially considering the heavy plant is located in the juxtaposed towers and the remote energy centre.

Building services of research facilities need to be capable of providing the specialised environmental needs of individual laboratories without disrupting adjacent research activities. Interstitial service voids provide the flexibility and support innovations that help to extend the life of the building and are critical to research programmes.
A huge challenge for the building-management system — the Medical Research Council’s Laboratory of Molecular Biology in Cambridge.

The world-class status of the Laboratory of Molecular Biology (LMB) and its leading role in the advancement of research into health and disease is reflected in the rigorous demands for the environmental control and protection of the laboratories.

A key feature of its design philosophy is the provision of environmentally friendly interaction areas conducive to the exchange of information and ideas.

This is a building where the purpose for which it was built is indivisible from efficient, effective and responsive building services.

The heating, ventilating and air conditioning plant and services are large, varied and complex. They span almost the complete spectrum of control and integration of building-management systems whilst being capable of changing its configuration to meet the specialised needs of its users.

Describing the control and integration involved with building management illustrates the scale and complexity of the HVAC system installed in the LMB. Integration and interoperability is absolutely essential for the success of the building control system.

The CentraLine Hawk 600 integration controllers using Niagara software are used as the main BMS platform with Arena AX as the front-end supervisor.

Open protocols (LON, BACnet and Modbus) were used throughout the building-management system, which incorporated 250 000 software and hardware points.

The following list gives a brief overview of the integration required: 2400 VAV units; 450 electricity meters; 13 rotary heat exchangers; 12 chillers; 50 fan-coil units and both chilled and heated ceilings.

The LMB has one of Europe’s largest ground-source heat-pump installations with five compressors. There are also 17 air-handling units, 34 extract air systems, two LTHW boilers and four gas-fired boilers serving the HWS needs. There are three boilers for autoclaves and steam humidifiers, numerous pump sets and pressurisation units with associated inverters, water storage tanks and booster sets.

The building control installation has over 1600 CentraLine Lynx controllers fitted to the VAV boxes and fan-coil units serving the laboratories, write up rooms and general offices. There are 900 Zio programmable user displays providing independent control of the environmental conditions in each area.

There are 58 CentraLine Hawk integration controllers with associated input and output modules monitoring and controlling the main plant and field equipment.

The building is supervised by a duplex PC duty/standby system, each server having four 60 cm screens. There are in excess of 150 000 monitoring points on this system.

Having been involved in the design, engineering and commissioning of the system, CentraLine’s Partner System Five Controls Ltd, based in Croydon, is now working as the servicing engineer to the LMB.

Ian Dalby, senior systems engineer of System Five commented, ‘The LMB
Inside the atrium of the Laboratory of Molecular Biology.

The building-management system continues to be a most exciting and challenging project. The size and complexity of the HVAC and associated services are one aspect, but the demands of the laboratories and associated research facilities take building control engineering and programming to another level.

‘Integration is critical to all aspects of this BMS, which must respond to the changing experimental requirements that influence the environmental conditions within the laboratories.

‘Working closely with the maintenance and engineering team is an essential part of our relationship with LMB. Unlike a typical BMS which once installed does not significantly change, this system is truly dynamic. It has to have the capacity and flexibility to respond to the requirements of the research as well as the normal demands of office work space.’

Matt Nockolds, services co-ordinator with the Medical Research Council resident at LMB made the point, ‘Critical to the management and supervision of this advanced facility is a thorough understanding of what the BMS can do to improve and enhance the effectiveness and efficiency of the buildings systems and equipment performance.

‘We are continually developing and tuning the building-management system’s capability to extend LMB’s environmental performance, whilst striving always to reduce energy consumption.’

The Laboratory of Molecular Biology is a very impressive example of what is sometimes called an ‘intelligent building’. However, it is clear that the intelligence is not the building-management system but the application, innovation and experience of the team managing the building and its systems that provide its ‘brain’.

Dr Stephen Holmes, soft-landing programme manager with the Medical Research Council, explained the team’s approach to working with the LMB building management system. ‘We work as a team to deliver and manage the services and environmental conditions required by our scientific community, whilst maintaining an efficient and enjoyable work space within the building.

‘Everyone brings their own background, skills and ideas that contribute to an efficient and highly motivated team that addresses opportunities to constantly improve the efficiency of the building. By working together and examining challenges from different perspectives, we find innovative and cost effective ways of moving forward.

‘I would describe the BMS installation as the ‘nervous system’ of the LMB building. Its feedback and monitoring provides the primary information we use to formulate the strategies we need to enhance the building’s performance.

‘It is a team of people which controls the building-management system. We make the decisions that ultimately drive the building’s operational effectiveness.’

Terry Bottle, director of System Five added, ‘Working with our client and being seen as one of the team has been crucial to the ongoing success of delivering and supporting the BMS in this wonderful building. What makes this project very special to System Five is the excitement and challenge of being involved with a building and people that are at the forefront of scientific research.’

Jim Sword, manager of CentraLine by Honeywell summarised, ‘The Laboratory of Molecular Biology is a remarkable building, designed by scientists, architects, and engineers for the pursuit of scientific research.

‘Its complexity, energy conservation and ever-changing operational demands managed by the maintenance and engineering team will continually expand the capabilities of its building control installation. We look forward to a long and rewarding relationship with LMB and our CentraLine Partner System Five.’
For further information, please contact CentraLine on 01344 656443.

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