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DESIGN AND CONSTRUCTION OF A SUITE FOR MOLECULAR TEM

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The focus of the Center for Integrative Molecular Biosciences is to study the structure of molecular machines and complexes through the use of integrative techniques including light microscopy, transmission electron microscopy, and X-ray crystallography. The Center is housed in a new building which was specifically designed to meet the needs of the researchers who would be occupying it. In particular the centerpiece of the first phase of development was an electron microscopy suite. We present some specific details of the design of the suite here to act as a guide for other researchers facing the challenge of building suitable accommodation for state-of-the-art microscopes.

The overall floor plan of the suite is shown in fig. 1. Six microscope rooms are at the core of the suite that is situated on the ground floor. Auxiliary space includes darkrooms and a computer server room as well as support rooms for scanners, an optical diffractometer and other supporting equipment. A control room center (fig. 2) provides computer and visualization facilities for monitoring experiments during data acquisition as well as for data evaluation and analysis.

In constructing the microscopy rooms we benefited from the previous experience of the National Center for Electron Microscopy [1]. Of the 6 microscope rooms, the 4 at the corners are each 13x14' and the middle two are slightly smaller at 10x14'. Each microscope room has a separate equipment room at the rear that is 4x14 and is used to house support electronics. The floor of each microscope room consists of a large concrete pad, 3' thick. The concrete pad was poured separately from the building slab on grade and then isolated by 2" of styrofoam and a special isolation joint installed with the flooring. A concrete sealer was sprayed over the concrete to help seal in the moisture. The rooms were constructed using full height steel stud and drywall walls. The walls had two layers of drywall installed on each side with ½" resilient channel to further provide a sound cavity. In addition to the two layers of drywall on each side, both the tops of the wall and bottom were caulked to the slabs to prevent the transmission of sound and air. Before the first layer of drywall was installed, a layer of plastic was wrapped around the perimeter of the entire area. A second layer of plastic was installed at the ceiling and on the interior of each room. The plastic was used to help prevent the migration of air between the dehumidified microscope rooms and the more humid common areas. Insulation was installed in every wall to help with the dampening of sound and vibration. On the interior of each room a layer of vinyl coated sound absorption board was installed after the drywall was complete.

Design considerations for the HVAC system include maintaining < 15% relative humidity for the entire suite, minimizing air movement within each microscope room and maintaining a constant temperature. A separate air handler serves the suite with a dedicated supply and return ductwork. Attached to that air handler is a desiccant drier. A "duct sox" was installed to the supply air inlet in each room to minimize air movement. The overall suite is designed such that the pressure is higher inside than outside in order to prevent the migration of non-humidified air into the suite. The chilled water required by each microscope is supplied by a chiller that is located in a separate mechanical

room removed some distance from the suite. The chilled water travels by means of copper lines running to each individual equipment room. To minimize the effects of electrical interference and vibration, all electrical conduit, fire sprinkler mains, ductwork, chiller water lines, hot water lines, and drains were routed around the entire suite and only those lines serving the suite penetrated into the suite area. No electrical or water lines cross directly above any of the instruments.

Network support for the suite includes Cat 5 connections to each microscope room. A cable tray runs from the server room along the vestibule to the control room. A central feature of the control room are three 72"x54" projection screens and a custom built console.

The suite has been operational for over a year and the design and construction is sound.

[1] J.H Turner, M.A. O'Keefe, R.Mueller, Proc. Microscopy and Microanalysis (1997) 1777-1778.
[2] The design team for the project included DPR construction, TKG engineering, and Architects Delawie Wilkes Rodrigues Barker.

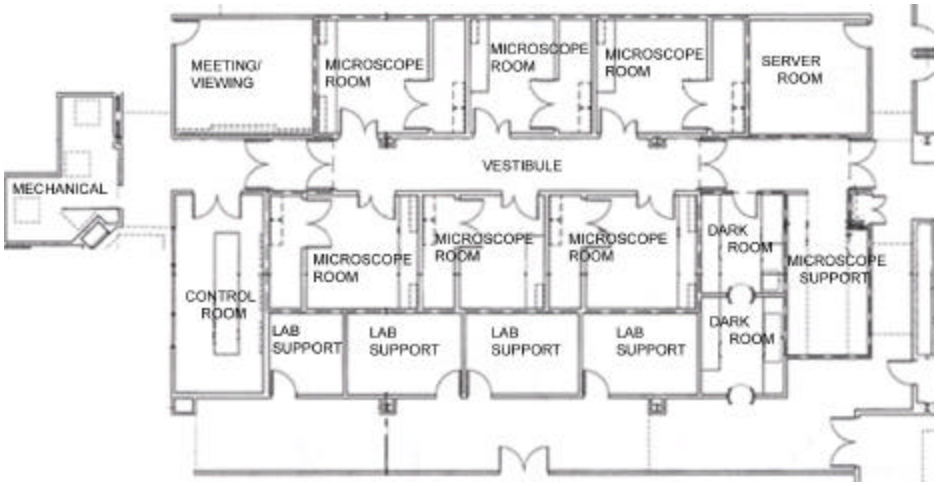

Fig. 1 Overview of the CIMBio microscopy suite.

Fig. 2 View of the control room

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