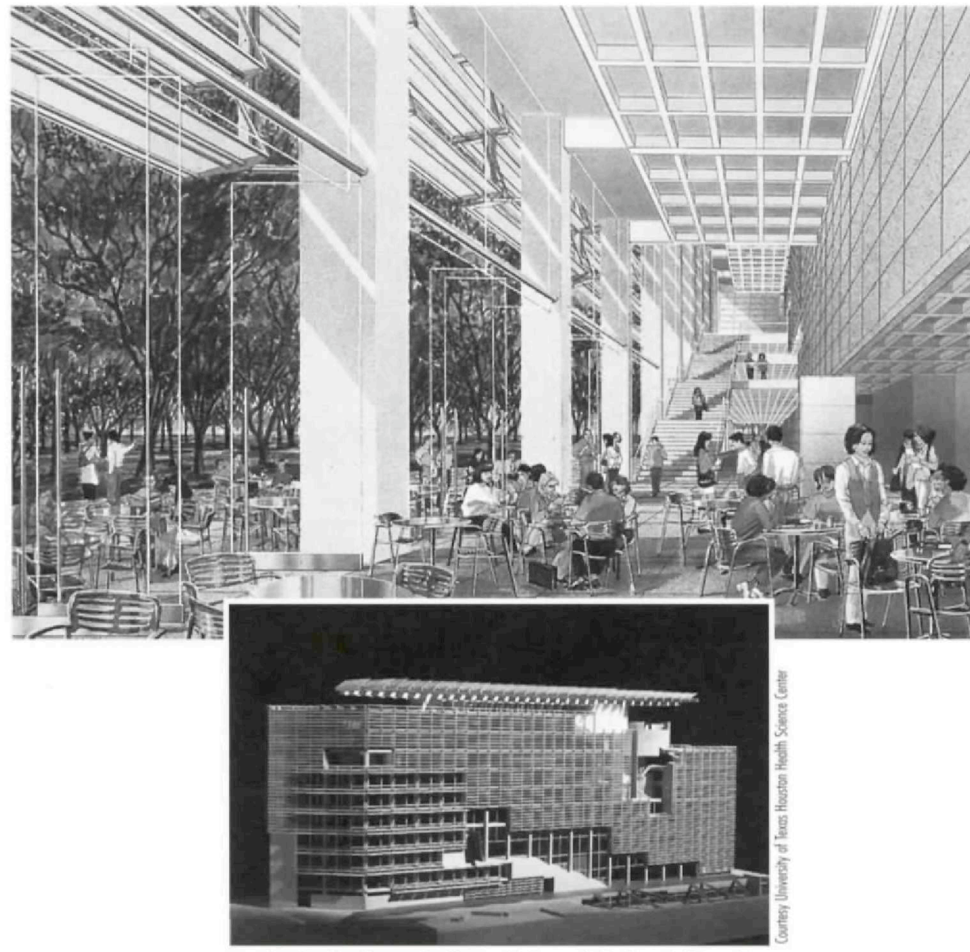
Getting Comfortable at the Medical Center

A new building prompts a new look at how to keep cool

By Rives T. Taylor



Courtesy University of Texas Houston Health Science Center

Interior (top) and exterior (bottom) views of Patkau Architects' winning entry in the design competition for UT-Houston's new Nursing and Biomedical Sciences building. In the process of planning the building, issues of air conditioning have come to the fore.

As an architect in Houston, I've watched the local building industry attempt to surmount the environmental conflict of constructing super-cooled and sealed masonry boxes in a semi-tropical environment. And I've also watched as we ignored better ways of accomplishing the task while dismissing the unintended consequences of the current technology. While no one debates the necessity of air conditioning, there's also no debating that these sealed buildings have a number of unfortunate characteristics: rarely do they create healthy environments; the workspace environment is never truly controlled by, much less comfortable for, those actually inhabiting the building; and the operational costs to maintain an often unpredictable and complex mechanical system are huge. Finally, the design of the full building systems often occur either in a vacuum or independently from each other.

My perspective is colored by my role as campus architect for the University of Texas Houston Health Science Center in the Texas Medical Center, a campus composed of classrooms, offices, and research labs. In the current process of designing our new Nursing and Biomedical Sciences Building, our UT-Houston team has uncovered surprising strategies for air conditioning that, like so much in our recent building history, are not really new. The Nursing and Biomedical Sciences Building, though a classroom structure, faces problems similar to those found in office buildings around the city. Among these is the fact that Houston's climate precludes the use of natural ventilation; the humidity works against using the chimney effect — the fact that hot air naturally rises — to draw cool air into the building through open vents and windows. But that truth doesn't give us license to forget that operable windows have positive effects on the inhabitants of our building. Students, faculty, or staff are happier when they can open the windows on a pleasant day to get fresh breezes and a sense of the natural movement of the outside air. More than that, we've found that operable windows have an unexpected effect on the demand for cooling. In a key discovery, we learned that when building users feel they can control their environment, they are happy to work in warmer offices.

We also learned that the standard approach to supplying dehumidified, cooled air needs to be rethought. In most office buildings, whose very design and method of construction lends itself to tenant space flexibility and ease of reorganization, cool air is supplied from ceiling grills. (Note that this is not *fresh* air, since most office buildings recirculate their air, occasionally mixing in some "fresh" outside air that has been cooled with recooled air pulled back from the office spaces.) The problem with cool air supplied from above is that it requires a mechanical system with fans to push the air through all the duct work as well as down into the habitable space. Thus the hiss and the drafts and the noise many people associate with air conditioning. Additionally, though cool air does naturally sink, when it's supplied from the ceiling it has to sink through the heated and often fouled air that's rising upward. To combat this, our designers are looking at a raised floor approach, a strategy used in older computer rooms and now finding increased acceptance in the speculative commercial realm. It is possible that a sealed floor plenum could end up letting us dispense with expensive metal ducts, while providing the cooled air at ground level, where it's closer to the building's inhabitants. The raised floor would also supply the air more slowly and quietly. Since the air grills are close to the inhabitants, they can be easily directed or turned off, once more giving the building's occupants the sense that they can control their own environment and not have to suffer through someone else's notion of what constitutes a comfortable interior climate.

While Houstonians know that dehumidification of the air brought into our buildings is as critical as the cooling of it, most assume that air conditioning simply makes that happen. Indeed, in residential mechanical units, which simply cool the air recirculating through the house and assume that outside air seeps in through a myriad of cracks, the condensation around the cooling coils is collected and drained. But larger commercial applications need to dehumidify air more quickly; outside air at much larger quantity is pulled directly into the building at a much faster rate. In these cases, dehumidification traditionally uses a method of super-cooling to cause the air to give up its water, since cold air holds less moisture than hot. Then the super-cooled air is heated up to return it to a human comfort zone.

In other cities whose climates are less tropical than Houston's, interior humidity is kept down by only bringing fresh air into a building at night or in other periods of decreased humidity. Since that doesn't work as well here, at the UT-Houston Nursing and Biomedical Sciences building we are looking to try another approach, one that uses desiccant wheels. The wheels are filled with a recyclable silicate material similar to what's found in the small desiccant packets with which most products are shipped to ensure dry storage. When a section of the wheel is placed in the intake air stream, the silicate material absorbs humidity. As the large wheel is rotated, the saturated section is removed from the air stream and then subjected to both a small drop in temperature, one that requires a much smaller amount of recirculated cooled air from the building, and a bit of gravity. The material drops its load of moisture, and then can be turned again into the air stream to pick up some more. We hope to harvest the captured water for such uses as site irrigation and, possibly, flushing commodes.

Such integrated design of all the building pieces we think gains some distinct advantages in the stewardship of both taxpayer dollars as well as energy resources, making keeping our people comfortable not only easier, but more efficient. ■