# A Demanding Control Environment

## W.M. Keck Genetics Research Facility
## The Ohio State University

> "The engineering properties of the venturi valve are superior to butterfly dampers when controlling differential pressure."

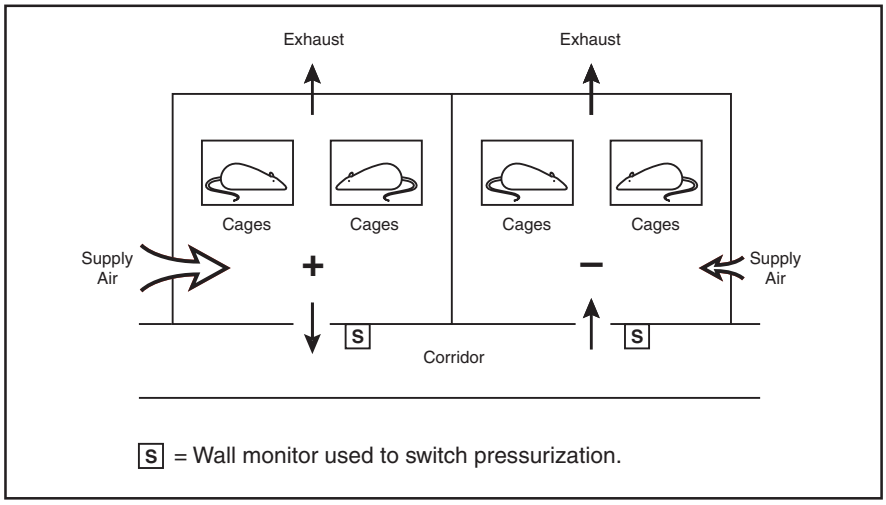
**Steve Galli**
**Architect**
**Ohio State University**

### Background

Ohio State University counts itself among the best in research institutions. Evidence supporting this reputation includes a 12,000-plus staff with faculty members who are internationally known for their academic credentials, experience, and cutting-edge research and a medical center consistently named as one of America's best hospitals. The university's laboratory facilities play an important role as one of the foundations for learning and research.

Laboratory research buildings must provide an environment that is conducive to research and one that keeps occupants safe. Depending on the type of laboratory, safe can mean proper ventilation and room pressurization, optimal temperature and humidity and allowable noise limits, among other factors. Animal laboratories, or vivariums, require some of the most stringent ventilation controls.

The sensitivities of the animals, especially to temperature and humidity, fall within a much narrower tolerance range compared to humans. Exposure to drafts and risk of contamination through airborne disease is of great concern. Researchers and support staff require a clean, comfortable working environment and rely on controlled ventilation to keep odor levels and the particulate levels of dust and dander low. These requirements, when combined with equipment heat loads, typically result in ventilation rates ranging from 10-15 air changes per hour (ACH) of




**Planning for flexibility, using switchable holding rooms.** Transgenic facilities generally operate holding rooms under positive pressure. In the event of a contagious outbreak, the rooms may be switched to a containment mode, with the room maintained at a negative pressure.

100% outside air. Ventilation control is a critical element in the design of animal care facilities to maintain a stable and controlled environment.

**The Challenge**

Ohio State elected to emphasize its research in molecular neuroscience and needed a rigid barrier to safely transfer incoming animals. To support this effort, former library space was converted into a transgenic animal facility, which includes two quarantine rooms and four holding rooms. Steve Galli, the architect, had extensive experience with animal laboratories and broached the idea of making these six rooms switchable. Knowing that research needs often change, he wanted the flexibility to make the room air pressure either positive or negative with a flip of a switch, while safely maintaining all other parameters.

The remaining criteria for the project were:

- Maintaining specified air change rates
- Low noise levels
- A system that fails under controlled airflow rates
- A user-friendly interface for all critical mechanical systems
- Minimal maintenance

**The Solution**

Minimizing risk in design is important in transgenic facilities, where a pair of mice can represent an investment ranging from $3000 to $5000. (A transgenic animal has had foreign DNA injected into its chromosome makeup for studying the molecular effects of a particular gene). Years of research can be compromised if the environmental control system is not stable.

Todd Miller, the project engineer from W.E. Monks & Company, had previous experience with teaching laboratories but this was his first animal facility. It was clear to him that the reliability of the ventilation controls was critical.

He designed each of the switchable rooms to be controlled using a Phoenix Controls room monitor, a device originally developed for hospital isolation rooms. The wall-mounted monitor has a keyed switch to easily change and maintain the directional airflow. Currently, two rooms are functioning as quarantine space and are negatively pressurized, while the remaining four holding rooms are positively pressurized. The quaratine rooms are negative to contain possible diseases until incoming mice are determined to be disease free. Viewed as even more important than future flexibility is the ability to isolate a room in the event of an unforeseen disease outbreak. The switchable rooms could become negatively pressurized quickly, containing airborne pathogens and preventing cross contamination.

Ventilation rates for the space, as recommended by ILAR (Institute of Laboratory Animal Research), were to be in the range of 10-18 ACH. At these high rates, the reverberation through the ductwork raised concerns about noise and its potential negative impact on animal behavior. For certain rooms, a sound cancellation device, known as the Neutralizer™, was added to the supply air ducts. The device is tuned to the output frequencies of the Phoenix Controls valve, lowering the sound power levels at each octave band.

Failing under control is an important criterion, as well as a distinguishing one. Most airflow control devices fail in their last position or fully open. Either position, occuring through a device or power failure, can create an unstable environment. In contrast, the venturi valve fails to a fixed airflow set point position and maintains that flow due to its pressure-independent mechanical regulator. Even under a loss of power, the valve output is stable and known.

Operating staff can view system status through a graphical interface monitoring Phoenix equipment, as well as exhaust and supply fans, humidifiers, temperature and lighting controls, and cooling and heating systems.

**The Result**

Although the project engineer had never worked with Phoenix Controls, Todd said he “had always heard it was a good system.” He viewed this application as a critical one that justified using a high level of control. The process, including installation, went smoothly with local project and field support from the Phoenix Controls Representative, Precision Air, in Columbus, Ohio.

Steve, the architect, had worked on numerous laboratory projects and was exposed to many different types of airflow control devices. In deciding on the mechanical system, he was convinced that the engineering properties of the venturi valve were superior to butterfly dampers, especially when controlling differential pressure.

The Director of University Laboratory Animal Resources is Dr. William Yonushonis. He notes that this is the second animal facility on campus using the Phoenix system. The first was a primate center for AIDS and cancer research with BSL-2 (biosafety level) and BSL-3 capabilities.

“With the W.M. Keck Genetics Research Facility, we now have a state-of-the-art animal facility that enables researchers to move into molecular neuroscience transgenic animal research,” Dr. Yonushonis said. The university seems well positioned to remain on the forefront of cutting-edge research and uphold its reputation.