Field stations in a box

At the UW's Biotron, every climate on Earth is simulated except one

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BRYCE RICHTER/UW-MADISON

Freshwater snails feed on lettuce in one of the Biotron Laboratory's controlled environment "boxes." This experiment

studies the human blood parasite Schistosoma mansoni.

Never mind Punxsutawney Phil. The thirteen-lined ground squirrels that hibernate in plastic drawers in the UW-Madison Biotron take their cues from Hannah Carey.

The Biotron is a three-story laboratory on Observatory Drive designed "to simulate every climate on Earth except Antarctica." (The coldest it gets is -5 degrees Fahrenheit.) Carey calls it "a field station in the middle of campus."

In addition to serving as the facility's director, Carey specializes in gastrointestinal physiology and hibernation biology and teaches comparative biosciences at the neighboring School of Veterinary Medicine. For 26 years she's used the Biotron to study the squirrels' digestive tracts as they emerge from torpor.

Built in the 1960s, the Biotron consists of 45 computer-controlled rooms and 29 climate-controlled greenhouses. Rooms are all on the second floor, separated from the HVAC on the third floor. (One 30-foot-tall room spans two floors.) They are grouped in quads, and each resembles an industrial walk-in freezer.

You access each room through a metal hatch door. Open one door and a rush of cold, wet fog escapes. Inside are rows of about 100 Tupperware-type containers with turfgrass inside, lined up on a table. Here researcher Paul Koch investigates what fungus grows — or doesn't — on golf course turfgrass treated with pesticides in an artificial Wisconsin winter.

Open another door and get transported somewhere tropical. It's warm and bright, and there are cornstalks thicker and taller than you've ever seen, stretching toward a ceiling of

lamps that put out “half-strength” daylight, 100 times brighter than supermarket lighting.

Animal life is sparse in the Biotron — just squirrels, rats and mice live there now, but the facility has also hosted Siberian cranes and rhesus monkeys.

Each room in the Biotron has its own air-handling system, with individual heating, air conditioning and humidifiers. In rooms designed for plant experiments, there is separate air conditioning for the lights alone so they operate at a constant and cool temperature. Everything is programmed by computer, and multiple sensors are set so that if a temperature is more than a degree off, someone on-call responds.

Pausing in the hallway, Carey opens a door to show how each box-shaped room shares no walls with any other room. You can walk behind and between them.

“We were part of the Wisconsin Science Festival, and we used the tagline ‘Global Biology in a Box,’” Carey says.

As for her box, Carey’s work has some intriguing applications, including advising the European Space Agency

on the possibility of humans some day traveling in deep space.

“They want to know if it is feasible if we could put humans into a semi-hibernating state. There are compelling reasons to think that we could get there,” she says, explaining that hibernation “is in the blueprint of the primate genes.” Fat-tailed dwarf lemurs from Madagascar, for instance, live off the fat stored in their tails as they hibernate in tree holes. “How are they tweaking their systems to pull this off so safely?”

This is not Biotron’s only connection to space research. It was here that NASA conducted tests on the Galileo probe before its journey to Jupiter in 1989. The probe was tested in a wind tunnel to get information about the behavior of the components at temperatures below the freezing point of water, an important transition.

Biotron is also the place that plants were first grown using LED lights in 1986, according to the laboratory’s literature, laying the groundwork for another first: In December, NASA astronauts on the International Space Station grew food in space for the first time, harvesting and eating lettuce they grew under LED lights.

In 2012, work began on a $6.1 million energy-saving renovation to Biotron. Now complete, Carey is hoping to attract more UW researchers and private companies alike to rent rooms for testing. Among their repeat customers are Harley-Davidson, which tested paint integrity in various environments.

Visitors are welcome from 7:45 a.m. to 4:45 p.m. on weekdays.