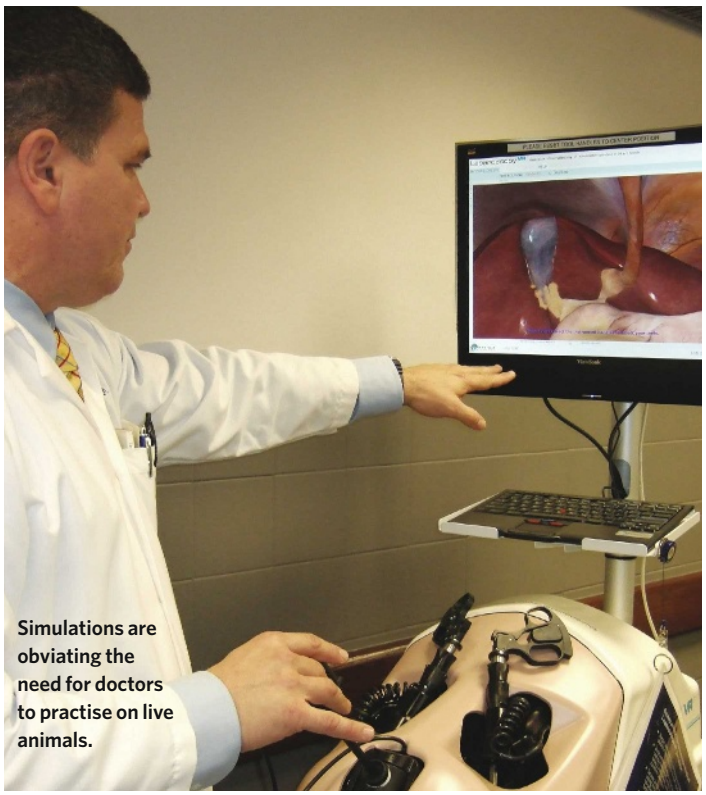
SPECIAL REPORT

Medical schools swap pigs for plastic

Doctors used to try out their surgical skills on animals before being allowed to work on patients. Now just a handful of US medical schools still have animal labs. **Meredith Wadman** asks if they've lost a vital tool.

This month sees the shutdown of the live-animal laboratory at Case Western Reserve University School of Medicine in Cleveland, Ohio. The lab is currently used to train medical students, allowing them to practise on anaesthetized pigs before attempting their first incision into humans. But the school, which has used live cats, dogs and ferrets in its surgery programme in the past, intends to stop using live animals at the end of this semester in favour of technologies such as virtual simulations.

It is the latest closure in a phase-out of animal labs across the United States: in 1994, live-animal experiments were on the curriculum in 77 of 125 medical schools; now it is thought that just eight use them. Several have stopped in the past year, including New York Medical College in Valhalla, which this year ended its practice of using live dogs to teach cardiovascular physiology to first-year students. And the trend is being played out across the globe (see 'All around the world').



Simulations are obviating the need for doctors to practise on live animals.

M. WADMAN

Cost is undoubtedly a factor — it is expensive to maintain animals and to employ veterinary staff. But schools such as Case Western and New York Medical College have said that the decision to eliminate live-animal experiments was based mainly on improvements in alternatives. The New York school now uses echocardiography on volunteer students and simulators that mimic cardiac arrest or a drug's action, for example.

Simulation has developed hugely over the past decade. "It is a lot more than a couple of mannequins," says Bruce Jarrell, vice dean of research at the University of Maryland School of Medicine in Baltimore, which a little over a year ago opened its surgery simulation and technology centre. Students practise using surgical instruments to lift coils of rope viewed over a monitor, much as intestines are lifted during bowel surgery. They use the controls during a simulated endoscopy while watching a realistic duodenum on a monitor. Nurses learn to intubate a mannequin that can be programmed to respond to administered 'drugs' with changes in heart rate and blood pressure. And minimally invasive surgery is tried by students using instruments that mimic those used in actual surgery to clip an 'artery' — complete with 'blood' — during a simulated gall-bladder removal, viewed on a computer screen.

The most advanced simulators have 'haptic feedback', which provides students with the sensation that their instruments are touching real tissue.

Advances such as these have made use of live animals for training in medical schools gratuitous, says John Pippin, a cardiologist based in Dallas, Texas. Pippin once used live dogs to study heart attacks but now works full-time as senior adviser for the media-savvy animal rights group Physicians Committee for Responsible Medicine in Washington DC. The group has become a thorn in the side of deans and administrators in the 6% of US institutes that continue to use live animals to train future doctors. Heading their list is Johns Hopkins School of Medicine in Baltimore, Maryland, which is consistently rated in the top few schools in the country and unapologetically uses live animals.

"Hopkins is the only top school that still uses animals in the medical school curriculum for any purpose," Pippin says. "It is on an island." He was one of seven doctors attending a demonstration outside Johns Hopkins hospital in March protesting against the use of live pigs.

Jonathan Lissauer, a doctor who recently trained at Johns Hopkins, concedes the argument for animal use in medical research and advanced surgical training. He says that sometimes they were used "as just a diversion for people who won't be using those skills at all. I think then you cross the territory from appropriate medical education to something worse than that," he says. "There was no medical utility in having pigs die so that people going into psychiatry could play around.

"From a purely academic perspective," he adds, "I thought there were substantial differences between human tissues and pig tissues — a lot of textural differences — and that the practising wasn't overly useful because of that."

But Johns Hopkins' director of surgery, Julie Freischlag, makes no apologies for her programme's use of roughly 50 pigs and US$75,000 a year. She argues that the two days students spend in the pig lab are important in helping them decide if they are drawn to a surgical specialty. It also trains doctors who won't become surgeons but still need to know how to start intravenous lines and work with sutures.

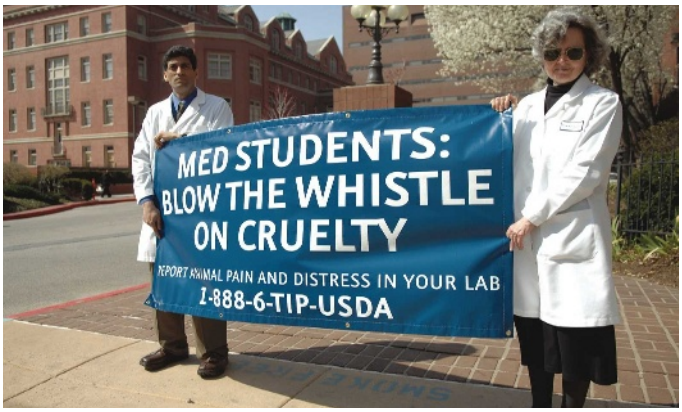
"The first time our graduates stitch you up in the emergency room as interns, they will have already done that on live tissue before," Freischlag says. "They will be safer and better. I think most of us would hope they have actually done that on someone or something else before us."

In the pig lab, students are taught how to take out the kidneys, part of the stomach, part of the liver, the gall bladder and the spleen. They learn how to operate on a lung and how to repair organs injured by trauma. They practise tying off arteries. They learn to control bleeding, handle tissues gently and finish the operation with the incision looking appropriate.

A veterinary assistant and veterinarian attend

the lab; the latter anaesthetizes and euthanizes the animals, which are purchased from contractors.

Freischlag says that the lab "is a totally elective part of the surgery rotation" — it is not graded, and students can opt out. She says that no student has opted out of the lab in advance in the five years she has been in her job. "One person did decide they didn't like it when they got into it and then opted out." Lissauer, however, claims that when he participated in the pig lab two years ago, "students who didn't feel comfortable taking part in an animal lab felt pressured to do so".



K. HAIRSTON/BALTIMORE SUN

The activist group Physicians Committee for Responsible Medicine campaigned against the use of pigs at Johns Hopkins Medical School.

Freischlag says that no amount of book learning, lectures or computer simulation can substitute for the experience of working with living tissue, and the unpredictability and bloodiness of real surgery. Controlling bleeding is a priority in surgery, not least because excess blood obscures the surgeon's vision. "It is really a contact sport," Freischlag says.

Others agree that there is value in schools training doctors-to-be on live animals. "More and more institutions are opting out and I don't think that there has been an adequate assessment of the educational impact, because it is very difficult to do," says Alice Ra'anan, the director of science policy at the American Physiological Society in Bethesda, Maryland, which supports the use of animal labs. "How do you do a controlled experiment of what the impact is as medicine evolves?"

Larry Laughlin, the dean of medicine at the Uniformed Services University of the Health Sciences in Bethesda, Maryland, which uses roughly 75 pigs a year to teach medical students physiology and surgery, says: "I'm not troubled if 10 or 100 other medical schools do not use animals. My focus is on what's best for our students, based on the educational professionals who advise me." A committee is in the process of reviewing his institution's use of animals and is expected to report in September.

Laughlin points out that US law requires that animal labs are approved by ethics committees, which must be persuaded that there is a compelling justification. "Thousands of times more pigs are slaughtered and have worse lives and suffer worse demises in Iowa every day than we do in a year," says Laughlin, who grew up on a livestock farm in the midwest. "Therefore it is hard for me to rationalize the intense concern."

One third-year medical student at Laughlin's institute, whom school officials insisted remain anonymous, says: "We have our simulation centre down the road where we learn how human bodies are supposed to react. But in our pig lab we have the opportunity to see how life actually reacts." And having experienced both, he contends that the pig lab has made him and his colleagues better surgeons-to-be than the fourth-year students from other medical schools that he encounters during their visiting, surgical electives. "We are a lot better prepared for what goes on in an operating room. To me, it is a real shortfall of their education, he says."

"I always feel sorry, a little bit, for knowing that that an animal gave its life for me. But at the same time, if I can take from this animal and learn how to save the lives of patients, definitely to me the benefit outweighs that sadness." ■

All around the world

The decline in the use of live animals to train medical students can be seen worldwide.

In the United Kingdom, a law has banned the use of live animals to train medics since 1986, except in microvascular-surgery training. However, nine UK universities use rodents to teach biosciences to undergraduates, a process that involves lengthy applications for project licences, which must be rewritten every five years.

Last week, five of the country's major funders of animal research, including the Wellcome Trust and the Medical Research Council, published common guidelines for use of animals in research. Compliance with the guidelines, which include looking at alternatives to animals and reducing their use, will be a condition of funding for new grants involving animal work.

Elsewhere in Europe practices vary. In Germany, for example, the Animal Welfare Act allows animals to be used for training purposes if an institution can provide a compelling reason for why they are needed and why alternatives do not measure up.

The Federation of European Laboratory Animal Sciences Associations is launching a working group to review animal use in education in 19 member countries. Its recommendations will influence the 22-year-old European Union directive on the protection of animals, which is under review.

In Australia, where 15 years ago medical students were taught neurophysiology using feral cats, there has been a marked reduction in the use of live animals. "I am not aware of any live-animal use in practical classes in any medical school in Australia," says Geoff Dandie, the chief executive officer of the Australian and New Zealand Council for the Care of Animals in Research and Teaching.

The decline is the result of successive revisions to an Australian code of practice, which discourages the use of live animals in classes other than specific areas of professional development. Animals are now rarely found outside of refresher courses for seasoned emergency-department doctors. There, sheep are used in training for rare, but essential, life-saving interventions such as tracheotomies.

Only one of 18 medical schools in Canada — Memorial University in St Johns, Newfoundland — still uses live animals, and it is reviewing its curriculum with a view to eliminating the practice.

In India, animals are available for the teaching of medical students under restrictive conditions, says Maneka Gandhi, a member of parliament and animal-rights activist. But Harmeet Rehan, head of physiology at Lady Hardinge Medical School in New Delhi, where rabbits are used, says that he is not aware of any Indian institution that uses large animals to teach surgical skills to undergraduates. Rehan liaises with several medical schools on behalf of a national committee that must give the go-ahead for any large-animal experiments.

In Argentina, "it is not common", according to Pablo Pratesi, chief of critical care medicine at Austral University in Buenos Aires, where Pratesi's programme uses 20 pigs a year to train final-year medical students in surgery skills. **M.W.**