The year 2020 was one of upheaval in education, and veterinary colleges were by no means exempt from the need to adapt to challenges presented by the COVID-19 pandemic. But the veterinary profession is nothing if not resourceful, and in some cases the need for social distancing merely accelerated the adoption of innovations already in play. Here is how a handful of schools are changing the way students are educated—and transforming the landscape of veterinary education.

**UNIVERSITY OF GEORGIA: VIRTUAL DISSECTION**

At the University of Georgia College of Veterinary Medicine, Professor Puliyur MohanKumar, BVSc, PhD, was already investigating ways to maximize students’ access to anatomy resources based on an anticipated increase in class size. After all, the dissection lab can accommodate only so many bodies at one time. Then COVID hit, and space became even more scarce. Suddenly the future need became urgent and immediate.

Based on Dr. MohanKumar’s recommendation, and with the support of departmental leadership, the college implemented software from a company called BodyViz (bodyviz.com), developed out of Iowa State University. This program reconstructs virtual 3D animals based on clinical cases that have used computed tomography and magnetic resonance imaging. These models can then be virtually dissected, with students able to “cut” in different planes to access, visualize, and identify anatomical structures.

When preparing to lead a dissection lab session, Dr. MohanKumar identifies an actual case from the veterinary teaching hospital and builds an anatomical rendering based on imaging data from that case.

“Let’s say we are dissecting the front limb of a dog and there is a bone broken or a tumor,” Dr. MohanKumar says. “We link that clinical scenario with whatever the students are dissecting. That way when they ask, ‘Why am I dissecting this? Why am I learning this thing? Why do I have to memorize this specific fact?’ This is the reason. We constantly bring it back to clinical relevance.”

Students also get a chance to work with real cadavers—on a given day in the laboratory, half the class does actual dissection while the other half works with virtual models at special workstations, all in accordance with social distancing guidelines. But the limitations imposed by the pandemic could very well be helping these students be better prepared for practice when they graduate.
“Anatomy is not going to show up in the clinic as an embalmed animal with an open body,” Dr. MohanKumar says. “This is a living creature, and the organs are on the inside. This gives students real-life experience of appreciating anatomy using images.”

Dr. MohanKumar says his students have taken to the technology readily. “The cool thing is, this is Xbox controller–based,” he says. “These kids are so good with Xbox controllers—they started having fun the day after I introduced the technology. My second-year students are jealous that they didn’t get to use it.”

**TEXAS A&M UNIVERSITY: VIRTUAL REALITY**

Jennifer Schleining, DVM, MS, DACVS-LA, a professor at Texas A&M College of Veterinary Medicine & Biomedical Sciences, loves it when a first-year veterinary student from, say, Dallas feels a tingle for agricultural medicine after performing their first bovine exam. But how does a kid from the suburbs become versed in the nuances of rural life? If they’re in one of Dr. Schleining’s classes, they start by donning a virtual reality (VR) headset.

“Here at A&M we’re very agricultural focused, but we’re in South Texas and all of the true production cattle are up in the Panhandle,” Dr. Schleining says. “That’s a 9-hour drive, which presents some significant challenges. And now with COVID, those challenges are even greater. How do you get a large number of students up into the Panhandle in the preclinical years?”

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To meet that challenge, Dr. Schleining partnered with OP McCubbins, PhD, a former classmate from Iowa State who also ended up at Texas A&M, where he founded a VR lab for the ag school. Together they shot hours of 3D video in west Texas, which led to the development of 3 modules for Dr. Schleining’s Rural Practice class. One module helps build observational skills to determine if an animal is sick. Another surrounds judicious use of antimicrobials, and a third covers field necropsy.

Wearing their VR goggles, students follow a pen rider as he identifies sick cattle, pulls them from the herd, and places them in hospital pens. In subsequent modules they continue to follow along as those same cattle are examined, treated, and tested. Conversations along the way address chute safety, body positioning, protocol development, and dealing with state labs.

Dr. Schleining has had to make some adjustments—in her first year using VR, she purchased very inexpensive headsets and the students complained of queasiness reminiscent of carsickness. This year she upped the quality of the hardware and is hopeful student surveys will reflect an improved experience. Despite these glitches, she says, students appreciate being part of an educational trendsetting experience. Plus, many are starting on the ground floor when it comes to knowledge of agricultural life. “If you are from the middle of Houston and decide agriculture is your passion and we put you into a rural community without preparing you, it can be a disaster,” Dr. Schleining says. “Part of what we’re doing is changing the perception that rural practice is archaic. We do a tour of a practice that has in-clinic bloodwork, an isolation facility, and digital radiography and use that to have a discussion and dispel myths.”

Dr. Schleining says she’s not necessarily a technology enthusiast, but she does have a passion for educating in innovative ways and thinking outside the box. “I get bored with just lecture; students get bored with just lecture,” she says. “So how do we engage students in a way that’s exciting and where they learn something in the same process? That’s the part that gets me really excited—trying something new in the classroom.”

COLORADO STATE UNIVERSITY: VIRTUAL ANATOMY
The Colorado State University (CSU) College of Veterinary Medicine & Biomedical Sciences also relies on a virtual teaching tool. Virtual Animal Anatomy (virtualanimalanatomy.colostate.edu/vaanopcomm)
serves multiple purposes, says Christianne Magee, DVM, PhD, DACT, who helped develop the program. One, it reduces reliance on cadavers, which is especially important as the availability of specimens dwindles and ethical concerns about cadaver use increase. Two, it lets students study at the pace and in the manner they choose—even when the lab is closed at 2 a.m.

“Students want to be able to study the cadaver when they’re not with the cadaver,” Dr. Magee says. “This lets them do that. It’s about improved learner control.”

Rather than relying on imaging data or artistic renderings and animations, Virtual Animal Anatomy uses photographic images of actual cadavers, which sets it apart from other virtual anatomy systems, Dr. Magee says. The program grew out of the work of Ray Whalen, DVM, PhD, who developed Virtual Canine Anatomy at CSU and brought Dr. Magee on to help expand the program to include equine and other species. Lately, the team has focused on exporting the program from Adobe Flash, which is no longer being supported, into another programming language.

“Fortunately, we started that process early enough that we could launch it with our own students [in 2018],” Dr. Magee says. “Then when COVID hit in March 2020, we were able to give 148 other schools and 12,000 students worldwide access to the program.”

Like the other instructors interviewed here, Dr. Magee is passionate about the student experience and finding
new ways to inspire a lifetime of learning and curiosity. In fact, she and her colleagues have conducted research on students who use the Virtual Animal Anatomy program, finding that those who do use VR spend less total time studying anatomy than those who use a more traditional approach. When they have control over the process, they study in the way that prepares them most effectively, so they’re more efficient, she says. Next, she wants to find out whether an immersive, augmented reality approach can be even more effective than the 2D experience on a handheld device.

Dr. Magee insists that she’s not an anatomist or a technology expert—she calls herself “a horse OB/GYN who stumbled into developing veterinary anatomy software.” In fact, she glazes over when her husband starts rattling off the specs of the latest VR headset.

But, as she says, “Very few of us are practicing veterinary medicine the way we thought we would when we wrote that application for veterinary school. I followed things that were interesting and let them take me places I never thought I would go. As it turned out, one of those was anatomy software.”

WHAT IS NEXT?

While the technology being used in today’s veterinary classroom is flipping conventional pedagogy on its head, these experts say more mind-blowing advances may be just ahead—with or without COVID restrictions. Perhaps 2 students will be able to stand together in a virtual environment and discuss the “specimen” lying on the table in front of them. Perhaps haptic feedback will let future veterinarians experience the feel of a scalpel as it slides through tissue. Whatever is next, veterinary professors and students will be there, figuring out how to best utilize it to improve the health of animals. TVP

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**Kristi Fender**

Kristi Fender, former editor of dvm360 magazine, has spent 20 years covering animal health and veterinary medicine. She holds a master’s degree in journalism from the University of Kansas and lives in Shawnee, Kansas, with her family, including 2 feisty shelter rescues: an old shepherd mix and a young calico-tabby.

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**Brief Summary:** Before using NexGard® (afoxolaner) Chews, please consult the product insert, a summary of which follows.

**CAUTION:** Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian.

**Description:** NexGard® is a soft chewable for oral administration to dogs and puppies according to their weight. Each chewable is formulated to provide a minimum afoxolaner dosage of 1.1 mg/lb (2.5 mg/kg).

**Indications:** NexGard kills adult fleas and is indicated for the treatment and prevention of flea infestations (Ctenocephalides felis), and the treatment and control of louse scapularis, Dermanyssus variabilis, Amblyomma americanum, and Rhipicephalus sanguineus infestations in dogs and puppies 8 weeks of age and older, weighing 4 pounds of body weight or greater. For one month, NexGard is indicated for the prevention of Borrelia burgdorferi infections as a direct result of killing, vector scapularis, or vector ticks.

**Dosage and Administration:** NexGard is given orally once a month, at the minimum dosage of 1.1 mg/lb (2.5 mg/kg). See full product insert for dosing table and details.

**Warnings:** Not for use in humans. Keep this and all drugs out of the reach of children. In case of accidental ingestion, contact a physician immediately. Keep NexGard in a secure location out of reach of dogs, cats, and other animals to prevent accidental ingestion or overdose.

**Precautions:** Afoxolaner is a member of the isoxazoline class. This class has been associated with neurologic adverse reactions including tremors, ataxia, and seizures. Seizures have been reported in dogs receiving isoxazoline class drugs, even in dogs without a history of seizures. Use with caution in dogs with a history of seizures or neurologic disorders.

The safe use of NexGard in breeding, pregnant or lactating dogs has not been evaluated.

**Adverse Reactions:** In a well-controlled US field study, which included a total of 333 dogs and 815 treated dogs (815 administered afoxolaner; 200 administered active control), no serious adverse reactions were observed with NexGard.

Over the 90-day study period, all observations of potential adverse reactions were recorded. The most frequent reactions reported at an incidence of >1% within any of the three months of observations are presented in the following table.

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Afoxolaner</th>
<th>Oral active control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomiting (with and without blood)</td>
<td>17</td>
<td>4.1</td>
</tr>
<tr>
<td>Dry/Itchy Skin</td>
<td>13</td>
<td>3.1</td>
</tr>
<tr>
<td>Diarrhea (with and without blood)</td>
<td>13</td>
<td>3.1</td>
</tr>
<tr>
<td>Lethargy</td>
<td>7</td>
<td>1.7</td>
</tr>
<tr>
<td>Anorexia</td>
<td>5</td>
<td>1.2</td>
</tr>
</tbody>
</table>

1 Number of dogs in the afoxolaner treatment group with the identified abnormality.

2 Number of dogs in the control group with the identified abnormality.

In the US field study, one dog with a history of seizures experienced a seizure on the same day after receiving the first dose and on the same day after receiving the second dose of NexGard. This dog experienced a third seizure one week after receiving the third dose. The dog remained enrolled and completed the study. Another dog with a history of seizures had a seizure 19 days after the third dose of NexGard. The dog remained enrolled and completed the study. A third dog with a history of seizures received NexGard and experienced no seizures throughout the study.

**Post-Approval Experience (July 2018):** The following adverse events are based on post-approval adverse drug experience reporting. Not all adverse events are reported to FDA/CVM. It is not always possible to reliably estimate the adverse event frequency or establish a causal relationship to product exposure using these data.

The following adverse reactions reported for dogs are listed in decreasing order of reporting frequency for NexGard. Vomiting, pruritus, lethargy, diarrhea (with and without blood), anorexia, seizures, hyperactivity/restlessness, panting, erythema, ataxia, dermatitis (including rash, papules), allergic reactions (including hives/swelling), and tremors.

**Effectiveness:** See full product insert for details regarding Effectiveness.

**Animal Safety:** In a margin of safety study, NexGard was administered orally to 8 to 9-week-old Beagle puppies at 1, 3, and 5 times the maximum exposure dose for a total of six treatments. There were no clinically-relevant effects related to treatment on physical examination, body weight, food consumption, clinical pathology (hematology, clinical chemistries, or coagulation tests), gross pathology, histopathology or organ weights. Vomiting occurred throughout the study, with a similar incidence in the treated and control groups, including one dog in the 1x group that vomited four hours after treatment.

In a well-controlled field study, no adverse reactions were observed from the concomitant use of NexGard with other medications.

**Contact Information:** For a copy of the Safety Data Sheet (SDS) or to report suspected adverse drug events, contact Boehringer Ingelheim Animal Health USA Inc. at 1-888-637-4251. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or www.fda.gov/reportanimalae.

**Trademark Information:** The information provided here is not comprehensive. The full FDA-approved product insert is available at www.nexgardfordogs.com. Consult your veterinarian for further information.

**Product Approval:** FDA under NADA # 141-406

**Marketed by:** Frontline Vet Labs™, a Division of Boehringer Ingelheim Animal Health USA Inc. Duluth, GA 30096

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