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THE CHEMISTRY OF KIBBLE

THE BILLION-DOLLAR, CUTTING-EDGE SCIENCE OF CONVINCING DOGS AND CATS TO EAT WHAT'S IN FRONT OF THEM.

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DESPITE THE CRYPTIC NAME and anonymous office-park architecture, the nature of the enterprise located at AFB International is clear the moment you sit down for a meeting. The conference room smells like kibble. One wall, entirely glass, looks onto a small-scale kibble-extrusion plant where men and women in lab coats and blue sanitary shoe covers tootle here and there pushing metal carts. AFB makes flavor coatings for dry pet foods. To test the coatings, the company needs to make small batches of plain kibble to put them on. The coated kibbles are then served to consumers: Spanky, Thomas, Skipper, Porkchop, Momo, Elvis, Sandi, Bela, Yankee, Fergie, Murphy, Limburger, and some 300 other dogs and cats that reside at the company's Palatability Assessment Resource Center (PARC), about an hour's drive from its St. Louis–area headquarters.

AFB's vice president at the time, Pat Moeller, a few other staff members, and I are seated around an oval table. Moeller is middle-aged, likable, and plainspoken. He has a small mouth with naturally deep-red lips and a pronounced Cupid's bow, but it would be inaccurate to say he has a feminine appearance. Rather, he has the look of an Army man, which he was when he helped develop foods for NASA's Apollo program. The fundamental challenge of the pet food professional, Moeller is saying, is to balance the wants and needs of pets with those of their owners. The two are often at odds.

Dry, cereal-based pet foods caught on during World War II, when tin rationing put a stop to canning. Owners were delighted. Dry pet food was less messy and stinky and more convenient. As a satisfied Spratt's Patent Cat Food customer of yesteryear put it, the little biscuits were "both handy and cleanly."

To meet nutritional requirements, pet food manufacturers blend animal fats and meals with soy and wheat grains and vitamins and minerals. This yields a cheap, nutritious pellet that no one wants to eat. Cats and dogs are not grain eaters by choice, Moeller is saying. "So our task is to find ways to entice them to eat enough for it to be nutritionally sufficient."

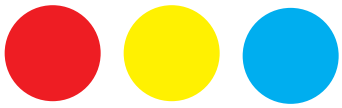
This is where "palatants" enter the scene. AFB designs powdered flavor coatings for the edible extruded shapes. Moeller came to AFB from Frito-Lay, where his job was to design, well, powdered flavor coatings for edible extruded shapes. "There are," he says, "a lot of parallels." Cheetos without the powdered coating have almost no flavor. Likewise, the sauces in processed convenience meals are basically palatants for humans. The cooking process for the chicken in a microwaveable entrée imparts a mild to nonexistent flavor. The flavor comes almost entirely from the sauce—by design. Says Moeller, "You want a common base that you can put two or three or more different sauces on and have a full product line."

Pet foods come in a variety of flavors because that's what humans like, and we assume our pets like what we like. We're wrong. "For cats especially," Moeller says, "change is often more difficult than monotony."

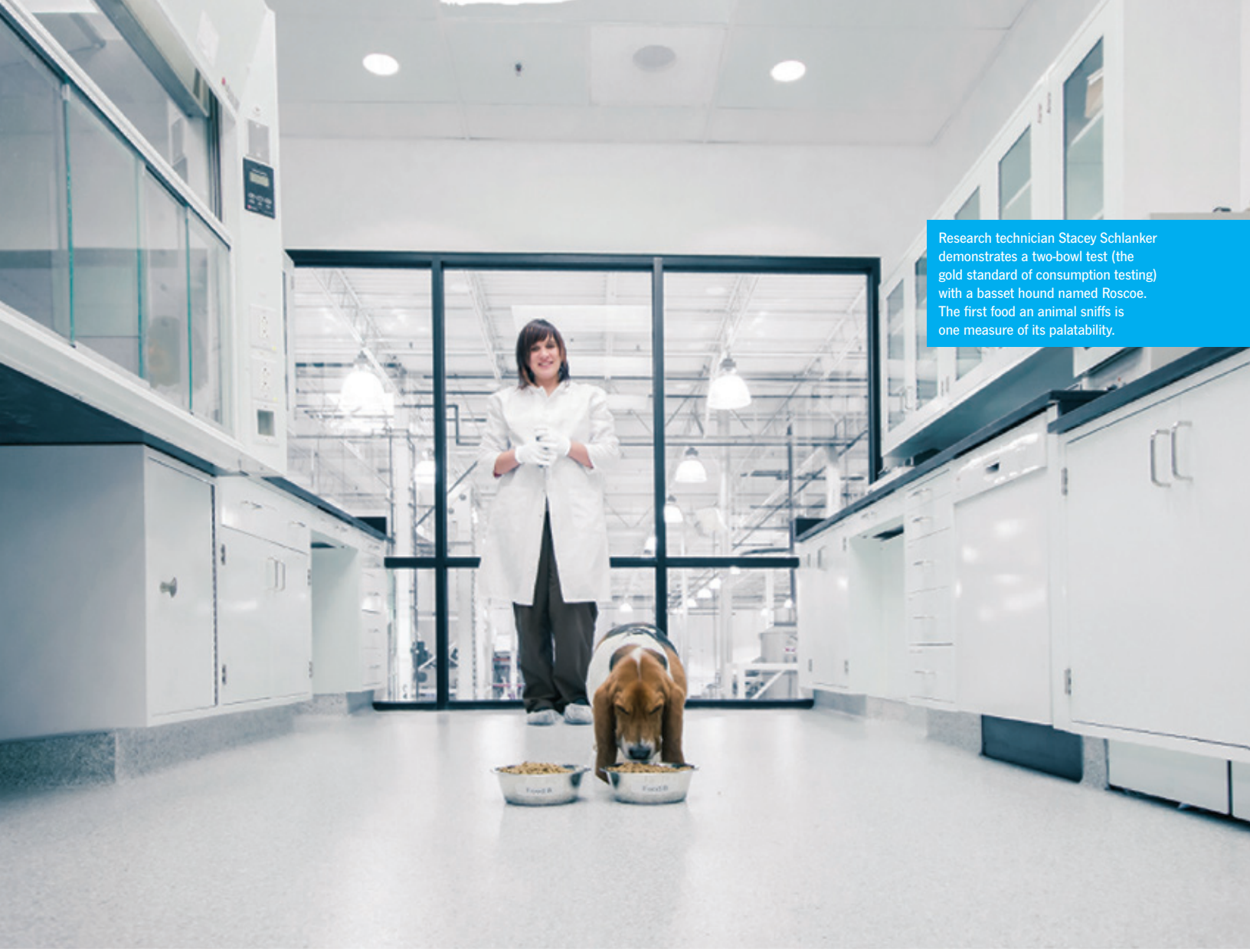
Nancy Rawson, seated across from me, is AFB's director of basic research and an expert in animal taste and smell. She says that cats prefer to stick to one type of food. Outdoor cats tend to be either mousers or birders, but not both. But don't worry: Most of the difference between Tuna Treat and Poultry Platter is in the name and the picture on the label. "They may have more fish meal in one and more poultry meal in another," says Moeller, "but the flavors may or may not change."

To gauge the acceptability of a new product, food science has traditionally relied on consumer panels: willing individuals who sample an array of products and report back on which they prefer. It's no different with pets. It's just that you can't ask them.

PYROPHOSPHATES HAVE BEEN described to me as "cat crack." Coat some kibble with it, and the pet food manufacturer can make up for a whole host of gustatory shortcomings. Rawson has three kinds of pyro-



PET FOODS COME IN A VARIETY OF FLAVORS BECAUSE THAT'S WHAT HUMANS LIKE, AND WE ASSUME PETS LIKE WHAT WE LIKE. WE'RE WRONG.



Research technician Stacey Schlanker demonstrates a two-bowl test (the gold standard of consumption testing) with a basset hound named Roscoe. The first food an animal sniffs is one measure of its palatability.

PHOTOGRAPHY BY JOHN FEDELE

phosphates in her office. They're in plain, brown glass bottles, vaguely sinister in their anonymity. I have asked to try some, which, I think, has won me some points. Sodium acid pyrophosphate, known affectionately as SAPP, is part of the founding patent for AFB, yet almost no one who works for the company has ever asked to taste it. Rawson finds this odd. I do, too, although I also accept the possibility that other people would find the two of us odd.

Rawson is dressed today in a long, floral-print skirt with low-heeled brown boots and a lightweight plum-colored sweater. She is tall and thin with wide, graceful cheek and jaw bones. She looks at once like someone who could have worked as a runway model and someone who would be mildly put off to hear that. Before she was hired at AFB, Rawson worked as a nutritionist at Campbell Soup Company and, before that, did research on animal taste and smell at the Monell Chemical Senses Center in Philadelphia.

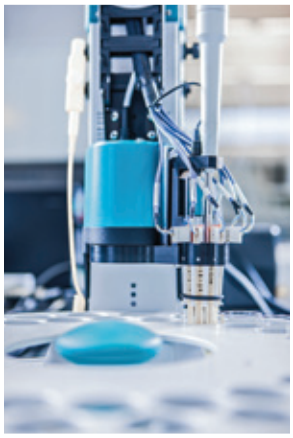
Rawson unscrews the cap of one of the bottles. She pours a finger of clear liquid into a plastic cup. Although pet food palatants most often take the form of a powder, liquid is better for tasting. To experience taste, the molecules of the tastant–the thing one is tasting–need to dissolve in liquid. Liquid flows into the microscopic canyons of the tongue's papillae, coming into contact with the buds of taste receptor cells that cover them. That's one reason to be grateful for saliva. Additionally, it explains the appeal of dunking one's doughnuts.

Taste is a sort of chemical touch. Taste cells are specialized skin cells. If you have hands for picking up foods and putting them in your mouth, it makes sense for taste cells to be on your tongue. But if, like flies, you don't, it may be more expedient to have them on your feet. “They land on something and go, 'Ooh, sugar!'" Rawson does her best impersonation of a housefly. “And the proboscis automatically comes out to suck the fluids.” Rawson has a colleague who studies crayfish and lobsters, which taste with their antennae. “I was always jealous of people who study lobsters. They examine the antennae, and then they have a lobster dinner.”

The study animal of choice for taste researchers is the catfish, simply because it has so many receptors. They are all over its skin. “They're basically swimming tongues,” says Rawson. It is a useful adaptation for a limbless creature that locates food by brushing up against it; many catfish species feed by scavenging debris on the bottom of rivers.

I try to imagine what life would be like if humans tasted things by rubbing them on their skin. *Hey, try this salted caramel gelato–it's amazing.* Rawson points out that a catfish may not consciously perceive anything when it tastes its food. The catfish neurological system may simply direct the muscles to eat. It seems odd to think of tasting without any perceptive experience, but you are doing it right now. Humans have taste receptor cells in the gut, the voice box, the upper esophagus. But only the tongue's receptors report to the brain. “Which is something

Nancy Rawson (left), director of basic research, and research associate Jean Stough at work in the AFB analytics lab. Far right: The "electronic tongue" provides data on a sample's taste profile.



to be thankful for," says Danielle Reed, Rawson's former colleague at Monell. Otherwise, you'd taste things like bile and pancreatic enzymes. (Intestinal taste receptors are thought to trigger hormonal responses to molecules like salt and sugar, as well as defensive reactions—vomiting, diarrhea—to dangerous bitter items.)

We consider tasting to be a hedonic pursuit, but in much of the animal kingdom, as well as our own prehistory, the role of taste was more functional than sensual. Taste, like smell, is a doorman for the digestive tract, a chemical scan for possibly dangerous (bitter, sour) elements and desirable (salty, sweet) nutrients. Not long ago, a whale biologist named Phillip Clapham sent me a photograph that illustrates the consequences of life without a doorman. Like most creatures that swallow their food whole, sperm whales have a limited to nonexistent sense of taste. The photo shows 25 objects recovered from sperm whale stomachs. It's like Jonah set up housekeeping: a pitcher, a cup, a tube of toothpaste, a strainer, a wastebasket, a shoe, a decorative figurine.

Enough stalling. Time to try the palatant. I raise the cup to my nose. It has no smell. I roll some over my tongue. All five kinds of taste receptor stand idle. It tastes like water spiked with strange. Not bad, just other. Not food.

"It may be that that otherness is something specific to the cat," says Rawson. Perhaps some element of the taste of meat that humans cannot perceive. The feline passion for pyrophosphates might explain the animal's reputation as a picky eater. "We make [pet food] choices based on what we like," says Reed, "and then when they don't like it, we call them finicky."

There is no way to know or imagine what the taste of pyrophosphate is like for cats. It's like a cat trying to imagine the taste of sugar. Cats, unlike dogs and other omnivores, can't taste sweet. There's no need, since the cat's diet in the wild contains almost nothing in the way of carbohydrates (which are simple sugars). They either never had the gene for sweet-detecting, or they lost it somewhere down the evolutionary road.

Dogs rely more on smell than taste in making choices about what to eat and how vigorously. The takeaway lesson is that if the palatant smells appealing, the dog will dive in with instant and obvious zeal, and the owner will assume the food is a hit. When in reality it might have only smelled like a hit.

Interpreting animals' eating behaviors is tricky. By way of example, one of the highest compliments a dog can pay its food is to vomit. When a gulper, to use Moeller's terminology, is excited by a food's aroma, it will wolf down too much too fast. The stomach overfills, and the meal is reflexively sent back up to avoid any chance of a rupture. "No consumer likes that," he says, "but it's the best indication that the dog just loved it."

"EVERYONE WANTS to be Meow Mix." Amy McCarthy, head of PARC, stands outside the plate-glass window of Tabby Room 2, where an unnamed client is facing off against Meow Mix, Friskies, and uncoated kibble in a preference test. If a client wants to be able to say that cats prefer its product, they must prove it at a facility like this one.

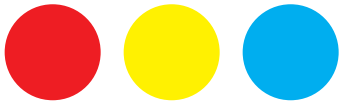
Two animal techs dressed in surgical scrubs stand facing each other. They hold shallow metal pans of kibble in various shades of brown, one in each hand. Around their ankles, 20 cats mince and turn. The techs sink in tandem to one knee, lowering the pans.

The difference between dog and cat is obvious. While a dog will almost (and occasionally literally) inhale its food the moment it's set down, cats are more cautious. A cat wants to taste a little first. McCarthy directs my gaze to the kibble that has no palatant coating. "See how they feel it in their mouth and then drop it?"

I see an undifferentiated ground cover of bobbing cat heads but say yes anyway.

"Now look there." She directs my gaze to the Meow Mix, where the bottom of the pan is visible through an opening in the kibble. McCarthy, who is in her thirties, speaks louder than you expect a person to, perhaps a side effect of time spent talking over barking.

Down the hallway, dog kibble A, dressed in a coat of newly formulated AFB palatant, is up against the competitor. The excitement is audible. One dog squeals like sneaker soles on a basketball court. Another makes a huffing sound reminiscent of a two-man timber saw. The techs are wearing heavy-duty ear protection, the kind worn on airport tarmacs.



TIME TO TRY THE PALATANT. I ROLL SOME OVER MY TONGUE. IT TASTES LIKE WATER SPIKED WITH STRANGE. NOT BAD, JUST OTHER. NOT FOOD.

Dry pet food, which took off in the 1940s, is nutritious but tasteless. Food scientists coat it with liquid or powdered palatants to entice cats and dogs to eat it.

PHOTOGRAPHY BY JOHN FEDELE

A tech named Theresa Kleinsorge opens the door of a large kennel crate and sets down two bowls in front of a terrier mix with dark-ringed eyes. She is short and brassy with spiky magenta-dyed hair. "Kleinsorge" is German for "little trouble," and it seems like a fitting name—trouble in the affectionate sense of well-intentioned mischief. She owns seven dogs. McCarthy shares her home with six. Dog love is palpable here at PARC. It is the first pet food test facility to "group house" its animals. Other than during certain preference tests, when animals are crated to avoid distractions, PARC is a cage-free facility. Groups of dogs, matched by energy level, spend their days roughhousing in outdoor yards.

The terrier mix is named Alabama. His tail thumps a beat on the side of the crate. "Alabama is a gobbler real bad," Kleinsorge says. In making their reports, the AFB techs must take into account the animals' individual mealtime quirks. There are gulpers, circlers, tippers, snooters. If you weren't acquainted with Alabama's neighbor Elvis, for example, you'd think he was blasé about both of the foods just now set before him. Kleinsorge gives a running commentary of Elvis's behavior while a colleague jots notes. "Sniffing A, sniffing B, licking B, licking his paws. Going back to A, looking at A, sniffing B, eating B."

Most dogs are more decisive. Like Porkchop. "You'll see. He'll sniff both, pick one, eat it. Ready?" She puts two bowls at Porkchop's front paws. "Sniffing A, sniffing B, eating A. See? That's what he does."

PARC techs also try to keep a bead on doggy interactions in the yards. "We need to know," says McCarthy. "Are you down because you don't like the food or because Pipes stole your bone earlier?" Kleinsorge mentions that a dog named Momo has lately had an upset stomach, and Porkchop likes to eat the vomit. "So that's cutting into Porkchop's appetite." And probably yours.

In addition to calculating how much of each food the dogs ate, PARC techs tally the First-Choice Percentage: the percentage of dogs who stuck their snout in the new food first. This is important to a pet food company because with dogs, as Moeller said earlier, "if you can draw them to the bowl, they'll eat most of the time." Once the eating begins, though, the dog may move to the other food and wind up consuming more of it. Since most people don't present their dogs with two choices, they don't know the extent to which their pet's initial, slavering, scent-driven enthusiasm may have dimmed as the meal progressed.

The challenge is to find an aroma that drives dogs wild without making their owners, to use an Amy McCarthy verb, yak. "Cadaverine is a really exciting thing for dogs," says Rawson. "Or putrescine." But not for humans. These are odoriferous compounds given off by decomposing protein. I was surprised to learn that dogs lose interest when meat decays past a certain point. It is a myth that dogs will eat anything. "People think dogs love things that are old, nasty, dragged around in the dirt," Moeller tells me. But only to a point, he says. "Something that's just starting to decay still has full nutritional value. Whereas something that bacteria have really broken down—it's lost a lot of its nutritional value, and they would only eat it if they had no choice." Either way, a pet owner doesn't want to smell it.

Some dog food designers go too far in the other direction, tailoring the smell to be pleasing to humans without taking the dog's experience of it into account. The problem is that the average dog's nose can be up to 10,000 times more sensitive than the average human's. A flavor that to you or me is reminiscent of grilled steak may be overpowering and unappealing to a dog.

Earlier today, I watched a test of a mint-flavored treat marketed as a tooth-cleaning aid. Chemically speaking, mint, like jalapeño, is less a flavor than an irritant. It's an uncommon choice for a dog treat. (As is jalapeño, although according to psychologist Paul Rozin, Mexican dogs, unlike American dogs, enjoy a little heat. His work suggests that animals have cultural food preferences too.) The manufacturers are clearly courting the owners, counting on the association of mint with good oral hygiene. The competition courts the same dental hygiene association but visually: The biscuit is shaped like a toothbrush. Only Momo preferred the minty treats—which may explain the vomiting.

ORGANS ARE AMONG THE MOST NUTRITIONALLY RICH FOODS ON EARTH. LAMB SPLEEN HAS ALMOST AS MUCH VITAMIN C AS A TANGERINE.

A dog named Winston is nosing through his bowl for the occasional white chunk among the brown. Many of the dogs picked these out first. They're like the M&M's in trail mix. McCarthy is impressed. "That's a really, really palatable piece." One of the techs mentioned that she tried some earlier and that the white morsel tasted like chicken. Or, rather, "chickeny."

I must have registered surprise at the disclosure, because Kleinsorge jumps in. "If you open a bag and it smells really good. . ."

The tech shrugs. "And you're hungry. . ."

IN 1973, THE NUTRITIONAL watchdog group Center for Science in the Public Interest (CSPI) published a booklet, *Food Scorecard*, that claimed that one third of the canned dog food purchased in housing projects was consumed by people. Not because those people had developed a taste for it, but because they couldn't afford a more expensive meat product. (When a reporter asked where the figure had come from, CSPI cofounder Michael Jacobson couldn't recall, and to this day the organization has no idea.)

To my mind, the shocker was in the nutrition scores themselves. Thirty-six common American protein products were ranked by overall value. Points were awarded for vitamins, calcium, and trace minerals and subtracted for added corn syrup and saturated fats. Jacobson—believing that poor people were eating significant amounts of pet food and/or exercising his talent for publicity—included Alpo in the rankings. It scored 30 points, besting salami and pork sausage, fried chicken, shrimp, ham, sirloin steak, McDonald's hamburgers, peanut butter, pure beef hotdogs, Spam, bacon, and bologna.

I mention the CSPI rankings to Rawson. We are back at AFB headquarters with Moeller, this time in a different conference room. (There are five of them: Dalmatian, Burmese, Greyhound, Calico, and Akita. The staff members refer to them by breed, as in "Do you want to go into Greyhound?" and "Is Dalmatian free at noon?") It would seem that in terms of nutrition, there was no difference between the cheap meatball sub I ate for lunch and the Smart Blend the dogs were enjoying earlier. Rawson disagrees. "Your sandwich was probably less complete, nutritionally."

A tech pours palatant—which can include proteins, yeasts, and antioxidants—over unflavored kibble in a hand coater, which rotates to cover the pieces evenly. Roger, a beagle, is one of hundreds of taste testers at AFB.

PHOTOGRAPHY BY JOHN FEDELE

The top slot on the CSPI scorecard, with 172 points, is beef liver. Chicken liver and liver sausage take second and third place. A serving of liver provides half the RDA for vitamin C, three times the RDA for riboflavin, nine times the vitamin A in the average carrot, and good amounts of vitamins B-12, B-6, and D, folic acid, and potassium.

What's the main ingredient in AFB's dog food palatants?

"Liver," says Moeller. "Mixed with some other viscera. The first part that a wild animal usually eats in its kill is the liver and stomach, the GI tract." Organs in general are among the most nutritionally rich foods on earth. Lamb spleen has almost as much vitamin C as a tangerine. Beef lung has 50 percent more. Stomachs are especially valuable because of what's inside them: The predator benefits from the nutrients of the plants and grains in the stomach of its prey. "Animals have evolved to survive," Rawson says. They like what's best for them. People blanch to see "fish meal" or "meat meal" on a pet food ingredient panel, but meal—which variously includes flesh, organs, skin, and bones—most closely resembles the diet of dogs and cats in the wild.

Animals' taste systems are specialized for the niche they occupy in the environment. That includes us. As hunters and foragers of the dry savannah, our earliest forebears evolved a taste for important but scarce nutrients: salt and high-energy fats and sugars. That, in a nutshell, explains the widespread popularity of junk food. And the wide spreads in general—an attribute we now share with our pets. A recent veterinary survey found that more than 50 percent of dogs and cats are overweight or obese.

People devoted to a healthier lifestyle have also begun to project their food qualms and biases onto their pets. Some of AFB's clients have begun marketing 100 percent vegetarian kibble. The cat is what's called a true carnivore—its natural diet contains no plants. Moeller tilts his head. A slight lift of the eyebrows. The look says, "Whatever the client wants." PS

Mary Roach is the author of the book Gulp: Adventures on the Alimentary Canal, *published this spring.*

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