The genome of a mouse is, structurally speaking, a **chaotic** place. At some point in its evolutionary past, the mouse shuffled its ancestral genome like a deck of cards, **futzing** up the architecture that makes most other mammalian genomes look, well, *mammalian.* "I always consider it the greatest outlier," Bill Murphy, a geneticist at Texas A&M University, told me. "It's about as different from any other placental mammal genome as you can find, sort of like it's the moon, compared to everything else being on the Earth." Mouse genomes are still incredibly useful. Thanks to years of careful tinkering, **meticulous** mapping, and a **bonkers** amount of breeding, researchers have **deciphered** the murine genetic code so thoroughly that they can age the animals up or down or alter their **susceptibility** to cancer, findings that have big implications for humans. But the mouse's genomic **disarray** makes it less suited to research that could help us understand how our *own* genetic codes are packaged and stored. Which is why some researchers have turned to other study subjects, just one step up the food chain.

Cats, it turns out, harbor genomes that look and behave remarkably like ours. "Other than **primates**, the cat-human comparison is one of the closest you can get," with respect to genome organization, Leslie Lyons, an expert in cat genetics at the University of Missouri, told me. Lyons and Murphy, two of the world's foremost experts in feline genetics, have been on a longtime mission to build the ranks in their small field of research. In addition to genetic architecture, cats share our homes, our diets, our behaviors, many of our microscopic pests, and some of the chronic diseases—including diabetes and heart problems—that **pervade** Western life. "If we could start figuring out why those things happen in some cats, but not others," Lyons told me, maybe humans and felines could share a few more health *benefits* as well.

Feline genomes are now being mapped essentially end to end, "with a nearly perfect sequence," Lyons said, a feat that researchers have only recently managed with people. Complete genomes create references—**pristinely** transcribed texts for scientists to **scour**, without blank pages or **erasures** to **stymie** them. Cats can't tell us when they're sick. But more investment in feline genomics could pave the way for precision medicine in cats, wherein vets assess genetic risk for different diseases and intervene as early as possible, giving them "a jump on diagnostics," Elinor Karlsson, a vertebrate genomics expert at the Broad

Institute, told me. Because humans and cats are **bedeviled** by some of the same diseases, identifying their genetic calling cards could be good for us too. Cats can develop, for instance, a neurological disorder that's similar to Tay-Sachs disease, "a life-ending disease for children," Emily Graff, a veterinary pathologist and geneticist at Auburn University, told me. But gene therapy seems to work wonders against the condition in cats, and Graff's colleagues plan to adapt a treatment for its **analogues** in kids.

The cat genome could fuel more basic science pursuits as well, Lyons told me. Essentially all the cells in our bodies contain identical genomes, but have extraordinarily different developmental fates. Researchers have been trying for decades to untangle the mechanics of this process, which requires cells to force some of their genes into **dormancy**, while keeping others in frequent use. One of the most dramatic examples of this phenomenon is the silencing of one of the two X chromosomes in female cells. "We still don't have a good sense of how *genes* get turned on and off," Sud Pinglay, a geneticist at New York University, told me. "This is an entire *chromosome*."

X inactivation is what **dapples** the coats of calicos. These cats are almost exclusively female, and must be genetic mutts: One of their X chromosomes carries an orange-furred gene, and the other, a black. In any given cell, only one chromosome stays awake. That decision happens early in a cat's development, and the cells that split off from these **lineages** stay faithful to the color their parent cells picked, creating big patches of color. "That helped us put together that the inactivated X chromosome was relatively stable, and kept stable for many rounds of cell division," Sundeep Kalantry, an X-inactivation expert at the University of Michigan, told me. "That's why the calico cat holds such an **exalted** place in X inactivation." Genomes can be so stubborn about X inactivation that they will hold their ground even after being moved into *other cells.* The first cloned cat, named Carbon Copy, or CC for short, was genetically identical to a classically colored calico named Rainbow. But CC was born sporting only shades of brown and white: She had, apparently, been created out of a cell that had shut its orange X off, and had refused to reverse the process.

Many of the **vagaries** of gene and chromosome silencing—their relative **permanence** or **impermanence** in different contexts, for instance—are still being worked out in different species by researchers including Kalantry, whose lab website features a **fetching** photo of a calico. But they have long known that the shape and structure of a genome, and the arrangement of the genes within, hold sway over how the contents are expressed. Most of our genome is thought to be **annotations** and **embellishments** that shape how the rest of it is read; **snippets** of DNA can even twist, bend, and cross great distances to punctuate one another. That's one big area where cats can help us, Lyons told me: If their genes are organized like ours, maybe they're regulated like ours too. "Maybe this is where the cats get to step in," she said.

Some people might feel uneasy about the idea of studying felines in the lab. But Murphy notes that lots of genetic work can be done quite gently. His team has gotten very good at extracting gobs of DNA from cat cheek cells, using little wire brushes that they **swivel** into the animals' mouths. There are also huge perks to working with popular pets: People in the community are often eager to contribute, either directly or through their vets. When cats get sick, researchers can sample them, and in many cases, help them get healthy again. "I'd say about 90 percent of studies on cats are done on naturally occurring disease models," Murphy told me. And the cats who pass through Lyons' lab in Missouri, she told me, get adopted after they've retired from their scientific careers.

Mice are easy and cheap to breed and house in labs, and they've had a hell of a head start in scientific research already. Cats are unlikely to **outpace** them; they might not even surpass dogs, which are *especially eager* to work with humans, and have done so extensively, Gita Gnanadesikan, a canine researcher at the University of Arizona, told me. As research volunteers, cats tend to be more **sullen** and **reserved**. (Canines, too, come with drawbacks. We know a lot about their genomes, but dog breeds have been so genetically **siloed** that their populations "are not diverse, so they're not as good a model for humans," Karlsson told me.) But cats have their place, experts told me—as a member of an entire **menagerie** of animals that humans would benefit from understanding better. "In genetics, there's this tension: Do you try to learn everything you can about a small number of organisms, or do you branch out and try to learn little bits about a larger number of species?" Gnanadesikan told me. "I think one of the answers to that is just … yes."