Health & Medicine

Brainchildren

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Chloe, age five, pulls a pair of blue latex gloves onto her hands. She’s probably the only little girl in New York with two brains: one between her ears and one in her tiny palms.

Other kids, and adults, too, are gathered in front of the table in the Kolb Annex at the New York State Psychiatric Institute on Columbia’s medical campus. Here at the Brain Expo — part of the Brain Month festivities sponsored by the Mortimer B.

Zuckerman Mind Brain Behavior Institute at Columbia — members of Columbia University Neuroscience Outreach (CUNO) have set up booths and invited the public to explore the mysteries of the most complex object in the known universe.

Beyond the wide floor-to-ceiling window lies the gray matter of a rainy March day: the steel cables and towers of the George Washington Bridge to the right, a boiler-room sky, the flinty ribbon of the New Jersey Palisades, and the sheet metal of the Hudson River, fractured into leaden shades.

Inside, behind the brain table, Cyndel Vollmer, a PhD candidate in biomedical sciences at the Graduate School of Arts and Sciences, fields questions. *Is this from a real person?* Yes. *Whoa!* Next to Vollmer is second-year postdoc Anita Devineni, who studies the olfactory and taste centers of the brains of fruit flies. “The human brain is a big stretch for me,” Devineni says. She got into brains as an undergrad at Stanford, captured by this “physical structure made up of cells — the thing that controls everything we do and everything we are.” The CUNO members explain that the color of a live human brain is pinkish gray (from blood vessels), and divided into gray matter (the neuronal cell bodies in the overlying cerebral cortex) and white matter (the myelin-coated tracts underneath the cortex, which carry information from one area to another). These two brains here, plastinated like the human parts in *Bodies: The Exhibition*, are the moribund beige of well-chewed Wrigley’s Doublemint gum.

CUNO is a student-run organization that visits area schools to “get people to think more about how they think,” says Vollmer. The program was the brainchild of Kelley Remole ’04CC, ’12GSAS, who, during her first year of grad school, started a student outreach group that soon grew into CUNO. Now she’s the director of neuroscience outreach at the Zuckerman Institute, where she creates and runs the institute’s public programs.

The average human brain weighs about three pounds, a miracle of lightness and compactness for such a prodigious engine, though given the infinitesimal weight of a single neuron, of which there are estimated to be one hundred billion in the brain, this mass feels frightfully substantial, almost fetal in its consequence. It *looks* fetal, a suggestion of a tucked head and flippers, though Vollmer more often hears “baseball mitt.” Aside from the brain in Chloe’s hands, the two halves of another brain rest on the table, having been split along the deep furrow (the medial longitudinal fissure) that divides the two hemispheres, so that you can see the cross-sectioned parts.

Snap comparisons to the topography of a cleaved cabbage or cauliflower are not without justice. *Why is the brain wrinkled like that?* Vollmer explains that the cortex (site of such higher faculties as abstract thought, problem solving, and language comprehension) is folded to permit more surface area in the skull for information processing neurons.

While the Brain Expo is aimed at children, the Morningside campus hosted a similar showcase earlier in the week. There, outside, at the Sundial, members of the undergraduate Columbia Neuroscience Society, dressed in black T-shirts that said “I [picture of hot-pink brain] NY,” displayed brains in their gloved hands. Students, mostly women, were crowded three deep, keen to glimpse the object, which even in its preserved state held an aura of the ultimate. The spectacle of a human being holding a human brain in contemplation seemed the very portrait of the consummation of consciousness. “It can’t be Kim Kardashian’s brain,” quipped a dandified grad student passing by, “because you’re holding it.”

Back at Kolb Annex, child-enticing bonbons and bright colors have been marshaled along with the brains. At one booth, you are asked to hold your nose and chew a jellybean — a simple exercise highlighting the role of smell in detecting flavor. At another booth, candy-colored pipe cleaners have been twisted into the shape of neurons: a round body (soma); a long, electric- impulse-conducting extension (axon); and the branch-like dendrites that protrude from the soma to receive information in the form of electricity or chemicals. The brain is said to contain one hundred trillion neural connectors, or synapses.

There are activities here, too: you can try to hit a target with a beanbag from ten feet away while wearing light-bending prism goggles that shift everything to the right or left so that the beanbag goes astray of the target, causing you to have to compensate and adjust your aim *away* from the target in order to hit it. Ideally, your neurons will adapt to the change in the environment and you’ll figure out where to toss the beanbag (some will figure it out faster than others). In the same mode, and even more vexing, is the trace-a-five-pointed-star-while-watching-your-hand-in-the-mirror game, which reduced at least one grown adult to a tense bundle of concentrated feebleness as his pen kept tracing the same line, back and forth, over and over, unable to find the way out, the sputter of electrical charges from neuron to muscle practically audible over the din. The two presiding CUNO members, Carmen Matos and Kristin Politi, make the reassuring point that improvement can occur through practice, alluding to the unusual case of Henry Molaison, known before his

death in 2008 as H. M. In 1953, surgeons, in a Hail Mary to cure H. M.’s epilepsy, removed parts of his brain — including much of his hippocampus on both sides (the hippocampi are seahorse-shaped structures under the cerebral cortex, now known to be responsible for forming memories). Molaison lost the ability to make new memories, living always in the present, yet was able to get better at tasks related to muscle memory.

Meanwhile, at the brain station, under the eyes of Vollmer and Devineni, little Chloe relinquishes the brain. In school, Chloe had learned about Alexa Canady, the first female African-American neurosurgeon, and had gone home and told her mother about the lesson, saying, “I want to be a neuroscientist.”

Now, with her mother nearby, Chloe reports that the brain “wasn’t that squishy. It was hard.” (Live brains are often described as having the consistency of soft tofu.)

When Vollmer was in second grade, her father, a bioengineer, brought her to his lab, in Montreal. “I fell in love — the bright lights, the benches, the chemicals; the magic of engineering and biology together,” she says. Chloe seems to be undergoing a similar initiation. For Kelley Remole, standing near the beanbag booth, that’s a big win.

In starting CUNO, for which she’s still an adviser, Remole had put a lot of effort into figuring out how to engage with schoolchildren. Ideally, the brain wasn’t something you just walked up to.

“We took fifteen minutes with questions like, ‘What are scientists?’ and ‘What is the brain?’” says Remole, who did her doctoral work on the anatomy and physiology of the hippocampus in animal models of schizophrenia. “By asking these questions, you have more time to introduce the brain, and to let the children know that this is a privilege — that few people get to see a real human brain.”

As the Expo ends, a colleague comes over to Remole, having noticed, for the first time, a nascent convexity at Remole’s midsection. She’s five months in, and people are just now catching on. Or rather, the visual information is being transmitted via electrochemical signals from their eyes to the occipital lobe at the back of the brain, leading to neuronal sparks in the cortex, followed by complex activations of the speech motor-control system, which generate the utterance, “Congratulations!”

At the brain table, Devineni and Vollmer put the brains back into their plastic containers. It’s a little mind-bending to think that in this roomful of brains, a new one

is taking root. In fact, every thought and emotion, every movement in this space, speaks to Remole's motto. "There's no more personal science than neuroscience," she says. "It's about who we are."

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