

The Woman Who Fixed Her Own Brain

BY NORMAN DOIDGE

READERS DIGEST

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One hundred trillion connections make up the human brain—highways still mostly unmapped. Those who do the mapping are often scientists whose brains are extraordinary, working on those whose brains are damaged. Rarely is the person who makes a discovery the one with the defect. Barbara Arrowsmith Young is an exception.

She was born with a devastating set of learning disabilities, side by side with extraordinary gifts and a resolve that, after years of work, allowed her to invent the treatment that transformed her. Today she runs the Arrowsmith School in Toronto, where her revolutionary approach is changing the lives of students with similar disabilities.

Lost in Space

Born in Toronto in 1951 and raised in Peterborough, Ont., Barbara had areas of brilliance as a child. Her auditory and visual memories were extraordinary. Her frontal lobes were exceptionally developed, giving her a driven, dogged quality. But her brain was "asymmetrical," meaning these parts coexisted with areas of retardation.

She had a confusing array of cognitive problems. She had trouble pronouncing words. She had no capacity for spatial reasoning, which allows one to construct a pathway of movements internally before executing them. It's important for a baby crawling or a hockey player planning his moves, but it is also necessary for organizing one's desk or remembering where one has placed one's keys. With no mental map of things in space, Barbara lost things all the time. Out of sight was literally out of mind, so she had to keep everything she was playing or working with in front of her, and keep her closets and dressers open. Outside, she was always getting lost.

She also had a kinesthetic problem: difficulty recognizing objects by touch and knowing where her body or limbs were. She literally couldn't tell her left from her right. She couldn't hold a cup of juice in her left hand without spilling it. She frequently tripped or stumbled.

All these problems combined wrought havoc. Her mother declared she would be surprised if Barbara lived beyond the age of three. Once, when she decided to treat herself for sniffles, Barbara grabbed an old nose-drops bottle in which her brothers kept sulphuric acid for experiments. Being dyslexic, she misread the new label they had written and mistook it for her own drops. Lying in bed with acid running into her sinuses, she was too ashamed to tell her mother of yet another mishap.

Then there were her most debilitating problems. The part of the brain that allows us to understand relationships between symbols was not functioning normally. She had trouble understanding logic, cause and effect, and grammar. She could not distinguish between the father's brother and the

brother's father. She couldn't read a clock because she couldn't understand the relationship between the hands. She could understand symbols only with effort and constant repetition.

This led to disorientation of many kinds. She reversed b and d, and q and p, and learned to read and write from right to left.

Unable to understand cause and effect, she did odd things socially. In kindergarten she didn't understand why, if her brothers were in the same school, she couldn't leave class and visit them whenever she wanted. She could memorize math procedures but couldn't understand concepts. Her father spent hours tutoring her, to no avail.

Wanting desperately to do well, she got through elementary school by memorizing during her lunch hours and after school. In high school she learned to exercise her memory and could remember pages of facts. Before tests, she prayed they would be fact based, knowing she could score 100 percent.

She understood nothing in real time, only lag time. She lived by reviewing the past in the present, to make its fragments come together. Simple conversations, movie dialogue and song lyrics were replayed more than 20 times because, by the time she got to the end of a sentence, she couldn't recall what the beginning meant.

Her emotional development suffered as well. Because she couldn't pick up on logical inconsistencies in the lines of smooth talkers, she was never sure whom to trust. But what plagued her the most was the chronic uncertainty that attached to everything. She sensed meaning everywhere but could never verify it.

"I live in a fog, and the world is no more solid than cotton candy," she told herself. Like many kids with multiple learning disabilities, she began to think she might be crazy. In elementary school she had already become depressed and suicidal.

Capitalizing on Her Strengths

Now after years in that cotton-candy world, Barbara Arrowsmith Young has a velvety presence and wispy amber hair. She looks younger than her 50 years. The fact that she is now running a school that treats similarly disabled children is even more astonishing when you consider she grew up at a time when little help was available.

"In the 1950s in a small town like Peterborough, you didn't talk about these things," she says. "The attitude was: You either make it or you don't. There were no special-education teachers, no visits to medical specialists or psychologists. The term learning disabilities wouldn't be widely used for another two decades. My Grade 1 teacher told my parents I had 'a mental block' and I would never learn the way others did." Today she might be called "learning-disabled gifted," a term that describes individuals with both substantial gifts and substantial disabilities, a less extreme version of the idiot savant.

Donald Frost, a sculptor and Barbara's childhood friend, says: "She was under incredible academic pressure. The whole Young family were high achievers. Her father, Jack, was an electrical engineer and an inventor with 34 patents for Canadian General Electric. Her mother, Mary, had the attitude: 'You will succeed, there is no doubt; and if you have a problem, fix it.'"

It was Barbara's memory that preserved her, allowing her to pass through high school, after which she gravitated towards the study of child development, hoping somehow to sort things out for herself. At the University of Guelph, teachers noted she had a remarkable ability to pick up nonverbal cues in the child-observation laboratory, and she was asked to teach a course. She felt there must have been some mistake. Then she was accepted in-to graduate school at the Ontario Institute for Studies in Education (OISE). Whereas most students read a research paper once or twice, Barbara typically had to read one 20 times to get a fleeting sense of the meaning. She survived on four hours of sleep a night.

Help From the Past

Kazan, u.s.s.r, 1922. Aleksandr Romanovich Luria, barely 20, wrote to Sigmund Freud, and Freud responded. Deeply interested in psychoanalysis, Luria corresponded with Freud and wrote papers on the psychoanalytic technique of "free association."

In 1929, however, Joseph Stalin assumed control of the Soviet Union and psychoanalysis became scientia non grata. Luria was denounced. To remove himself from view, he went to medical school to study neurology.

In May 1943 Lieut. Lyova Zazetsky entered Luria's office in a rehabilitation hospital. He had sustained a bullet wound to the head, with massive damage to the left occipito-parietal region deep inside his brain.

His symptoms were very odd. The bullet had lodged in the part of the brain that helps us understand relationships between symbols. He could no longer understand logic, cause and effect, or spatial relationships, or distinguish his left from his right. He couldn't understand a whole sentence or recall a complete memory. All he could grasp were fleeting fragments. Yet his frontal lobes were spared. Thus he was left with the capacity to recognize his defects, and the wish to overcome them.

Over the next 30 years, Luria would observe him and witness his fight "to live, not merely exist."

Because Barbara was so adept at child observation, her teachers in grad school had trouble believing she was disabled. It was another gifted but learning-disabled student at OISE, Joshua Cohen, who first understood. Running a small clinic for learning-disabled kids, Joshua used the standard treatment: "compensation." It was based on a theory that damaged brain cells could not be restored and no new brain cells could develop in adults. Compensations work around a problem. For example, people with trouble reading are told to listen to audio tapes. But Barbara's thesis, an outcome study of learning-disabled children treated with compensations at the OISE clinic, showed

that most were not really improving. Because she had had so much success developing her memory, she told Joshua there must be a better way.

One day Joshua suggested she look at some books he'd been reading by Aleksandr Luria. She went over the difficult passages countless times, especially a section about people with strokes or wounds in the juncture of the parietal and occipital lobes who had trouble with grammar, logic and reading clocks. This led her to *The Man with a Shattered World*, Luria's summary of and commentary on a diary Zazetsky kept. Their illnesses seemed similar. She thought, He is describing my life.

"I knew what the words mother and daughter meant but not the expression mother's daughter," Zazetsky wrote. "The expressions mother's daughter and daughter's mother sounded the same to me." About watching a film, he wrote, "Before I've had a chance to figure out what the actors are saying, a new scene begins."

Zazetsky's bullet was lodged in the left hemisphere, where language, sight and kinesthetic sensation are brought together and where symbols are related. While Zazetsky could perceive properly, Luria realized he could not relate perceptions or parts of things or symbols. He lived with fragments and wrote, "I'm in a fog all the time... All that flashes through my mind are images...hazy visions that suddenly appear and disappear."

For the first time, Barbara realized her brain deficit had an address. But Luria did not provide the one thing she needed: a treatment.

Reeducating Her Brain

At this point in her life, at 28, a paper came across Barbara's desk in graduate school. In postmortem exams, professor Mark Rosenzweig of the University of California, Berkeley, had found that the brains of stimulated rats had more neurotransmitters, more numerous interconnections and better blood supply than the brains of rats from less stimulating environments. He and his co-workers were among the first to demonstrate "neuroplasticity," the theory that nerve-cell activity might produce changes in the function and structural wiring of the brain.

Lightning struck for Barbara. Rosenzweig had shown, in essence, that the brain can be modified. Her own breakthrough was to link Rosenzweig's and Luria's research. She embarked on what would be her life's work.

She isolated herself and began toiling at mental exercises she had designed. She exercised her weak-est function—relating symbols—progressively. One exercise involved reading hundreds of cards with clock faces showing different times. She had Joshua write the correct time on the back. The cards were shuffled so she couldn't memorize the answers. When she couldn't get the time right, she'd spend hours with a mechanical clock. At some point, she started to get the answers right, and after many exhausting weeks, she noticed improvements with her other difficulties in relating symbols. She began to grasp grammar, math and logic, and what people were saying as they said it. She left lag time behind. The discovery of neuroplasticity is the continental divide of neuroscience. Before it, conventional wisdom about treating many brain problems flowed in one

direction—towards compensation, going around a weak area or function and, hence, never stimulating it.

Barbara Arrowsmith Young has been going in the other direction, putting neuroplasticity into practice for more than two decades. After her first success, she designed exercises for her other disabilities and brought them up to the "average" level. Barbara and Joshua Cohen married, and in 1980 they opened the Arrowsmith School. They did research together, and Barbara continued to develop brain exercises for the 19 brain areas most commonly weakened in those with learning disabilities, as well as to run the school day-to-day. (Barbara and Joshua eventually parted, and he died in December 1999.)

Arrowsmith School is located in a small building in Toronto's St. Clair Avenue West neighbourhood. Children are individually assessed to determine which areas are weak and whether they might be helped. Using a brain map Luria made before high-tech scans were available, Barbara has formed focal exercises to target precise areas. The school is a private operation with 54 children enrolled this year.

Students, many of whom were distracted in regular schools, sit quietly, working at their computers. They include children who had been diagnosed as having attention-deficit and learning disorders. Some are on Ritalin, and some, as their exercises progress, safely come off medication, revealing that their attention problems were secondary to their underlying learning disorders. One can see kids who previously couldn't read a clock working at computers reading ten-handed millennium clocks in mere seconds. At other tables children are studying Urdu and Persian characters to strengthen their visual memories. The exercises are taxing because the weak area has to be worked until it is strained

Academic improvement and capacity to know and understand are measured every six months. The Toronto Catholic District School Board is now using Barbara's techniques in five different schools, and four Ontario private schools have Arrowsmith programs.

"Our mental operations are only as strong as the weakest link in the chain," says Barbara. "Weak brain areas can often function with effort."

Today Barbara Arrowsmith Young is sharp and funny, and there are no noticeable bottlenecks in her mental processes. She flows from one activity to the next, from one child to the next. Far from being caught in lag time, her work has advanced ahead of many international programs. Yet she carries herself with a humility that doesn't befit the achievement—perhaps a trace of thinking herself mentally deficient for three decades, before she came out of the fog.

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