

OLIVER SACKS

THE DOC ON THE BIKE AND IN THE BRAIN

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Oliver Sacks was a neurologist who brought the brain to popular imagination in latter part of the 20th century. In the article, the author presents Sacks's work on brain phenomena, ranging from hallucinations and colour blindness, against the backdrop of his life that was as interesting as the brains and people he studied. Also highlighted is Sacks's remarkable ability to connect with and communicate about his 'patients' in a very humane way.

Imagine a doctor, a friendly gentleman with a white beard, who smiles genially at you from across his chair. He would like to know how you feel after being struck by lightning. You tell him how you have been suffering from blinding headaches since the incident - headaches that seem to resist medical intervention. A friend had suggested that you meet this doctor, a neurologist. Sitting at his desk, you add that you've suddenly discovered an irresistible taste for learning classical music, something you never particularly liked until you were hit by lightning. This doctor listens deeply, and seems to take furious notes on everything you say. He is interested in your headache, but seems to be more interested in your new found musical tastes. You discuss Bach and Debussy. At the end of the session, he writes out a prescription for your headache but asks you to visit him again. You thank him and leave his office. In a few months, you receive a handwritten letter from the doctor asking for your permission to include your story in a collection of medical cases that the doctor is compiling on people with interesting life stories around brains and music. You are thrilled to hear this, but would like anonymity in the book. He agrees. A year later, you walk by a bookstore and notice a new book on the shelves - Musicophilia by Oliver Sacks, your doctor, with your story featured prominently in it, without mentioning your name.



Figure 1. Oliver Sacks at the Brooklyn Book Festival in 2009. Source: Luigi Novi, Wikimedia Commons. License: CC-BY. URL: https://en.wikipedia.org/wiki/Oliver_Sacks#/media/File:9.13.09OliverSacksByLuigiNovi.jpg

The fictionalized description above is an attempt to capture the spirit and approach of Oliver Sacks, one of the greatest 20th century chroniclers and communicators of neurological stories. He could very well have been your doctor if you had lived in New York in the last three decades of the 20th century, and had a puzzling neurological condition. Dr. Sacks was a neurologist - a medical doctor who specializes in understanding the workings of the brain, especially under conditions where it malfunctions or displays unusual functions. The human brain looks like a lump of grey tissue, but has made our species capable of communicating in thousands of languages; create cultures, cities and the stock market. It can also be the site of life-changing conditions like depression, schizophrenia or dementia. The brain was Dr. Sacks' laboratory, and writing about the brain was his passion.

The brain is a complex organ. Some simple classroom activities like those described here: <http://faculty.washington.edu/chudler/chmodel.html> can be used to make the structure and function of this organ more accessible. This is another useful site: <https://ntp.neuroscience.wisc.edu/teacher-resources.htm>, with a wide-ranging collection of activities on introducing neuroscience to children of various age groups. Children may also enjoy seeing a brain preserved in formalin, possibly on a visit to a local hospital museum.

Dr. Sacks was an inveterate collector of stories, of people's lives and their brains. The fictionalised story here is similar to the hundreds of real-life stories that Dr. Sacks has captured in his 14 books¹ published over 45 years. In these stories, he has pondered over the marvels of the brain - from its ability to produce blinding headaches captured in his first book **Migraine**; its capacity for producing visions of objects that don't exist that he wrote about in **Hallucinations**; and the fantastic and universal ability of the human brain to create, process and appreciate music that he explored in **Musicophilia**. Instead of simply listing diagnostic criteria for various conditions he came across as a doctor, he recounted the life stories and case histories of the people he met during his years as a clinician.

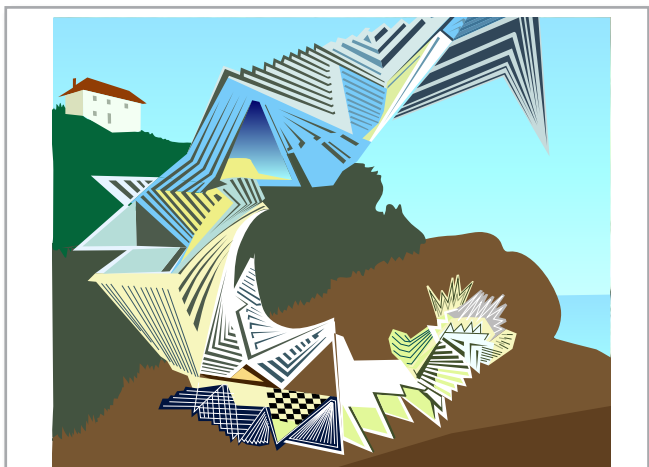


Figure 2. Illustrated representation of a migraine aura.

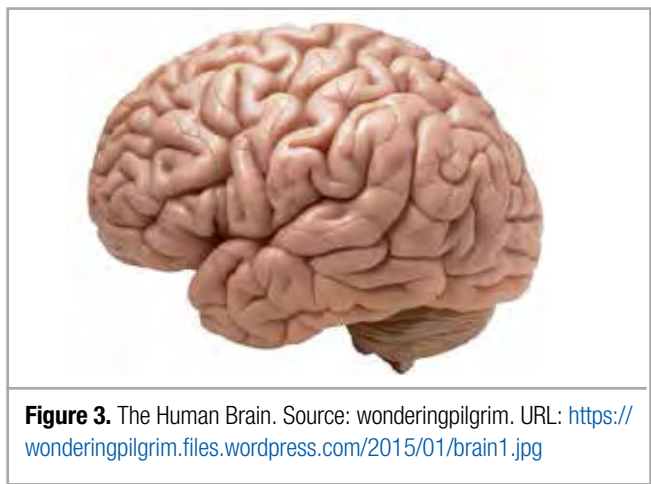
Dr. Sacks was clearly moved by the people he met and wrote about in his books. In a case published as "The Twins"², he describes the mathematical gifts possessed by a pair of twins he observed for some time in the 1960s and 70s. These twins possessed, among various other abilities, an intuitive ability to count prime numbers. He verified their ability by

cross-checking the large multi-digit numbers they spoke aloud against a table of prime numbers. In a moving passage, he describes the close emotional connection they shared that became particularly evident when they played a game of exchanging ten digit prime numbers. He later describes the loss of this ability once the twins were separated and put on a programme to help them integrate into society. He leaves it to the reader to wonder about society's approach to such people – was separating the twins the right thing to do, given that they derived great joy in communicating to each other through numbers? His writing conveys the empathy he feels for their lives, something that you don't often expect to see in a doctor's typical report of a case. Sacks wrote about these people not as mere medical marvels or clinical objects for diagnosis, categorization and treatment; but as real people with real life stories, with their ups and downs, joys and sadness, connections and mishaps, as illustrated in the story of the mathematically gifted twins described earlier.

The story of the twins can be shared with children familiar with prime numbers. Children can be asked to come up with progressively larger prime numbers. First let them attempt these themselves, with any approach that they can think of on their own, like by dividing numbers. Then, introduce them to the 'Sieve of Eratosthenes' technique (<http://www.geeksforgeeks.org/sieve-of-eratosthenes/>), and ask them to identify the largest possible prime by this technique. Encourage them to time themselves. Compare this with the time taken by the twins, in Sack's case study, to identify very large primes intuitively.

Dr. Sacks' fascination for the brain may have begun at home. He was the third of four sons born to doctor parents in London on 9th July 1933. When he was seven years old, he survived the Blitz, the bombing of London by the German air force. He describes these early years in his memoir **Uncle Tungsten**³ where he expands on what turned out to be a life-long fascination with chemical elements and the periodic table. This book is very instructive in appreciating the role of free exploration and questioning in a child's attempt to understand the world. He was too young to fight in the war, and so after it ended, he attended Oxford University in the early 1950s where he initially chose to qualify as an obstetrician. He shifted to neurology under the influence of two gifted teachers. He mentions them in his autobiography, **On The Move: A Life**,

remembering them both with ‘affection and gratitude’ - one of them he credits for having taught him to be observant and intuitive; and the other, to look for possible physiological mechanisms underlying a particular set of behaviours⁴.



Dr. Sacks’ books repeatedly reveal his intuitive approach to understanding underlying causes of neurological conditions. Nowhere is this highlighted more than in his **Awakenings**⁵, where he describes his use of the drug L-Dopa to wake a series of patients who had been in a coma-like state for over forty years from their sleep. He also describes their reactions to the world around them in this awakened state, and their varied behavioural responses to the drug. This book, published in 1973, was later made into a movie that made him well-known in the United States where he lived since 1961. His primary work as a clinician was to diagnose and think of a course of treatment best suited to a particular condition. He seemed to have found validity in the use of medication, as he describes in the case of his younger brother Michael. Michael was diagnosed with schizophrenia as a teenager, and subsequently struggled with meeting the demands of society. Dr. Sacks describes his own struggle with trying to understand his brother’s condition, and his sense of failure at not being able to personally help; but recognizes the role of medication in reducing some of the more debilitating psychoses and hallucinations⁶.

He approached the case of Ray, who had Tourette’s syndrome, with the use of medication. People with Tourette’s syndrome display sudden, repetitive, non-rhythmic physical movements (motor tics) and utterances (phonic tics). Ray, whose condition is described in ‘Witty Ticky Ray’⁷, was excessively

Introduce children to optical illusions by sharing some examples of such illusions.

Here are two good sources for illusions:

1. <http://www.optics4kids.org/home/content/illusions/>
2. <http://www.michaelbach.de/ot/>

Encourage children to come up with a theory that explains why we fall for these illusions. Ask them to test if the illusion persists when they look at it with one of their eyes closed. This can be tried out for one of the images in the links above. Ask children to repeat this experiment, with their other eye closed instead. What can you conclude? Does this hold for other illusions? How are illusions different from hallucinations? Encourage children to offer explanations, or come up with their own ideas for conducting this investigation; with teachers ensuring that care be taken before any experiments are actually attempted.

impulsive, and showed ‘tics, jerks, mannerisms, grimaces, noises, curses, involuntary imitations and compulsions of all sorts’⁷. Medication seemed to take away his symptoms, but it also took away his spontaneity and changed his personality completely. In such a situation, Dr. Sacks often wondered who the real Ray was. Through his detailed and humane medical descriptions, Dr. Sack’s writing showed remarkable depth in connecting modern science and medicine with questions of social significance.

In his early days in the United States, in addition to meeting patients and practising as a clinician, Dr. Sacks explored the countryside on long bike rides⁸. Given his passion for speedy bike rides and adventures in the countryside (resulting in the occasional accident), people were often surprised to know that he was a doctor. He describes a walk in Norway in his 1984 book, **A Leg To Stand On**⁹, where chased by a huge bull, he had a devastating fall from a cliff that left him with a badly broken leg. He goes on to describe how during his recovery, he sometimes strongly experienced the feeling of his leg as not being part of his body, a condition known technically as Body Integrity Identity Disorder (where parts of the body may feel like they shouldn’t be there, demonstrating the intimate relationship between mind and body)⁹. Among his other talents, Oliver Sacks was a champion weight lifter¹⁰. He had to give this up

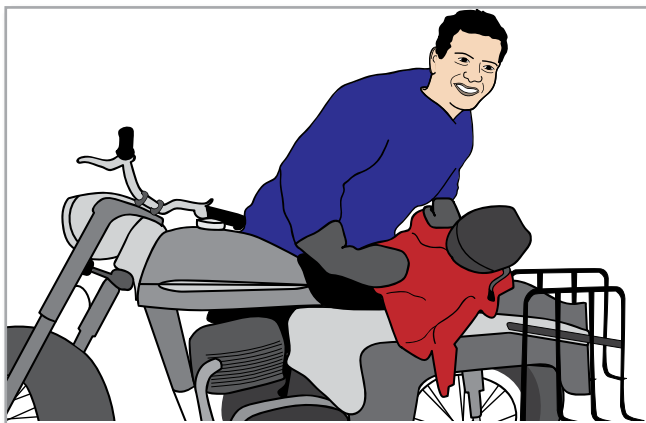


Figure 4. Doctor on a Bike.

The phantom limb phenomenon¹ is a disorder where a person experiences the presence of a limb when it is actually not there, and can be looked symptomatically as the opposite of the Body Integrity Identity Disorder. The phantom limb phenomenon can be used to demonstrate the mind-body relationship and the idea that various parts of the body are actually mapped in different parts of the brain. This phenomenon can be easily demonstrated in class through the experiment described here: <http://brainu.org/phantom-limb>

as he grew older and his body began to feel the strain from his numerous accidents with bikes and bulls!

Dr. Sacks was very widely read. The extensive footnotes to his books reveal his eclectic taste - ranging from philosophy to poetry, although he was most fascinated by plants and natural history. He never travelled anywhere without his notebook and pencil, and was always ready to note anything he found interesting. In his **Island of the Colour-blind and Cycad Island**¹², he describes two strange stories about people living on these islands. The first story describes the high prevalence of achromatopsia (or complete colour blindness) that was common among the inhabitants of the Pingelap islands in the Pacific Ocean. Nearly 5% of the population of 3000 people on this island suffered from this disorder, i.e., they see their world in black, white and shades of grey. In comparison, only 1 in every 30,000 people across the world is affected by the same condition. Dr. Sacks connects the occurrence of a typhoon in 1775 and the genetics of island populations with these high rates of prevalence.

To introduce Red Green Colour blindness in class, use the Ishihara Colour blindness Cards, available online at: <http://colorvisiontesting.com/ishihara.htm>. This activity can be used to understand how the eye detects colour. When introduced along with physical models of the brain, these cards can also be used to understand visual processing in the brain.

The second strange story was of the people living on Guam, a remote island in the Pacific Ocean. These islanders experienced symptoms of dementia, typically a disease of old age, where people slowly lose their normal bodily functions and memory due to the death of their brain cells (neurons). The rates of dementia on this island were a hundred times higher than in any other part of the world. Detailed medical investigations showed that the brains of people who died from this disease revealed a high concentration of a particular chemical. Further investigations revealed that this chemical was probably derived from fruit bats that were consumed by the islanders. Bats possessed high concentrations of the chemical because they fed on the fruit of cycads, a tree species that grew commonly in Guam, which had high concentrations of this chemical. With over-hunting leading to a decline in fruit-bat numbers, the disease disappeared from the island as well. The story of this (Lytico-bodig) disease is another in Dr. Sacks' long list of descriptions and observations that have been so useful in asking good questions in science. After all, science builds on such detailed observations, and it is questions and theories that stem from these observations and experiments that help test and reject unworthy ideas. Dr. Sacks' observations and experiments, such as those described in **Awakenings**, are of the kind that stimulate questions which can be investigated experimentally to understand the underlying basis for the brain's function.

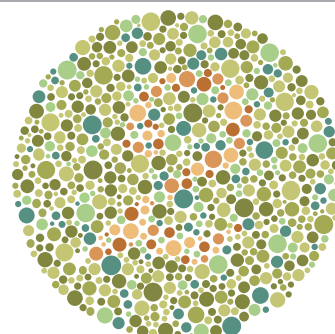


Figure 5. An example of an Ishihara card for colour blindness.

Oliver Sacks was also a pioneer in popularizing the study of the brain. Another popular writer and neurologist, Vilayanur Ramachandran, has spoken on the impact of Dr. Sacks' writing, describing his ability to 'connect seemingly unconnected disciplines, and inspire students to take up medicine and neurology'¹³. Atul Gawande, a doctor who writes about aging and death, attributes the humanity in Dr. Sack's books

You can demonstrate the inheritance of colour blindness by using a simple family tree (pedigree chart) that simply traces patterns of inheritance without going into details of chromosomes, DNA, etc. Starting with a few people surviving a typhoon, you can use such a pedigree chart to easily demonstrate how island populations can become quickly inter-related due to marriages between relatives. If one of the initial survivors is totally colour blind, the pedigree chart can be used to demonstrate the high prevalence of total colour blindness in a few generations.

The case of cycad-caused dementia can be used as an interesting example to introduce the concept of food chains.

as his inspiration to write for a popular audience¹⁴. What may seem surprising and unfortunate is that many people in India haven't heard of Sacks, in spite of his being such a popular writer and having authored books that have been translated into over 25 languages (but not in any Indian language) globally¹⁵.

Dr. Sacks died on 30th August 2015 due to complications arising from ocular cancer¹⁶. Even on his death bed, at age 82, Oliver Sacks couldn't resist the urge to tell a story. He wrote for the New Yorker magazine¹⁷ on the memories of a fish dish his mother used to make when he was a child. In this article, you see the doctor coming to terms with the inevitable end to his life - a long journey of curiosity and discovery, deep empathy with people under his care and a knack for connecting to a global audience.

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