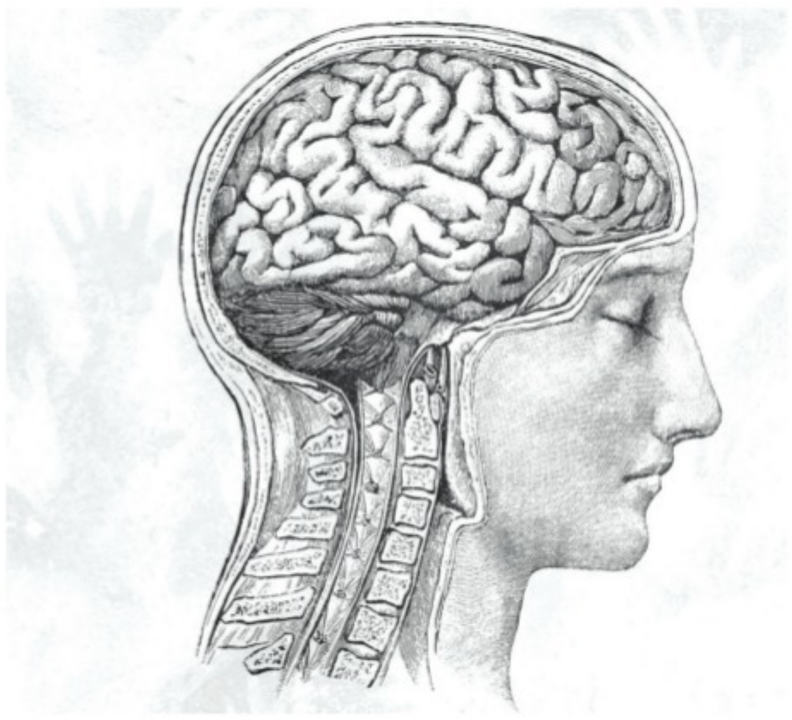
Science and disease of the mind

A new book by Anne Harrington called *Mind Fixers — Psychiatry's Troubled Search for the Biology of Mental Illness* has started a dialogue in the world of biological psychiatry

S ANANTHANARAYANAN



A study that describes the progress of psychiatry and examines the choices before practitioners today has invited some opinionated reviews. Anne Harrington, the Franklin L Ford Professor of the History of Science at Harvard University, the author of *Mind Fixers — Psychiatry's Troubled Search for the Biology of Mental Illness*, in a letter to the journal, *Nature*, responds to one of them.

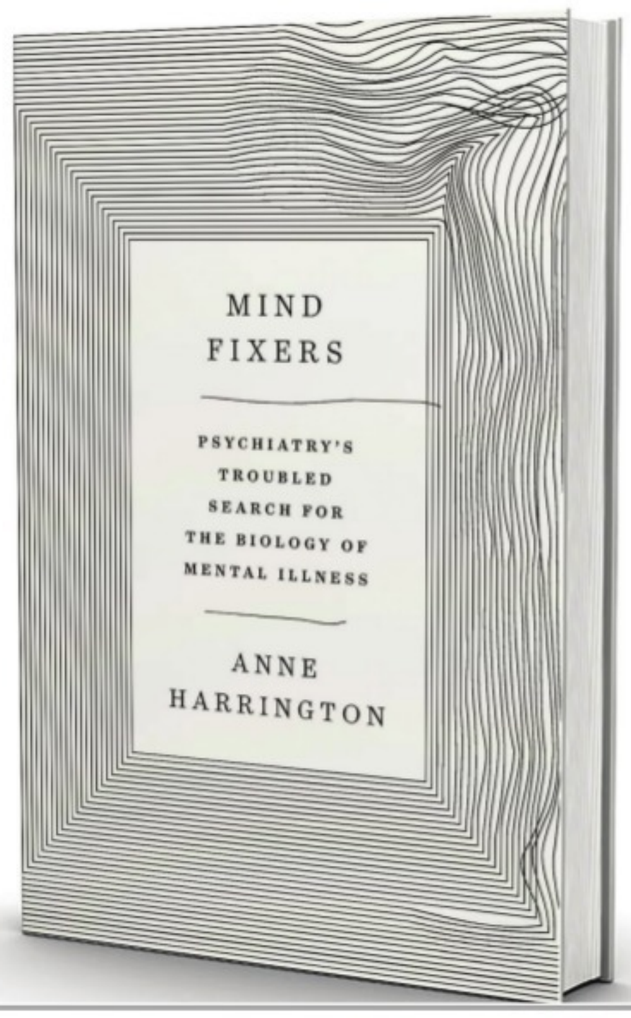
The progress of medical science traces a path from early ideas of "humours" or the "disposition" of the organs, as if they were sentient objects, to understanding the structure of the body in physical terms, by observation and dissection. This was first undertaken by Galen in the 2nd century AD, and continued energetically in the second millennium. What followed was the discovery of the circulation of the blood, vaccines, chemistry, pharmacology, microbiology and genetics, and we are now able to effectively deal with a great many physical ailments of the human body.

The same, however, cannot be said about diseases of the mind. While the role of the counsellor, or the confessor, was there to manage levels of anxiety, overt imbalance was labelled "insanity" and considered to be possession by spirits. Affected persons were usually excluded from society and confined to asylums, if not subjected to torture and methods of exorcism. As there had been similar beliefs about the reasons for physical disease, until they were replaced by the study of anatomy and scientific medicine, efforts were made to find physical reasons for mental disease as well. Those attempts, however, during the 19th century, were largely the dissection of the brains of deranged persons, after they died, to see if there were gross changes in brain tissue, which could be related to the mental condition.

The attempts, naturally, did not lead anywhere and a reaction was the rise of Sigmund Freud, who sought the reasons for neurosis, obsessions, and even hysteria in childhood experiences or memories, formed before the child had learnt to articulate or which the grown person did not recollect. Freud considered the early stages of life — the oral, where a child's need is mainly food; the anal, when she becomes aware of excretion, with the reactions of parental figures to oral or anal needs, and finally the sexual, all of which influence future relationships.

Freudian and other theories gave rise to psychoanalysis, where a trained practitioner probes into a patient's recollection of past events, the influence of associates, the images or voices in the patient's mind, and dreams, to unravel the causes of the patient's current maladjustment. Psychoanalysis grew in popularity and did report many successes and Freud-based analysis is the basis of most behavioural therapy or analysis. The methods, however, are either ineffective or impractical in cases of schizophrenia, bipolar disorder or where the patient is incapable of communication.

There was also evidence of biological reasons for mental illness. The first instances were the association of insanity with syphilis, that schizophrenia could keep away epilepsy, and the use of electroconvulsive therapy (shock treatment) for severe depression. Although the psychoanalytic approach dominated in the middle years of the 20th century, Harrington writes that this practice, and state-aided psychiatric hospitals, ran into disrepute. Drugs were also discovered that could control schizophrenia or manic-depression, and severe behavioural problems in children, and the need for hospitals where patients had to be admitted was questioned.



Drugs, however, were the answer for only some of the diseases and even then, they often needed to be stopped because of side effects. Without the support of institutions, patients were abandoned and many ended up in prison. Harrington notes that the places with the most mental health patients in the US are jails.

The definitions of mental health and illness also began to be questioned. Mental illness, it was suggested, was a sign of mental health, it was the social environment that was diseased! Apart from even the cures being questionable, the very diagnoses by the professionals were found to be, in many cases, contradictory.

For all this, the discovery of a number of preparations that alleviate conditions of schizophrenia or depression, and the science of drugs that affect specific portions, or even specific classes of nerve endings of the brain, to relieve symptoms, have put biological psychiatry in a promising light in recent times. "The brain is also an organ", is a slogan that psychiatrists of this conviction use and drugs form an important part of most hospital-based mental health programmes.

Harrington, however, points out the great complexity of how the brain functions, and that the mechanism of the action of most drugs is still not known. In a number of cases, pharmaceutical companies that market new drugs make claims that are not realised, or only with unacceptable side effects. Overall, Harrington says that psychiatry is in a state of crisis and leading practitioners need to take stock, to make the best of the directions — some drug based, others interventional, like electroconvulsive therapy, and then the psychoanalytical — for the alleviation of suffering.

Alison Abbot, science writer and *Nature*'s senior correspondent at Munich, in her review of *Mind Fixers*, starts by citing an article in the journal, *Science*, where the writer describes an experiment that shows many hospitals to be "unable to distinguish the sane from the insane." This, Abbot says, exemplifies the burden of the book, but adds that Ms Harrington has reached a pessimistic conclusion, because she believes "psychiatrists should devote themselves...serious psychoses, and leave mental suffering that is not a true illness to therapists and social workers."

This, in fact, is scarcely the position that Harrington has taken. What we need, she says in her letter to *Nature*, in response to the review, is "to know how to engage constructively with the distrust, and how to balance the relationship between immediate patient needs and long-term scientific insights."

Abbot also says Harrington "fails to acknowledge promising approaches in biological psychiatry, particularly very new insights about brain circuitry as a potential target for treatment."

On one hand, Harrington's book is not a survey of current research. On the other, our knowledge of how the brain works is quite rudimentary. The best, so far, is that we can use a light signal to reset a neuron in a mouse brain to reverse a "fear" memory. Not really "new insight" to give us confidence while dealing, in the near future, with the psychological turmoil the world will be going through.

The writer can be contacted at response@simplescience.in

PLUS POINTS

Extracting methane

Researchers from the Indian Institute of Technology, Madras, are developing new techniques for extracting methane from natural gas hydrates. Promising results from their research have been published in international journals such as *Energy and Fuels* and *Applied Energy* recently.

There has been worldwide interest in the development of techniques to extract methane gas trapped in ice-like crystalline cages called "gas hydrates", which are present in shallow sediments along continental coastlines. Hydrates are particularly promising methane sources in India because nearly 1,900 trillion cubic metres of methane gas lie untapped in these cages within the waters of the Indian Exclusive Economic Zone. This is 1,500 times more than the country's present gas reserve.

The Union ministry of earth sciences reports that the Krishna-Godhavari basin and Andaman Basin have large amounts of gas hydrates. This IIT-Madras research can enable indigenous supply of natural gas and potentially lighten the nation's natural gas import burden.

The research is being headed by Jitendra Sangwai, professor (petroleum engineering), department of ocean engineering, IIT-Madras, who studies state-of-art processes used to recover crude oil from offshore reservoirs in India, and includes research scholars Pawan Gupta and Vishnu C (*in photo*).

In their study on thermal stimulation and depressurisation, the IIT-Madras research team reported that the combination of the two processes is more efficient for methane production from clayey hydrate reservoir than either, individually. This has been attributed to the relatively faster increase in volume available for the gas to expand upon application of heat, which results in faster decrease in pressure of the hydrate reservoir. For the depressurisation process alone, the researchers also found that multistep depressurisation is more efficient than the single-step depressurisation.

Depressurisation is the most energy-efficient production approach for extracting gases from clayey hydrates and is possibly the most likely technology to mature in near future.

It is believed that energy content of methane occurring in a hydrate form is immense, possibly exceeding the combined energy content of all other known fossil fuels. "Controlled extraction of methane from gas hydrates can not only meet the enormous demand for energy all over the world but can also reduce detrimental geological release of greenhouse gas into the environment from these sources", Sangwai said.

Development of emerging techniques for controlled extraction of methane from hydrates entails concerted efforts between academic, government and industrial laboratories and can potentially lead the country towards self-sufficiency in the energy sector.

Engineered wheat

Wheat plants engineered to have fewer microscopic pores — called stomata — on their leaves are better able to survive drought conditions associated with climate breakdown, according to a new study. Scientists at the University of Sheffield's Institute for Sustainable Food in the UK found that engineering bread wheat to have fewer stomata helps the crop to use water more efficiently while maintaining yields.

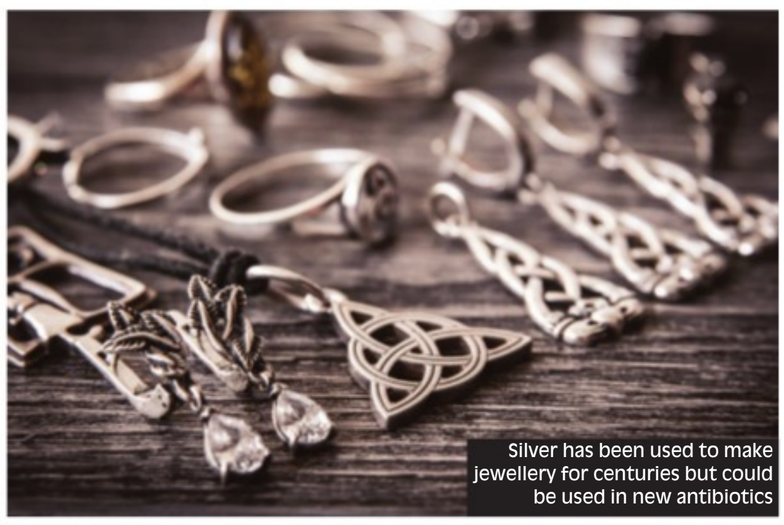
Like most plants, wheat uses stomata to regulate its intake of carbon dioxide for photosynthesis as well as the release of water vapour. When water is plentiful, stomatal opening helps plants to regulate temperature by evaporative cooling — similar to sweating. In drought conditions, wheat plants normally close their stomata to slow down water loss — but wheat with fewer stomata has been found to conserve water even better, and can use that water to cool itself. During the study, published in the *Journal of Experimental Botany*, the scientists grew wheat in conditions similar to those expected under climate breakdown — with higher levels of carbon dioxide and less water. Compared to conventional wheat, the engineered plants used less water while maintaining photosynthesis and yield.

Julie Gray, professor of plant molecular biology at the Institute for Sustainable Food, said, "Developing wheat that uses water more efficiently will help us to feed our growing population while using fewer natural resources — making our food systems more resilient in the face of climate breakdown."

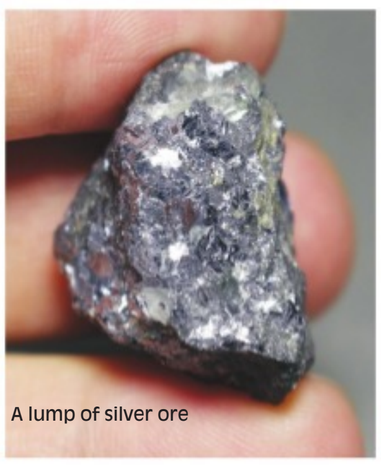
Silver deserves a gold

It makes beautiful bling but is also good for keeping bacterial bugs away

MARK BLASKOVICH


Silver has been used to make jewellery for centuries but could be used in new antibiotics


Socks made of silver


A lump of silver ore

In sport, it is the symbol of second place, giving way to gold in the medals

Silver has long played second fiddle to other elements. In sport, it is the symbol of second place, giving way to gold in the medals. In jewellery, airline frequent flyer programmes and credit cards, silver is also topped by gold and platinum. But in the world of useful elements, silver should be gold.

My interest in silver originated when growing up in Canada, searching through loose change for pre-1968 quarters (25 cents) that were made from 80 per cent silver (currently worth at least US$2.24 each). More recently, in my current scientific role fighting antimicrobial resistance, my interest has been piqued by silver's association with killing bacteria.

The silver medical treatment

Silver has a long history of antibacterial activity. The Phoenicians lined clay vessels with silver to preserve liquids (around 1300 BCE), the Persians and Greeks used silver containers to store drinking water (around 5000-300 BCE) and Americans travelling west during the 1880s added silver coins into water barrels.

More recently, both American and Russian space programmes have used ionic silver to purify water, including on the International Space Station.

Colloidal silver, a suspension of very small nanoparticles of silver metal, has found widespread use as a popular home remedy for a range of ailments, but is often marketed with dubious claims and is not supported by the scientific community.

Some websites claim the use of silver cutlery and dinnerware by wealthy Europeans in the Middle Ages may have helped favour their survival during the bubonic plague, though evidence supporting this is scant.

On a related note, one version of the origin of the term "blue blood" to describe the wealthy is based on their use of silver dinnerware, with significant silver ion ingestion known to cause argyria, or purple-grey skin.

Despite these non-scientific associations, silver has found widespread acceptance in the medical community for specific applications of its antibacterial properties.

Silver for burns

Silver nitrate solutions were found to prevent eye infections in new-borns in the 1880s, and were still commonly used for this in the 1970s. Solutions were also used to treat burn injuries, leading to many scientific reports in the 1960s, such as a 1968 study on treating extensive thermal burns with 0.5 per cent silver nitrate solution that describes an apparent reduction in death. Both 0.5 per cent silver nitrate solution and one per cent silver sulfadiazine cream are still used in burn care and are accompanied by new silver-based wound dressings.

The antimicrobial use of silver has crept into consumer products, such as antibacterial bandages, socks and deodorants, and antibacterial coatings on a range of products such as refrigerators.

While this may sound like a good idea, there are concerns that widespread use of silver could cause bacteria to become resistant, not only to silver, but also to our important antibiotics. It's not known exactly how silver kills bacteria, but it seems to work by multiple mechanisms, including cell membrane damage and free radical generation.

Our work on silver is looking at whether it can help existing antibiotics work more effectively, especially against resistant bacteria. This research, which has been ongoing for more than five years, has identified that there is better synergy between silver and some types of antibiotics than others, but we don't yet know why.

Eventually, this research could lead to new formulations of antibiotics with better activity, where the actual antibiotic remains the same but it is delivered as a salt with silver, instead of a more common ion like sodium.

The silver resources

The actual word silver stems from the Anglo-Saxon name for it, siolfur, while its chemical symbol *Ag* comes from the Latin name for silver, argentum.

Silver can sometimes be found as nuggets of pure metal, though this form is more rare than gold. Most often it is found combined with other elements in ores such as argentite (with sulphur) or galena (with lead). The ores are mined and the silver generally removed by smelting (heating combined with chemical reactions). It is believed this technique was discovered before 2000 BCE.

Historically, the major use of silver has been as coinage and in jewellery. Traditional photography uses silver halides for the photosensitive film, while mirror backings and Christmas ornaments use silver-plated glass.

Silver lies in the middle of the periodic table. It is encircled by other useful and well-known metals such as (clockwise from above) copper, zinc, cadmium, mercury, gold, platinum, palladium and nickel. I would argue that silver shines brightly above its neighbours — it actually does, as it has the highest reflectivity of any metal — and also is the best at conducting electricity and heat.

So silver really does deserve top of the podium — a gold for silver!

The writer is senior research officer, the University of Queensland, Australia. This article first appeared on www.theconversation.com