Why We Alter Our Consciousness

Evolving defenses against internal parasites may have taken a different trip.

In October, 2022, the US National Park Service issued an advisory against licking the Sonoran desert toad (*Bufo alvarius*), something which, one might think, few people would have been inclined to do. Yet people have been licking the toads, or killing them and smoking their gooey skin secretions, because the toad's defense mechanism—deadly toxins put out by their warty parotid glands—turn out to contain powerful hallucinogens. The poison is powerful enough to kill many small species, but taken in small doses by large animals such as humans, it causes visual and auditory hallucinations and euphoria.

Many of the other psychoactive substances used by people started out the same way. They were the chemical armor of plants or animals, intended to sicken or kill any animal who ate them. As with the Sonoran toad, many of these defensive compounds attack the central nervous system of predatory animals. Neurotoxins are efficient because very small amounts can have a large effect if they get past the blood-brain barrier and affect cognition. Neurotoxins in plants work especially well by confusing or discouraging insects from eating the plants. But as insects evolve mechanisms to metabolize the poisons, plants evolve new means of defeating them—an arms race that has gone on for more than 300 million years.

About 90 percent of adults in the world use some sort of psychoactive chemical on a regular basis. They range from a cup of coffee or tea in the morning to chewing betel, bhang, or khat, to a cigarette or an injection of cocaine or heroin. Many times we may not know we are selecting foods that tweak our neurochemistry. Chocolate and nutmeg have psychoactive properties, as do chamomile, valerian, primrose, kola, and tart cherries. Many mushrooms possess psychoactive compounds, not just the psilocybin or "magic" mushrooms found in many places around the world.

As Ian Tattersall and Rob DeSalle discussed in their July/August 2022 *Natural History* article, "Why Do We Drink Spirits?", alcohol is another ubiquitous human product. People have been making alcoholic drinks for as long as there were containers to hold them, and probably long before. Among animals, humans have the relatively rare ability to detoxify and metabolize the various alcohol molecules found in alcoholic drinks. For most other animals, alcohol is a poison, produced by yeasts to destroy competing microorganisms. But for us it is a way to alter our consciousness, from easing the anxiety of social interactions to blotting out consciousness entirely.

RUDRA NARAYAN MITRA/SHUTTERSTOCK

*A Hindu Sadhu smoking marijuana (*Canabis sativa*), locally called Ganja.*

Our desire for plants with psychoactive properties may be subconscious to some extent. Most of the herbs used in cooking come from the mint and salvia families and delicately tweak our neurochemistry. Rosemary, sage, mint, basil, thyme, and lavender all have subtle effects. Chocolate also seems benign enough, but it carries a medicine-cabinet-full of psychoactive substances. One set enhances the effects of chemicals our bodies make naturally, endocannabinoids. Through these chemicals, chocolate affects the same parts of the brain as THC (Tetrahydrocannabinol), bringing about a mildly blissful state. Chocolate also contains terpene molecules that relax muscles and have other calming effects. It contains caffeine, theobromine, and phenylethylamine, three stimulants. Some dark chocolates have as much caffeine as espresso coffee. The stimulant effect of theobromine is slower to set in and slower to dissipate, with effects lasting twelve hours or more.

Chocolate also contains a large dose of tryptophan, a sleep-inducing chemical. It promotes a sense of well-being and contentment, associated with tryptophan's role as a serotonin precursor. Addiction to chocolate is not imaginary. Ancient Maya domesticated cacao and used it to brew a powerful psychoactive drink that was widely adopted throughout the Americas.

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Sonoran Desert Toad

The addictive powers of cannabis (*Cannabis sativa*), or marijuana, are not in doubt, but it is surprising how long humans have known of its psychoactive properties. Using both archaeological and genetic evidence, scientists have recently argued that people were domesticating cannabis around 12,000 years ago, several thousand years before they were selectively altering the genes of food crops, such as rice or wheat. In 2021, Swiss and Chinese scientists sequenced 110 varieties of cannabis growing around the world and found that all the world's drug and hemp varieties derive from wild progenitors in China.

AUTHOR ILLUSTRATION OF RÍO AZUL, GUATEMALA VESSEL

Maya glyph for cacao, the source of chocolate

The profusion of cannabis across Eurasia mirrors the expansion of Indo-European languages—which are now as different from one another as Hindi and Urdu to Gaelic or Welsh but diverged from a common ancestor between 5,000 and 6,500 years ago. The earliest archaeological evidence suggests that wherever there are Indo-European speakers, there is cannabis. Around the time of the earliest Neolithic villages, agriculturalists brought cannabis along from an origin of domestication in China across Eurasia from Japan to Ireland. Because its seeds are easily transported and able to grow nearly anywhere, and its psychoactive properties were so compelling, it is not far-fetched to think of cannabis as the first pan-Eurasian trade good. Cannabis's spread shows that the trade routes we think of as the Silk Road go back more than 6,000 years.

The semi-mythical Chinese emperor, Shennong, (purportedly born in the twenty-eight century BCE), was associated with farming and domestication. He is said to have compiled the book of plant medicines, or pharmacopeia, *The Divine Husbandman's Herb-Root Classic*, which has survived in many forms through the ages. This work was collected in the last few centuries BCE and contains hundreds of descriptions of medicinal plants with psychoactive properties, including cannabis. Calling it *Ma Fen*, Shennong describes cannabis as useful in treating a variety of symptoms and conditions. He cautions that, "taking much of it may make one behold ghosts and frenetically run about. Protracted taking may enable one to communicate with the spirit light and make the body light." Further reported characteristics are that it tends to make one fat, strong, and never senile. Cannabis is also described in the *Sushruta Samhita*, a Sanskrit text from south Asia dating to the first centuries BCE. It was written by the early Indian naturalist and physician Sushruta and is a key text in Ayurvedic medicine. Today cannabis is in daily use in India as a component of *bhang*—a paste of the plant's leaves mixed with other substances and consumed as a drink or a chewed paste.

In the fifth century BCE, the Greek historian Herodotus describes Scythians from the Eurasian steppes throwing hemp seeds onto red-hot stones while under a wool blanket, and then exclaiming with delight and dancing around. Several Greek and Roman authors also mention cannabis, especially in the context of making hemp ropes, but also in using an extracted sort of THC oil for earaches and other ailments. These uses are described by Dioscorides, Pliny, and the physician Galen, who also mentions the use of cannabis-seed cakes as an intoxicating snack in drinking events.

Tobacco (*Nicotiana sp.*) is the Western Hemisphere's parallel to Eurasia's cannabis as an early and ubiquitous trade good. As with most drugs, the psychoactive molecules in tobacco evolved as neurotoxins to deter insects from eating the plant in the tropics, and the same molecules produce a pleasant and highly addictive neurochemical stimulation in humans. Recent archaeological research found tobacco seeds in a hearth in western Utah dating to around 12,300 years ago, pushing back

the evidence for tobacco use by thousands of years. Nearly every indigenous group in the Americas has stories about the arrival of tobacco, often as a gift from the gods. For the Baníwa of the northwest Amazon, for example, it was a gift from Grandfather Tobacco that "makes our souls content." Among many indigenous Americans, tobacco is associated with serenity, social cohesion, and harmony. The colonial era practice of smoking tobacco to cement agreements or treaties—in the peace pipe ceremony—was an ancient practice.

One of the most powerful psychoactive substances is opium, obtained from the seed capsules of the Mediterranean and Eurasian poppy flower (*Papaver somniferum*). The narcotic effects of this plant have also been known for thousands of years, with widespread archaeological evidence for its use. It is as prevalent in the religious practices of the Mediterranean world and Middle East as tobacco is in the New World, with several Egyptian, Mesopotamian, and Greek gods associated with it. Sumerian clay tablets from 2100 BCE list uses for opium, as does the Egyptian *Elbers Papyrus* (another early collection of medicinal plants, from 1550 BCE). Opium was used by Greek physicians Hippocrates and Asclepius, mentioned in the Old Testament, and as Lucy Inglis concluded in her article, "Opium's Human History"(Natural History, *March 2019*), "many of us will end our lives dependent on it."

The latex from the seedpods of opium poppies is scraped off and collected to make opium.

Why do we have such a compulsion to alter our consciousness? Having discovered thousands of psychoactive substances—many of them dangerous or deadly—why do we use them? Throughout history it is clear that humans came to depend on them in all their various forms, levels of potency, and effects on our body, from pleasure to pain relief to euphoria. And now we are able to synthesize psychoactive molecules in labs without depending on plants and animals to do it for us. The synthetic opioid fentanyl activates the same μ-opioid receptors in the brain as heroin, but is fifty times as powerful.

One compelling argument is that humans evolved ways to ingest small amounts of plant toxins as a way of self-medicating against macroparasites, especially gastrointestinal worms and blood flukes. Larger parasites with nervous systems (e.g. helminth worms, ticks, fleas, leeches) are particularly susceptible to plant neurotoxins, and this is especially true for the endoparasites that spend most of their life cycle in our intestinal track or bloodstream. According to this theory, we evolved a neurochemically-induced inclination to ingest some of these toxic substances to combat our own internal parasites.

In a sense, then, our evolutionary history has left us with a proclivity to ingest some amount of plant and animal toxins, which has leads to some extreme practices. For example, if you collect the skin secretions from some of the South American frogs of the genus *Phyllomedusa* and administer them subdermally, through burns or a series of cuts to the skin, one undergoes nausea, vomiting, diarrhea, tachycardia, and an acute state of intoxication. However, for Panoan-speaking people of the southeastern Amazonian rainforest this protocol is used in the Kambo Ceremony. It is said to improve one's hunting skills and also diminish the effects of depression, anxiety, and negative mental energy. (It can also cause psychosis, kidney and liver damage, seizures, and death.) It is but one example of the extent to which we will go to alter our minds, and it makes a little Sonoran toad-licking seem benign.

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