

Article

Entheogens, the Conscious Brain and Existential Reality: Part 1

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ABSTRACT

The purpose of this article is to provide a 'state of the art' research overview of what is currently known about how entheogens, including the classic psychedelics, affect the brain and transform conscious experience through their altered serotonin receptor dynamics, and to explore their implications for understanding the conscious brain and its relationship to existential reality, and their potential utility in our cultural maturation and understanding of the place of sentient life in the universe.

Part 1 contains the following sections: 1. Cultural and Historical Introduction; 2. The enigma of Subjective Consciousness; and 3. Fathoming the Mind-Brain Relationship and Experiential Modalities.

Key Words: entheogens, conscious brain, existential reality, psychedelics, serotonin, conscious experience, sentient life, universe.

1. Cultural and Historical Introduction

Human societies have been actively using psychoactive substances since the earliest cultures emerged. In "The Alchemy of Culture" Richard Rudgley notes that European cave depictions, from the paleolithic on, abound with both herbivorous animals of the hunt and geometrical entopic patterns similar to the phosphenes seen under sensory withdrawal and under the effects of psychotropic herbs. By the time we find highly-decorated pottery 'vase supports' in Middle Neolithic France, we have evidence consistent with their ritual use as opium braziers. At 4200 BC at the Cueva de los Murciélagos site in Spain we find burials with bags containing *Papaver somniferum* capsules. During the 18th Egyptian dynasty 1550-1295 BC there was an active trade with Cyprus of juglets, whose form is neatly in the shape of an inverted poppy pod, indicating they contained opium. This trend is confirmed in detail in the terracotta Goddess figurines discovered from a small shrine at Gazi west of Knossos in Crete, dated to 1350 BC, whose headdress consists of a row of three poppy heads explicitly slit in the exact way opium resin is extracted from the poppy to this day. A goddess with the same emblems - three poppies - in her hand is depicted also in a gold signet ring from Mycenae from 1500 BC.

Evidence for *Cannabis sativa* use in Europe also dates back to the neolithic, where there is evidence that it was used for rope and for its psychotropic and potentially hallucinogenic effects. Polyploid bowls with rope imprints again look to be braziers for consuming plant vapours. Pipe cups dating from a third millennium BC burial site in Romania explicitly contain charred hemp seeds, consistent with their being the remains of a smoked cannabis pipe. According to The Living Torah *kaneh-bosm* (Hebrew: כֶּנֶף-בֹּסֶם) identified with cannabis may have been one of the ingredients of the holy anointing oil mentioned in various

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sacred Hebrew texts. The Scythians of southern Central Asia used Cannabis to attain trance during funeral rites, using a metal tripod censer. Censers have been found still containing hemp seed (Rudenko). Herodotus, more than 2000 years ago, described the way Scythians burned portions of the plant in metal tripod censers, beneath small tent structures that enclosed the vapors inhaled for ritualistic and euphoric purposes (Merlin, Schultes & Hofmann). "The Scythians then take this seed of hemp and, creeping under the mats, they throw it on the red-hot stones; and, being so thrown, it smolders and sends forth so much steam that no Greek vapour bath could surpass it. The Scythians howl in their joy at the vapour bath." The Yanghai Tombs of Xinjiang have revealed the 2700-year-old grave of a shaman. Near the head and foot was a large leather basket and wooden bowl filled with 789g of cannabis, superbly preserved by climatic and burial conditions. This material still contained the active ingredient THC. Cannabis use in the Indian subcontinent may also go back to the earliest cultures. Cannabis is first referred to in Hindu Vedas between 2000 and 1400 BC, in the Atharvaveda. Shiva, who is the patron deity of Cannabis, can be seen in Mohenjo-Daro in a meditating pose with trident, as Pashupatinath Lord of the Animals surrounded by his beasts. Cannabis or Ganga carries the name of the sacred river itself.

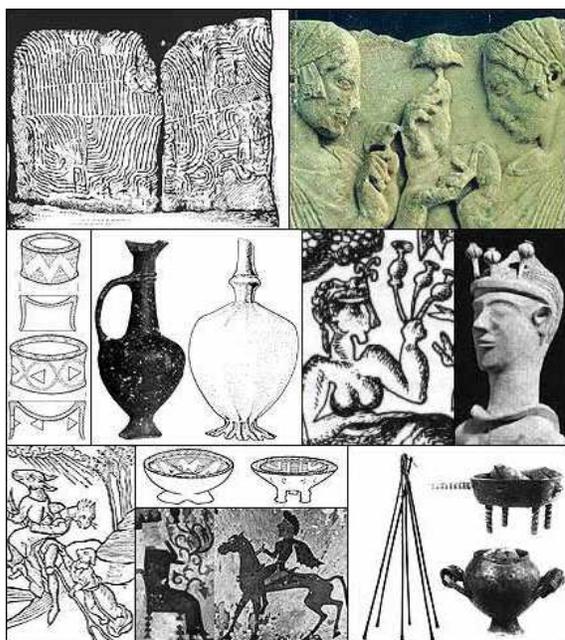


Fig 1: Phosphene-like finger markings Neolithic tomb of Gaverinus, Brittany. Persephone passing what looks like a liberty bell psilocybe to Demeter, Er Lannic pottery possibly used for opium, opium juglets from Cyprus (Rudgley), poppies being offered and the poppy goddess with slit poppy heads on her crown, the oldest illustration of witches, polyploidy bowls which may have been used for vaporizing cannabis, the Scythian goddess showing a horseman the tree of life, braziers and pots in the Scythian ritual use of cannabis (Schultes & Hofmann).

Likewise by the fourth millennium BC, we also find evidence of alcohol use, probably initially from date palms and then the grape vine *Vitis vinifera*. Barley beer is referred

to in early Sumerian and Akkadian texts. The soma or haoma of the Indo-Aryans extolled in the Rig Veda and the Avesta remains a botanical enigma, but nevertheless shows another psychotropic concoction which was extolled to semi-divine status, which has been attributed to Syrian rue *Peganum harmala* which contains psychoactive monoamine oxidase inhibitor harmaline and to the muscimol-containing *Amanita muscaria* which has also been ritually used by Siberian shamans, because references to it suggest it was recycled in excreted urine. There is also an enigma surrounding the Eleusian epoptea which was said to be a sacramental repast of visionary transformative power, which has been associated with various psychotropic agents, including the liberty cap Psilocybe species which Persephone appears to be passing to Demeter on a stele as noted by Graves (O'Prey), and ergot fungus containing rye (Wasson et al).

In medieval times, in the midst of Christian persecution against all manner of heretics, witches and mystics, stemming from the Crusade against the Albigenses, there are also frequent references to the use of 'devilish' witching herbs which were an underlying part of pre-Christian European history and folklore, including Mandrake, Henbane, and Belladonna which are highly toxic deliriant which were rubbed on the body as herbal ointments causing sensations of flying, joining the sabbat, or lovemaking with an imagined suitor, due to the libido enhancing effects of hyoscyamine, and related muscarinic acetyl-choline receptor antagonists, followed by unconsciousness. These were pursued by the Inquisitors, as evidence of witchcraft and their practitioners condemned to death by drowning or burning at the stake. To compound matters, there were also episodes of mass poisoning due to lysergic acid derivatives in ergot fungus on the rye, resulting in outbreaks of collective madness, sometimes accompanied by the loss of appendages from gangrene caused by the vasoconstrictive effects of the alkaloids.

The term entheogen is derived from ancient Greek, ἐνθεός (entheos) "full of the god, inspired, possessed," the root of the English word 'enthusiasm', and γενέσθαι (genesthai) "to come into being." Thus, an entheogen is a substance that causes one to become inspired or to experience feelings of inspiration, often in a religious or "spiritual" manner. In a strict sense, only those vision-producing drugs that can be shown to have figured in shamanic or religious rites would be designated entheogens, but in a looser sense, the term can also be applied to other drugs, both natural and artificial, that induce alterations of consciousness similar to those documented for ritual ingestion of traditional entheogens. Evidence for the first use of entheogens may come from Tassili, Algeria, with a cave painting of a mushroom-man, dating to 8000 BP and mushroom idols from the Konya plain and the Vinca site in Europe (McKenna).

Part of the difficulty facing the acceptance of entheogens in European culture is that the most potent psychedelic entheogens have natural habitats in the Americas, where European cultures have come upon them as alien diabolical practices by often violent warrior pre-Colombian cultures such as the Aztecs, who themselves had horrific sacrificial practices worshipping gods of war regarded as heathen and devilish by the conquistadores. Christianity and conservative European culture, still reeling from its own paranoid religious conflicts, as flagellating Penitente Catholics set out for a new world, regarded all such practices with horror, and although Christianity was also a sacramental religion with an equally bloodthirsty Eucharist of the *soma* and *sangre* of Christ, violently repressed all such use of visionary sacraments.

Nevertheless potent psychedelic entheogens were ritually used and held sacred by diverse pre-Colombian cultures for centuries and even millennia before the arrival of Columbus. Long before the Aztecs the Mayans record the use of sacred mushrooms belonging to the *Psilocybe* genus in both frescos and mushroom stones dating back as far as 1000 BC which show obvious evidence of use as a visionary agent. The sacred use of the mushroom *teonanactl* or 'flesh of the gods' continued as an unbroken tradition for 1,500 years to Columbus and then secretly for another 500 years to the present day.

The Aztecs a particularly vicious sacrificial warrior culture nevertheless freely embraced sacred mushrooms in their own frenzied way, seen through the distorting prisms of Conquistador diabolization. Friar Sahagun, one of the first conquistadors to chronicle *teonanactl*, flesh of the gods, remarked:

“when they become excited by them start dancing, singing, weeping. Some do not want to sing but sit down and see themselves dying in a vision; others see themselves being eaten by a wild beast; others imagine they are capturing prisoners of war, that they are rich, that they possess many slaves, that they have committed adultery and were to have their heads crushed for the offence . . . and when the drunken state had passed, they talk over amongst themselves the visions they have seen” (Schultes and Hofmann 1979 146).

“During the coronation feast of Moctezuma in 1502, teonanacatl (the divine mushroom) was used to celebrate the event. War captives were slaughtered in great numbers to honour Moctezuma's accession to the throne. Their flesh was eaten, and a banquet was prepared after the victims' hearts were offered to the gods. After the sacrifice was over, everyone was bathed in human blood. Raw mushrooms were given to the guests, which one writer described as causing them to go out of their minds-in a worse state than if they had drunk a great quantity of wine. In his description, these men were so inebriated that many took their own lives. They had visions and revelations about the future, and Duran thought the devil was speaking to them in their madness. When the mushroom ceremony ended, the invited guests left. Moctezuma invited rival rulers to feasts which were held three times a year. One of these important feasts was called the Feast of Revelations, when the invited dignitaries and Moctezuma, or his representative, ate the wild mushrooms. " ... "During the Aztec king Tizoc's enthronement feast, all those present ate wild mushrooms - the kind that made men lose their senses. After four days of feasting, the newly crowned Tizoc gave his guests rich gifts and sacrificed the Metztitlan victims” (Dobkin de Rois 142).

By contrast the Mazatecs continued to use sacred mushrooms for divination and curing maladies in absolute secret, a secret so assiduously kept that all trace of magic mushroom worship became lost to the world at large until Maria Sabina accepted Gordon Wasson into the mysteries of the little flowers.

At the same time, Mexico was rich with other entheogenic sacraments. Various peoples consumed the mescaline-containing cactus *peyotl* or ‘hairy one’, the Huichols undertaking an annual pilgrimage across Mexico to collect it from the high deserts around their sacred mountain of Wirikuta, describing the effects of the cactus as opening the *nierika* or portal to the spirit world where everything becomes one:

“There is a doorway within our minds that usually remains hidden and secret until the time of death. The Huichol word for it is *nierika*. *Nierika* is a cosmic portway or interface between so-called ordinary and non-ordinary realities. It is a passageway and at the same time a barrier between the worlds. ... When the *mara'akáme* passes through the *nierika* [visionary tunnel] he moves just as the smoke moves; hidden currents carry him up and in all directions at once ... as if upon waves, flowing into and through other waves ... the *urucate*. As the *mara'akáme* descends and passes through the *nierika* on the return, his memory of the *urucate* and their world fades; only a glimmer remains of the fantastic journey that he has made” (Halifax 239).

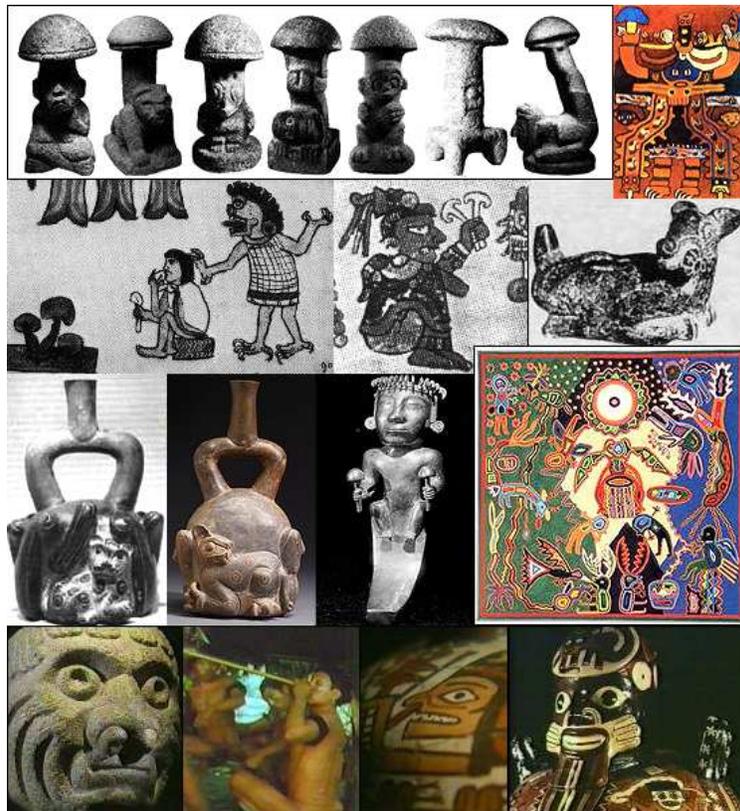
Evidence of peyote use goes back to the Toltecs in 500 BC where a snuffing pipe with a deer holding a peyote in its mouth has been found at Monte Alban. Others used the lysergic acid amide containing black seeds or *bardo negroh* of the morning glory, and the Herb of the Shepherdess, *Salvia divinorum* to induce visions when sacred mushrooms were not available.

In the southern continent, an equally diverse spectrum of entheogenic sacraments had been discovered, from the mescaline-containing San Pedro cactus *Trichocereus pachanoi* (holding the keys to the golden gate), through snuffs such as and *epena* from *Virola* species and the famous pan-Amazonian brew *ayahuasca* of “Vine of the Soul” containing DMT from plants such as *Psychotria viridis*, beta-carboline MAO inhibitors such as harmine from the vine *Banisteriopsis caapi* and occasionally solonaceous alkaloids from *Brugmansia* a tree-datura having deliriant effects similar to the witching herbs of Old Europe.

Archaeological records of sacred use likewise go back to ancient times, with evidence of San Pedro use, in the cactus found alongside a leopard in Chavin culture (1200-600 BC), evidence of sacred mushroom use in Paracas culture (800-100 BC), and San Pedro and snuff use among Nazca (100-800 CE). As well, as an energetic mainstay and spiritual guide, the coca leaf was chewed, along with stimulants such as caffeine.

Likewise in the African subcontinent, two of the oldest human cultures the Bushmen and Pygmies have traditional sacred use of psychotropics. Biaka pygmies use the hallucinogen *Tabernanthe iboga* and there is also a pattern of Cannabis use among the Bushmen, to complement their trance dancing visitations. Although this is an imported tradition, it is done in a unique ancient manner, filling a hole in the ground with plant material, from which the herb is smoked cool.

Fig 2: Diverse sacramental use over millennia in the Americas. Mayan sacred mushroom stones, a blue topped mushroom carried by a shaman Paracas culture, Aztec murals showing sacred mushroom deities (Magliabecchiano Codex), the deer snuffing pipe holding a peyote from Monte Alban, two Chavin urns with jaguar beside San Pedro cacti, a sacred mushroom deity from South America the Huichol nierika or visionary portal opened by peyote, a Chavin statue and Nazca gourd showing hallucinogenic snuffing, and a Nazca pottery showing San Pedro use.



We need to examine at this point why diverse pre-Columbian cultures have consistently managed to incorporate entheogens successfully into their highest cultural expressions, remaining as a spiritual record for archaeologists to discover, while so-called emancipated Western society has made them an absolute taboo,

ring-fenced by dire penalties of long-term imprisonment or even death, amid threats of insanity and permanent brain, or genetic damage.

We can again see currents of the schizophrenic attitude of Western society to psychotropic agents in its romantic and demonic attitudes to opium and cocaine. While Samuel Taylor Coleridge composed "Kubla Khan" in 1797, according to his preface, one night after he experienced an opium influenced dream, and Sigmund Freud extolled the virtues of cocaine in his 1884 paper "On Coca", Great Britain had become deeply involved in the trafficking of opium from factories in India to China, against Chinese legislation, in the Opium Wars (1839-1860) with the explicit purpose of addicting the Chinese population, to redress an unfavourable trade balance between the countries. At the same time the Victorian press was hot with scandalous stories of debauchery and dissolution in the opium dens of London. By 1886 Arthur Conan Doyle was writing of the hideous dependence of Sherlock Holmes on cocaine injection and the stage was again set for regarding psychotropic drugs as agents of evil.

At the turn of the twentieth century, long after its spread to the plains Indians in the 15th century, there had been a resurgence of religious peyote use in the US in the form of the Native American Church (Anderson), which has fought a long and tortuous battle for the legal use of the sacrament.

*Speak to the peyote with your heart, with your thoughts. And the peyote sees your heart ...
And if you have luck, you will hear things and receive things that are invisible to others,
but that god has given you to pursue your path (Schultes and Hofmann).*

*"God told the Delawares to do good even before
He sent Christ to the whites who killed him ...
God made Peyote It is His power. It is the power of Jesus.
Jesus came afterwards on this earth, after peyote." (Anderson).*

In 1897 Arthur Heffter isolated the alkaloid mescaline from peyote and the modern era of psychedelic, or "mind manifesting" research began. William James author of "Varieties of Religious Experience" who had tried many psychoactive agents unfortunately had a bad intestinal reaction in 1896 and missed out on its "chromatic" effects, but noted "all kind of odd experiences, mescal, ecstasies etc. give them indeterminate possibilities". It is said that around 1911 the young Adolf Hitler took peyote during his formative period, provided him by apothecary Wilhelm Pretzsch (Andrews 417-425). In 1938 Albert Hofmann synthesized LSD, but had to wait five years before accidentally absorbing enough on his fingers in 1943 to discover its psychedelic effects. Interviewed shortly before his hundredth birthday, he called LSD "medicine for the soul" and was frustrated by the subsequent worldwide prohibition of it. Nevertheless for several decades these substances remained research materials and were not regarded as dangerous drugs of abuse.

While both opium and cocaine had essentially been legal in the 1800s, cultural migration had begun to cause social problems both through patterns of addiction and through racial prejudice and cultural profiling. Chinese populations in the US were perceived to be addicted to opium and Negro populations were accused of abusing cocaine resulting in rape of white women and improved marksmanship among criminals. A series of tax and drug laws were passed leading to successively tighter restrictions. By 1930 the newly formed Federal Bureau

of Narcotics, headed by Harry J. Anslinger, as part of the government's broader push, to outlaw all recreational drugs, advertising marijuana as a "killer drug" inviting "Murder! Insanity!" and "Death!" By 1935 the Geneva Trafficking Conventions outlawed international trafficking in opium, cocaine and cannabis, but the US, headed by Anslinger, refused to sign the final draft because it didn't include cultivation, production, manufacture and distribution and considered it too weak in relation to extradition, extraterritoriality and the confiscation of trafficking profits. Given these Calvinistic attitudes, it is not hard to understand how the vastly more confounding entheogens might come to be treated.



Fig 3: Maria Sabina passing the sacred mushroom to Gordon Wasson (Riedlinger). The renowned Huichol elder Don Jose Matsuwa (Schultes & Hofmann), Tellus 'Goodmorning', the roadman at my first peyote meeting in 1976, attending his son's meeting in 1992 at the age of 93. Senor Trinico by infra-red video in the dark during our ayahuasca ceremony in 1999.

All records of sacred mushroom use had been lost to history by the turn of the 20th century and it had become assumed that the sacred mushroom was a case of

mistaken identity for peyote. However in 1938 Blas Reko and Richard Evans Schultes traveled to Huautla de Jiménez, where Robert Weitlaner had a year earlier located a specimen and managed to find four species of *Panaeolus* and *Psilocybe*, including *caerulescens* and *cubensis* (Ott). A year later Weitlaner's daughter Irmgard witnessed a mushroom velada without partaking, but was intervened. Then in 1953 Gordon Wasson would finally meet Maria Sabina the Mazatec curandero, in Huautla, after strong encouragement from Robert Graves.

It was in his own words, an entheogen - "the divine mushroom of immortality", calling it "Ecstasy!" after Greek *ekstasis* - flight of the soul from the body. "In truth he is the five senses disembodied, all of them keyed to the height of sensitivity, and awareness, all of them blending into one another most strangely until, utterly passive he becomes a pure receptor infinitely delicate of sensation. ... Your very soul is seized and shaken until it tingles, until you feel that you will never recover your equilibrium". He also noted that Greeks call mushrooms *broma theon* "the food of the gods" and specifically likened the experience to the epoptea of Eleusis "For me there is no doubt that the secret of Eleusis lies in hallucinogens". Wasson was to describe the experience as Pentecost and the long-held secret of sacred mushroom again greeted the world. "By comparison with the mushroom, the Element in the Christian agape seems pallid. The mushroom holds the key to a mystical union with God, whereas only rare souls can attain similar ecstasy and divine communion by intensive contemplation of the miracle of the Mass" (Riedlinger, Furst).

"On both nights RGW stood up for a long time in Cayetano's room at the foot of the stairway, holding on to the rail transfixed in ecstasy by the visions that he was seeing in the darkness with his open eyes. For the first time that word 'ecstasy' took on a subjective meaning for

him. ... There came one moment when it seemed as though the visions themselves were about to be transcended, and dark gates reaching upward beyond sight were about to part, and we were to find ourselves in the presence of the Ultimate. We seemed to be flying at the dark gates as a swallow at a dazzling lighthouse, and the gates were to part and admit us. But they did not open, and with a thud we fell back gasping. We felt disappointed, but also frightened and half relieved, that we had not entered into the presence of the ineffable, whence, it seemed to us at the time, we might not have returned, for we had sensed that a willing extinction in the divine radiance had been awaiting us. ... The spirit of the agape of which we have already spoken was a prelude to a wave of generous tender feelings that the mushroom aroused in everyone ... Twice in the course of the night the Senora reached out her right hand to me and sought contact with my fingers in friendly greeting, across the chasm of the language barrier - Gordon Wasson & Valentina Wasson - Mushrooms Russia & History (Riedlinger).

To Maria Sabina, although also using it for curing maladies, it was also an entheogen, reciting it's illumination in her chants:

*“Woman who thunders am I, woman who sounds am I.
Spiderwoman am I, says hummingbird woman am I says
Eagle woman am I, says important eagle woman am I.
Whirling woman of the whirlwind am I, says
woman of a sacred, enchanted place am I, says
Woman of the shooting stars am I. ...
I'm a birth woman, says I'm a victorious woman, says
I'm a law woman, says I'm a thought woman, says I'm a life woman,
I am a spirit woman, says I am a crying woman, says
I am Jesus Christ, says ... I'm the heart of the virgin Mary.”*
(Mushroom Ceremony - Smithsonian Institute)

Her vision of the inner world of the sacred mushroom is both entheogenic and prophetic:

“There is a world beyond ours, a world that is far away, nearby and invisible. And there is where God lives, where the dead live, the spirits and the saints, a world where everything has already happened and everything is known. That world talks. It has a language of its own. I report what it says. The sacred mushroom takes me by the hand and brings me to the world where everything is known. It is they, the sacred mushrooms that speak in a way I can understand. I ask them and they answer me. When I return from the trip that I have taken with them I tell what they have told me and what they have shown me. The more you go inside the world of teonanacatl, the more things are seen. And you also see our past and our future, which are there together as a single thing already achieved, already happened . . . I saw stolen horses and buried cities, the existence of which was unknown, and they are going to be brought to light. Millions of things I saw and knew. I knew and saw God: an immense clock that ticks, the spheres that go slowly around, and inside the stars, the earth, the entire universe, the day and the night, the cry and the smile, the happiness and the pain. He who knows to the end the secret of teonanacatl - can even see that infinite clockwork” (Schultes & Hofmann).

The reaction of the US government was swift. Within a few days, a Mexican botanist had phoned the CIA to confirm Wassons find, and a CIA agent James Moore was dispatched as a

mole on Wasson's return trip, so that the government could use it as a mind-altering drug in chemical warfare and interrogation, in Project MKULTRA, demonstrating the Western establishment's proactively malign attitude and complete failure to understand the nature and potential social benefits of entheogenic sacraments (Riedlinger).

In 1948, Rappoport had discovered a hormone, named serotonin for its effect on vascular tone in cow blood serum, which was identified in 1952 to be 5-hydroxytryptamine, or 5HT, and was discovered in high concentrations in brain tissue in 1953. By 1954 Gaddum and Hameed, and Woolley and Shaw, both suggested the effects of LSD might arise from 5HT receptor agonism, or antagonism, because of the obvious similarity with psilocin (Braden). However as late as 1973 electron donation was still being advanced for the 'LSD receptor' for the obvious reason that serotonin itself, although a 5HT receptor agonist, did not cause hallucinations (Nature 242, 367).

By 1954 Aldous Huxley had captured the imagination of young readers in his description in "The Doors of Perception" of his experiences with mescaline:

"Confronted by a chair which looked like the Last Judgment - or, to be more accurate, by a Last Judgment which, after a long time and with considerable difficulty, I recognized as a chair - I found myself all at once on the brink of panic. This, I suddenly felt, was going too far. Too far, even though the going was into intenser beauty, deeper significance. The fear, as I analyze it in retrospect, was of being overwhelmed, of disintegrating under a pressure of reality greater than a mind, accustomed to living most of the time in a cosy world of symbols, could possibly bear. The literature of religious experience abounds in references to the pains and terrors overwhelming those who have come, too suddenly, face to face with some manifestation of the *Mysterium tremendum*. In theological language, this fear is due to the incompatibility between man's egotism and the divine purity, between man's self-aggravated separateness and the infinity of God. Following Boehme and William Law, we may say that, by unregenerate souls, the divine Light at its full blaze can be apprehended only as a burning, purgatorial fire. An almost identical doctrine is to be found in *The Tibetan Book of the Dead*, where the departed soul is described as shrinking in agony from the Pure Light of the Void, and even from the lesser, tempered Lights, in order to rush headlong into the comforting darkness of selfhood as a reborn human being, or even as a beast, an unhappy ghost, a denizen of hell. Anything rather than the burning brightness of unmitigated Reality - anything!"

The eloquently expressed popularity of these agents began to illuminate the public imagination, particularly among young people breaking out of a conservative post-war colonial Christian straight-jacket. From 1960 to 1962, Timothy Leary, Richard Alpert, Ralph Metzner and others ran a series of projects involving mescaline and psilocybin now referred to as the Harvard Psilocybin Project. In the Marsh Chapel Experiment, run by a Harvard Divinity School graduate student under Leary's supervision, Boston area graduate divinity students were administered psilocybin as a part of a study designed to determine if the drug could facilitate the experience of profound religious states, and nine out of the ten divinity students reported such experiences.

Leary's espousal of LSD, originated from an entheogenic religious experience with sacred mushrooms:

“Three years ago on a sunny afternoon in the garden of a Cuernavaca villa, I ate seven of the so-called ‘sacred mushrooms’, which had been given me by a scientist from the University of Mexico. During the next five hours, I was whirled through an experience which could be described in many extravagant metaphors, but was above all and without question the deepest religious experience of my life. ... A profound transcendent experience should leave in its wake a changed man and a changed life. Since my illumination in August 1960, I have devoted most of my energies to try to understand the revelatory potentialities of the human nervous system and to make these insights open to others. I have repeated this biochemical and (to me) sacramental ritual over fifty times personally and, almost every time, I have been awed by religious revelations as shattering as the first experience” (Weil).

At about the same time a rubber tapper José Gabriel da Costa in Porto Vehlo, Brazil inspired by his visions under the potion, began a church the UDV or União do Vegetal based on the Amazonian entheogenic brew ayahuasca, partaken by diverse tribal cultures claiming roots back to the tenth century BC. Also contemporaneous was the discovery by Calvin Stevens of ketamine, named a “dissociative anaesthetic” by the wife of Edward Domino, the first person to test it on humans after describing his amazement at seeing a person who was fully awake but “not there.” It was found to be a potent hallucinogenic drug, and the effects were described as trance-like (Jansen).

However reaction to the experimental use psychedelics including LSD led by 1962 to end of the official experiments, an investigation by the Massachusetts Department of Public Health that was eventually dropped, and the firing of Leary and Alpert, ruining promising academic careers, and sending them on a mission to popularize their affects with student culture in a collision course with conventional society, encouraging the next generation to ‘turn on, tune in and drop out’ - in retrospect a naïve and fanciful attempt to convert a mono-phasic society (Walsh & Grob) lacking the multi-layered spiritual traditions which had enabled the ritual use of such substances for millennia in pre-Columbian cultures. At the time only mescaline and the peyote cactus were illegal, with some uncertain exceptions for the Native American church. By 1966 psilocybin had become a schedule I prohibited drug, swept along by social anxiety about LSD use, and scientific research outside animal studies came to a halt for decades.

History now embarks on the florid journey that led immediately to Ken Kesey and the Merry Pranksters, the Electric Kool-aid Acid tests, the Grateful dead singing “Dark Star” and the Beatles “Lucy in the Sky with Diamonds”, and the hippie revolution of free love, all the time denounced by the authorities and treated as social mayhem by the traditional media. At Stanford in 1959, Ken Kesey had volunteered to take part in MKULTRA at the Menlo Park Veterans Hospital, where he worked as a night aide studying the effects of LSD, psilocybin, mescaline, cocaine, AMT, and DMT on people. Kesey wrote many detailed accounts of his experiences with these drugs, both during the Project MKULTRA study and in the years of private experimentation that followed.

On the basis of a few iconic cases such as Charles Manson, who was a manifest psychopathic long before his hippie debut, who had pleaded to be allowed to stay in jail at the age of 32, having spent more than half his life in institutions, the whole flower power movement was consigned to suppression echoing the suppression of the Gnostics in the witch hunts and Inquisition. Timothy Leary became a cultural whipping post for the establishment’s paranoiac vendetta. Having been caught with a couple of marijuana roaches in 1965 and

1968, he appealed the 1965 offence successfully to the Supreme Court and stood for Governor of California, inspiring the Beatles song 'come together' as a campaign number. However in 1970, Leary was sentenced to 20 years in prison for the 1968 possession charge but later used his psychological guile to escape. He and his wife were smuggled out of the US by the Weathermen leading to a long international manhunt, refusal by Switzerland to extradite, and eventual capture on board a US airliner in Afghanistan. On his re-incarceration he played double agent and secured early release without incurring the ire of the underground.

Fig 4: Timothy Leary, Alex and Anne Shulgin with one of his phenylethylamine molecules and Albert Hofmann with LSD (Alex Grey), Ken Kesey and the Merry Pranksters beside the freak bus, the Grateful Dead playing at Haight Ashbury.



Stanley Owsley was a sound producer for the Grateful Dead, who in September 1965 became the primary LSD supplier to Ken Kesey and the Merry Pranksters. By this time, Sandoz LSD was hard to

come by. While touring the country with the Dead, Tim Scully met Stanley and claimed that they perfected a pure process. Between 1965 and 1967, Stanley produced more than 1.25 million doses of LSD moving their laboratory out of California when LSD became illegal there. They briefly made DOM or STP but ceased production when it quickly gained a bad reputation. Nick Sand was a humanities student, when he took Mescaline in 1961. He also often visited Millbrook, the communal home of Timothy Leary's League for Spiritual Discovery. During a vision quest on DMT, Sand came to believe that he should devote his life entirely to manufacturing entheogens. He became a criminal as a matter of principle and as an act of civil disobedience, because he believed he was working for a higher good.

In 1969, Nick Sand worked with Tim Scully, producing millions of doses of the Orange Sunshine LSD. Sand was a member of "a secretive group of hippie acid dealers and hashish smugglers known as the Brotherhood of Eternal Love. The purpose of the group was "the aim of transforming the world into a peaceful utopia by promoting consciousness-expanding drug experimentation through LSD. Eventually both were arrested. At his trial, Tim Scully said that his intention was to "turn on the world" and as far as LSD chemists go, "we were doing a public service." Sand relocated to Canada. For roughly twenty years, he formed the core of international LSD manufacturing, producing about 250 million doses. In 1996, he was arrested in Vancouver, Canada, where his laboratory was found with 42 grams of LSD, or roughly 200,000 moderate doses, tested above 100% pure by the government's chemists. By late 2000, he was given an early release from prison, serving just under four years.

This stark cultural division has resulted in a continuing schizoid fracture in Western society pitting forcibly protecting a supposed emancipated society from its own freedom of choice against the right to have personal transformative experiences induced by other psychotropic substances than alcohol or tobacco. Given the prodigious production of Nick Sand alone and the lack of concrete evidence of physical or manifest social harm ensuing from such widespread consumption, and the safety of psychedelics rating far below alcohol and tobacco in terms of risks, as demonstrated in fig 21, the situation is clearly irrational and socially counterproductive.

The varying names associated with these substances illustrate society's schizoid attitude towards them. The traditional name "hallucinogen" implies 'mind-wandering', seeing things that aren't there. "Psychedelic" or 'mind manifesting' puts a more positive spin. "Psychotomimetic" incorrectly implies mimicking psychosis - the way such substances are cited in models of schizophrenia, in contradiction to their capacity to induce integrative healing and restorative life experiences. Finally we have "entheogen" highlighting the commonly reported experience that the altered state manifests a spiritual dimension of union with divinity.

The war on drugs has led relentlessly to the rise of major marijuana, cocaine, heroin and methamphetamine trafficking on an international basis and a cultural civil war in Western society fuelled by the unquenchable appetite of the very culture seeking to repress it, and the insatiable curiosity of the taboos generated by this suppression, fuelling an endemic subterranean underground, leading on to the euphoric dance culture of ecstasy, and with each successive banning to the diversification of a multitude of designer drugs with varied and unpredictable consequences. This is a war of attrition, filling US prisons with social casualties, with distinct racial undertones. This can end well only in the legitimization of psychotropic agents and dealing with undesirable social consequences of hard drugs as a medical problem. The alternative is the complete suppression of any agent that can mimic, or be construed to transform, or liberate consciousness from its cultural straight-jacket - clearly not a conscionable outcome.

Meanwhile many of the people formative of the most creative processes in society today admit they owe a central place in the meaning in their life's quest to entheogens. To take six examples on LSD: Francis Crick, Nobel prizewinning co-discoverer of the structure of DNA later told a fellow scientist that it was LSD, that helped him to unravel the discovery that won him the Nobel Prize (Alun Rees, Mail on Sunday 8/8/04). Kary Mullis controversial Nobel prize-winning discoverer of the polymerase chain reaction for amplifying DNA " I found it to be a mind-opening experience. It was certainly much more important than any courses I ever took. What if I had not taken LSD ever; would I have still invented PCR? I don't know. I doubt it. I seriously doubt it" (BBC Psychedelic Science). Steve Jobs said taking LSD was one of the two or three most important things he had done in his life. He said there were things about him that people who had not tried psychedelics - even people who knew him well, including his wife - could never understand" (The New York Times, 10/5/11). Alex Gray: "Twenty-five years ago I took my first dose of LSD. The experience was so rich and profound, coupled as it was with the meeting of my future wife, Allyson, that there seemed nothing more important than this revelation of infinite love and unity. Being an artist, I felt that this was the only subject worthy of my time and attention. Spiritual and visionary consciousness assumed primary importance as the focal point of my life and art. My creative process was transformed by my experience with entheogens." Stanislav Groff: "In one of my early books I suggested that the potential significance of LSD and other psychedelics for

psychiatry and psychology was comparable to the value the microscope has for biology or the telescope has for astronomy. My later experience with psychedelics only confirmed this initial impression.” Albert Hofmann: "When you study natural science and the miracles of creation, if you don't turn into a mystic you are not a natural scientist. I think that in human evolution it has never been as necessary to have this substance LSD. It is just a tool to turn us into what we are supposed to be.”

We like to look back on previous cultures with irony at the severe taboos they instituted, such as stoning women for adultery, burning people at the stake for heresy, or throwing the early Christians to the lions for their somewhat obsessive beliefs. In retrospect, these penalties look like desperate attempts to repress natural reproductive and intellectual choices, in societies who perceive these individual freedoms as existentially threatening because the society itself is founded on false premises that leave it vulnerable unless dire measures are taken to repress such feared individual freedoms. It thus serves us well to ponder why our so-called emancipated Western society has chosen to taboo the very agents that might bring us a new understanding of the fabric of existence and our place in the universe.

“All the cultures in human history except the Western industrial civilization have held holotropic states of consciousness in great esteem. They induced them whenever they wanted to connect to their deities, other dimensions of reality, and with the forces of nature. ... They spent much time and energy to develop safe and effective ways of inducing them” (Grof).

Essentially, as already noted, the problem comes down to Western society lacking any social process for deep mental exploration in a safe sheltered setting, guided by respected elders, or people who have personal experience of transformative agents, who are able to provide protective guidance to ensure a safe passage and a healing outcome. In the sophistication of modern society, this is a contradiction because this has been a common feature of human traditional peoples throughout human history.

Although Christianity is a nominally sacramental religion, centered on the Eucharist, the Christian roots of Western culture are maladapted to inner mysteries conveyed through forbidden fruit, quickly condemned as diabolical or at least false agents of insanity and decadence. The mystical path has been under siege in Christianity from the fourth century, when Athanasius repressed the Gnostic gospels in favour of the social conformity of the Catholic canon, despite reemergence of mystical traditions in the Cathars and Albigenses, the Free Spirit Movement and mystics, from Meister Eckart to Margurete Porete, who was burned at the stake for writing “Mirror to the Simple Mind”. Compounding this, particularly in the US, is the role of a government whose electoral majority depends on appeasing the conservative vote, and the consequent oppressive use of the law, strongly aligned with the capitalist ideal of a mindless consumer society, like Huxley’s “Brave New World”, where drugs are only accepted as pacifiers of the ongoing consumer culture, tranquilizers and anti-depressants are compulsively over-prescribed, and agents which seem to manifestly unhinge these cultural norms are perceived as existential threats.

The rapidity with which psilocybin was outlawed, without evidence of physical, or social harm, in contradiction, both to the historical evidence of long-held spiritual devotion, and ongoing experiments confirming fulfilling spiritual and religious experiences in Western subjects, shows the process to have been driven by cultural paranoia rather than the public good. The consequence has been that, in an era of very rapid scientific progress, unearthing

sweeping discoveries, scientific research into entheogens in humans was consigned to oblivion. It has thus taken the work of a few researchers, including the those at the Heffter Institute in Europe, MAPS conferences, Erowid, and of course the work of Shulgin, Nichols, Stamets, Griffiths and others in the US to bring us to the point, nearly fifty years later, where the socially beneficial properties of these agents are again becoming recognized and in particular their capacity to elicit mystical experiences of long lasting value and significance years later, as reported by both the subjects and their partners and acquaintances (Griffiths et al. 2006, 2008, 2001, Szalavitz, Brown).

Although MDMA, or ecstasy, is an entactogen, and not strictly an entheogen, it has clearly become a drug of emotionally transformative ritual use, so this history would not be complete without including the story of E. The term entactogen, for any chemical agent that induces feelings of empathy and connectedness in the user, was coined by David Nichols as an alternative to empathogen, owing to the potential for improper association of the latter with negative concepts related to the Greek root "pathos" (suffering).

The tale of Ecstasy (Jennings) forms another chapter in the futility and confusion of the war on drugs. MDMA was first accidentally synthesized in Merck's laboratories in 1912, but lay forgotten until Sasha Shulgin resynthesized it in 1976. Shulgin saw it as a valuable therapeutic psychological drug and it remained largely in therapy circles until Michael Clegg, an ex-priest, who had married, and found MDMA opened the boundaries of positive emotions and empathy between people, named it "ecstasy" and came to the conviction that his "mission was to get ecstasy to the wide world". He began to produce hundreds of thousands of ecstasy tablets and distribute them legally in Dallas Texas where an exponentially rising demand led by 1985 to him producing 500,000 tablets a month, making him the first ecstasy millionaire.

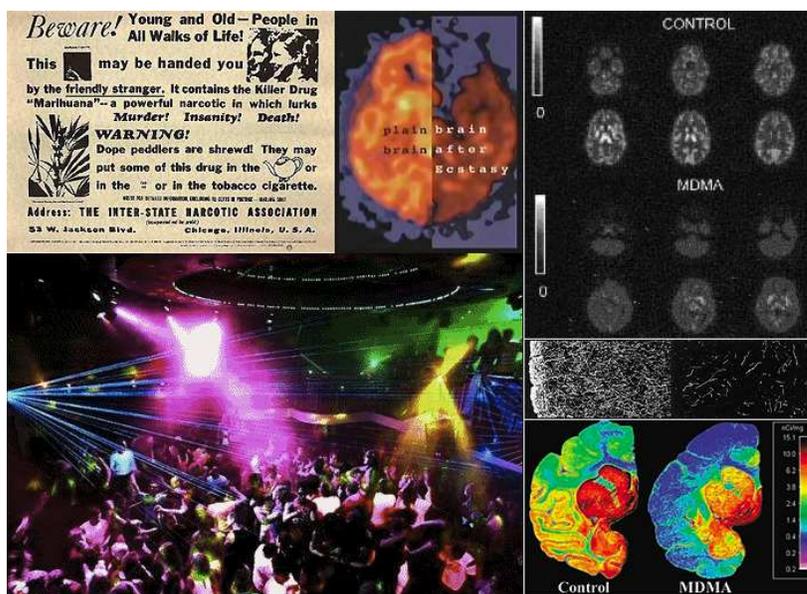


Fig 5: (Clockwise) Nothing new under the sun. Late 1930s scare marijuana poster "Murder! Insanity! Death! Late 1990s brain full of holes on ecstasy poster. Lancet study used as a basis (McCann et al). Claimed damage to serotonin Raphe pathways seven years after monkeys were dosed with MDMA (Hatzidimitriou et al). Claimed evidence of MDMA dopaminergic

damage in baboons later retracted (Ricaurte et al). The trance rave has become the ritual celebration of empathy of an entire generation.

However the DEA, threatened by ecstasy's manifest lack of harm and socially positive

profile, being used by relatively ordinary people rather than a bunch of weird hippies, felt it imperative to suppress the phenomenon, lest it undermine the entire attempt to treat recreational drugs as dangerous enemies of society. Ecstasy was thus, without any evidence of social harm, in 1985 classified as schedule 1, along with cocaine and heroin, ending its legitimate therapeutic use and driving its manufacture underground. A major part of ecstasy production then transferred to Europe with increasingly massive black market imports arriving back in the US.

Ecstasy became the drug of choice in the rave party scene, driven as much by ecstasy's pro-social bonhomie as by trance music and light shows. The NIDA then embarked on a public campaign to strike fear into prospective ecstasy users, by claiming that a single dose could permanently damage the brain, using a factually flawed scientific study by George Ricaurte of the Johns Hopkins School of Medicine claiming to show vast areas of the brain of ecstasy users were full of full of holes due to loss of serotonin function. When in 2002 Ricaurte published a follow up study in *Science* purportedly of MDMA's effects on rodent brains, he was forced to retract it, claiming the chemical supply company had incorrectly labeled methamphetamine as MDMA, which the company overseen by the DEA denied, suggesting intentional scientific fraud on the part of the US government. When these two strategies failed, attempts were made to exaggerate the number of cases of ecstasy deaths, however James Gill, Deputy Chief Medical Examiner New York City states that of 19,000 deaths undergoing autopsy over a 3 year period, only 22 people had ecstasy in their system at the time of death and of these only 2 could be construed to have died as a result of ecstasy alone. Around 2100 people die from drug overdoses in NY in a 3 year period, around 20% of which are due to paracetamol, dwarfing the ecstasy deaths. Given the fact that, according to the DEA up to 110 million doses of ecstasy were consumed in the NY area during this time, these claims also have to be seen as part of a campaign of disinformation. Nevertheless MDMA has been found to be neurotoxic in rodents and there is some evidence of long-term effects in humans, which we will examine in due course.

2. The Enigma of Subjective Consciousness

Part of the reason psychedelic entheogens pose such a paradox for Western society is that, although we have decoded the human genome, come close to discovering the theory of everything describing the fundamental forces of nature and the cosmological process, and become a global society driven by digital computer technology, with the powers of nuclear self-destruction and global impact on the biosphere, the nature and origin of subjective consciousness remains an unresolved abyss in the scientific description.

This leads to the so-called 'hard problem in consciousness research' (Chalmers) - the fact that conscious qualia and other attributes of subjective experience are so fundamentally and qualitatively different from the objects and processes of the objective description that no brain processes such as electrical activity associated with cognitive processes in the gamma band (Crich & Koch), or conceptual models such as multiple drafts (Dennett), can form an adequate explanation. The best we can do is link coherent excitations in the global workspace with conscious processes as opposed to the incoherent unconscious processing of different brain regions (multiple references under Consciousness and Global Workspace).

Although the scientific description tells us the world around us is made out of molecular matter and that we as biological organisms are dependent on our fragile brains to survive and remain conscious, we gain this understanding only as a consensus agreement about our subjective conscious experiences, which are our only veridical access to the physical universe, from birth to death. Although brain science sees subjective experience as merely an internal model of reality constructed by the brain, it is actually through our subjective consciousness that we build up our consensual description of the physical world, both in early childhood and through learning scientific ideas of the natural world, so in this sense, subjective experience is primary and the physical world is inferred. Moreover the existential status of internal experiences, from dreaming REM sleep to meditative and visionary experiences, remains undetermined. From the subjective point of view, dreams can be as real and rich as waking experiences, and their explanation purely in terms of memory consolidation processes remains ambiguous.

This suggests that the subjective and objective aspects of existential reality might be complementary. The tantric origin says precisely this - that the existential origin lies in intimate coital fusion of subject and object, which in their retreat from union become the subjective conscious mind (Shiva) dancing the dance of Maya or illusion, in which the cosmic consciousness of the observer becomes lost in the manifold phenomena of the objective world (Shakti), perceived by individual sentient beings. Likewise the Tao is a complementarity between creative and receptive Yang and Yin principles in nature. The quantum description of the physical universe is similarly founded on complementary wave-particles, leading to a series of other complementarities, such as between matter-forming fermions and force-bearing bosons.

Current cultural perspectives on existential reality remain in a schizophrenic state between a purely materialistic perspective and religious cosmologies inconsistent with physical reality. The materialistic view is that we are simply chemical machines, that subjective consciousness is just an internal model of reality constructed by the biological computer of the brain, that mind is an illusion which can have no effect on matter and that all human action is no more and no less than a complex mechanism. If we took this description at face value, there would be no point in life, no meaning in existence, and the simplest act of voluntarily deciding to go for a walk in the park would be a catatonic delusion, for in the harsh light of reality, our conscious minds would have no control over our physical bodies.

At the other extreme religious people believe that the universe was created in seven days by God producing the plants before the Sun and Moon, that flawed nature is going to be discarded in the Rapture, where we are all going to be assigned to a heavenly life in the skies, or condemned to eternal hell-fire and damnation amid visions of feathery-winged angels and the intimate presence of God in the form of an ancient man with white hair. This is clearly a mentally driven-description, consistent only with a naïve flat-Earth view of the heavens as great domes in which the stars are set, while we know the upper atmosphere is a vacuum, and there is no place for the heavenly host in intergalactic space. Looked at with any integrity we can see that all religious visions, from Genesis to Revelation, are imaginative mental fantasies of the subjective mind, coming from dreams, prophecies and visionary states.

In reality neither of these descriptions are remotely adequate and Western society stands at a cross-roads, where the central enigma of existence is still a complete conundrum pivotal to our understanding of who we are, what we are doing on the planet and how to care for an

ever more fragile biosphere and protect the diversity of life and the future generations of humanity from extinction due to our own lack of foresight.

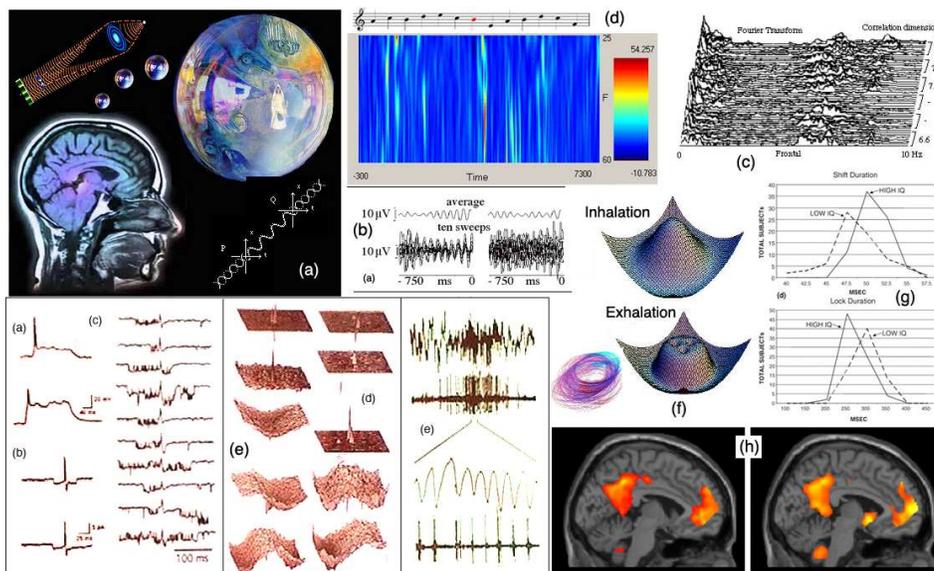


Fig 6: (a) The existential nature of subjective experience and its relationship with autonomous will remains unresolved. It's anticipatory properties could be a manifestation of quantum properties, here illustrated by the Wheeler delayed choice experiment and the transactional interpretation of quantum mechanics. (b) responses gain wave coherence (left) when their temporal occurrence becomes anticipated (Basar et al). (c) The eeg consists of broad-spectrum oscillations characteristic on non-linear chaos, also manifest (d) in active brain states such as recognizing an odd note in the wavelet transform frequency profile (King ROC). (e) Discrete change at an ion-channel can excite a hippocampal cell which in turn can result in cortical excitations through stochastic resonance (Liljenström & Uno). (f) Freeman's model of learning through chaotic excitations forming new strange attractors (Skarda & Freeman, Freeman). (g) High IQ is associated positively with phase shift durations and negatively with phase lock duration consistent with phase coherence and transitions involving disordered intermediates (Jung-Beeman). (h) Brain states involving envisaging future situations are almost indistinguishable from those dealing with past memories suggesting the brain is organized to deal with past and future using a single space-time process (Addis et al, see also Marshall, Hassabis et al, Szpunar et al).

We can gain hints of a possible solution to this existential dilemma by looking more closely at the evolutionary process and at the relation between quantum mechanics and the neurodynamic brain. Firstly the quantum universe is not a deterministic mechanism. Quantum uncertainty means many fundamental processes, such as Schrodinger's cat experiment are unpredictable. Many physicists interested in the mind-brain problem have pointed out the quantum uncertainty could in-principle provide a causal loophole making it possible for conscious mental states to influence a critically poised brain state without physical contradiction. Many processes in neurodynamics, including self-organized criticality, chaotic sensitivity and stochastic resonance show that critically-poised brain states can have tipping points triggered by a single cell, synapse of ion channel, demonstrating

quantum events could indeed influence whole brain states. Chandelier cells have been shown to have such recruiting properties (Molnar et al, Woodruff & Yuste).

Notably, although pyramidal neurons have pulse-coded action potential intensities, pattern discrimination in the cerebral cortex depends not on discrete digital signals, but broad spectrum wave fronts, whose phase coherence distinguishes an attended stimulus or attended process from the ground swell of extraneous stimuli. Global phase coherence of excitations across cortical regions is also the basis of the most plausible current idea of how conscious brain states differ from unconscious peripheral processing. Phase coherence of the wave function is precisely the process underlying quantum dynamics as well, since the uncertainty relation between energy and frequency is derived from counting wave fronts.

To understand subjective consciousness it is fruitful to consider how it evolved in biological organisms. Neurosystems are not just electro-dynamic systems but heavily dependent on chemical neurotransmitters. Many of these molecules go back to the first single-celled organisms. Serotonin, our pivotal example for entheogens, has a very early origin with photosynthesis, where the indole group of tryptophan is the receptor of excited electrons. Serotonin and melatonin thus emerge as signalling molecules as soon as bacterial photosynthetic processes provided oxidation potential (Muller & Jacobs) and may have become ubiquitous through horizontal gene transfer (Iyer et al). At another extreme, immune reactions to soil bacteria appear to be able to induce an antidepressant effect in the prefrontal cortex through serotonin emission at the Raphe nuclei (Lowry et al). The hepta-helical protein family, common to G-protein linked serotonin receptors and many other neurotransmitters, as well as the rhodopsin of the eye, although one of the most sophisticated and diverse receptor types, occupying two percent of the human coding genome, is also one of the earliest to appear in evolution (Muller & Jacobs).

This evolutionary picture means that most of the critical features of both electrochemical excitation, and biochemical modulation, were already in place in excitable single eucaryote cells, in providing them with complex and diverse responses to their environment. One can see this in the neural nets of coelenterates, such as hydra, which has twelve distinct modes of locomotion, where it is not the structured organization of the nervous system which provides for complex behaviour, as there is only a disordered primitive net, which can reassemble along with the entire organism if it is turned inside out, but the dynamic sophistication of the individual neural cells (King 2008).

This picture addresses one fallacy, coming from the artificial intelligence school of thought, that the brain is just a very complex sophisticated computer, which, given the right kind of firmware and software design, could be replicated in principle by a digital computer thus showing consciousness is only a question of computer design. There are several reasons why this is in fundamental conflict with the way the brain evolved. Most, if not all, environmental decision-making problems are computationally intractable and prone to exponential runaway, like the travelling salesman problem, because the complexity of the computation grows super-exponentially with the factorial of the number of incident factors involved. The gazelle can't afford to wait at the cross roads until its computer solves each survival issue or it will surely get jumped by the tiger without ever having made the decision, so the brain has to find a way to make real time decisions regardless of classical complexity.

The brain appears to have solved this problem by utilizing massively parallel processing rather than a set of serial processors with only nominal parallel capacity. However parallel processing is not naturally suited to digital signalling because the traffic management problem of parallel threads becomes unmanageable. To avoid this, the brain appears to use a combination of wave front coherence processing and chaotic sensitivity. Wavefront coherence is ideally suited to parallel processing in precisely the way a hologram is, the wave fronts can be continuously superimposed and only the phase-coherent ones will reinforce. Dynamically this spatial superposition is complemented by non-linear temporal dynamics, which provides for sensitively-dependent transitions in and out of chaos, enabling the dynamics to remain critically tuned to its own self-organized criticality.

This brings us to an even deeper problem complementing subjective consciousness, that of intentional or 'free' will. All our ideas of personal accountability, and the rule of law and religious guilt, let alone our sense of sanity and personal autonomy, hinge around the notion that we can make conscious decisions about the physical world. Yet science tends to argue that this is an illusion and that we are really helpless victims of our brain state. Hence genetic predispositions have become commonplace defence arguments against criminal culpability.

However many of the environmental decisions our gazelle must make do not depend on determining factors, but on unrevealed contingencies, events yet to happen, and on situations where several choices might all lead to viable outcomes, something akin to collapsing the wave function of Schrodinger's cat in the quantum description. There may be a lion on the mountain path and a tiger on the jungle path, or neither today. What matters is anticipation, and it is here that subjective consciousness is tuned to do two things, firstly to give an immediate hunch which path to take, and secondly to be acutely sensitive in an anticipatory way to existential threats that may be about to strike as the gazelle goes to the water hole.

This gives us a much clearer idea of why the blind watchmaker of evolution arrived at the sappy biochemical conscious brain, rather than a blue gene super-digital computer. And why, despite having 10^{11} neurons and 10^{15} synaptic junctions, the human brain is a lousy computer, no better than a cheap pocket calculator. The brain is not a computer at all, but a real-time space-time anticipator using chaotic sensitivity, wave super-positions and quantum entanglement to anticipate reality, by setting up dynamically unstable global brain states limiting in effective cat paradox experiments, possibly utilizing unusual aspects of quantum reality in the process. Quantum theories including quantum electrodynamics are time-reversible and examples, from the Wheeler delayed-choice experiment, to many manifestations of quantum entanglement and the handshaking processes in the transactional interpretation, illustrate 'spooky' potentialities spanning space and time.

Intriguingly recent brain scan studies have shown the cortical regions excited by looking into the future to be virtually identical to those involved in memorizing the past (Addis et al, Marshall, Szpunar et al) and damage to episodic memory structures also prevents subjects being able to envisage future events (Hassabis et al), suggesting the way the brain is going about this is in a sense 'time symmetric'. This raises all manner of to be elucidated questions about the anticipatory capacity of subjective consciousness, including reports and studies of precognitive dreaming (Dunne).

3. Fathoming the Mind-Brain Relationship and Experiential Modalities

Both electrodynamic magnetodynamic EEG and MEG investigations and metabolic PET and fMRI scans utilizing radioactive metabolites and nuclear magnetic resonance have provided windows on the active brain in live subjects which give us a much clearer idea of how brain processes correspond to conscious experience. The former have good temporal but low spatial resolution while the latter are slow in time evolution but spatially more precise.

The mammalian brain is dominated by the cerebral cortices, a wrinkled pair of envelopes of neural tissue forming a sheet about a quarter of a metre in area populated by some 10^{11} neurons in five to six distinct layers, consisting of excitatory pyramidal cells mediating the output, innervated by a variety of inhibitory and excitatory inter-neurons, the 'grey' matter, with different regions connected by bundles of axon fibres, the 'white' matter connecting different cortical regions, including traversing the two hemispheres, in a massive conduit called the corpus callosum. Each pyramidal cell has dendrites permeating all the layers, with up to 10^4 incoming excitatory and inhibitory synaptic junctions involving a spectrum of distinct neurotransmitters. It is believed the cortex is organized into around 10^8 mini-columns each consisting of 50-100 neurons responding to one common feature. It is believed that the basis of the EEG's brain waves consists of resonant excitatory and inhibitory circuits in the cortex, and that fast oscillatory activity in the gamma band 30-80 Hz may correspond to active cognitive processes.

With the exception of olfaction, which has direct input through the olfactory bulbs, sensory input to the cortex and output from it, pass through a series of ganglia in the thalamus. Excitation of the cortex is maintained both by active loops between the thalamus and cortex, and by a series of basal brain centres including the Reticular Activating System, and centres mediating specific neurotransmitters, including the Raphe nuclei, and Locus coeruleus, mediating ascending serotonin and nor-adrenaline (nor-epinephrine) pathways which fan out widely across the cortex, entering specific layers to modulate excitatory tone and mediate conscious arousal and the cycles of REM and non-REM sleep. A similar dopamine pathway fans out into the frontal cortex to do with reward. An intriguing slant on the complex role of serotonin in mood is that knockout mice lacking tryptophan hydroxylase 2 which cannot synthesize serotonin, lack all sexual selection in mating, which is reversed by supplementing with 5-hydroxytryptophan (Liu et al). In addition there are loops of activity running from the cortex to the striatum and basal ganglia, to the thalamus and back to the cortex - the CSTC loop, involved in learned motor activities such as piano playing, which also play a role in learned cognitive behavior and can be disrupted by Parkinson's and Huntington's diseases. Another loop runs through the cerebellum, to do with bodily balance and finely-timed movement, which also plays a role in finely-timed cognition.

The regions of the cortex broadly form a mathematical transform akin to a hologram (Pribram), consisting of a set of sensory and abstract features defining each subjective experience. Thus each experience consists of multiple features and each feature can be associated with multiple experiences. There is thus no specific cortical centre associated with consciousness and the best correspondence that can be made between conscious thought, as opposed to subconscious processing, is that conscious processing corresponds to globally coherent excitations channelled through the major attention networks, as opposed to regional processing which is 'out of phase with major global processes but might come to contribute to them with the changing brain state.

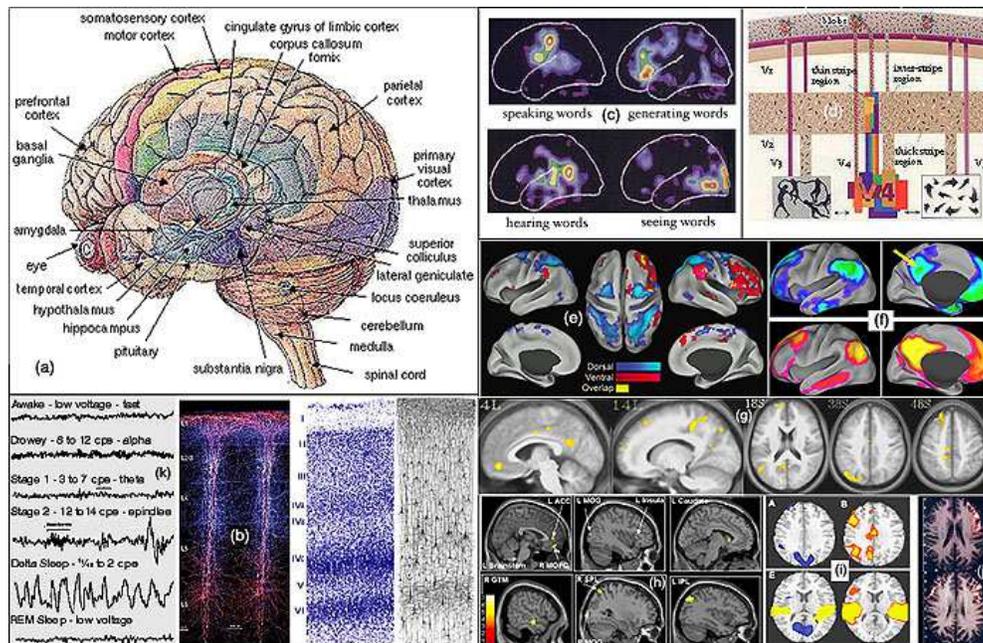


Fig 7: **(a)** The human brain outlining cortical areas, as well as underlying structures including the thalamus and limbic system, including the hippocampus processing long term episodic memory and the amygdala dealing with multi-sensory reactions to flight and fight survival and basal brain structures, including the Raphe nuclei and Locus coeruleus involved in sleep wakefulness cycles. **(b)** The cortex consists of up to six layers of neurons in which pyramidal cells provide the excitatory output from one region to another while inhibitory and excitatory inter-neurons provide lateral inhibition and feedback. The 10^{11} cells in the cortex are believed to be organized into around 10^8 mini-columns each processing a single feature. The cortex is dynamically organized into functional regions processing features of experience in massively parallel ‘computation’ here illustrated in verbal tasks **(c)** involving Broca’s vocal expression and Wernicke’s semantic interpretation areas and parallel processing of visual features **(d)** e.g. of colour and motion. **(e)** There are believed to be two attention systems in the human brain (Fox et al.) a bilateral dorsal attention system (blue) involved in top-down orienting of attention and a right-lateralized ventral attention system (red) involved in reorienting attention in response to salient sensory stimuli which occupies location in the right hemisphere somewhat complementary to the left hemisphere language areas, although the language areas tend to be more bilateral in females, who also show differences in the balance of focal and salient attention responses to crisis. **(f)** A third network has also been associated with mental activity not tied to the immediate stimuli loosely entitled the default circuit (Raichle & Snyder, Mason et al, Fox D, Horovitz et al, Buckner et al), because it was found to have decreased activity when attending a sensory task (above) while the same areas become active when resting, following a stream of thought, or daydreaming. This is believed to be involved in rehearsing future scenarios (Marshall) to aid survival. Different forms of meditation display structured forms of control of the attention process and brain activation. **(g)** Zen meditation studies (Pagnoni et al, Ritskes et al) in which subjects are asked to switch from a verbal task to contemplation show transient activity consistent with the default circuit which is more quickly suppressed by experienced meditators more effectively inhibiting verbal thought. **(h)** Carmelite nuns entering oneness with God show fMRI activations in areas in very specific frontal, parietal, temporal and basal areas consistent with directed control

(Beauregard & Paquette). (i) Likewise Tibetan Buddhists performing compassion meditation for other people's suffering show specific activation in limbic regions including cingulate cortex and insula, consistent with an empathic response to another's pain (Lutz et al 2008). (j) Sex differences in language areas (Shaywitz et al).

A good idea of the way features are mapped across the cortex can be gleaned from examining the major cortical areas. The rear occipital cortex contains primary visual areas responding to lines of a given orientation, and with increasing abstraction, more abstract features such as human faces, facial expressions, and as we move forward across the parietal lobe, spatial relationships, such as finding one's way through the city. Colour and motion are processed in parallel in complementary regions and over twenty different visual areas have been identified dealing with different visual aspects.

Where the parietal deals with spatial relationships, where things are, the temporal deals with what they are. Hearing is processed to either side of each cortex in the temporal lobes, which also have major functions in representing temporal processes like melodies, semantic memory, and associating a given situation, with a variety of others sharing abstract features with the current one. Many features of hearing, such as melody, pitch and rhythm are processed in parallel in different areas, although the primary auditory cortex is believed to have a tonotopic map similar to the line detectors of the visual system.

Separating frontal areas of the cortex from the parietal is the deep fold of the Sylvian fissure. To the rear of this is the somato-sensory cortex with a map of the bodily areas, complementing our visual experience of the outside world with our tactile sensations of ourselves. To the frontal side of the fissure we have a corresponding motor map of musculature and bodily actions. As we move further forward into the prefrontal cortex we have increasingly abstract features of action, consisting of how we apply focussing attention to control our thought processes, and our idea of our active goals and what we want to achieve in life. Many specific prefrontal areas governing forms of executive control have been elucidated from studies of the effects of damage to these areas. Some prefrontal areas affect cognitive control of attention while others such as the orbito-frontal leave intellect and IQ unaffected but disrupt the person's capacity to make realistic emotional life decisions. The region around the principal sulcus of the frontal lobes contains both an active representation of the visual field, enabling working memory to anticipate actions in time, and a representation of what these things are, forming a complementary relationship with parietal and temporal regions in working memory (Kandel et al). We can thus envisage conscious thought processes in terms of a 'global workspace' consisting of major feedback resonances between the frontal cortex and the temporal and parietal mediating the spatial and temporal aspects of the ongoing decision-making process.

On the inner side of the cortical sheet facing the centre plane is the cingulate cortex, dealing with emotional representations. This is also connected with the extreme of the temporal lobe and two other centres on the periphery of the cortical sheet, the amygdala and hippocampus in a global feedback loop loosely entitled the 'limbic system', associated with emotional dynamics. The amygdala has a role in integrating sensory experiences in relation to flight and fight survival and the hippocampus has a pivotal role in laying down experiences into sequential memory. Temporal lobe epilepsy can give rise to complex orchestrated experiences, some of which can be given a quasi-mystical status by the subject. This caused the neuroscientist Ramachandran to suggest that Temporal lobe excitation carrying across to

the amygdala could be the basis of religious experiences of emotional exaltation combined with overwhelming significance - the so-called "God spot". At the least this gives an interesting interpretation of religious fervour as an idiopathic brain state (Ramachandran & Blakeslee, Persinger, Bielo).

Several key processes, including language, are believed to be lateralized, enabling the two cortices to have complementary functions. For example, language meaning is processed in the left temporal Wernicke's area and fluent execution in the left frontal Broca's area, although women often appear to have a more bilateral processing of language, in which right hemisphere activity might be associated with creative use of language. Due partly to some intriguing experiments in which the corpus callosum of intractable epileptics has been severed, the concept of lateralization has led to some fanciful concepts with only partial validity, stylizing the left hemisphere connected to the right hand with structured organized processing and the elusive right hemisphere with intuitive and creative processing.

Consistent with this view, two opposing global attention systems have been identified, one the dorsal attention network deals with focal attention in the global workspace and is bilateral connecting areas such as the frontal eye fields to parietal and other areas. Complementing this is the ventral attention network whose role is to bring in salient stimuli, important to the subject, from the periphery. Intriguingly this has lateralized activity in the right cortex, complementing the left hemisphere regions traditionally associated with language, lending support to the above model of lateralization. A third system connecting the frontal anterior insula and the anterior cingulate, involving fast-transmitting von Economo neurons, may mediate integrated bodily interoception, emotional and cognitive awareness and timed framing of the immediate present, forming a central process of self-consciousness (Allman et al, Cauda et al, Craig, Williams).

A fourth system, the 'default network', is associated with mental activity not grounded to any immediate activity. It was first discovered because there were areas with enigmatic deactivation in a variety of brain studies. When subjects were then tested just resting or daydreaming the same areas were activated. The default circuit is activated by processes as diverse as autobiographical memory, envisioning the future, theory of mind, moral decision-making (Buckner et al, Mason et al, Raichle M. & Snyder), as well as mind-wandering activities such as daydreaming and worrying. The default circuit is believed to be a state in which we aid our survival strategies by using down time to rehearse impending situations of significance to enhance our ability to cope with them successfully. It has also been associated with improved creative thinking over focussed working memory, for example in solving counter-intuitive puzzles (Christoff et al).

Dreaming, or REM sleep remains an enigmatic and life-shaping aspect of subjective experience whose physiological and experiential status remains unresolved. Sleep begins with short EEG bursts called sleep spindles interrupting waking EEG and enters a series of cycles, in which waves of deep slow wave SWS sleep alternate with rapid eye movement REM or dreaming sleep, where the cortex has an EEG similar to the waking state, and the body, except for the eyes, is effectively paralysed by a filter in the basal brain. The cycles of deep sleep are driven by synchronous burst firing in the thalamus interrupting the low voltage asynchronous passage of information to the cortex, associated with the activity of waking and REM sleep. Sleep cycles, although they appear to occur widely across the animal kingdom from arthropods (Shaw et al, Hendricks et al) to vertebrates (Hobson), vary a great deal

among mammals with different circadian habits (Siegel 2001, 2005, 2008). The sleep cycle, like the default network, has been associated with aiding the brain in forming better responses to strategically stressful situations plaguing waking life. Although the REM state is similar to waking EEG, fMRI and PET scans show reduction of prefrontal activity and heightened activity in visual areas, as shown in fig 11.

Both REM and non-REM sleep have been associated with memory re-encoding and consolidation. Non-declarative aspects of memory, from solving the towers of Hanoi to physically manipulating an unstable object, show significant improvements from the learned plateau with specific sleep phases, from REM, through light stage 2, to deep SWS sleep. Episodic memories are thought to consist of multiple hippocampally linked memory traces located within neocortical regions and dependent on the hippocampus for their integrated recall. Cycles of SWS and REM sleep appear to be associated with re-encoding of emotionally significant memories, with information passing between the hippocampus holding space-time indices of significant recent experiences into long term optimized form in the prefrontal cortex. Hippocampal activity is enhanced over other activity in REM as against both waking and non-REM sleep, while the dorsolateral prefrontal cortex, involved in decision-making and memory, becomes further inactivated. Low cortisol and reduced reticular acetyl-choline activation early in sleep favours cycles of deep SWS, with cortisol rising slowly over the night, as periods of REM sleep become more accentuated. Studies have detected replays of spatial tasks in the hippocampus, time-compressed in SWS, and then in REM. REM is also believed to enhance synaptic plasticity resulting from adapting to novel environments, enhancing the adaptive response (Payne & Nadel, Stickgold, Stickgold et al, Maquet et al, Nielsen).

These cycles are mediated by reciprocal changes in activation between the reticular activating acetyl-choline system and serotonin, nor-adrenaline and dopamine pathways fanning out across the cortex from the hypothalamus and basal brain nuclei (Saper et al). In REM, the Raphe nucleus serotonin and Locus coeruleus nor-adrenaline pathways mediating cortical responsiveness and arousal in the waking state are silent, while there is reticular activation of acetyl-choline pathways, in excess of the waking state and an EEG similar to waking, rather than the light sleep spindles, or slow waves of deep sleep.

Memory processing may be consistent with many of the experiential features of dreaming, such as bizarre content, which may appear to mix features of many experiences, and dreams being perceived as direct experiences in the present, often having emotionally charged character. Although dreams can be hard to remember, and episodic memory is idiosyncratic, dreams and particularly intense nightmares, can have substantial episodal content. Furthermore a person can often retrogressively remember quite long sequences of dream episodes on lying still on waking from a dream provided the weird disconnections plaguing dreaming experience can be negotiated. Brain scans of REM sleep show strong activations of perceptual, e.g. visual areas, while the prefrontal cortex has reduced activity consistent with the relative difficulty we have controlling the direction of our dreams and also with the memory consolidation model.

Dreams can have a very rich existential status, often as convincing to the experiencer as waking life, making it hard to give oneself criteria to distinguish dream from reality, for example to endeavour to enter a lucid dreaming state. The existential status of dreaming experience remains undetermined, along with any perceived implications for subconscious

discovery or prophetic precognitive hunches. Although dreaming reality may be just a manifestation of memory processing, just as waking life may be just an internal model of reality constructed by the brain, the existential nature of dreaming experience remains a challenging and very different realm from waking experience, whose potentialities remain to be fully explored.

By contrast with the rich and bizarre nature of dreaming, mental states associated with prayer and meditation tend to involve focused control and suppression of the wandering mind through limiting the verbal thought process, or focussing on a spot. While these mental states are highly varied, they share common features of intentional control of the mental process.

Zen meditators in fMRI studies show more rapid and complete suppression of the mind-wandering of the default network (Pagnoni et al), with increased activity in the prefrontal cortex and basal ganglia and decreased activity in the occipital (visual) cortex and anterior cingulate processing emotion (Ritskes et al). In EEG studies they showed a significant increase in frontal alpha and occipital beta power, whereas an average increase of theta power was observed in controls indicating loss of concentration (Huang et al).

Tibetan Buddhist meditators in PET and fMRI studies have increased blood flow in the cingulate, inferior and orbital frontal cortex, dorsolateral prefrontal cortex and thalamus (Newberg et al 2001, Hanky). EEG studies show greater activation in attentional regions, including fronto-parietal, cerebellar, temporal, para-hippocampal, and posterior occipital, possibly due to the attended dot (Brefczynski-Lewis et al). They have also been found to enter high-amplitude gamma-band oscillations with high phase-synchrony during meditation, consistent with a one-pointed concentration with heightened attention (Lutz et al 2004). By contrast, compassion meditators under PET show similar activations to a person feeling empathy for a person in pain (Lutz et al 2008). In a more recent fMRI study contrasting “focused-based” and “breath-based” practice. In the first, blood flow increased in the medial prefrontal cortex and left caudate, but decreased in parietal and occipital regions. The second induced activation in several limbic structures and the left superior temporal cortex (Wang et al).

Investigation of Transcendental meditators by PET (Newberg et al 2006b) also found bilateral prefrontal activation associated with relaxed attention on the mantra, other increases in frontal, occipital and parietal areas and a decrease in the thalamus and hippocampus. An fMRI study centered on the capacity of the relaxed state to be helpful in dealing with an induced painful stimulus saw reductions in the prefrontal cortex, anterior cingulate cortex, and thalamus (Orme-Johnson et al), and has been suggested to be linked to hormonally induced increases in GABA (Elias et al). Catholics observing a Marian image saw increases in the ventrolateral prefrontal cortex and brain stem leading up to the thalamus (Wiech et al).

Brain studies of Carmelite (Beauregard & Paquette) and Franciscan nuns (Bielo) in professed ‘union with god’, which they admitted was difficult to achieve in a noisy MRI tunnel, show different structured activations, with increased activity in the caudate nucleus associated with learning, memory and falling in love, the insula processing body sensations and social emotions, the inferior parietal processing spatial awareness in contradiction to the Zen studies, the medial orbito-frontal and prefrontal cortices dealing with emotional and executive decision-making, and the middle of the temporal lobe. Most prevalent brain waves were long, slow alpha waves such as those produced by sleep, consistent with a relaxed state. By contrast with the prefrontal control evidenced in Buddhist meditation, during speaking in

tongues, by Christian women who had practiced glossolalia for more than 5 years, there was a decreased blood flow in the frontal lobes bilaterally and in the left caudate, indicating relaxation of executive controls (Newberg et al. 2006a).

In comparing these highly varied and contradictory results, one can conclude that claimed states of higher spirituality are varied products of different forms of concentration, which share the feature of overall focused control, but otherwise look like distinct humanly-generated states of mind, rather than convergence on the 'divine'. One needs to consider the possibility that the profound transformations of the cortical dynamic induced both by dreaming and by entheogens may give rise to deeper potential for exploratory existential processes, which might nevertheless be enhanced by contemplative repose.

[References at end of Part 4]