

Evolution's Gamblers

A diagnostic profile ...

FAMILY NAME: **Hominidae**
AGE: about 2.5 million years old
PROFESSION: gambling
MAIN BET: that they have 'dual existence'
ODDS AGAINST: 20 million to one (minimum).

When modern members of this family bet on racehorses they tend to recoil from bets that involve odds that are much greater than 50 to one, and they would scorn punters who habitually make bets at vastly greater odds—at 500:1 for example. Such gamblers are dismissed as laughably naive, even delusional to the point of insanity.

Yet when members of this family consider the enigmas of biological existence, most of them make one particular bet against vastly greater odds without hesitation. They bet that, unlike the other 20 million species on the planet, they live a dual existence—on two planes, one physical and the other mental or spiritual.

As in horse racing, these gamblers can bet to 'Win', or place an 'Each-way' bet:

1. **WIN**: this extreme option bets that there is some unseen supernatural power that will intervene and arrange matters in the gambler's favour if the gambler plays his or her cards right. An even bigger payoff is promised in a mystical afterlife when the gambler is supposed to become similarly unseen and endowed with unnatural wisdom and eternal life.

2. **EACH-WAY**: this moderately irrational option bets that the gambler's family is unique within the biota because evolution has endowed it with three crucial assets: complex language, high intelligence, and a rational 'mind' that can juggle abstractions. Even some scientists make this bet without hesitation.



Homo habilis KNM-ER 1470
(1.88 m.y.old)



HOMINIDAE

Homo sapiens

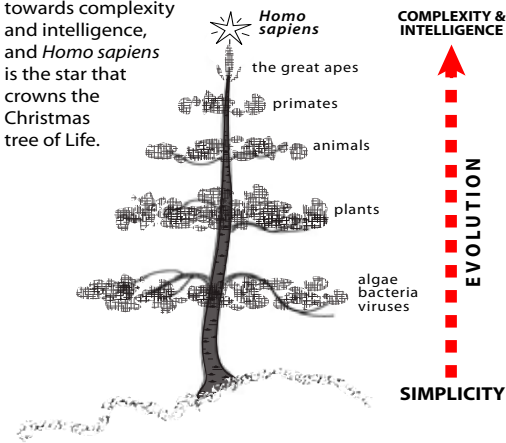
Homo erectus

Homo habilis

THE TRADITIONAL BET

Humanity's Dangerous Delusion:

Evolution progresses towards complexity and intelligence, and *Homo sapiens* is the star that crowns the Christmas tree of Life.



The traditional idea of humanity's place within the Earth's biota is best expressed as 'A Christmas-tree of Life'. Such human-centred views probably originated with the very earliest groups of humans some two million years ago when the growth of rudimentary language and tribalistic mysticism were fashioning the mental fangs and claws that evolution had failed to provide.

When our ancestors gradually learned to settle in one place and tame the natural environment by farming it, inevitably their Christmas Tree concept became set in cultural stone, reinforced as it was by complex language, high intelligence and an unshakable belief in their tribe's primacy,

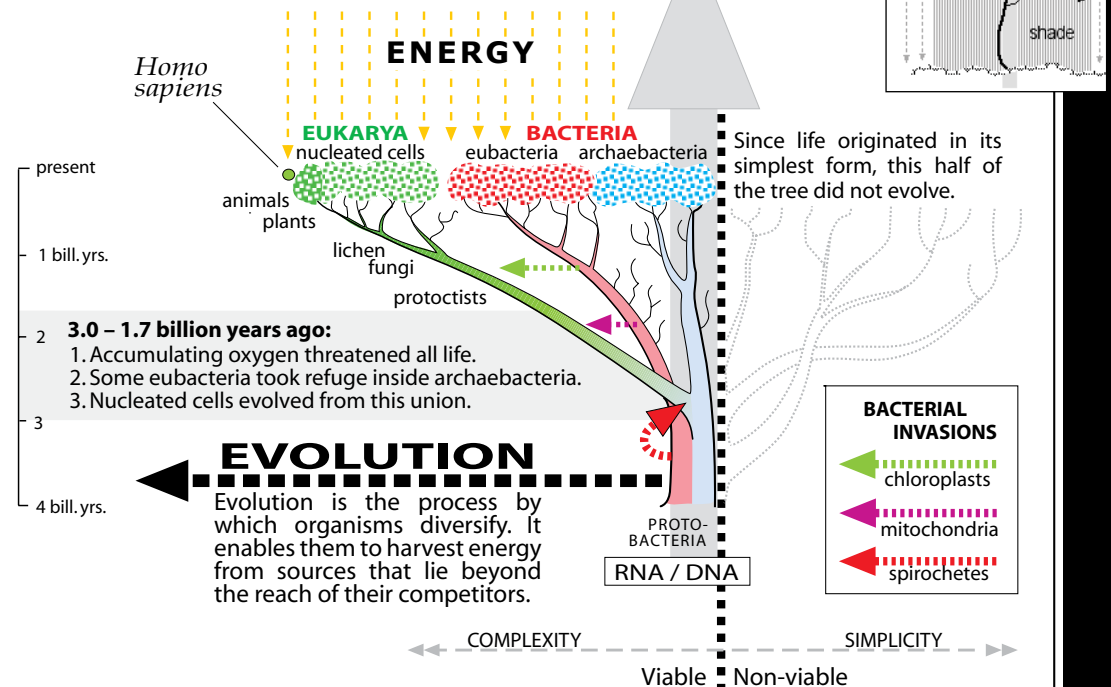
The passionate tribalism that characterises modern civilisation is a relic of those vital primal myths. Transplanted into urban settings however, our ancient tribal delusions now seem certain to disable us as the global environment deteriorates. Increasingly stressed by the growing shortage of gross energy (fuels+food), populations will splinter into aggressive tribalist groups, making cooperation against the common threat of global warming virtually impossible.

THE EVIDENCE

All life shares a single driving mechanism—genetic material in the form of DNA and RNA. These complex molecules survive by replicating themselves, so the primary drive of all life is to reproduce. This requires energy. Plants harvest most of their energy from the sun, thanks to photosynthetic bacterial relicts in their leaves. As their leaves multiply however, the increasing density of central growth forces lower branches to grow continually outwards in search of sunlight.

The same rules apply throughout the biota. New species are continually forced to diversify and acquire complexity in order to harvest energy that lies beyond the reach of their simpler competitors. So life's tendency to diversify and acquire complexity over time does not represent 'Progress': it merely confirms that the tree of life is showing signs of middle-age spread.

Evolution is not Progress, It's just Middle-Age Spread!



TRADITIONAL BET: 'Humans are unique'

Most humans bet that they are fundamentally distinct from all other animals because they believe that they exist on two separate planes, one physical and the other spiritual. This dual existence then bestows the ability to choose their behaviour on a moral basis. Of the 20 to 100 million species that inhabit this planet no others are thought to possess this 'duality'. *

The bet has two forms:

1. Most humans bet that their spirituality is a unique attribute bestowed on them by an unseen supernatural intelligence. This asset automatically involves the responsibility to comply with moral rules that help to minimise the possibility of misfortune, supernatural displeasure, and possibly, eternal damnation during an 'afterlife'. Meticulous compliance with these rules is believed to bring great rewards in this 'afterlife'.

2. In similar fashion many scientists believe that modern humans have achieved a unique duality of existence, but via a process of selective evolution. They believe that by about 40,000 years ago the rational cortex of their evolutionary ancestors had grown so large and efficient that it was able to take on a life of its own and assume behavioural control on a semi-continuous basis. This bestowed on them a uniquely rational 'consciousness' that allowed them to overrule at will, their 'baser' animal instincts.

EVOLUTIONARY STATUS

The two **anthropocentric** propositions outlined above contribute to the general perception that humans are the 'highest', most 'advanced' form of Earthly life, either by divine appointment or via 'evolutionary progress'. Either way, humans are duty-bound to take responsible control of the natural world and are entitled to utilise whatever natural assets and resources they think might benefit them. Consequently, they believe that humans are not bound by the evolutionary rules that govern all other species; and being a 'special case' they are exempt from most of evolution's penalties.

***Odds against this bet: at least 20 million to 1**

THE EVIDENCE: 'Humans are NOT unique'

The biological evidence suggest that humans are not unique in any fundamental aspect of their structure or behaviour. This is corroborated by the universal nature of the genetic material that builds and orchestrates the behaviour of all species, including humans. *

In other words, there is no hard evidence to support the propositions: [a] that human bodies incorporate any unique chemistry or structures, [b] that they exhibit any behavioural imperatives that lie outside the standard genetic repertoire—'survive and reproduce'. All behaviour, whether plant or animal, originates in the genes via the proteins expressed by their DNA. This means that there is no such thing as 'human behaviour', since humans display only primate behaviour that has been selectively modified to suit their evolutionary circumstances.

The clearest evidence of the genetic origin of human behaviour appears in a society's 'morality'. Operating in committee-like groups, genes are often forced to 'lobby' for conflicting strategies. These conflicts arise from discords between strategies that contribute to the short-term survival of the individual's genes versus those that aid the long-term survival of gene counterparts that exist in related individuals. These discords underpin the 'moral dilemmas' that arise throughout our lives (see p.17).

EVOLUTIONARY STATUS

These biological facts suggests that the evolution of life is an artefact of Earth's energy-loaded crust. It therefore represents an aspect of the planet's energy dissipation within the chaotic process of cosmic entropy. It also suggests that the evolutionary process has nothing to do with 'Progress' or 'Improvement', but merely expresses the tendency of all species to diversify and gain complexity in their struggle to harvest energy and resources that lie beyond the reach of simpler competitors. Humans are therefore not 'Special' and are entirely bound by evolution's rules.

***Odds against this bet: shorter than 1 : 1**

TWO CRUCIAL QUESTIONS ARISE:

1. How do our genes manipulate our perceptions?
2. Why do our genes manipulate our perceptions?



To explore these questions we first need to look beyond our genes and consider

EPIGENETICS ...

DNA's Mastercode

It has only recently become clear that all DNA is subject to an overriding 'epigenetic' code in the form of hydrogen-loaded carbon 'tags' that are attached at various points along the side rails of the double helix. These carbon tags determine whether or not particular genes or groups of genes are available for transcription. The precise pattern of their attachment therefore determines precisely which genes are expressed.

If all of the DNA present in each of our cells was stretched out in a line, it would be almost 3 meters (10 feet) long, so DNA must be folded up and compressed to fit inside the cell nucleus. In general, genes in tightly compressed DNA are not readily expressed, while DNA that is more loosely packed is more accessible to the machinery involved in transcribing its genes into messenger RNA (mRNA), and thereby into protein. Appropriate DNA methylation is therefore essential for protein production and for the appropriate development and functioning of an organism.




This mastercode is highly flexible in that there are both internal and external factors that are able to interfere with the sequence of its methyl tags. Some viruses, bacteria and chemical pollutants are able to disturb an organism's basic patterns of methylation, as does the body's immune system, its hormonal response to stress, and the process of aging. Such factors are thereby able to produce, via these subtle interventions, small changes in the structure and behaviour of an organism in response to changes in its environment.

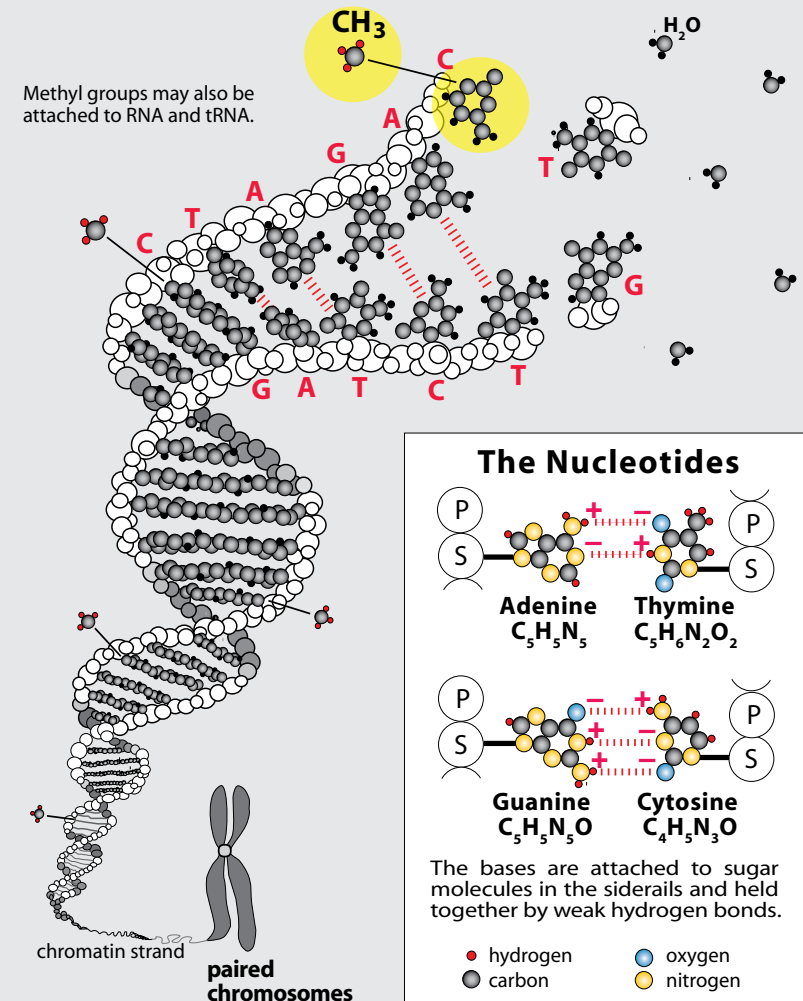
Our species offers no exception to this rule.

So although our genes determine our fundamental structure and behaviour, our overriding epigenetic code orchestrates all the finer details of our mental and physical existence.

DNA Methylation

Methyl tags (CH₃) are most commonly attached to cytosine, but occasionally to adenine and other sites, including the histone 'bollards' about which the strands of chromatin are wrapped.

Adenine (A)  (T) Thymine
Guanine (G)  (C) Cytosine
hydrogen bond 



By regulating the folding pattern of DNA's chromatin strands its methyl tags determine which genes can be transcribed and which are 'switched off'. DNA's epigenetic code thereby constitutes a highly flexible gene-management system that is sensitive to external and internal interference initiated by environmental factors.

Methylation in corn

The most dramatic illustration of methylation occurs in ornamental corn. Its kernels are dark purple if a 'Red' gene is inherited from the egg (female), but they are blotchy lavender if the same gene is transmitted via sperm. This observation was first made in 1910. Today we know that in corn pollen, which contains the plant's sperm cells, the Red gene is methylated. During kernel development the methyl tags are successively removed, thereby allowing full genetic expression to gradually appear as it matures.

In the human fetus, methylation determines what type of cell each one becomes, for example whether it is a red blood cell, a brain cell, a muscle cell, or a skin cell. Every cell in our bodies contains two copies of every one of our genes, with one copy of each gene coming from our mother and one copy from our father. Each gene is thereby 'imprinted' with its parent's peculiar pattern of methylation (exceptions to this rule are genes on X or Y chromosomes, the sex chromosomes that determine whether we develop as males or females.)

When a cell's methylation machinery malfunctions it can often cause serious developmental problems.

People with mutations that cause abnormal function of the methyltransferase enzyme Dnmt3b develop a disease called ICF syndrome. These people have abnormal, semi-dysfunctional immune systems plus a few other genetic problems. Similarly, those with abnormalities in a methyl-binding protein called MeCP2 develop Rett syndrome, a form of mental retardation affecting young girls. Rett males just die.

To put it bluntly, we, like all other species, cannot develop or function normally unless we have the appropriate DNA methylation.



The colour variations in ornamental corn graphically display the process of gradual de-methylation.





Unbridled Emotion

A powerful rush of inappropriate emotion, such as the rage shown by the autistic boy in this picture, may well be a by-product of inappropriate methylation.

New research shows that many autistics have brains that are larger than normal and appear to have produced an excessive number of cortical neurones during a very early stage of their brain development. This could be caused by aberrant methylation that switches off the normal controls.

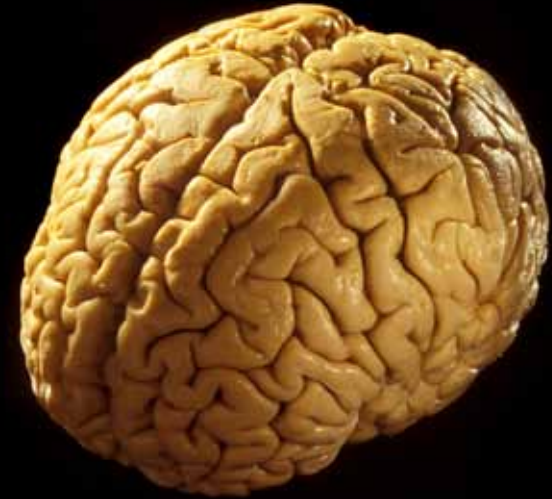
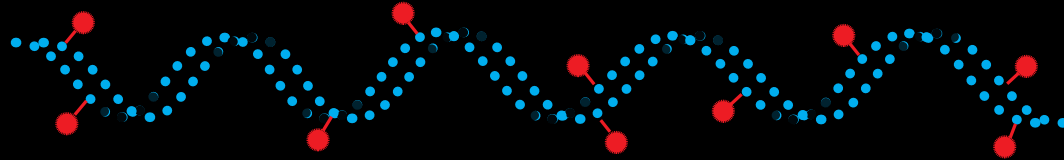
The overproduction of cortical cells would result in varying degrees of disruption to the normal pattern of dendrite connections throughout the cortical regions of the brain.

This hypothesis offers a persuasive explanation for the extraordinary range of abilities and disabilities that autistics display. [\[1\]](#)

Traumatic stress in childhood, or a lack of appropriate parental nurturing during our developmental years has also been shown to slightly alter our methylation patterns.

Such changes can significantly alter our perceptions of the world around us, and can thereby remould our adult behaviour to some degree.

Methylation



MEMORIES ARE MADE OF THIS ...

SHORT-TERM MEMORY: This mammalian characteristic appears to be based on epigenetic changes that emerge in the DNA of neurons in the brain's hippocampus in response to environmental stimuli. The resulting methylation pattern and its associated memory tends to disintegrate within a few days.

LONG-TERM MEMORY: This appears to be a faint cortical echo of the short-lived hippocampal changes, but these changes are much more permanent and become semi fossilised in the methylation patterns of cortical DNA. [2]

The human cortex has doubled its volume and quadrupled its surface area during the past three million years and is now able to archive a large number of these minor changes. This archive constitutes a very useful form of long-term memory—fragmentary, error-prone and malleable though it may be.

Consequently, DNA methylation plays a major role in manipulating our perceptions of the world around us and thereby helps to shape our day-to-day behaviour.

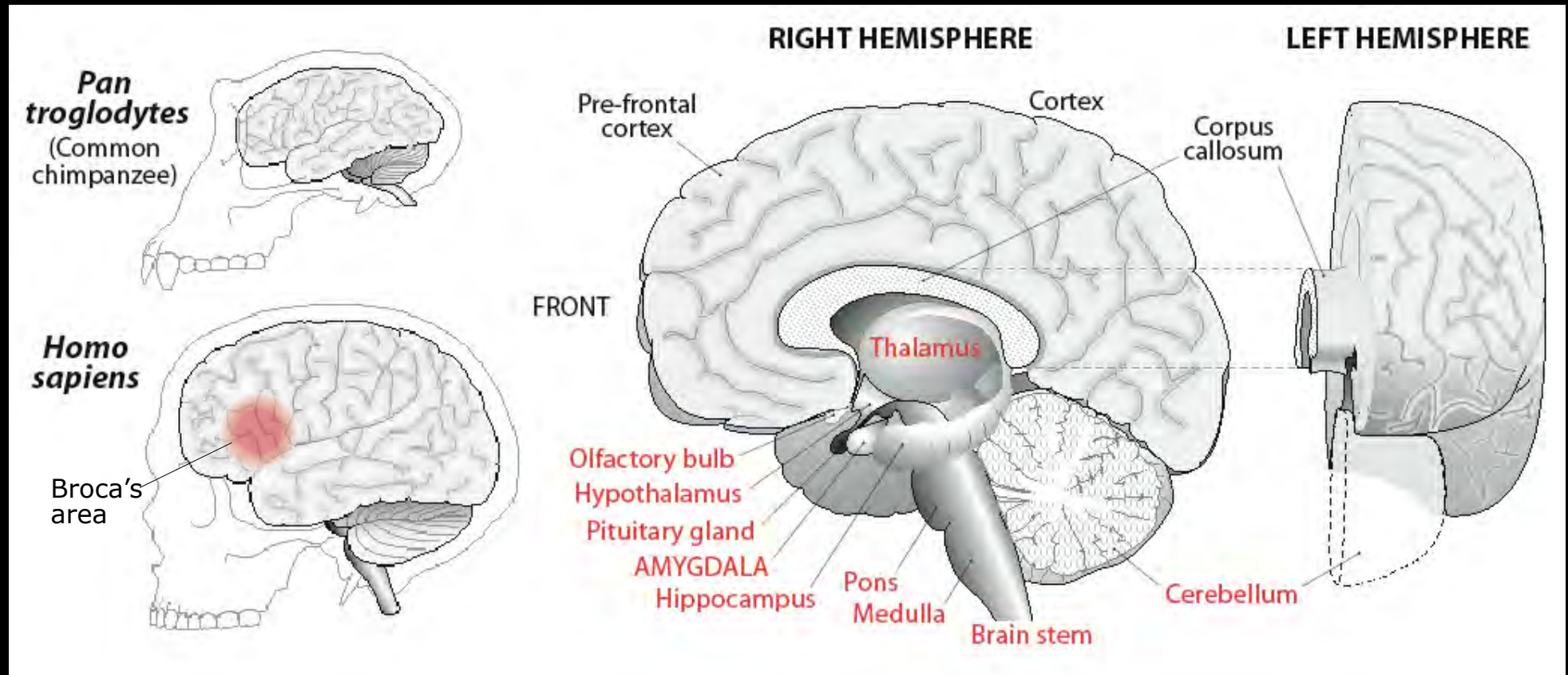
We can now return to our primary questions:

1. **HOW** do our genes manipulate our perceptions?
2. **WHY** do our genes manipulate our perceptions?



Vietnam Moratorium march, Perth, 1969.

Evolution of the human brain



The structures labelled in red are the brain's ancient mammalian-reptilian components. Incoming sensory information is immediately assessed in these regions, and if urgent behavioural responses are required, such as 'fight' or 'flight', these orders are fired directly to the motor control system, bypassing the rational cortex entirely. Information that does not involve any hint of threat is passed on to cortical regions for rational consideration and decision making.

In short then, we are typical animals driven by genetic decisions that have already been thrashed out in the secret parliament of genes that is housed in the ancient, unconscious basement of the brain. These decisions only enter our consciousness some 500 milliseconds later, after they have been relayed into the 'conscious', cortical regions of the brain. Unaware as we are of the primary assessment that occurred in the brain's basement, we are then easily fooled into the belief that we are thinking them out for ourselves, consciously and rationally. [3]

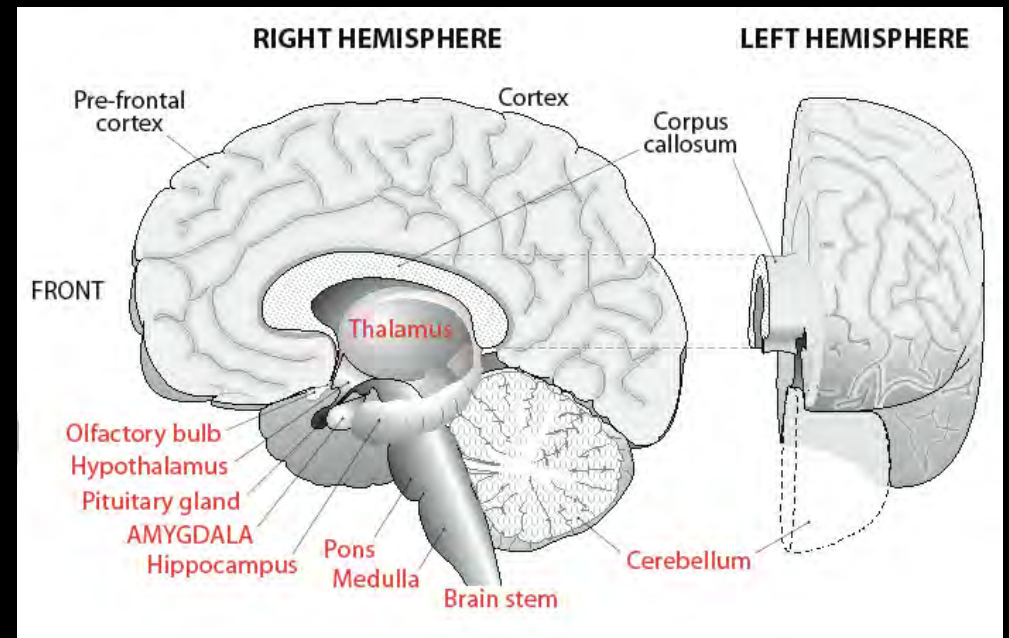
The mechanics of delusion

The brain structures that enable us to tune out rational thought and resort to ancient patterns of behaviour have been largely identified. They lie, as might be expected, in the older structures at the core of the brain (labelled in red). Central to these are the hypothalamus, the pituitary gland and the small, almond-shaped amygdala.

The amygdala is primarily involved in appraising the genetic significance of situations in which an immediate threat might be involved. In other words, it governs our 'fight-or-flight' reflexes and determines the particular thresholds of aggression and discretion that characterise each one of us.

The hypothalamus meanwhile acts as the control centre for a wide diversity of other phenomena, including the physical expression of mental states. It achieves this in conjunction with the amygdala and the pituitary gland that sit just below and in front of it. Electrical stimulation of one part of the hypothalamus can unleash rage and a full-blown attack response, both in humans and other mammals, while stimulation of a neighbouring part of the hypothalamus can elicit feelings of intense pleasure.

All of these ancient mammalian-reptilian structures at the core of the brain are directly linked to our sensory systems as well as to the autonomic nervous system. This ancient neuronal machinery is known as the Limbic System. When triggered, these ancient brain structures act corroboratively, and like a petrol-engine 'choke', they are able to flood the entire body with the appropriate hormonal chemistry for violent action at a moment's notice, by-passing the rational brain entirely. [4]



ABOVE: Limbic systems hard at work, 'by-passing the rational brain entirely.'

Our split brain - 1

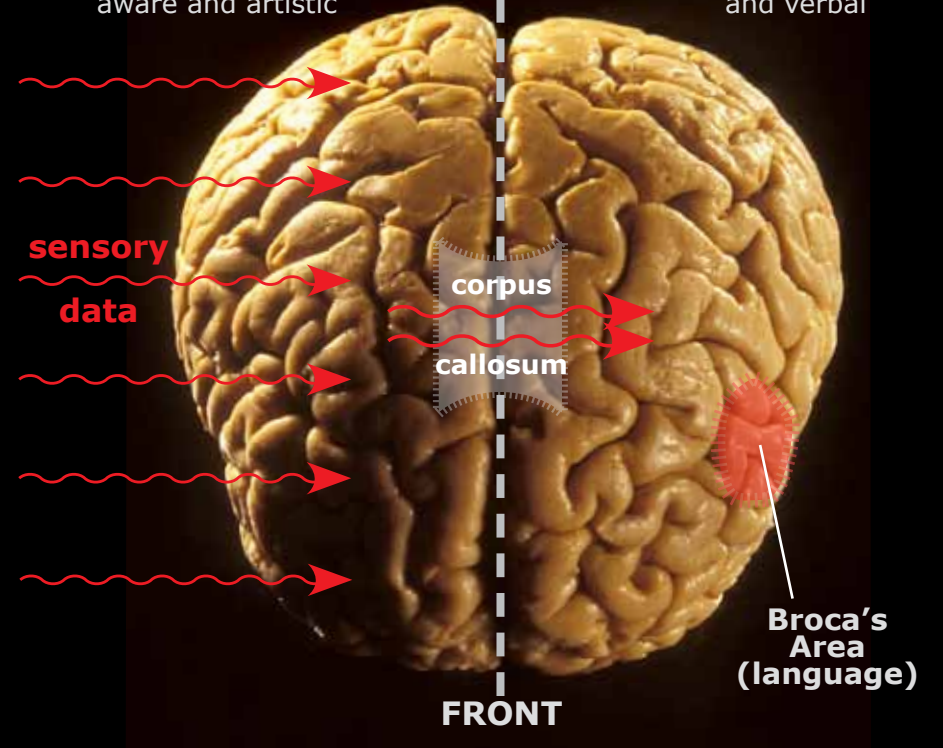
After a long series of experiments in the 1960s with patients whose brain hemispheres had been surgically separated (by cutting the strap-like *corpus callosum* that directly links them), neurobiologist Roger Sperry found himself forced to conclude that: "surgery has left these people with two separate minds, that is, two separate spheres of consciousness." And: "This mental dimension has been demonstrated in regard to perception, cognition, volition, learning and memory."

In most cases, severing the *corpus callosum* separated the right hemisphere from its only means of communication with the outside world, the left hemisphere's language factory known as Broca's Area. In one extraordinary case however, a split-brain patient who had sustained some left-hemisphere brain damage as a child revealed verbal competence in both hemispheres after surgery. Sperry and his colleagues were then able to communicate with each hemisphere separately, and during extensive tests designed to reveal the patient's personality, discovered that **two entirely separate and distinct characters inhabited the two hemispheres.** [5]

Equipped in this fashion with the capacity to operate on two levels of awareness while being 'conscious' of only one, our hominid ancestors were sitting ducks for the evolutionary sting that followed. That gap between the two spheres of human awareness left genes with precisely the loophole they needed to retain ultimate control of the body's entire communications system. If the analytical and constructive hemisphere, the left, was not at all times fully aware of the wide range of perceptive activity occurring in the right hemisphere, then here was a gap in the cortical defences through which whole truckloads of mystical nonsense might pass virtually unchallenged.

RIGHT HEMISPHERE
perceptive, spatially aware and artistic

LEFT HEMISPHERE
analytical, constructive and verbal



Of the torrent of sensory data that enters the receptive right hemisphere relatively little is accurately transferred via the *corpus callosum* to the analytical and communicative left hemisphere. Significantly, the one area of the brain where sexual dimorphism is most evident is the corpus callosum. The female version is thicker and more bulbous than the male version, and has far more nerve fibres linking the two hemispheres than has the male. Consequently men have poorer communication between the left and right sides of their brain. [6] It is as if evolution specifically widened the 'brain gap' in men to ease the birth of their elaborate mystical fantasies.

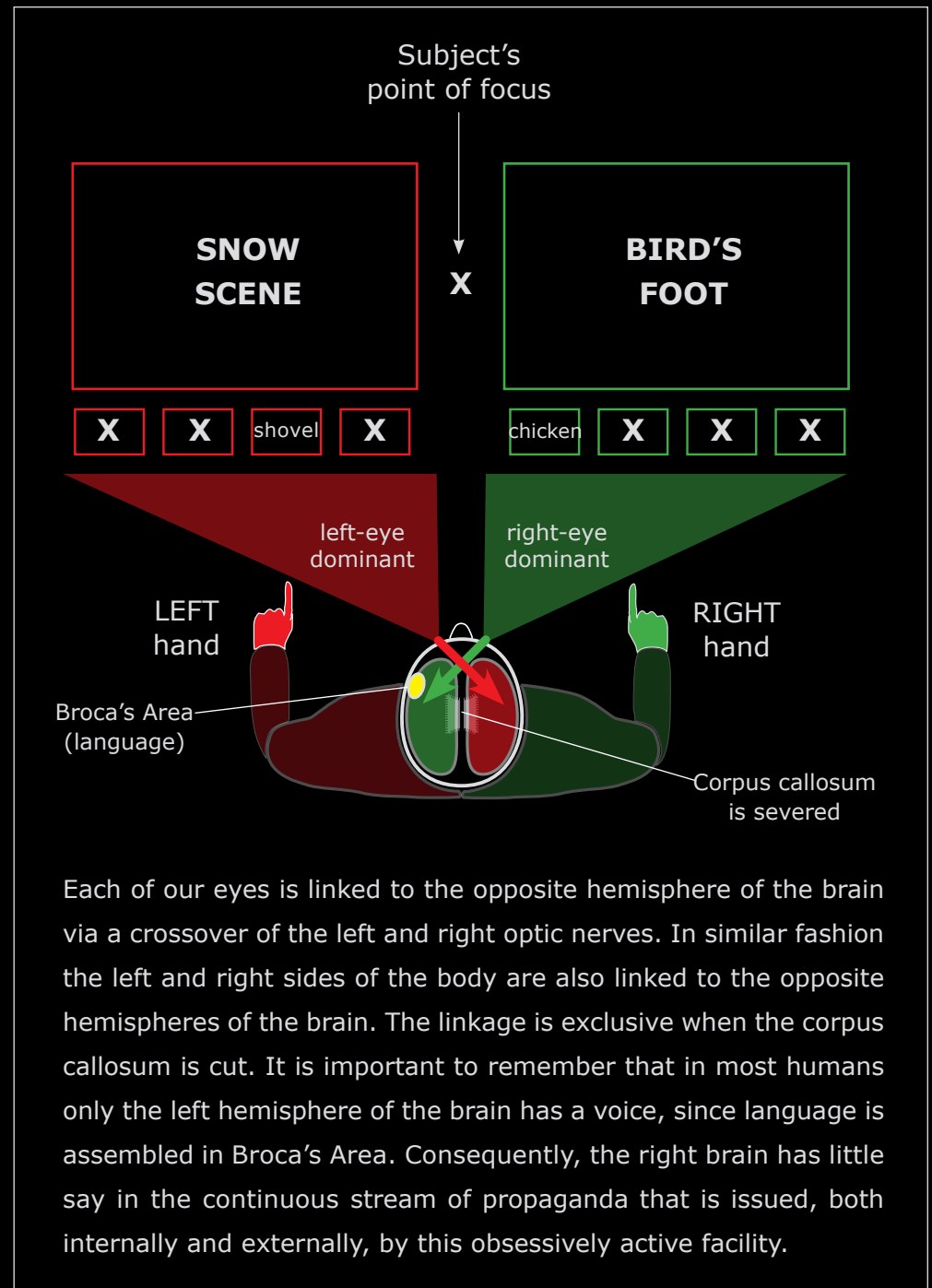
Our split brain - 2

During experiments with a split-brained patient conducted in the 1970s by Michael Gazzaniga in collaboration with Roger Sperry, a picture of a bird's foot was flashed to the patient's left hemisphere via his right eye, and a picture of a snow scene was presented to his right hemisphere via his left eye. Below these images were four smaller pictures, only one of which could be readily associated with the main image. When asked to identify these connections he correctly chose a shovel with his left hand (controlled by the right hemisphere) and a chicken with his right hand (controlled by the left hemisphere). When asked to explain his choices, he responded: "Oh, that's simple. The chicken claw goes with the chicken, and you need a shovel to clean out the chicken shed." [7]

Gazzaniga concluded that the left brain observed the left hand's choice of a shovel—which stemmed from the right brain's nonverbal, inaccessible knowledge—and offered a fictional explanation to conceal its ignorance of the real reasons for that choice.

Further work indicates that the left-brain can influence memory—sometimes for the worse. In one study, Gazzaniga and his colleagues presented an assortment of novel pictures to the left hemisphere of split-brain patients. Where these new pictures shared elements or themes with a picture that the patients had already studied, the patients often mistakenly identified the new ones as having been seen previously.

It seems that our Broca's Area cannot abide a vacuum, and so wherever there is an information gap, it constructs a fictional narrative that might reasonably account for the body's inexplicable right-brain activity. Here then, is the curious brain machinery that underpins our mystic visions, religious experiences and spiritual fantasies, as well as our false-memories and tire-some conspiracy theories.





The Birth of Culture

Two million years ago the key to human survival would have been membership of a tribe. Lone warriors, roaming the dangerous plains of East Africa, would have enjoyed very short lives indeed. Slow, puny, and bereft of fur, claws or fighting teeth, even the bravest and strongest of them would have been no match for the ice-age predators of those times. But by hunting in packs that prized and rewarded tribal loyalty and heroic cooperation above all, *Homo sapiens* gradually became one of Africa's most formidable predators.

The powerful discord that arose between the primary genetic imperative to survive and reproduce, and the genetic imperative to defend the tribal gene-pool—with life and limb, if necessary—remains with us still. This discord and its attendant tides of emotion characterise all of the moral dilemmas of today, just as they did two million years ago.

But although culture and its morality is plainly a by-product of our genes, it is essential that we remain blind to this fact. If we could see its genetic origins more clearly we would be unable to manufacture sufficient emotion to make our tribalistic cultures work. Our genes therefore prefer that we take the 1 in 30 million bet and believe in the imaginary forces of Goodness and Evil, and in one or more of their unlikely agents—gods, angels, witches, astrologers, psychics, clerics and politicians, to name but a few.

But an old evolutionary problem remains: how do you marry such spectacularly irrational beliefs with an unusual talent for rational thought, and still keep the primate brain running relatively smoothly? . . .

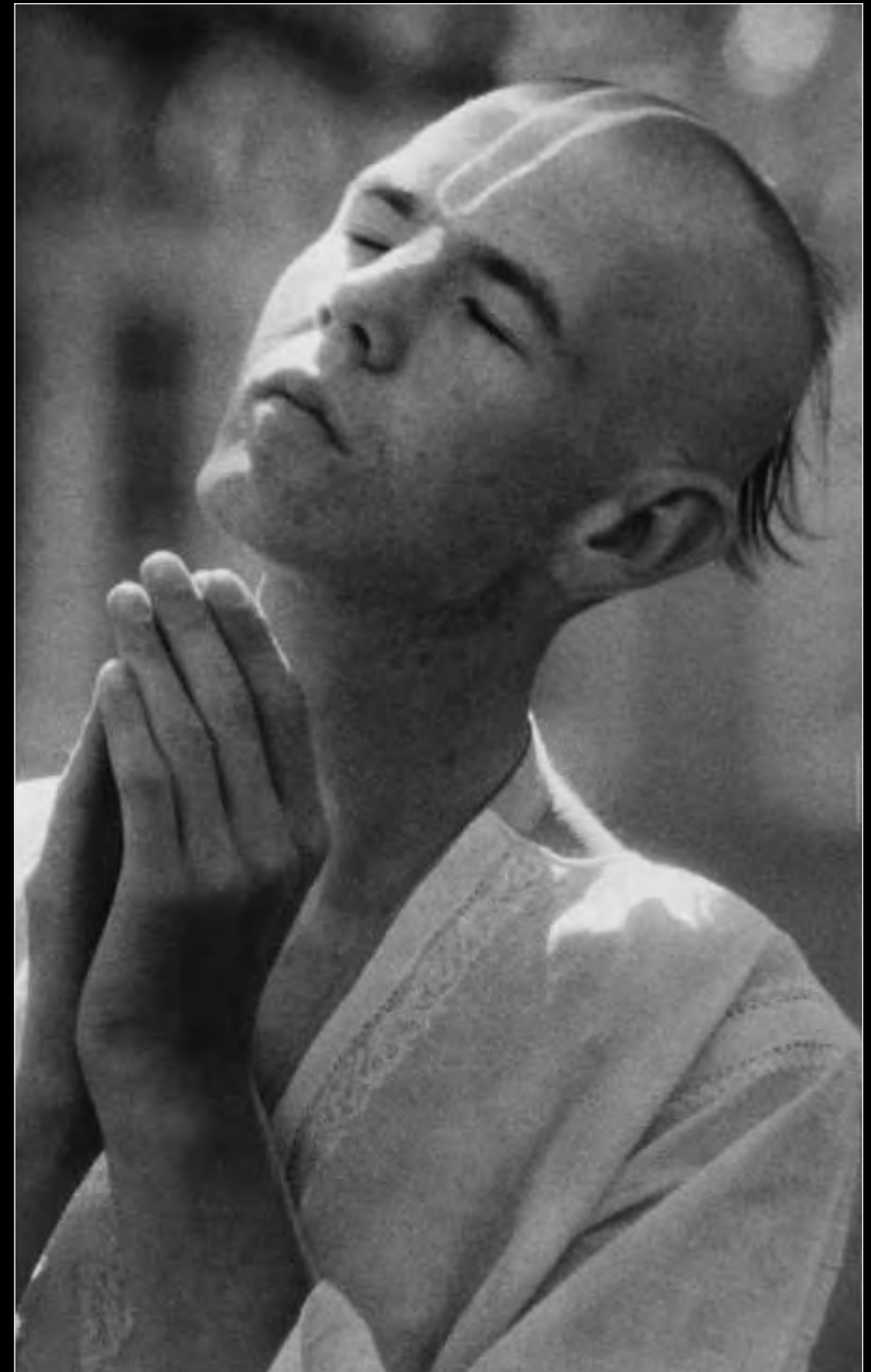
Solving the 'Rational' dilemma

In order to properly accommodate a vital streak of mysticism in an increasingly rational brain it was first necessary for humans to perceive, quite accurately, that their genetic imperatives—in the form of instincts, feelings and desires—represented a source of considerable wisdom and 'super-natural' power; and second, to believe, quite irrationally, that this inner wisdom had its roots in an invisible world of super-intelligence, a mystical world that lay beyond rational comprehension.

Evolution had here hit upon the sweetest of solutions. Such perceptions were guaranteed to produce a faith-dependent species that believed itself to be thoroughly separate from the rest of the animal kingdom, but followed its genetic instructions to the letter—and left more offspring as a consequence.

Here was a gene-driven animal just like any other, and yet one that believed itself to be under special guidance that was not merely 'spiritual', but in most instances 'divine'. Here was a very practical insanity indeed, one that eventually enabled this physically under-endowed 'paragon of animals' to devour the planet like a ripe fruit. (*Homo sapiens* now appropriates almost 40% percent of the solar energy that is photosynthetically trapped by the world's terrestrial vegetation.)

So here at last was a substitute for the fur, claws and fighting teeth that evolution had failed to provide, and here in the guise of mysticism, was the Excalibur that would eventually catapult our species from the brink of extinction to global domination and evolutionary stardom. It might even be argued that human mysticism evolved specifically to counter the development of the rational cortex, in that it was clearly aimed at circumventing our talent for critical analysis and reasoned thought whenever any of our genes perceived a hint of threat to them—or to their alleles.





THE PEACOCK EFFECT

Evolution's great strength lies in the fact that even the most efficient and fecund species are available for culling. This universal vulnerability hinges on what might be called the Peacock Effect. In peacock society the male's spectacular tail is a major reproductive asset, but only in the species' birthplace—a forest. Should the forest disappear, the peacock's cumbersome tail instantly doubles as a gaudy advertisement for fast food in the eyes of any passing predator.

All species possesses adaptive specialisations that have enabled them to survive and reproduce within the habitat that nurtured their specialisation. But change the environment, and such specialisations become handicaps—the more extreme the specialisation, the more lethal the handicap. In other words, each species has its own personal peacock tail, even that paragon of animals, *Homo sapiens*. In an evolutionary sense our peacock tail is just as spectacular as the bird's. The difference is that it is entirely intangible and very well concealed, residing as it does in the three billion base pairs of our DNA.

Our peacock tail is our inherently mystical nature. It is expressed in our peculiar capacity to believe implicitly in the patently unbelievable, and to attribute unnatural power or mystical significance to anything that either contributes to, or threatens, our genetic survival—thereby revealing its true origin. Mysticism's universality and its umbilical links to DNA's primal imperatives, 'survive and reproduce', clearly identify it as a genetic artefact.

Whether our mysticism relies on a belief in supernatural forces such as gods, angels, witchcraft, astrology and intergalactic aliens, or whether we believe in luck, tea leaves, memes or market forces, the precise nature of the belief is of little consequence to our genes. The only thing that matters to them is the quality and strength of the tribal passion that those beliefs generate. Darwinian selection does the rest. Two million years of hunter-gatherer hardship has honed human mysticism into an evolutionary Excalibur of unrivalled power . . .

EMOTION: The Battle-Cry of Genes in Action

The appearance of emotion signals that our genes have been stung into action by some external threat, explicit or implied. From that moment on, any other judgements made by our rational cortex may be overridden or remoulded in favour of ancient genetic behaviour that has survived in human genomes for a million years or more. The switching device is known as the "Suspension of Disbelief". *

The only real problem arises when there is a major discord between behaviour that might help an individual's to survive and reproduce, and behaviour that contributes to the tribe's survival. Such discords lie at the very core of the 'hero's dilemma', and in varying degrees, they represent the genetic foundation of all human 'morality'.

Looked at in this light, all culture is blatantly genetic. It is preserved by emotions that disengage rational thought whenever our genes perceive the slightest threat—to themselves or to their alleles.¹

This allelic imperative is typically reinforced by an variety of social carrots and sticks designed to lock our behaviour into patterns that best preserve our alleles in other members of the 'tribe'.

Since genes tend to replicate, cooperate, and survive in groups, and since alleles therefore tend to cooperate and replicate in similar groups, this helps to explain some of the powerful allegiances that form between 'like-minded' people, whether directly related or not.

It explains the strong loyalty bonds that often exist within social, commercial and political sub-groups, steering them towards behaviours that seems appropriate to them at the time.

Hence our predisposition to adopt mystically driven tribal behaviour of all kinds, and hence our ready resort to fight or flee . . .



The 'Spirit' is in the Gene

"Although our species' conquest of the planet might appear to represent the gradual triumph of the intellect over our brutish nature, in fact, precisely the reverse is true. Being primarily founded on, and driven by, mystical beliefs of one kind or another, human civilisation represents not so much a triumph of the mind over the body as the triumph of the gene over gene-threatening rational thought."

'The Spirit in the Gene' / 'Plague Species'

* See next page

¹ An allele is a corresponding gene (not necessarily identical) that occurs in related individuals.

'Suspension Of Disbelief': Birthplace of Daydreams and Nightmares

There is an intriguing mental device that our genes use whenever they want to squeeze our perceptions into a shape that better suits their purpose. This curious neuronal phenomenon is commonly known in theatrical circles as the 'suspension of disbelief'. The term refers to the brain's ability to switch out reality and replace it with a fictional scenario that rhymes with our genetic imperatives.

Like the 'hot-wire' that a car thief uses to fire up the motor when he has no key, the ancient hotwire that links our senses directly to our genes allows us to by-pass our inexperienced and error-prone rational cortex the moment our genes perceive the slightest threat, either to them or to their alleles. It gives us instant access to behavioural responses, such as 'fight' and 'flight', that have helped to preserve human genomes for the past two million years.

This ancient genetic hotwire has an astonishingly wide variety of every-day uses. The world of entertainment utterly depends on 'suspension of disbelief' to seduce the viewer into switching off rational thought and believing instead in the factitious characters and events that are portrayed on stages and screens around the world.

This ancient neuronal short-circuit switches in the moment a fictional character or event touches one of the multitude of mental buttons that are linked to our basic genetic imperatives to survive and reproduce. Touch one of those buttons and a stew of hormones and neurotransmitters flood the body and brain, generating a rush of emotion that switches out the neuronal cortex, and brings rational assessment to a halt. The imagination fires up, transforming fantasy into 'reality', and in that extraordinary instant almost anything

becomes mentally possible. In that bizarre moment even the most trivial event may be transformed into something 'divine'.

Here is our genes' secret weapon in their age-old struggle to survive and reproduce in a hazardous and unstable environment. Here is the shrewd old genetic midwife that delivers passionate belief in the patently ridiculous—in witchcraft and spells, in gods, miracles, angels and devils; in the validity of religious dogma and astrological predictions; in sustainable development, 'market forces', alien abductions and perpetual economic growth.

In essence then, here is the device that bestows peculiar mystical significance on 'the home team', 'the political party', 'the Church', and 'the Flag', thereby bonding us into families, tribes, nations, religions and ethnic groups; into teenage and criminal gangs, and into political parties and their childish factions. And it was this same dream-making facility that allowed 19 al Qa'eda terrorists to see only heroic martyrdom in their suicidal attacks on New York and Washington on the 11th of November, 2001.

As our social stress levels grow, so will the level of emotion throughout society. And in consequence, our ability to censor reality will grow stronger, nurturing more nightmares in the form of religious, ethnic and political extremism. In this fashion our genes will keep us largely oblivious to the threat of extinction that faces our species as it slides headlong into resource depletion, climate change and population collapse. Midwifed by our inability to disbelieve 'visions' of all kinds, our genetically enforced tribalism will nurture even more extremism—religious, political and pathological.

MYSTICISM: OUR FAUSTIAN BARGAIN

Here then, is our *Excalibur*, our invincible sword. But here too, is a terrible price-tag. Concealed within the gaudy verbal packaging is evolution's insurance against our overwhelming success...



Although language and imagination armed our tribal ancestors with mysticism, the most formidable weapon that evolution had ever unleashed on this fertile planet, our recent flurry of technological and reproductive success has triggered the lethal penalty clause that lay buried inside this former asset. Having helped to midwife our unbridled proliferation and technological extravagance, mysticism will now immobilise and fragment our civilisation, directly in the path of evolution's juggernaut of retribution.

Mysticism, our old Excalibur, "will run us through with due despatch when our little play is done." ([The Spirit in the Gene](#))



OUR EVOLUTIONARY EXCALIBUR

“The widespread acceptance of such credos as creationism, astrology and sustainable economic growth gives adequate warning that the fraction of the population capable of applying even the most basic rules of evidence to mystically derived information is so small as to be inconsequential. It means also that the most seductive and dangerous forms of mysticism, those that underpin racism and religious fundamentalism, are totally bullet proof.

By selectively preserving the mystics among our hominid ancestors evolution not only gave us the weapon that would catapult us from obsolescence to world domination, it seems also to have taken out a shrewd insurance against our overwhelming success. Only such a deliciously rewarding and tamper-proof device as mysticism could have prevented us from foreseeing the danger of overpopulation a long, long time ago.

But despite the folly and the pain that mysticism breeds, we should dread its disappearance. Without it, no dingo would howl nor nightingale sing. Spring, like all life, would be a silent thing indeed.

We may not be able to hurl our Excalibur back into the gene pool from whence it came, but we owe it to our children to lower our shining weapon for a moment or two so that we might gaze just once with undazzled eyes upon this ailing Camelot of ours.” ***(The Spirit in the Gene)***

EASTER ISLAND: An Icon for 'Cultural Collapse'

Like the Tikopians, the Polynesians explorers who colonised Easter Island brought their pets and domestic livestock with them. Among the animals were pigs, chickens and a few rats. The humans and their animal companions were about to play out a human and environmental tragedy of Shakespearian proportions

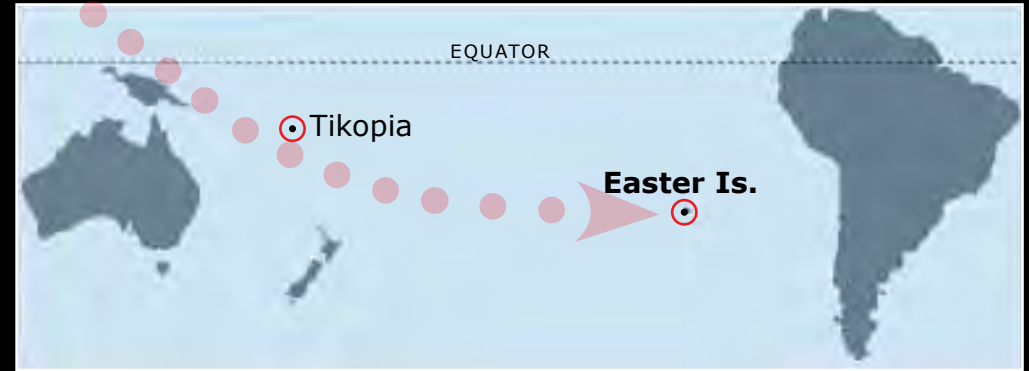
In traditional fashion the islanders set about clearing the island's dense palm forests to provide cropland, pasture and wood for their canoes and cooking fires. They were rewarded by an abundance of food and a satisfying growth in the population.

When most of the island had been cleared however, food and timber became increasingly scarce. But by failing to alter their traditional pattern of farming, hunting and timber-getting they had sealed their evolutionary fate.

As their habitat deteriorated, the population became aggressively tribalised and increasingly mystical. They even continued cutting logs to roll their stone figurines from the quarry to their chosen sites.

When the last trees fell however, they could no longer roll their statues into place, or build new houses or new boats. Erosion accelerated and their harvests shrank. And with no timber to repair their aging fleet they could no longer escape their evolutionary fate. Subjected to these multiplying stresses their mysticism became obsessive, and internecine warfare soon followed.

By the end of the 18th century the island's vibrant culture had largely disintegrated and the population had collapsed. They had paid the standard price that evolution imposes on any species that extracts disproportionate energy from a finite habitat.



Genetic analysis suggests that the first colonisers of the South Pacific region originated from the Taiwan region more than 3,000 years ago. They reached the limit of their eastward migration more than 2,000 years later when they discovered and colonised Easter Island, the most isolated island in the world.



Easter Island's Moai

Almost 400 of these massive stone sculptures, or Moai, are scattered around the island. The largest of the figures lies unfinished in the island's quarry. Carved from volcanic 'tuff', it is 20 metres long and weighs about 245 tonnes—far too large and heavy to have been moved by the few islanders who were left alive at that time.

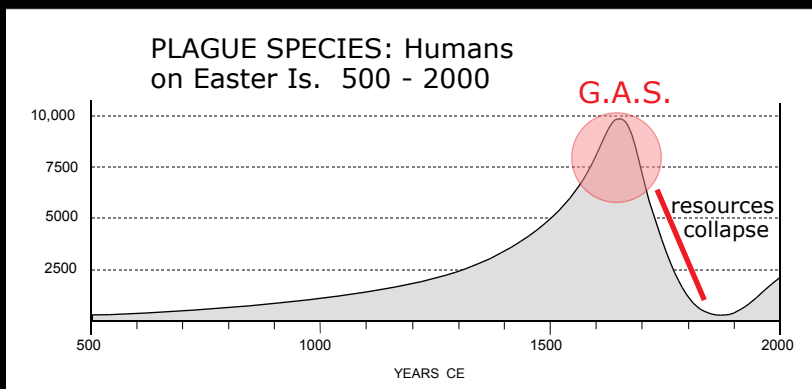
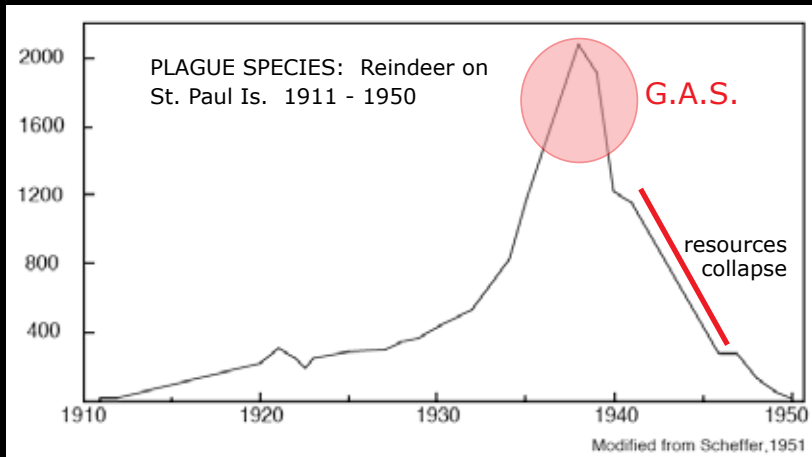
EVOLUTION'S AUTOMATIC PLAGUE LIMITER (G.A.S.)

Exponential population growth by a highly successful species threatens the survival of other species that share its habitat and compete for its energy resources. Inevitably, an automatic plague-limiting device has evolved. It consists of a combination of hormones, enzymes and epigenetic switches that interact to bring exponential growth to a halt and reduce the fecundity rate below replacement level.

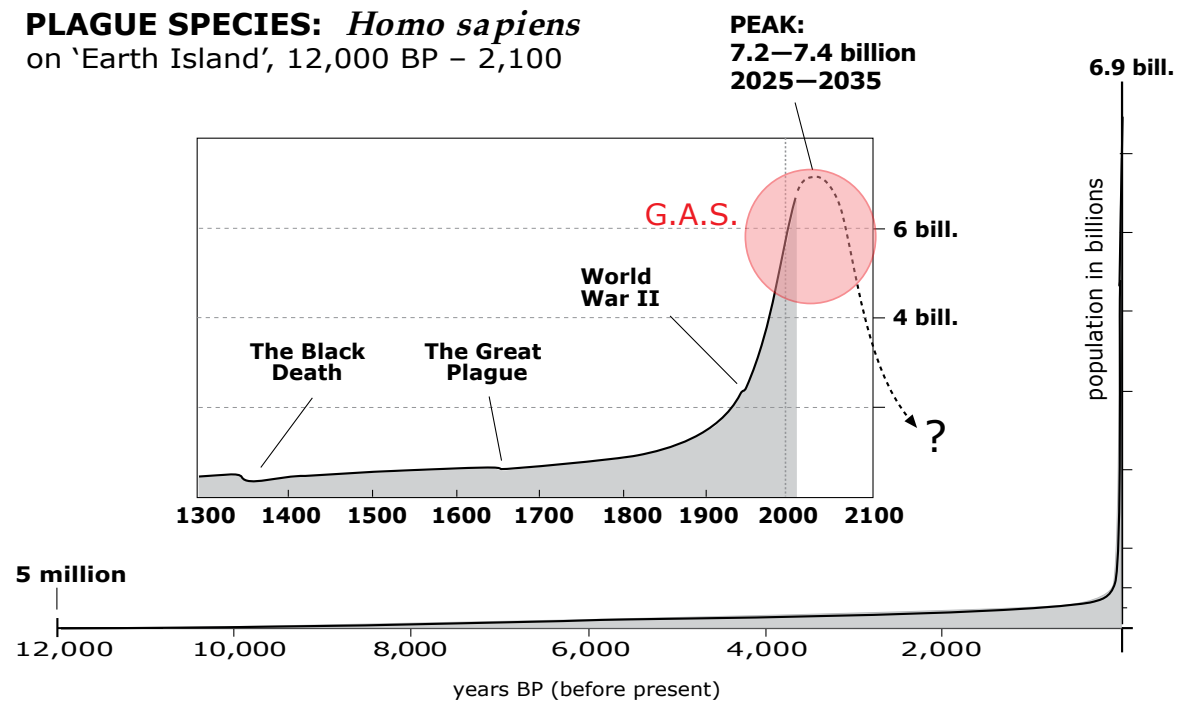
This little-known reproduction brake cuts in well before the environment collapses and food shortage launches the final culling process. Known as the General Adaptation Syndrome, this

evolutionary safeguard was first defined in rodents by Canadian endocrinologist Hans Selye in 1936. He realised this was a stress related response to exponential population growth, and his data showed that it occurred regularly in rodents, both in the wild and in laboratory populations. It later became clear to him that it also applied to many other species, especially humans.

By applying an automatic brake to exponential population growth during an animal plague the General Adaptation Syndrome (GAS) imposes a crucial upper limit to the degree of damage that such events might otherwise inflict on the regional biota.



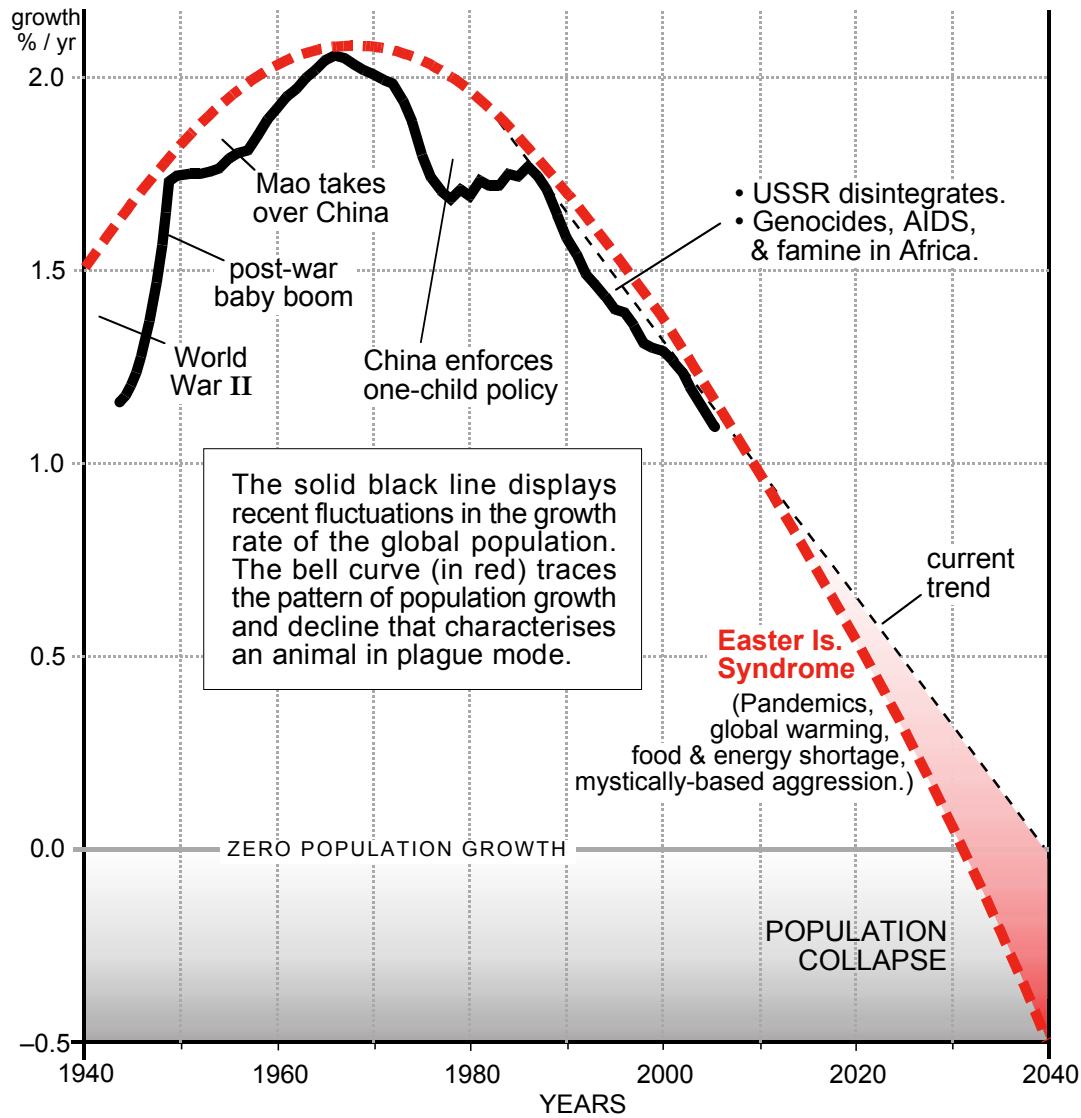
PLAGUE SPECIES: *Homo sapiens*
on 'Earth Island', 12,000 BP - 2,100



Assuming that our species is a typical by-product of genetic and Darwinian evolution this is the kind of graph we should expect to see. The period of explosive exponential growth between about 1800 and 1967 makes the label 'Plague Species' unavoidable.

POPULATION GROWTH

Expressed in percent per year

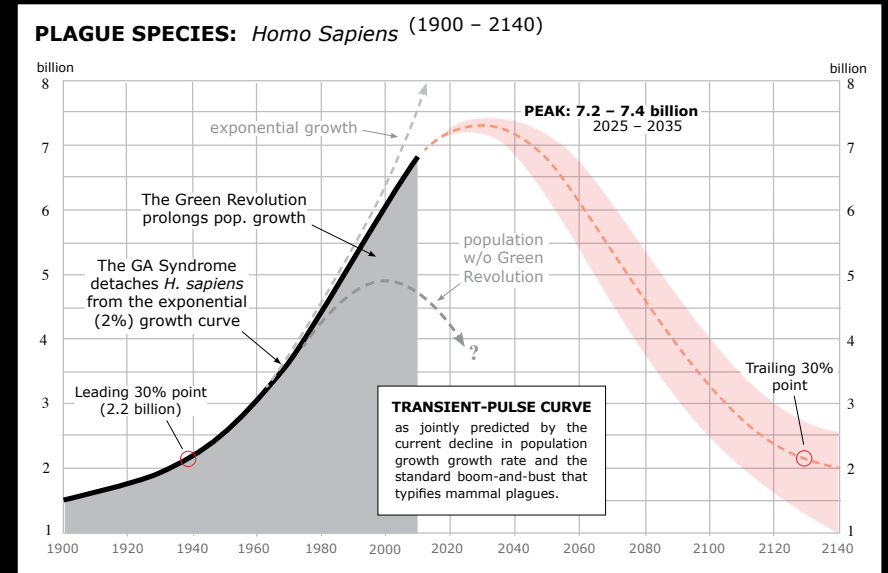


THE EASTER ISLAND SYNDROME

This is the standard pattern of exponential boom and bust that defines all animal plagues. Its graph describes what is known as a transient pulse, or more simply, a 'bell curve'.

Our species detached itself from its exponential growth trajectory in the late 1960s, but instead of swiftly peaking and declining as other plagues do, our fecundity became prolonged by the abundance of food that was generated by the so-called Green Revolution.

This technology-boostered abundance has finally come to an end, however, and as the looming shortage of gross energy (food and fuel) begins to bite, so our fecundity will decline, producing a population peak of somewhere between 7.2 and 7.4 billion people around 2030. An accelerating decline in fecundity will then launch our species into a standard plague collapse that mirrors our explosive growth phase.



CULTURE'S SHINING EXCEPTION

"A culture must keep growing in order to remain vibrant and strong!"

Despite the inane nature of this axiom it has become the cornerstone of modern civilisation and the catch-cry of economists and politicians alike.

One exception to this suicidal cultural rule stands out: the society of Tikopia in the south-western Pacific. It began as a typical Polynesian settlement nearly 3,000 years ago, and its inhabitants followed the standard pattern of 'civilised' behaviour: extensive land clearing, followed by diligent farming, hunting and fishing.

This traditional pattern initially produces a fairly regular abundance of food that results in population growth and cultural prosperity. If the land is reasonably fertile and the people are diligent such populations invariably peak within a thousand years and then collapse in the dismal fashion that was epitomised on Easter Island in the South Pacific during the 17th and 18th centuries.

However, thanks to an astonishing flash of insight that occurred about a thousand years ago on Tikopia, its inhabitants managed to relinquish tradition and adopt an entirely new pattern of behaviour designed to restore the island's ecological balance, limit their population, and avoid an 'Easter-Island collapse'.

Their recipe for survival was rigorous to the point of savagery:

- Re-establish the island's forests and grasslands via an 'Arbor culture'.
- Eliminate all pigs. (As omnivores, pigs were too competitive).
- Enforce rigid birth control (via infanticide where necessary).
- Send undisciplined young men on 'no-return' canoe voyages.

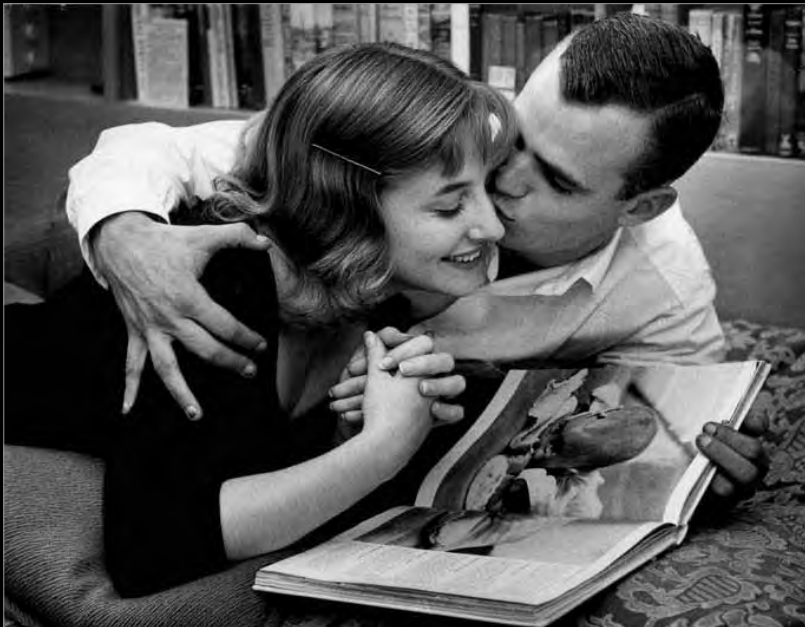
By enforcing these strategies and by exclusively planting only those forest species that offered some nutritional aspect, the Tikopians managed to stabilise their habitat, their population and their culture for the next thousand years. It represents a cultural triumph that appears to be unparalleled in human history.



Tikopia is a very small volcanic island at the south-western edge of the Pacific plate. It was discovered and colonised about 2,900 years ago by a small group of Polynesian explorers. Within 800 years much of the forest had been cleared and the population had exploded. During the next 1000 years the Tikopians restored the island's ecology and limited the population to about 1000 inhabitants.



ALL BEHAVIOUR IS GENETIC



This is the molecular reality that binds all life together.

**Here is an aside that was scribbled in a notebook 150 years ago
by one of our species' most accurate and perceptive observers of the natural world:**

*“Thought, however unintelligible it may be, seems as much a function of organ, as bile of liver.
This view should teach one profound humility, no one deserves credit for anything.
. . . nor ought one to blame others.”*

Charles Darwin

Sadly, this fact-based proposition is as unpalatable now as when Darwin noted it,
and he very wisely refrained from pursuing the subject in his books.

Had he pursued it, his books would have been burnt as heresy,
his seminal insights would have been spurned,
and his work would have slipped
into obscurity.

END

NOTES

AUTISM & STRESS

[1] Eric Courchesne, *et al.* University of California San Diego Autism Center of Excellence, "Autism Linked with Excess of Neurons in Prefrontal Cortex." *Journal of the American Medical Association*. "We found a really remarkable 67 per cent increase in the total number of brain cells in the prefrontal cortex," says Courchesne.

Ian Weaver, Moshe Szyf and Michael Meaney, "Maternal care effects on the hippocampal transcriptome and anxiety-mediated behaviors in the offspring that are reversible in adulthood". *Nature Neuroscience* vol.7 p.847, 2004 (Proceedings, National Academy of Sciences.)

MEMORY, SHORT AND LONG-TERM

[2] Courtney Miller and David Sweatt. "Covalent Modification of DNA Regulates Memory Formation", *Neuron*, Volume 53, Issue 6, pp.857-869, 15 March 2007

EVOLUTION OF THE HUMAN BRAIN

[3] Benjamin Libet, a Californian neurophysiologist, demonstrated in the 1990s that the brain starts responding to an external command about 500ms before a person makes a conscious decision, suggesting that free will is a rationalization produced by the mind after the fact to explain its actions. As a result of this research he was awarded the very first Nobel Prize for Psychology in 2003. Libet summarized his research in the 2004 book "Mind Time: The Temporal Factor in Consciousness."

See also: Peter Halligan and David Oakley, "The Greatest Myth of All", *New Scientist*, 18.11.2000, pp.34-39.

MECHANICS OF DELUSION

[4] Richard F. Thompson, *The Brain*, 1985, pp.19-21.

OUR SPLIT BRAIN

[5] R.W. Sperry, "Lateral specialisation in the surgically separated hemispheres." *Neurosciences: Third Study Program*, 1974, pp.5-19.

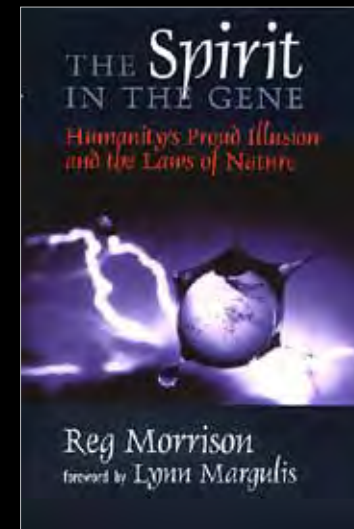
(Sperry was awarded a Nobel Prize in 1981 for his work with split-brain patients.)

[6] Anne Moir and David Jessel, *Brain Sex* (1989) 1992, pp.39-49.

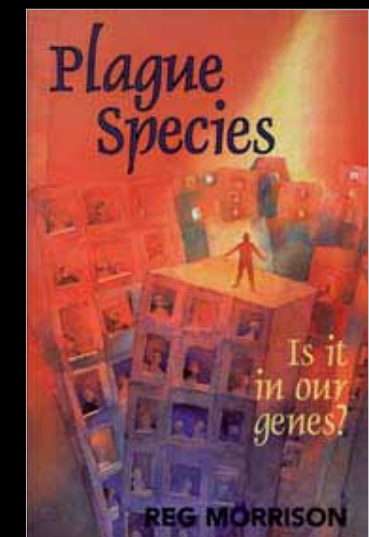
[7] Michael Gazzaniga, "The Split Brain Revisited", *Scientific American* 1998, pp.35-39.

See also M.J. Tramo *et al.*, "Hemispheric Specialisation and Interhemispheric Integration", in *Epilepsy and the Corpus Callosum*, 1995.

"*Evolution's Problem Gambler*" is based on, and also contains extracts from *The Spirit in the Gene*. (Cornell University Press, New York, 1999.)



The book summarises the massive impact that humans have had on the biosphere, and explores the evolutionary origins of the behaviour that produced this impact.



This book was revised and republished in 2003 by Reed New Holland, Sydney, under the title *Plague Species: Is it in our genes?*

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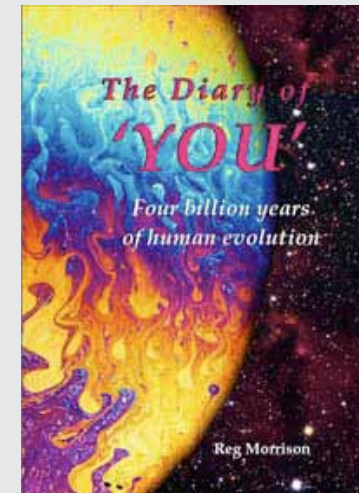
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Biographical note

Originally a West Australian, Reg Morrison is now a Sydney-based writer-photographer who, for the past 25 years, has specialised in environmental and evolutionary matters. His latest book, ***THE DIARY OF 'YOU': Four-billion-years of human evolution***, explores the evolution of the essential cellular features and chemical pathways that now characterise us. Compressed into 12 'diary' installments, the momentous events that produced these biological milestones builds a narrative of evolution that highlights its inherent majesty and drama. This richly illustrated book represents a new kind of biology resource for students and teachers in Australian High Schools. (Sainty & Associates, 2008)



A companion work, ***Australia's Four-billion-year Diary***, similarly compresses the geologic and tectonic evolution of the continent into 12 'monthly' episodes. Illustrated by maps, diagrams, and photographs, each chapter is also accompanied by references to the biological significance of those evolutionary events. The book is primarily designed for High School teachers and students doing Earth and Environmental Science. (Sainty & Associates, 2005).

The author is indebted to a number of Australian and American university professors for their help in compiling the evolutionary narratives outlined in each of these books.

By the same author:

Australia, Land Beyond Time, New Holland Publishers, 2002
(original title: ***The Voyage of the Great Southern Ark***, 1988).
The Great Australian Wilderness, Phillip Mathews Publishers, 1993.
Australian's Exposed, Paul Hamlyn, Sydney, 1973.