

**Some atavistic mental states : being a lecture delivered before the
Hongkong Branch of the British Medical Association on January 28th, 1909
/ by C. Marsh Beadnell.**

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SOME ATAVISTIC MENTAL STATES

-- BEING --

A LECTURE DELIVERED BEFORE THE

HONGKONG BRANCH OF THE

BRITISH MEDICAL ASSOCIATION

-- ON --

January 28th, 1909.

-- BY --

FLEET SURGEON C. MARSH BEADNELL.



With the Author's Compliments -

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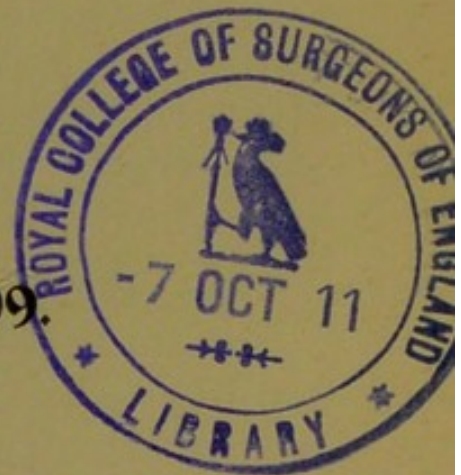
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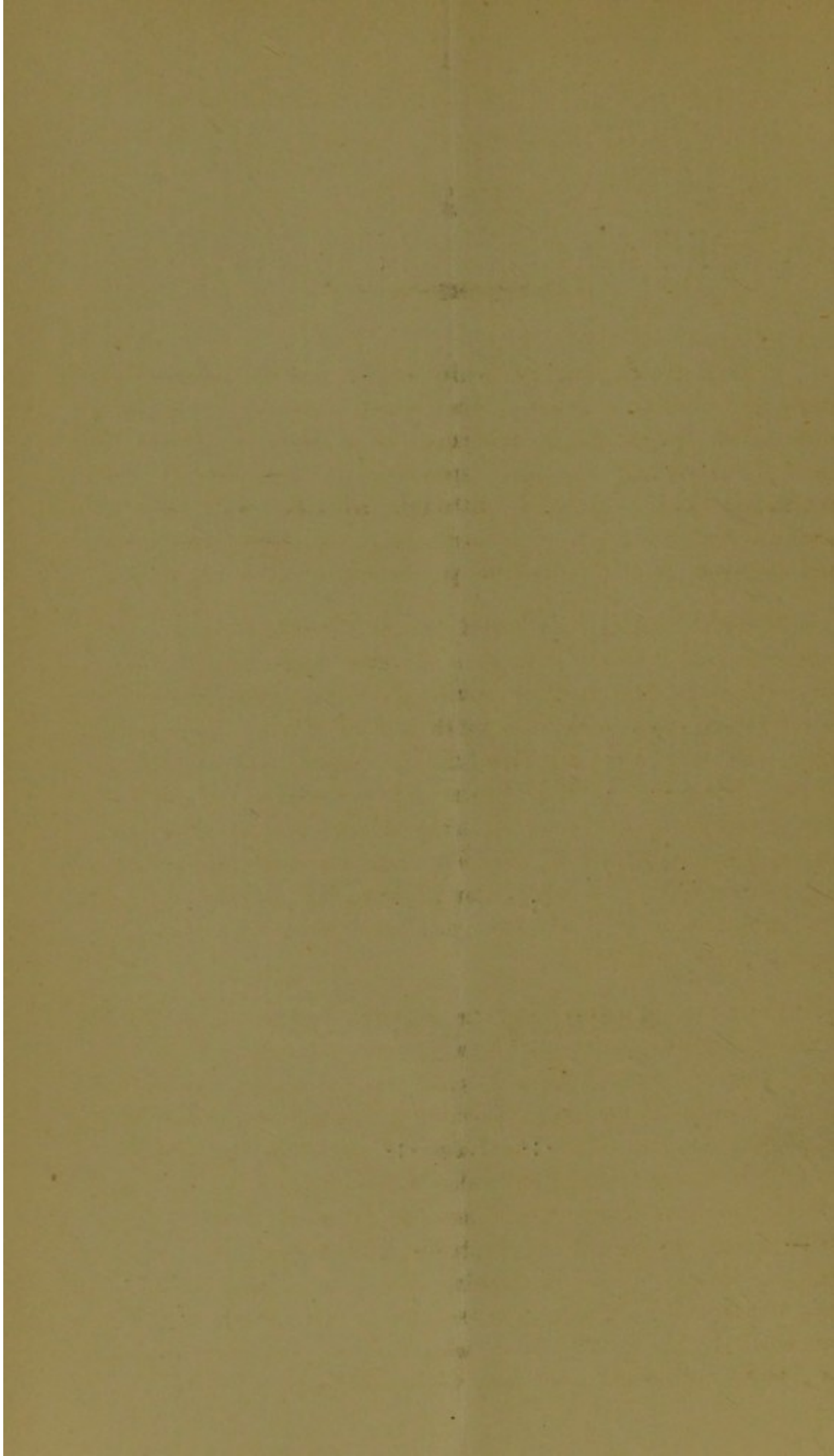
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SOME ATAVISTIC MENTAL STATES.

I have chosen this particular subject partly because the study of evolution, whether of the human frame or of the mind with which that frame is associated, or of matter in general, is one of exceeding interest especially to members of our profession, partly because, although teeming with facts of practical significance it has hitherto been but little investigated and discussed from the medical point of view.

Medicine, using the word in its broadest sense, now covers so vast a field that there is an ever increasing tendency for workers in that field to devote their attention exclusively to subordinate features and so get their field of vision encroached upon and their horizon limited, thus it is good, now and again, to raise ourselves out of our own little accustomed groove and take a comprehensive view of things as they are, as they were and as, possibly, they will be. For these various reasons I ask you to overlook my presumption in bringing forward a paper that does not conform to what you have been accustomed to regard as the orthodox.

There is probably no one here to-night who does not acknowledge that the body of man has evolved from a lower and more primitive form, that such is the case has been demonstrated by an overwhelming mass of evidence and an irresistible array of proofs. On the other hand some of you, like the physicist Sir Oliver Lodge and the naturalist Alfred Russell Wallace may not feel disposed to admit the same of the mind of man. This half-hearted acceptance of evolution comes from the prevailing but faulty habit of picking out the mind of civilised man and devoting the attention exclusively to it. Such wonderful faculties as the musical and mathematical bewilder us and we shake our heads and deny their counterpart in the lower

animal world. In committing this error we wilfully ignore the fact that we are taking into consideration only one out of countless units in a measureless chain. What we ought to do, is to pass in review the various units in the chain and make a comparative study of them. If this be done we are almost forced to acknowledge that there is a practically unbroken line of continuity from the mind of man, through that of the savage, ape and dog, the conscious nervous processes of the reptile, amphibian and fish, the less complex nervous processes of the mollusc and medusa, the elementary sensitiveness of the paramoecium and amoeba, the attractions and repulsions of the microorganisms, until ultimately we arrive at that diffuse irritability of matter in general. "To the evolutionist the scientific spirit of research is but an exalted brute curiosity, itself the outcome of the habit of examining all things in search of food. Artistic genius has evolved from monkey-imitativeness, loyalty and piety spring from filial love, gentleness and kindness from parental love. That love which so exalts and softens a man's whole life is yet based upon the desire which impels the male to seek a mate, maiden modesty and coyness is the outcome of that sexual timidity which by making the females flee from the males increases rivalry and ardency among the latter and so benefits the species as a whole." The love of little girls for dolls, of old maids for cats is a throwback to the fundamental instinct of maternity, the love of wanton destruction seen in boys, and of hunting and killing game in men is related to the struggles and pursuits of far-off ancestors. The instinctive horror sometimes seen in young children for old people may be not unconnected with the fact that in primitive societies it was the wisest, most experienced and consequently the oldest and most grizzly individual who meted out punishment to unruly members. Just as a new-born and blind kitten will spit and scratch at the hand that has just fondled a dog, so a baby that has not yet learnt to distinguish its mother's face will shrink at a gruff voice. Traced to its ultimate stronghold we are forced to own we know nothing of mind, but it is equally true that fundamentally we know nothing of matter. Are they separate entities or are they inseparable or are they different aspects of the same thing?

In his Presidential address to the British Association last year Professor Darwin, son of the great naturalist, stated that there is something psychic in all living things, plants included. At no point can we say "Here is mind" or "Here mind ceases". Matter has become so dematerialised by modern science that its endowment with the potentialities of mind is unavoidable. I think it was Tyndall who said "in the nebula are the potentialities of the human mind". Matter of all kinds is irritable and retains impressions made upon it for variable lengths of time, a razor blade gets "fatigued" and blunt after frequent use but "recovers" and becomes once more sharp after a period of rest; platinum reacts in the bolometer to a ray of light so feeble as to raise its temperature only the one hundred millionth of a degree, witness also the phenomena of remaining magnetism and the curious behaviour of electrodes after use.

Anaesthetics diminish and then abolish the irritability not only of animal but plant protoplasm and potassium bromide slows the activity of both a human brain and a photographic negative. Le Bon in his work "*L'Evolution de la Matière*" claims that matter is endowed with an unconscious sensibility to which the conscious sensibility of no living thing makes any approach. Nature should no longer be divided into living and not-living but into dynamic and adynamic worlds. Consider the potentialities of so wondrous and complex a thing as the human brain which for our purpose may be looked upon as matter highly differentiated and specialised for the purpose of storing up impressions. It consists of an agglomeration of centres all interconnected by an amazing network of fibres. Each centre is composed of thousands of neurons or cells with their nuclei, dendrons and filamentous dendrites for receiving and transmitting modes of motion to contiguous cells. These myriads of neurons are divided up into the physiological units or biogens and each of these units is made up of molecules. A single molecule of protoplasm contains some nine hundred atoms each of which is now looked upon as a small universe in itself, a single atom of Oxygen, one of the most important of the brain elements, is composed of sixteen thousand electrons all of which whirl round at the inconceivable speed of many thousands of miles per second

and at distances, which, relative to their size, are enormous. "These electrons are now regarded as centres of strain in the ether and the energy of but a few such electronic systems is stupendous." My main purpose to-night is to submit to you that many otherwise inexplicable phenomena exhibited in certain mental states become quite comprehensible on the supposition that those inscrutable and complex molecular processes going on in the brain-cells, have themselves evolved from more primitive and less complex molecular processes. The mental centres which in our primitive ancestors were the highest, are, in civilised man, either absent, suppressed or relegated to a position subordinate to more recently developed centres. However in abnormal brain conditions these former centres may once more usurp authority, and when this is the case the mental state of the individual is atavistic, for example, a man afflicted with kleptomania, homicidal mania or a lust of cruelty is undoubtedly in a condition of mental atavism. It was essential for the very existence of the primitive clan that its members should be murderers and thieves, cunning, ferocious, fraudulent and cruel but such qualities are now for the most part atavistic and are being transmitted in a decreasing ratio; crime is diminishing and man becoming more humane.

What is meant by atavism? It consists firstly in "the attainment of a functional condition by structures normally suppressed;" secondly "in the reversion of bodily parts to a primitive type." In its development the last descendant of a species must recapitulate the traits of the first ancestor plus the traits in their order of all succeeding ancestors, thus presenting a fleeting resemblance to each in turn. Atavism is therefore simply "an arrest of development, a halting at a stage reached by some forefather."

In dreamless sleep all the mental centres, being in a condition of anaemia are functionless; but in dreams this is true for the highest and most recently developed centres only, the lower and more primitive are bathed in blood and active. In normal waking conditions the higher neurons are constantly inhibiting or augmenting the activities of the lower, telegraphing to them,

as it were, messages of guidance and control. Our desires are the product of ancestral conditions reaching far back into the past and in many ways out of keeping with modern times. When angered, our first impulse is to strike the offending individual, such doubtless was the invariable course adopted by primitive ancestors. However before the order from the lower neurons can be obeyed—perhaps the hand is already uplifted to strike the deadly blow—the noblest individuals in the citadel of the mind flash down a peremptory, “No!,” the hand is stayed and trouble averted. A starving man passes a baker’s shop, lower brain cells whisper “Here is food, seize it and allay your pangs.” Ages ago such an order would have been unhesitatingly complied with, just as a hungry monkey at the present day will snatch a banana irrespective of consequences. In certain stages of dreams, deliria etc: the higher brain-cells are dormant and the lower become *pro tem* the ruling powers. In such conditions the mind reverts to a more primitive type, sensations and thoughts are experienced, and acts performed all of which are entirely at variance with those of the healthy waking state. The conscious or subjective states consist of (1) Sensations and Emotions; (2) Intellect; (3) Will or Volition. The simplest mental operation is a sensation, that is, the conscious reception of an impression from the outer world. Group the sensations together and so bring the object before the mind and you have a perception; just as perceptions are built up of sensations so the highest intellectual operations, known as conceptions are built up of perceptions, e.g. by smelling, tasting or seeing a certain object we experience a *sensation*, grouping these together we have the *perception, apple*, and ultimately we arrive at the *conception, fruit*.

Most people have experienced that horrible nightmare of falling over a precipice. Usually just as the victim is about to be dashed to pieces at the bottom of the imaginary cliff he awakes with a startled cry, thus, though suffering all the mental tortures of “falling” he escapes the more serious shock of the actual “stopping”; this latter fact has an interesting explanation. Our remote ancestors, in order to escape their nocturnal foes, slept like many existing simians, cradled in the tree tops. To fall from their perches during sleep or boisterous

weather could have been by no means an uncommon event, but it is highly probable they succeeded in saving themselves in their headlong flight through the darkness by clutching the branches. The motions of "frantic clutching" may be witnessed in the human being when through any cause the higher mental cells are less active than lower ones. Doubtless this is why a child so constantly throws its arms above its head at the same time opening and shutting its little fists. Again in dreams and certain stages of anaesthesia the hands are sometimes thrown upwards alternately opening and shutting in a spasmodic manner. Drowning men clutch at a straw. Why? Because higher mental centres have given up the ghost and from lower ones emanate orders that would have been useful under somewhat similar circumstances ages ago; hence drowning men when about to sink, throw up their hands making wild clutching movements. Why should this "falling through space" dream recur so persistently in the human race? Because the vivid sensations consequent upon the "falls" to which our arboreal ancestors were so liable caused impresses to be registered in their cerebral cells and these impresses, in time, became transmitted to descendants. When, in the latter, these particular cells are called into play a phantasmal fall through space is experienced. Those of our ancestors who fell to the bottom of the tree were killed or so injured that the reproduction of their kind was prevented; hence molecular changes in the neurons due to the shock of "stopping" would not be transmitted. This explains why, just before the dreamer reaches the bottom of the precipice, he awakes.

A not uncommon nightmare is one in which the sleeper is pursued by terrible monsters. Shrieking with terror, his legs like lumps of lead, he is in much the same pitiable condition as the bird hypnotised by the snake, happily, he awakes just before the dream-monster actually pounces upon him. Our prehistoric progenitors lived surrounded by formidable and fierce leviathans and in those perilous times must have been frequently chased by them. Those lucky enough to escape would transmit to their descendants the cerebral changes resulting from the exciting run for life.

The emotion of fear is shewn by innervation of the voluntary muscles and convulsive tremors, in extreme cases all movements are suppressed and one is rooted to the spot; the voice becomes hoarse and ultimately fails; the various secretions cease, the mouth becomes dry, there are cold sweats, "goose-flesh", "the hair stands on end", and the "flesh creeps". This "creeping flesh" feeling is due probably to an apposition of all the hair of the body to the skin just as a frightened bird wishing to escape observation presses his feathers close to his body. The "thrill down the back" experienced at the sound of martial music or at the scratching of a slate pencil is due to powerful contraction of the hair muscles causing a ridge of hair along the backbone to partially erect itself. Our ancestors employed this device when they heard the loud roar of a foe as it gave them a more formidable appearance; the phenomenon may constantly be witnessed to this day in the domestic cat and dog.

Fear further causes evacuations of the stomach, bowel and bladder; constriction of the blood-vessels and shivering, pallor, dilated pupils and proptosis and, in extreme cases, death. Some of these stages were, in the past, means adapted to an end, viz:—escaping and concealing oneself from an enemy, assuming the defensive in view of attack; but it is difficult to understand why at the decisive moment men and animals become paralyzed and cataplectic.

In acute alcoholism atavistic mental states are peculiarly in evidence. There is first of all a period of excitement, the very antithesis of calm and deliberate reflection, the inhibitory function of the will disappears and the man can no longer control his tongue but tells all his secrets, delicate voluntary movements lack coordination, semi-automatic movements become affected and he staggers, muscular tone is weakened and he collapses in a heap, reflex movements disappear and finally the fundamental mechanism of circulation and respiration is destroyed, thus we witness a paralysis of nerve centres in the inverse order of their evolution. The same is true in chronic alcoholism, the disinterested emotions vanish first, the altruistic next, then the ego-altruistic and finally the purely egoistic emotions.

Some symptoms in *delirium tremens* are also very suggestive of bygone days. "Loathsome reptiles and insects harass the unfortunate sufferer on every side, snakes, rats and great black-beetles crawl and run over his bedclothes, he peers into corners and behind cupboards, lifts imaginary objects from the ground, shakes them, stamps and scrapes with his foot as though crushing an insect, he claps his hand to his thigh to crush a huge spider which, he says, was crawling up him." Monkeys and human beings, especially women, show an inborn horror of all crawling and creeping animals. When our fingers are burnt or otherwise hurt we flick them to and fro in a manner suggestive of a monkey trying to shake off a hurtful insect and the mere sight of a large spider will often cause some of us to indulge in these movements. We do so because such action was useful to ancestors when a noxious insect clung to their prying finger tips. In the emotion of despair, we "wring our hands" and so revert to this primitive movement. The phenomenon known as "picking at the bedclothes" is an alarming symptom in delirium as it generally presages the end and it is significant that the movements of the hands and fingers are precisely those of a person essaying to snatch up an insect and throw it away. Paralyzed portions of the body often show those involuntary never-ceasing movements known as athetosis, the fingers and toes working in a tentacle-like manner. Nystagmus again, is proof of mental degeneracy and like other mental reversions is frequently associated with bodily-reversions such as the Darwinian ear, supernumerary digits, lengthened coccyx, polymastism, hermaphroditism, *uterus bicornis*, hypertrichosis etc.: A monkey's eyeballs often oscillate laterally with such frequency that we should call the state pathological in man but in the simian these movements are necessary as it is constantly on the lookout for possible foes. Nystagmus plus the head-nodding of infants is a beautiful example of the usurpation of authority by subordinate or rather insubordinate centres. In conjugate deviation of the head and eyes, the highest centre merely gives the general order to turn head and eyes to the right it is the subsidiary centres who arrange that this is to be accomplished by the external rectus of the right eye supplied by the sixth nerve and the internal rectus of the left eye supplied by the

third nerve and numerous other muscles of the neck and back of both sides.

The first stage of language is simple intonation and we scold a dog in deep tones and caress a baby in falsetto. Reptiles as a class are more or less silent but when they do emit sounds these as a rule are simple and primitive, often little more than a hiss. Now birds are a comparatively late offshoot of the reptiles and as a class are the opposite of silent, many have the power of pouring forth most beautiful melodies. It is significant that the nestlings of the robin, willow wren and, I believe, of most singing birds will, when alarmed, hiss. The parrot, too, when frightened will make a hiss-like sound. In aphasia infantile characters of the speech are noticeable, e.g. lisping and the cutting off of terminals and initial syllables, "a kind of overflow occurs in the brain, so that primitive, emotional and expletive expressions get recorded in the right as well as the left brain. Thus if speech be lost owing to a lesion in the left brain, the right is able to reproduce these primitive expressions, and in young children may be educated to take the place of the left."

Laughter is a form of speech and also has its atavistic side. Monkeys will smile and chuckle when pleased; in the human infant it is significant that the smile appears at the second month, but the laugh not until the fourth. Laughter consists of two elements, there is the recently-added or civilized which consists in the consciousness of some incongruity, and there is the primitive and atavistic which consists in the consciousness on the part of the laugher of some superiority over the person laughed at. A monkey dressed up in clothes makes us laugh because of the incongruity and because only pleasurable feelings are raised, but a broken-down old lady carrying a heavy burden does not evoke laughter because, although the incongruity is there, yet painful feelings are raised. The most brutal expressions of laughter is that of the savage when trampling on his vanquished foe, the most kindhearted person still shows traces of this brutal element when he laughs at any slight loss of dignity in another, such for instance as the stout man chasing his top-hat. Other examples of atavistic laughter are seen in the laugh of the insane—in the general paralytic it

is often little more than a ululation—and in that of those well-meaning but hysterical people who cannot help bursting into fits of uncontrollable laughter when a serious and disastrous accident happens to their nearest and dearest friends.

Colour plays a conspicuous part in dreams and hallucinations. As regards the colour red this may be partly due to light penetrating the fine capillary meshwork of the eyelids and so reaching the retina; but that there are other causes is proved by the fact that dreams and hallucinations in which his colour figures, may occur in darkness. We must probe deeper for the true explanation. Why have red, green and blue been fixed upon as the three primary colours? Because they are just those that most appealed to the colour-sense of primitive man, above him the blue vault of heaven, around him, vegetation and inside him, blood. When one of our primitive ancestors was mauled in the field, he connected the flowing blood with the pain of the wound; long after it had healed the red colour of blood would call up the memory of the past pain. The effect of a red rag on a bull is well known, the sight of blood infuriates the wild buffalo and kindles the latent passions of strife among savages and the coarser types of civilised man. Australian aborigines work themselves into a frenzy before battle by sprinkling their blood over one another; on the other hand monkeys exhibit horror if shewn blood and many human beings, even children who have never seen it and in whom therefore the cause must be hereditary, will swoon away at the sight of this red fluid.

Many animals are parti-coloured red as a warning to would-be destroyers that they are unpalatable, for instance the Sphinx caterpillar. The red breasts of the robin and bullfinch and the red eye-spot of the wild-cock bear relation to their notorious pugnacity. The red spines of fishes and the red sterns of many stinging insects are danger signals; the wattles of the turkey, comb of the cock and cheek of the maiden become deep red in anger and the universal recognition of this colour as one of danger has even extended to signals, poison labels and doctors' lamps.

Gower describes how, in one of his epileptic patients visions of a red light preceded the epileptic seizure; in another patient under Graham's care the aura was the appearance of a hideous old woman in a red cloak who struck the sufferer on the head whereupon he fell to the ground in convulsions. The epidemics of dancing in Germany and the Netherlands in the Middle Ages were started by "red visions" and the afflicted thought they were wading in seas of blood, again, a patient with delirium tremens was haunted by red lanterns swinging from trees. The conspicuous part which red plays in these hallucinations is an indication, supposing our theory to be true, of how forcibly it must have appealed to primitive man.

The colour yellow is associated with disgust. Just as pain is a sensation protecting the skin, so disgust protects the alimentary canal. A dog from whom Goltz had removed the cerebral hemispheres starved rather than eat meat saturated with quinine, yet his own pet dog ate it when coaxed to do so, but with many signs of disgust. The most refined and delicate people will vomit at a disgusting smell or sight owing to an association of ideas, the act of vomiting would have been useful under somewhat similar circumstances in bygone times. Sulphuretted hydrogen and other gases cause marked signs of disgust, the smell suggests a corpse, foul and toxic substances, disgust is also aroused by parasites and venomous reptiles. Nasty-tasting and bad-smelling butterflies and marine polypes are coloured yellow with the object of repelling, many snakes and newts have a yellow underside and the latter animals when in danger, will throw themselves belly upwards, and so present the colour; poisonous toadstools and the excrements of most mammals are yellow, from all which we see that there is a great deal in the old saying "All is yellow to the jaundiced eye".

Sensations of sound occur in dreams and disease with great frequency. At that early period in the history of the race when all life was aquatic, sound vibrations were "felt" but not "heard". When later our ancestors emerged from the water and struggled for existence, first on the littoral shores and then on dry land, a portion of the epiblast in the cephalic region became modified

into a primitive organ of hearing and for the first time, noise was heard.

As the ages rolled on and this primitive receptacle of sound improved, regular sound vibrations, in other words, music, began to be discriminated. Now music is but "organised noise" and may be divided into simple or melodic and complex or harmonic. Many of the lower animals and all races of men appreciate melody, but harmony, being a later product is only appreciated by civilised races. Our prehistoric ancestors, though delighting in melody, had no knowledge of harmony and only melody or the most rudimentary harmony appeals to the present-day savage. Noises are frequently heard in dreams, melodic music to a less extent and harmony only on the rarest occasions and by the gifted few. Just as the events of early youth figure largely in the dreams of old age at the expense of current events, so sound and simple melody figure more frequently in dreams than does harmony, appreciation of which is a comparatively late achievement of the human race.

Dream sensations of suffocation recur with comparative frequency. Local causes no doubt account for some, for instance, the bedclothes fall across the face, or an overfull stomach interferes with the action of the heart and lungs. However, their persistence in the human species may possibly be due to the fact that certain usually quiescent cerebral cells whose ancestors received impressions, millions of years ago, at a stage of the world's history when our forefathers were terrestrial-aquatic in their habits, suddenly spring into activity.

Human consciousness has been derived from the consciousness of free living organisms by the same evolutionary processes as those which have evolved the human body from the bodies of separate organisms. At the very threshold of life "a little active, hungry, katabolic cell unites in fatigue with a larger, passive, anabolic one"; the spermatozoid and ovule do on a small scale what the two completed individuals do on a large one and in each instance the same fundamental impelling force is at work.

Civilised people have acquired the power of curbing their

passions, in dreams and conditions of mental instability this power is to a great extent lost and the most timid and demure will behave in a quite unnatural manner. The life of lower animals is regulated by instincts, in the higher these are controlled by intelligence and in the highest, instincts are practically subordinated to intelligence: the monkey has but little control over his violent passions of love and hate, and prehistoric man was more swayed by such emotions than is the untutored savage of to day. Intelligence is more powerful than instinct since it protects the animal in unforeseen dangers, a mole-cricket instinctively tries to bury itself when placed upon a glass plate, intelligence would tell it that to try and scratch up glass is useless and that flight would be the better course.

The emotion of anger constitutes a powerful argument of man's psychological descent from lower animals, he frowns, because his ancestors found themselves at an advantage when by a similar movement they excluded the sun from their eyes; his cutaneous and cerebral blood-vessels dilate, his muscles become inco-ordinated, "his breath comes in gasps and his nostrils dilate, his hands and teeth are clenched and lips drawn back to show the primitive weapons of war." There is increased action of the salivary glands, foaming at the mouth, and the various secretions become toxic. The bite of a mad-man is notoriously dangerous and the milk of an angry mother is poison to her child. Those beings who are lowest in the scale of evolution are continually exercising the passion of anger, children on animals, boys on their weaker mates, and savages, coarse-natured people and idiots on anyone who does not resist them.

The emotion of surprise also has atavistic traits. Many adults when surprised open wide both eyes and mouth, an attempt to open the eyes widely, even in the absence of astonishment, is invariably accompanied by an opening of the mouth. Children suffering from photophobia when told to open their eyes open their mouths. If the finger be placed between the teeth and gripped firmly and the eyes suddenly opened wide, relaxation of the grip is at once felt; conversely, closing the eyes tightly is

associated with closure of the lips; these cooperative movements of the eyes and mouth seen in health but more especially in disease are undoubtedly atavistic, relics of times when our ancestors actually watched their prey intently previous to springing upon them with open mouth. To obtain the key to these associated movements we must go back millions of years; the earliest vertebrates had no face-muscles, certain muscles which really belonged to the spiracle—a vestigial gill-cleft behind the eye—became diverted from it and adapted to the use of the eyelids and nictitating membrane. These muscles received their nerve-supply from the nucleus of the fifth and seventh nerves; they reached their full development in man in whom so-called face-muscles are simply the differentiated slips of the adapted spiracle muscle. "Grimace-making so characteristic of monkeys, savages, children and imbeciles is probably in part owing to a less specialised and differentiated facial musculature, for they tend to disappear as development progresses." There are other interesting associated movements of the mouth muscles, for instance sucking the finger or pursing the lips and sucking at them when in deep thought; the explanation here is that the very first mental efforts made by every human being, by every mammal in fact, are directed towards sucking in order to obtain food. Then again there is the rhythmic clenching of the jaws when cutting tough material with the scissors, the thrusting of the tongue out of the mouth when learning to write, thus we see that the explanation of those curious cooperative movements is that they are the reappearance of exceedingly remote ancestral habits.

Nearly everybody has experienced that delightfully realistic dream in which one is flying or soaring through the air. Sensations of floating in the air commonly precede loss of consciousness under anaesthetics. The intoxication of haschisch has been thus described by Gautier "it seizes you and lets you go again, lifts you up to heaven and carries you back to earth". If these sensations are atavistic the impresses giving rise to them must have been exceedingly remote. Man has not come through any bird-stage, for the birds diverged from man's line of ascent when they were still half-reptile and long before they had mastered the air, however it is conceivable that in his ascent from simple plasm

to his present high estate he may have passed through some flying or, at any rate, soaring stage.

Certain painful mental states occurring in hysteria, hypochondriasis and sleep in which weeping occurs may be looked upon as atavistic in that the flow of tears then forms no useful function. As Wundt has well remarked the lachrymal glands were originally organs for assuaging pain and swept away dust and insects from the sensitive cornea. When we cry at the reception of bad news we are really endeavouring to expel painful thoughts, there being an association between painful sensations and the shedding of tears.

I alluded at the beginning of this paper to the mathematical faculty and to the difficulty experienced by some in recognising its evolution from the mental processes of lower animals. Now the fundamental basis of those marvellous capacities for concentration and abstraction evinced by the mathematician, is the power of accurate and quick calculation and Dr. Louis Robinson claims that these faculties of calculation are based upon sub-conscious brain processes evoked by the daily need of a past arboreal existence. Man owes his very existence to the trees and could never have reached his present high estate had the grasses been evolved earlier. It is to the trees that he owes the fact that in spite of his defective physique he has outwitted all competitors for did not the trees enable him to remove himself from the immediate vicinity of fierce carnivorous foes and so place his mind rather than his body at the disposal of Natural Selection to act upon and improve. During past ages these ancestors of ours dwelt in the trees and must have developed a wonderful power of rapidly and accurately calculating distance and adjusting their muscles to the practical solution of complex physical problems. A scamper through the tree tops was very different to progression on level ground as it afforded no two similar movements; every leap meant a calculation and getting a right answer was a matter of life and death. Many mathematicians acknowledge that some of their most difficult mathematical feats are achieved unconsciously so that they have found themselves puzzled to explain how the results were obtained and,

as Dr. Louis Robinson has suggested, it is more than probable that those wonderful mental feats performed by "prodigies" such, for instance, as those performed some years ago by the "calculating boy" are, in part, atavistic.

As is well known there are two extreme schools of evolutionists, the one, with Professors Weissmann and Ray Lankester and Dr. Archdall Reid as prototypes, denies *in toto* the transmissibility of acquired characters and claims that no one has yet shewn how a quality acquired by any part of the body can be transferred to the reproductive cells and so passed on to descendants: it must indeed be acknowledged that removal of or injury to parts in a parent has no effect on the subsequent offspring unless these changes took place during embryonic development. We, in this country, have ample and daily proof of this fact, the feet of Chinese women have, for thousands of generations, been mutilated yet children's feet that have not been subjected to the apparatus which artificially arrests growth and development never shew any signs of hereditary transmission of the mutilation. Many other examples might be quoted but it will suffice if I remind you of the negative effects of docking the terrier's tail and of circumcising the Jews; these operations have been performed for innumerable generations yet the offspring shew no signs of inheriting the mutilation.

The other school, with, it must be confessed but few adherents, claims, like Haeckel, Herbert Spencer, Professor Marcus Hartog and Charles Mercier that acquired traits are transmitted up to a certain point. In a third category might be placed those who, like Professors P. Geddes and J. A. Thomson, take up a non-committal attitude.

During the last year the question of the transmission of acquired characters has come much to the fore, one of its most ardent champions being Professor Hartog.

The whole contention that certain sensations experienced in dreams and deliria are atavistic, falls to the ground if psychical traits acquired during the life of an individual cannot be transmitted to offspring. There is nothing logical in the argument that

because one cannot see *how* the somatic or body cells influence the germ or reproductive cells that therefore such process cannot take place. One cannot see *how* the germ cells affect the body cells, but we know that they do so in a marked degree for if the germ cells from a male human being are removed the voice remains high pitched and the face hairless; if corresponding cells from the female be removed the voice becomes masculine and the face hairy and in both the whole mental life is altered. It is well known that very old hens, in whom the germ cells may be presumed no longer to functionate, take to growing a comb and spurs and to crowing, all masculine characteristics.

Be this as it may the fact remains that certain intense, vivid and realistic sensations are experienced by millions of human beings of every generation in their dreams and deliria although the same individuals have never experienced such sensations during their waking state. These facts can, in my opinion, only be satisfactorily explained by the theory which has been submitted to you this evening, namely that they are, in part at any rate, the present day results of long-past incidents and events.

Mr. President and gentlemen I owe you a debt of gratitude for your kindness in listening with such patience to this lecture which I will now conclude with those lines of Wilberforce that so exquisitely sum up the whole content of mental and physical evolution :—

A fire-mist and a planet,

A crystal and a shell.

A jelly-fish and a saurian

And caves where the cave-men dwell.

Then—a sense of Law and Beauty,

A face turned from the clod.

Some call it Evolution,

And others call it God.

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