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## EDITORIAL

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## Anticytotics - Radiopalliation/chemopalliation and neuraxial neoplasms

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## Full Text

The Bard of Stratford-on-Avon, has aphorized in *Romeo and Juliet* (2,ii,43) that "a rose, by any other name, would smell as sweet". Given his versatility, he would have loved to complete the story by adding that "a thorn, by any other name, would prick as deep". To euphemistically elevate radiation/chemicals to the status of therapy ("art of healing") is to present thorny palliation as rosy treatment. Such verbal trickery deludes the oncologists and devastates the unsuspecting patient. In the increasingly eyeless monetaristic medical scene, the age-old caution of caveat emptor - Let the buyer beware, has to hold a red light to the buyer, namely, the cancer patient, through some semantic honesty.

Chemomimetic radiation and radiomimetic chemicals are agents that indiscriminately age or ravage an animal cell, so as to earn the appellation anticytotoxic. Nobelist Solzhenitsyn, the Tolstoy of our times, in his highly illuminating novel *Cancer Ward*, poses this reality through the hero, Oleg, to whom the medically-advertised "differential" effects of irradiation were not at all clear. He wondered how "the harsh X-rays, the trembling vectors of electric and magnetic fields could bomb a tumor without touching the rest of the body". Oleg searched for an answer from his oncologist Vera Kornilyevna, but "What could she tell him about the blind artillery which cuts down its own men with the same pleasure as it does the enemy's?" What is true for so-called radiotherapy is true for the so-called chemotherapy as well. The oncologically convenient assumption that oncocytokinetics are more rapid than normocytokinetics has been nailed long ago. Going by the ceaseless rapidity with which epidermis, mucosae, and bone marrow cells multiply, the trade-off is that before a cancer cell may be killed, a million normal cells, will be. From the simplistic Roentgenian beam through the latest accelerator, the foregoing truth has remained unchanged.

## Historical background

Within months after its discovery by Roentgen, in 1894, the X-ray was introduced widely into the diagnosis and treatment of disease. At the same time, harmful effects of radiation were encountered almost immediately. The first such effects to be recognized typically appeared within hours or days after exposure and rapidly subsided.

It was not until 1902 that cancer, arising on the hand of a radiologist at the site of radiation induced skin damage, was recognized as a potential late-occurring complication of radiation injury. In the ensuing decades, before safety measures were improved, similar growths occurred in scores of pioneer radiation workers.

The implication that any dose of radiation, however small, might involve some risks of serious injury aroused concerns which have persisted to the present. As a result, radiation protection standards no longer assume the existence of a level of exposure that is totally 'safe'. (The Oxford Companion to Medicine, 1986)

The above radiational history makes it clear that radiation has been, a priori, foreknowingly, cancerogenic. The late Karnofsky, chief of cancer chemotherapy at SKI, NY, launches his chapter thereon with a very revealing generalization: "If an agent has certain biologic effects, such as carcinogenic, mutagenic, or bone-marrow-depressant activity, it merits testing for chemotherapeutic activity against cancer". So, it has been, so far. Cancer chemotherapy owes its beginning to sulfur mustards (World War One) and, the latterly developed nitrogen mustards (World War Two). "The disappearance of lymphocytes and granulocytes from the blood of rabbits was a useful marker of toxicity and gave rise to the idea of possible efficacy in lymphoid cancer". From 1945, till to-date, the cytotoxic ambivalence of the so-called cancer chemotherapy remains the writing on the wall. The latest, 7<sup>th</sup> edition of Oxford Handbook of Clinical Medicine, 2007, pulls no punches.

## Immunosuppressive drugs

As well as being used in leukemias and cancer, these are used in organ and marrow transplants, rheumatoid arthritis, psoriasis, chronic hepatitis, asthma, SLE, vasculitis (eg Wegener's giant cell arteritis, polymyalgia, PAN), inflammatory bowel and other diseases (so this page could figure in almost any chapter).

This parenthesis, by the Handbook itself, is proof-positive of the indiscriminate cytotoxic nature of the so-called anticancer drugs.

What do anticytotics - radiational or chemical - do to cells? As of today, medical science knows naught. The entire biosphere owes its existence to solar radiation that, quickening chlorophyll, creates the fabulous food chain. Your mobiles work only because of radiation. The so-called therapeutic radiation is a high-energy electromagnetic beam that, to say the least, ionizes a cell to ravage it or age it. Actively dividing cells die. Non-dividing cells age. The result is short-term or long-term inflammation, vasculitis, and overall aging. Ionizing radiation does NOT cause cancer per se, but by aging a cells drags it closer to its inbuilt cancerous destination.

Chemical anticytotics mimic ionizing radiation and their side effects (which in reality are main-effects) strongly resemble those of radiation. Body's survival instinct tends to deload circulatory blood of these toxins by exiling them to avascular areas such as epithelia, mucosae, and bone-marrow; wherein the maximal impact of toxicity occurs. The above tissues being renewing in nature have the highest mitotic rate (exceeding the fastest growing cancer), and hence have a very high population of dividing cells that take all the insult from radiation

and chemicals. Epidermitis and mucositis produce sore skin and mouth, sore passages and sore exits, hence cystitis, urethritis, and proctitis. Bone marrow depression has all the predictable effects. The constellation of side-effects makes an average cancer patient forget his/her cancer.

From the above basics, let us move on to hardcore oncologic practice to glean some truth from the 4-megatome, 5296 pages, 20 editors, 629 authors, 108 page 3-column index titled Youmans Neurological Surgery, 5th edition, 2004, "Chemotherapy can benefit some patients with CNS tumors to a modest extent, but the most effective drugs or drug regimens and the best method of delivery are unknown". Radiotherapy looks as nebulous: "Although much is known about the radiobiology of radiotherapy in the central nervous system, there is even more that is unknown. Hence, we have merely scratched the surface in discovering how radiation works and its potential use in treating disease." The complications of radiotherapy are acute/subacute/late. Acute ones are more because of skin damage and are evanescent. Subacute, several weeks/months after therapy are complex, comprise somnolence, syndromes of demyelination, dysphasia, cerebellar ataxia and ocular damage.

Late complications, occurring after several months or years, comprise radiation necrosis, mineralized angiopathy, enlarged ventricles, microcalcifications, dementia, ataxia, significant white matter atrophy, neurocognitive impairment; optic neuropathy, hypopituitarism, stroke, and development of secondary neoplasm. Regardless of the above, "The most common malignant tumor of the brain is a secondary metastatic deposit, which is most often treated with radiation therapy".

If, 114 years post-Roentgen, and 64 years post-mustards, there does not seem to be enough light at the end of the anticytotic tunnel, then, may be we are in need of a revised Weltanschauung on the thorny issue. Should you grudge that this is all philosophy but no science, please note that lexicons define philosophy as scientia scientiarum - meaning, science of all sciences. Set below are a few points-

Voltaire averred that humanity's chief penchant is to foist unreason through the use of reason. Cancer has NO treatment. What is treated is signs and/or symptoms which is but palliation (from pall = coffin). All palliation rests on confining the clarity on the primary disease, and merely easing whatever the disease. And if radiopalliation and chemopalliation are predictably pathogenic, can they ever be christened as palliatives?

"The science of therapeutics", Bodley Scott observed "is founded on the touchingly naive assumption that there is an answer to every question it poses". We always ask "What is the treatment of this disease?", but not "Is there a treatment of this disease?" The universal illusion is that treatment and effectiveness go together.

Glemser, in his globe-trotting survey Man Against Cancer concluded that surgery is best avoided, radiotherapy is obsolete, chemotherapy is "an absolute farce".

Yet the common oncological textbook generalization that the three primary modes of cancer therapy are surgery, radiation and chemical springs from what Richard Asher, the British medical wit, generalizes: It's better to believe in therapeutic nonsense than to admit therapeutic bankruptcy.

Osler observed that mankind ails from must-treatism. Yet a survey of American doctors who themselves had cancer showed that most of them had no faith in any of the above modes of treatment nor in the so-called early diagnosis.

The BMJ asked the Director of Surgery at St. Mary's Hospital, London, what he would do if he had cancer of rectum. His submission is a revelation by itself: 'I am absolutely certain - and this I am sure will bring wrath of most colorectal surgeons on my head, but no matter - I would not have an abdominoperineal resection with a colostomy. However managed, however much we delude ourselves, a permanent potentially incontinent

abdominal anus is an affront difficult to bear, so I marvel that we and our patients have put up with it so long. It says much for the social indifference of the one and the social fortitude of the other'. (Dudley, H.A.F.: If I had carcinoma of the middle third of the rectum.Brit. Med. J ., 1:1035,1978).

The intellectual bankruptcy of oncology and hazards of anticytotics get revealed by Current Medical Diagnosis and Treatment 2008, a celebrated yearly tome, in so many languages: "The single most important risk factor for developing cancer is age. About 76% of cancers are diagnosed in persons aged 75 years or older..... An additional cause of cancer is chemotherapy or radiotherapy for prior malignancy".

"In my experience, for what it may be worth, it does not usually work out in the long-run to be seduced into telling the untruth". This plea by an oncologist is supplemented by a declaration from a cancer-patient:"The time to be honest about cancer is now." The time to be honest about tumor radiotherapy or chemotherapy, neuraxis or elsewhere, is now. Both do not deserve the euphemism palliation. How about describing each of these as a MOTTO- Medicine/Measure Of Troublesome Trade-Off?That done, you, as a neuro-onco-therapist have empowered your patient by a general rule of the thumb in making a choice. Buyer (of treatment or MOTTO), beware.

And this caution urges that the patient rather should put up with the cancer, or ask for anticytotics, understanding fully well the price that the body must pay from scalp-hair to toe-nails. So if a person is at ease with the primary/secondary tumor, no anticytotic is needed. If the dis-ease is compelling, the purely palliative nature and the price-to-be-paid must be written in neon letters.

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## EDITORIAL

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## 'Aqualisation' of neuraxis: Wondrous neuraqua CSF

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## Full Text

Domenico Cotugno (Cottunius), Professor of Anatomy at Naples, pioneered an adequate description of CSF in 1764. The term cerebrospinal fluid (CSF) was first used by Francoise Magendie in 1827. Since then, the term and the concept have served medicine well, meriting now a more wholesome appreciation. CSF as a term/concept turns out to be too abrupt, not telling whether the fluid is from/around/across/within the neuraxis, nor has any allusion to the wide subarachnoid space that has the temerity to extend well beyond the lower limit of the so-called spinal cord.

The 18-lettered term 'cerebrospinal fluid' may be replaced by an 8-lettered neologism 'neuraqua', which is evocative, euphonious, euetymologic and extensively embracing. Anatomic and physiologic data render it clear that neuraqua is all around, through, in and from the neuraxis, being secreted not only by the choroid plexus but also by the 'brain parenchyma' itself. Neuraqua makes the neuraxis, inflates it from within to shape the ventricles, surrounds it to render it weightless and moves through the neuraxial wall to make one continuous neuraqual whole that suspends not only the whole neuraxis but every single neuron, neuroglial cell and synapse.

Neuraqua that renders the neuraxis essentially weightless can be called buoyaqua or buoyneuraqua. This is in line with the fetus rendered, in utero, weightless by the amniotic fluid, to deserve the appellation amnionaut, much like the weightless astronaut in the outer space. The neuraxis is neuraquonaut by the simple expedient of having its specific gravity almost identical with that of the neural substance. 'The brain weighs about 1400 g in air, but in its "water bath" of CSF it has a net weight of only 50 g.' The buoyed brain keeps the wider part of

the brainstem off the unyielding foramen magnum so that the vertebral arteries are free of pressure, nor does it exert weight on the underlying/overlying venae magna (venous sinuses). The Pascalian hydrodynamics of neuraqua make it a fail-safe cushioning medium for the neuraxis, so strong that it requires repeated raining of punches before a boxer develops dementia pugilistica .

The near isodensity (difference of 4%) of neuraqua and neuraxis offers the possibility of their commutativeness whereby one becomes the other, a ceaseless two-way traffic. No wonder that the commonest form of (so-called) hydrocephalus is normal-pressure hydrocephalus wherein the age-related shrunken brain enlists the help of an additional volume of neuraqua to fill in the intracranial gap.

The neuraqual universe can now be given its subsets. Cytoneuraqua forms neural tissue, neuroglia too, providing them with a separating milieu of intercytoneuraqua or extracytoneuraqua. The manifest neuraqua is ventraqua, in ventricles, to give them and maintain their shape and buoyaqua that fills the subarachnoid space. The neuraqual advaitism should be self-evident. No subset is separable from another, all the subsets making a gestalt whole that ceaselessly communicates and commutates.

The buoyaqual compartment is a double-walled cushion between arachnoid and the pia meriting the appellations subarachnoid/suprapial/intermeningeal/interleptomeningeal neuraqua. Myelocanalicular (i.e. in the central canal of the cord) neuraqua and Sylviodochal neuraqua (in the Sylvian aqueduct) are small but significant subsets. The triad of neuraqual foramina - midline of Magendie and the two lateral of Luschka - allows free communication between neuraqua within and around the neuraxis.

The substratum for all the nuances of neuraqua is a miracle called aqua,  $H_2O$  or plainly water. The Encyclopedia Britannica bristles with 'Abnormalities in the properties of water', namely highest specific heat, infinite incompressibility, high dielectric constant that provides it with highest solvency, ionizing power and so on. Guy Murchie in The Seven Mysteries of Life poetizes that 'Life on Earth and perhaps life mostwhere, is primarily organized water.... A new-conceived human embryo averages 97 percent water, a newborn baby 77 percent and a grown man 60 percent'. Since neuraxial development dominates early embryogenesis, it pays to generalize that it is water that gets configured as our neurons and neuroglia.

Romer, a celebrated anthropologist-author from Harvard, in his classic The Vertebrate Body, musing over the endless quarrel embryologists have had on whether the iridal sphincter is ectodermal or mesodermal in origin, concluded that 'Nature in her pristine innocence forgot to read the textbook of embryology'. Water, in its pristine innocence, exercises its divine right to flout many an established law of physics so as to invite the judgemental slur of 'anomalous' behavior in more than one way.

Among the four basic elements - air, water, fire and earth - water is the simplest. Water manifests its miraculousness by having the daring to expand on cooling, an event scientifically called 'anomalous' for no science can explain why an iceberg that cut into the 'unsinkable Titanic' should have been lighter than the Atlantic water that gently flowed around the sinking ship and its 1503 sunk lives on April 14, 1912. In the lightness of the rocklike ice or mountainous iceberg and the heaviness of the ripple of water resides the ability of marine life to survive merrily despite the deepest frost in the oceans. Nature asked water to think transcendently so as to defy the laws of ordinary physics. Water thinks. At the Last Supper, Christ had no wine to start with. But when he looked into the jug to see how much water there was, water saw its Master and blushed red. So Christ ended up serving red wine to his disciples.

The manifest, thinking ability of water (its science-defying anomalous expansion on either side of 3.98 degree centigrade), its mystical emotional capacity, make water best qualified to be the seat of thought, in the animal frame, as neurons. The self-sameness between neuraxis and neuraqua, the two perpetually running into each other to be each other, renders it likely that neuraqua itself thinks, a bold assumption that allows many an

imponderable to be, at best, comprehended. Guyton describes the various areas that neuraqua occupies and then generalizes. 'All these chambers are connected with one another and the pressure of the fluid is maintained at a surprisingly constant level'. The added italics declare physiology's inability to explain the how of the constancy. Neuraqual pressure-precision is amazing. At a pressure of 112 mm neuraqua, which is the normal average neuraqual pressure, filtration and absorption are equal. Below a pressure of approximately 68 mm, neuraqua absorption stops. Neuraqua knows at what pressure to stop losing itself, so that the neuraxis is not denied its buoyancy.

The survival-symphony between the neuraxis and neuraqua is best illustrated by the spatial enormity accorded to cisterna interpeduncularis housing the hypothalamus and cisterna pontomedullaris cushioning the vital centers in the brainstem. Of the two leptomeninx, the arachnoid jumps all sulcal and flexural gaps, while pia stays tethered to the surface resulting in every tiny sulcus cushioned by a mini-lake of neuraqua. A large posterior-fossa tumor threatening to compromise the vital centres gets held at bay by an unexplainable interposition of neuraqua. When there is neuraqual rhinorrhoea (CSF rhinorrhoea), the production of neuraqua is stepped up and its resorption brought to a grinding halt. Following accidental/operative trauma, neuraquastasis (neuraqual homeostasis) is maintained to assist recovery and survival. Enormous intracranial tumors remaining compatible with, often symptom-free life is thanks to the neuraqual wisdom in action-ready even to induce cerebral edema and flattening of gyri and the creation of ventricular hydrocephalus that forms a pressure balancing-opposite to the tumor, all these serving as a natural defense mechanism assuring functional integrity of the wider neuraxis. It needs to be noted that the so-called cerebral edema is an exaggeration of normal intercytoneuraqua that is compatible with the integrity and function of the neurons and neuroglia in the edematous zone.

Gray's Anatomy succinctly sums up some facts and figures on neuraqua.

'CSF is clear, colorless liquid which in normal individuals contains a very small amount of protein and differs from blood in its electrolyte content. The intracranial CSF volume has been estimated at 123 ml, some 25 ml in the ventricles and 98 ml in the subarachnoid space. Its ionic composition suggests that CSF is not just an ultrafiltrate of blood but there is active secretion by the choroid plexus epithelium. Choroid plexus epithelial cells have the characteristics of transport and secretory cells with microvilli on the apical surfaces and interdigitations and folding of the basal aspects of the cells. CSF is secreted from the apical surface of the epithelial cells at the rate of 0.35-0.4 ml per minute; this means that 50% of the CSF is replaced in 5-6 hours. A CSF barrier therefore exists and is sited at the choroid plexus epithelium. A dramatic demonstration of the blood-CSF barrier is seen at postmortem in jaundiced adult patients in whom the stroma of the choroid plexus is stained yellow by bile whereas CSF and brain remain unstained. As extracellular fluid from the brain parenchyma also drains into CSF, some 11% of CSF (in the rat) is derived from this extrachoroidal source. Other estimates vary from 30-60%.'

The term blood brain barrier is as abrupt and incomplete as CSF. Bloom and Fawcett are at pains to point out that 'it is important to recognize that it applies equally to the spinal cord'. Moreover, barrier is synonymous with block, obstacle, obstruction, a sort of Berlin wall, which surely neuraqual-secreting endothelium is not. Endothelium, per se, is now accorded extraordinary wisdom and power (J Anat London, Oct. 2007). So it pays to realize that what is thoughtlessly called a barrier is a highly computerized regulator of the transport between endothelium and neuraqua (either way) meriting the evocative ensemble Neuraqual Endothelial Audited/Selective Transport (NEAT/NEST). In a deeply jaundiced human sans kernicterus, the neuraqual universe can declare to the rest of the yellowed body that our NEST is NEAT.

In Nature's infinite book of secrecy

A little I can read.

- Shakespeare

Lyall Watson and Lewis Thomas, from either side of the Atlantic Ocean, have observed that the greatest discovery of the 20 th century is of the profundity of human ignorance. We need to know that we know naught. The musings on neuraqua are but an exercise in the sense of wonder. From wonder comes reverence, which begets humility that enforces restraint that helps the practice of the Hippocratic Primum , non nocere as also the recently reasoned ( Neurology India , March 2006) Secundum, quieta non movere , that pleads that 'pathologies' at peace with the owner be left unpersecuted. In all 'advanced' countries, iatrogenic (rather iatral ) morbidity and mortality are competing with cancer and car-accidents. Unless we learn/teach how to wonder, we shall rush in where Angels fear to tread. Should the subject of a 'Sense of Wonder' (SOW) be integral to every medical curriculum?

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## EDITORIAL

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## Cavernous sinus and its role in eye movements and eye health

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## Full Text

The cavernous sinus is relatively small in size in human beings when compared to that in lower animals. Like the 'human tail', the general observation is that the cavernous sinus is a vestigial structure. There are only isolated reports in the literature speculating about the possible function of this structure.[1],[2]

The cavernous sinuses are relatively large in lower animals probably because their function is more pronounced. The eye movements in these animals are not only essential in the provision of binocular vision, but also essential in protection of their lives. For example, when the deer runs and the tiger is running behind in an attempt to catch it, the deer is able to see not only ahead, but can also see the chasing tiger at the same time. This is due to the wide range and rapidity of its eye movements. The cavernous sinuses in the fish are relatively much large in size. The eye movements in the fish not only assist in provision of a wide range of visual field, but are also essential in providing balance whilst swimming. Absence of vision in one eye is not compatible with life in most fishes. The range of eyeball movements and its possible functions in a human are limited and that may be the possible reason of the cavernous sinus being relatively small in size.

The cavernous sinuses drain the entire venous blood of the orbit. Their relative capaciousness, ability to stretch and their interconnectedness are essential elements on which the hydrodynamics of the fluid filled anterior and posterior chambers of the eyeball thrive. The fluid turnover in both the chambers has to be rapid, fairly constant and at highly controlled pressure. A single cavernous sinus provides a large efferent area into which the orbit can quickly drain any excess blood. As a further backup, one cavernous sinus is connected to another to provide yet more area. The sinusoidal dilatation of the venous circuitry in the region of the cavernous sinus appears to

be necessary for the performance of the function of a sponge or a shock absorber of the eyeball. The pathos of the eye when the cavernous sinuses are thrombosed speaks for the significant role that they play during physiological states. All eye movements are lost despite functioning and anatomically intact cranial nerves. In severe cavernous sinus thrombosis, the venous drainage from the eye ball can be hampered, and there can be severe rise in intraocular pressure and even blindness. The eye movements and function return to normal when the blood flow within the venous spaces of the cavernous sinus is restored. It appears that the veins participate in all the movements of the eyeball by constant drainage and blood pooling. The intercavernous sinuses probably assist in coordinating movements of both the eyes. When an external pressure is applied on the eyeball, the venous spaces behind the eyeball and the cavernous sinuses protect the eyeball by providing a buffer space, a situation simulating the buffer provided by cerebrospinal fluid in the brain. The rapid drainage that the cavernous sinuses provide protect the delicate retinal artery, which is devoid of muscularis layer, from raised pressure and consequent rupture due to the venous congestion.

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## ORIGINAL ARTICLE

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## Comparative quantitative analysis of osseous anatomy of the craniovertebral junction of tiger, horse, deer, and humans

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## Abstract

**Aim:** To compare the osseous anatomy of the craniovertebral junction of a horse, deer, and tiger with that of a human being. The variation in the structure of bones in these animals is analyzed. **Materials and Methods:** Various dimensions of the bones of the craniovertebral junction of the horse, deer, and tiger were quantitatively measured, and their differences with those of human bones were compared and analyzed. **Results:** Apart from the sizes and weights, there are a number of structural variations in the bones of these animals that depend on their functional needs. The more remarkable difference in joint morphology is noticed in the occipitoatlantal joint. The occipitoatlantal articulation is remarkably large and deep, resembling a «SQ»hinge joint«SQ» in all the three animals studied. The odontoid process is «SQ»C shaped«SQ» in the deer and horse and is «SQ»denslike«SQ» in the tiger and humans. The transverse processes of the atlas are in the form of large wings in all the three animals. The arches of the atlas are large and flat, but the traverse of the vertebral artery resembles, to an extent, to that of human vertebral artery. The rotatory movements of the head at the craniovertebral junction are wider ranged in the horse and deer as compared with those of the tiger and humans. The bones of the craniovertebral junction of all the three animals are adapted to the remarkable thickness and strength of the extensor muscles of the nape of the neck. **Conclusions:** Despite the wide variations in the size of the bones, the basic patterns of structure, vascular and neural relationship, and joint alignments have remarkable similarities and a definite pattern of differences.

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## Full Text

## Introduction

The anatomy of craniovertebral junction bones of the tiger, horse, and deer was analyzed and compared with human bones. The evolutionary changes and structural alterations that have occurred due to the functional variations are clearly seen in the comparison. Understanding the anatomy of these animals clarifies the function of the various components of the bones of the craniovertebral junction. The evolutionary changes in the shapes and architectural design of the craniovertebral junction bones in each of these animals have been perfected to suit the job at hand.

## Materials and Methods

Two dried bones each of the adult tiger, horse, and deer were procured. One of the coauthors (S.A.G.) has a special permission from the Government of India to procure and handle cadavers of tigers for scientific purposes. The craniovertebral region bones were collected, and their major anatomical features were studied and compared with those of the adult human bones [Figure 1],[Figure 2],[Figure 3],[Figure 4]. Palpation and visual examination of the bones were carried out. The shape, orientation, size, texture, foramina, and borders of each bone were studied and compared. A microcalliper was used for the measurements. Relationship of the vertebral artery and C1 and C2 spinal nerves to the craniovertebral junction were studied on the basis of literature survey. [1],[2],[3]{Figure 1}{Figure 2}{Figure 3}{Figure 4}

## Results

The major anatomical features that were evaluated are summarized in [Table 1] and [Table 2].{Table 1}{Table 2}

## Discussion

In quadrupeds, the cervical spine is a vertical part of the entire vertebral column and the thoracic spine is more or less horizontally oriented. The head of the tiger, deer, and horse

protrudes anteriorly in such a fashion that it is in the maximally flexed position at the occipitoatlantal joint articulation [Figure 2]. On the other hand, the cervicothoracic junction is aligned in the maximally extended position. This 'asymmetric' placement of the vertebrae in quadrupeds ensures an energy-saving balance of the head when the animal is in the resting position. [4] When in the resting position, the movements permitted at the occipitoatlantal articulation are primarily of extension (flexion being gravity-assisted passive movement); accordingly, the posterior cervical neck musculature is markedly strong in these animals. The occipital crest is remarkably thick, providing a site for muscular attachment. The occipital crest is most remarkably thick in the tiger, as seen in [Figure 4]. In humans, the entire spine assumes a general vertical orientation and its curvatures are much less pronounced when compared with the quadrupeds studied. The vertical stance of the human being places the head directly over the neck in line of the weight bearing of the rest of the spine. [4] The muscles of the nape of the neck and the occipital crest in humans are significantly small in dimension. The atlantoaxial bone and joint complex of the tiger have much more remarkable resemblance to human beings than the bones of herbivorous animals such as horse and deer.

#### Platybasia

There is platybasia in all the three animals studied. The clivus and the anterior skull base are in the same horizontal plane. The maxilla and the upper jaw protrude anteriorly from the cranial base. The brain size is relatively small and the olfactory nerves well developed and long, reaching to a length of about a foot in the horse. The cerebellum is proportionately large in animals as compared with the cerebral hemispheres. In humans, the angulation of the anterior skull base in relationship with the clivus is probably related to the relatively large size of the cerebral hemispheres.

#### Occipitoatlantal articulation

The superior articular surface of the atlas (referred to as anterior articular facet in quadrupeds) and the occipital condyles are much larger, thicker, and stronger in all the three animals studied as compared with the corresponding human bones. The large occipital condyles of these animals sit deep into the cup-shaped anterior (superior) articular facets of the atlas [Figure 2],[Figure 3],[Figure 4] and form a joint that appears like a 'ginglymus or a hinge joint', providing an opportunity for extra stability and enhanced mobility as compared with the human occipitoatlantal joint. The superior facet of the atlas is much deeper in all the three animals as compared with the human superior facet, which is almost flat. The range of movements at the occipitoatlantal articulation is chiefly of extension and flexion, with a small amount of lateral oblique movements. [3] The total range of motion at the occipitoatlantal articulation varies between species. It is 90-105° in the quadrupedal mammals and only 11-13° in humans. [5] The cervical part of the vertebral column is most mobile in horses; the mouth may be brought around to reach the flank on full lateral flexion of the neck and ventrally to reach the pasture on ventral flexion. [6]

#### Atlas

The atlas bone has ring-shaped anterior and posterior arches and has wide lateral platelike projections or wings of the transverse processes in all the three animals studied [Figure 2], [Figure 3],[Figure 4]. The transverse process in the human atlas is reduced to only the vertebral artery canal. The ventral (anterior) and dorsal (posterior) arches of the atlas are much thicker in the tiger, horse, and deer as compared with the humans. [7] The dorsal arch presents a median tubercle. It is perforated on either side near its cranial margin by the lateral vertebral foramen [Figure 2]. In these animals, the term lateral vertebral foramen is used instead of the term intervertebral foramen in the case of the atlas and axis as this foramen does not lie between the two vertebrae as the term 'inter' implies and rather lies on the dorsal arch of the atlas. [3] The ventral arch is thicker, narrower, and less curved than the dorsal arch. On the ventral surface is the ventral tubercle, which is more prominent in the horse and deer as compared with humans and tiger.

Although the transverse processes are large in the horse and deer as compared with humans, they are proportionately smaller in size as compared with those of the tiger. The ventral surfaces of the transverse process of the atlas in the horse and deer have a greater depth than those of a tiger, in which they are shallower but wider. Between the ventral aspect of the transverse process and the lateral mass is a depression called the atlantal fossa. In horses, each wing is perforated by two foramina: the cranial one is the alar foramen, which connects with the lateral vertebral foramen by a short groove; and the caudal one is the transverse foramen[3] [Figure 2]. In tigers, there is a lateral vertebral foramen for the first cervical nerve close to the cranial border of the dorsal arch. The alar foramen is replaced by a notch in the cranial border of the wing that transmits the ventral branch of the first cervical nerve. The base of the wing is perforated by the transverse foramen. While the human transverse process is horizontally oriented (transverse), it is vertically aligned in the animals studied.

The articular surface of the superior facet of the atlas accounts for roughly 75% of the entire ring of the atlas as compared with less than 40% in the atlas of humans. The joint surfaces are separated by a wide notch dorsally and a narrow one ventrally. The atlantodental joint is remarkably prominent in the horse and deer, providing articulation to the large and C-shaped odontoid process in these herbivorous animals [Figure 2] and [Figure 3]. The inferior articular surfaces (referred to as posterior articular surface in quadrupeds) of the lateral mass of the atlas are confluent anteriorly with the joint surface on the posterior arch of the atlas to form a saddle-shaped articular surface.

#### Axis

In the horse and deer, the axis is the longest of all vertebrae. It measures 16 cm in the horse and 4.9 cm in the deer in its vertical length.

The odontoid process of the tiger simulates the odontoid process of a human being. The odontoid process is denslike in human and tiger bones, whereas it is a C-shaped, relatively thin and flat ring that has a wide area of joint formation with the posterior surface of the anterior arch of the atlas [Figure 2],[Figure 3],[Figure 4]. This wide area of the atlantodental joint is seen uniformly in herbivorous animals as against the denslike odontoid process in carnivorous animals. The odontoid process of humans simulates more closely with that of carnivorous animals. The anterior surface of the odontoid process forms a well-defined joint with the posterior surface of the anterior arch of the atlas. The joints of the horse and deer are much larger as compared with those of humans and tiger. The rotatory movements of the neck at the craniovertebral junction are superior in the horse and deer as compared with those of the tiger and humans. The limitations of the rotatory movements at the craniovertebral junction and the placement of eyeballs in a more anterior perspective of the head in the tiger and humans as compared with those in the horse and deer are adaptations that suit their lifestyle and preying, hunting, and survival needs. The dorsal surface of the odontoid process has two deep impressions on either side of the midline in a horse and deer for the attachment of the thick and fan-shaped longitudinal ligament [Figure 2]. This ligament extends from the rough concave dorsal surface of the dens, widens cranially, and is attached to the transverse rough area on the inner surface of the ventral arch of the atlas. These impressions are not prominent in the odontoid process of the tiger and humans. The atlantoaxial joints are relatively similar in their inclination and depth in human beings and in all the three animals studied.

In the horse, the lamina or the arch of the axis has a notch on each side of its cranial border that is converted into a lateral vertebral foramen (intervertebral foramen) by a ligament that ossifies later [Figure 2]. A groove extends ventrally and caudally from this foramen and houses the ventral branch of the second cervical spinal nerve. In the deer and tiger, the cranial border has a deep notch that is not converted into a foramen. In humans, there is no such notch or groove. The inferior articular processes of the three animals are vertically oriented as compared with their more horizontal orientation in humans. The transverse process in the deer and horse is small and single and projects caudally. It has an obliquely oriented foramen for the vertebral artery. The transverse process and the vertebral artery foramen in the axis of the tiger are similar to those in humans.

The spinous processes of the axis of all the three animals studied are large, strong, and bifid [Figure 1],[Figure 2],[Figure 3],[Figure 4]. The axis in the tiger is characterized by its length and its enormous spinous process, which overhangs both the dorsal arch of the atlas and the laminae of the C3 vertebra. The cranial extent of the spinous process matches that of the dens [6] [Figure 4]. The C2 spinous process of humans is short, stubby, and bifid and is smaller than that of the other three animals. The lateral surfaces are concave and rough for muscular attachments.

#### Vertebral artery

The vertebral artery has a peculiar relationship with the transverse process of the horse. After exiting from the transverse foramen of the axis, it crosses the capsule of the atlantoaxial joint and enters the transverse foramen of the atlas. After coursing through the atlantal fossa, it anastomoses with the occipital artery. It then runs dorsally through the alar foramen and enters the vertebral canal through the lateral vertebral foramen (intervertebral foramen). [3]

In the tiger, the vertebral artery, after exiting from the transverse process of the axis, courses over the dorsal arch of the atlas and enters the transverse foramen, which is present in the base of the wing of the transverse process. It then runs an intraosseous course in the wing for about 2.5 cm. It then exits on the ventral aspect, loops posteriorly, and enters the lateral

vertebral foramen to pursue its intracranial course. [6]

#### C1 spinal nerve

The first cervical nerve emerges through the lateral vertebral foramen of the atlas and supplies several large muscles of the nape of the neck in all the three animals studied. This is unlike the situation in humans, where the C1 nerve root is 'rudimentary' in nature and function. In the horse and deer, the dorsal branch of the nerve passes dorsolaterally and supplies the dorsal neck musculature. In the horse, the ventral branch descends through the alar foramen of the atlas and passes anteriorly into the neck. [3] In the tiger, the C1 nerve exits from the lateral vertebral foramen and its ventral branch exits through the notch in the cranial border of the atlas along the course of the vertebral artery. [6]

#### C2 spinal nerve

The second cervical nerve is larger than the first one in all the three animals, as in humans. It emerges from the spinal canal through the lateral vertebral foramen on the cranial border of the lamina of the axis. This nerve also supplies a number of muscles and skin over the neck. Their function is also significantly in excess to that in humans.

### Conclusions

The craniocervical junction bones form a pillar of stability and mobility. The basic architecture and design have remarkable similarities in all the animals studied. The variations in morphometry have a relationship with the quadruped stance, acute flexion position of the neck in the neutral position, and hunting and survival needs of the individual animal.

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## EDITORIAL

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## Ethics and neurosurgery

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## Full Text

If you were to scan the critiques of modern medicine offered by various thinkers, you would glean their despair over the declining societal consciousness. This concert of painful perspective is a pointer to the overall decline in social and medical ethics, neurosurgery not excluded. This piece is an attempt at keeping the gentle flame of neurosurgical ethics burning steady and bright, against the cyclonic winds of crass commercialism.

Ethics, as a word, has had a chequered career. English lexicons trace it to the Sanskrit word Swadha, which briefly connotes a sense of self-respect that as a mere custom denies you the right to do anything wrong, even when not policed or monitored. It is an inner conviction about what is proper and philanthropic, a conviction sustained in action under pressure. Ethics cannot be taught, much less available in coaching classes. At best, Ethics can be imbibed along the lines of Thomas de Kempis' 'The imitation of Christ'. This necessitates that we have amidst us neurosurgical role models of integrity, of character; that the students may take as a role model. All told, Ethics is one's innate being, one's weltanschauung. The peon of the President, Prime minister or the Principal may be more ethical than the boss. To that extent, to be ethical, is to be ready to walk, as the Kathopnishad says, on the razor's edge.

Could Buddha, - Swami Vivekananda eulogizes him as the Light of Asia - be the Presiding Deity of Neurosurgery? Neurosurgery is privileged to handle the most evolved among cells, namely the neurons, the repository of buddhi, chaitanya or cosmic consciousness, and capable of perceiving and expressing the same. Neurosurgery thus could choose to go the way of Lord Buddha, and follow an Eightfold path pithily presented below.

Firstly : Primum, non nocere . 'Above all, do no harm'. The fact that Hippocrates had had to enunciate this as the leading ethical code 4 millenia earlier implies that all therapies are inherently pregnant with iatrogeny. Arthur Bloomfield after an iatrogenic tragedy pleaded that every hospital should have a plaque in the physicians' and students' entrances stating: ' There are some patients whom we cannot help; there are none whom we cannot harm '. Neurosurgery has the magical touch of restoring the might to the paralysed. Equally, the opposite can as well happen. What is powerful for good, can be potent for evil .

Secondly: Quieta non movere , meaning Don't fix it if it ain't broke . Perfect ease is compatible with the grossest, manifest pathology, the 1000 tumors in a person with von Recklinghausen's being but an example. Hoerr's Law frankly declares: ' It is impossible to make an asymptomatic person feel better '. The corollary is that, should you yet interfere, you can surely make the person feel worse.

In an age of preemptive strikes, modern medicine has not lagged behind, and has spawned its 5-star check-up clinics the world over. This multistarred place can be magical in the sense that a person may walk in, and a patient may walk out ; a tragic-comedy enacted because of the medical obsession with some abnormality/ties detected in a person fully at ease. It was the Lasker-awardee Rustom Jal Vakil who bemoaned that the ECG machine may have done more harm than the atom bomb , a lament loudly echoed by Harrison of the Harrison's Principles of Internal Medicine fame. The state-of-the-art imaging techniques - MRI of the spine for example - are equally pregnant with the havoc they can wreak by misleading a technocrat into justifying an unwarranted adventure, albeit, at the expense of the patient. Distorted body geography sans disturbed history is the surest recipe for grave iatrogeny. We need to appreciate that an investigation no matter how sophisticated is rooted in vestige , meaning a trace, a footprint. Surgery under such circumstances is rank subjectivism of the operator wherein the only objectivism is the price that the patient must pay. Trust a person's own body, when you cannot trust an abnormality that you may encounter on investigation .

Thirdly : Eric Ericsson felt that the Golden rule of practical medical ethics can be borrowed from Talmud; Do what you - capital YOU - would be done by, and not do what you would choose not to be done by.

Walter Alvarez, the pioneer gastrointestinal surgeon at the Mayo Clinic observed in his autobiography The Incurable Physician that, whereas everyday patients young and old were 'curatively' treated by gastrectomy and vagotomy, not one of the physician population of the Mayo clinic, many of whom had the same problem, ever underwent that surgery. This is the tale retold in many a different disciplines of medicine.

Aldous Huxley begins his Perennial Philosophy with the lead theme of Chhandogya Upanishad- Tat twam asi: That art thou. Put pithily, the patient is none but you, albeit in the role of a sufferer . It is interesting that lexicons trace the word crime to krinos= I separate and hence the terms exocrine and endocrine. The day we treat our patients differently than we would treat ourselves, we separate them from us, and like it or not, it ends up being an act of crime.

Fourthly: Sir William Osler stressed three qualities of a good teacher- Knowledge, Enthusiasm, and Humility . A neurosurgeon is a teacher one way or another. She/he should be enthusiastic to share the feast at the table of knowledge, a quest that is always unending. The flip-side of knowledge was underscored by Adi Shankaracharya who aphorized that If knowledge is infinite, so is ignorance. Blaise Pascal metaphorized that knowledge is the inner surface of a sphere whose outer surface is painted with ignorance . Ergo, the more you know, the much more you know not . This, one must realize, is at the root of the innate humility of the truly greats, for they alone know, and admit, how ignorant they are, and we can be. Wilder Penfield has striven to make us knowledgeable about our ignorance: 'How little we know about this brain ... and of the mind. How little we know of the nature and spirit of man and God' .

Fifthly : Any pathology that one encounters in neurosurgery occurs on a probabilistic basis - a state of

knowledge greater than ignorance, but lesser than certainty. A glioblastoma multiforme, or a meningioma, in any given herd, must occur on a probabilistic basis, thus signifying that its occurrence in your patient spells your freedom from the same. This herdistic principle is widely applicable from IQ to inflammations, and demands from we intellectuals a more compassionate scheme of things. Before such an utopia comes to pass, it behoves a neurosurgeon to look at any patient with a sense of reverence, and gratitude: ' Since you are bearing the cross, I am free therefrom '. Such a creed, clearly, based on steady statistics, mellows the technocrat in us into a more humane individual ready to do the best for a fellow sufferer. When you convey this distributional design to a patient with a dire disease, the malady becomes meaningful, unburdening him of a sense of guilt, of being punished for some past karmas and what have you.

Sixthly : Emerson foresaw in the mid 19th century: Things will ride the minds of men . Things- Money, Mercedes, Machines -ride the minds of men, neurosurgeons not excluded. One may concede that refined neurosurgery needs sophisticated gadgets, one after the other. But while one is on this compelling trip, one may bear in mind what Einstein told of the modern times: A profusion of means, and a confusion of ends .

More than the neurosurgeons (or other physicians) themselves, it is the aggressive thrust of the medicine/machine-manufacturers, which is fast shaking the convictions we may have scientifically arrived at. Trials, publications, and texts are progressively doctored by vested interests so that often it is not possible to separate the wheat from the chaff. It is indeed a paradox of current medical scene that the industrially offered extravaganzas of a scientific conference smother its very spirit. Arthur Koestler portrayed this in the *The Call Girls* , a book that urges that one-day we should all aim at spartan meets where the mind triumphs over matter. It is a tradition worth establishing.

Seventhly : How about understanding the two terms- modern , and medicine ? The lexicons trace them both to Latin- modus = measure, from Sanskrit- matra : To that extent, the hackneyed phrase modern medicine, like holistic health, is a tautology, Medicine by drugs or by device, by suggestion or by surgery- is something you exercise in a precise measure-thus far and no further. The measure connoted by the appellation modern implies that you take a measured-step, a decision arrived at after taking all the extant data and opinions into consideration. So modern does not imply that your medical move should be the latest, costly, imported, or sophisticated. It only means that you exercise your sagacity to jettison that may pose to be so. It was not for small reason that K.G. Mussif, used to end all his lectures with a message; A good surgeon is one who knows when not to operate. A modern neurosurgeon is one who will have the courage to avoid a surgery however sophisticated it may seem, if its utility has just been revealed to be doubtful. In the final etymological analysis, modern medicine is highly rational medicine. Modern neurosurgery must rest on rationality. Harvey Cushing, in a letter to Henry Christian famed for Hand-Schuller-Christian disease and Weber-Christian disease, wrote: ' I would like to see the day when someone would be appointed surgeon somewhere who has no hands, for the operative part is the least part of the work' .

Eighthly and lastly : YOU, the neurosurgeon, are the Chief BENEFICIARY of what has been hinted at in the foregoing principles. Your personality, your humaneness should have the better of your excellence as a neurosurgical artist.

We can, may be with difficulty, uphold the few tenets outlined above, in order that the qualities of our heart do not wilt under the might of the technical head. That, with passage of time, we have fewer intellectual and spiritual regrets, an uncluttered right brain, a light heart, and a soft pillow at night. It is laudable to be a good neurosurgeon. It is imperative to be, *pari passu* , a better human being. Was it not Lord Buddha who emphasized that when we serve others ethically and compassionately, we truly serve our own selves !



## EDITORIAL

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## Fluidity of the body

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## Full Text

All is flux, nothing stays still

Heraclitus of Ephesus (circa 5 century B.C.)

Flux, fluid and fluidity are derived from L. fluere to flow and Gk. phluein to flow abundantly, or to overflow. Everything is flowing all the time, all the ways. Restlessness rules. In a manner of speaking, a fluid's mind is flow-id. "The melancholy view of Heraclitus as to the changing and fleeting character of life led to his being known as 'the weeping philosopher'. The constant flux, according to Heraclitus, of atoms, molecules and what have you, created unity-in-opposites, to create an illusion of steadiness or static-ness.

At the atomic level, the electrons spin in their own orbit at about 800 miles a second and the protons and neutrons, in the nucleus, waltz around each other at 40,000 miles a second. The seemingly lifeless matter is throbbing with dynamism of its own kind. All flux, you see.

The kinetic theory - kinetic meaning a state of flux, fluidity, or movement - holds that "the particles of matter in all stages of aggregation (gaseous, liquid, solid) are in a violent state of agitation, the vibratory motions becoming more energetic with an increase of temperature. Evidence of molecular agitation is provided by diffusion and Brownian movement." Conversely, with a decrease in temperature, the particulate movement becomes progressively less, until absolute zero (i.e. 0°K, -273.15°C, -459.67°F), when the thermal energy of random motion of particles is also zero, obviating all movements to create a state, albeit theoretical, of absolute static-ness.

What avails at the micro level asserts at the macro level. The nervous system is an excellent example of fluidity in function.

The neuraxis - brain and spinal cord - is 96% water that with the addition of a modicum of 4% of salts, proteins and lipids assumes a seemingly solid state that is suspended, cell by cell, in neuraqua. [1] Neuraqua (so-called cerebrospinal fluid [CSF]), isodense with the neuraxis, is constantly moving in and out of the neuraxis and in and out of the vascular system. The constant influx and efflux of this neuraqua serves to nourish the neuraxis, to serve as its lymphatic system as it were and to render the central nervous system weightless due to it having the same specific gravity as the neuraqua.

Electrical activity of every neuron and the whole neuraxis is never a flat line, with the activity shooting up to high levels in deep sleep. That was the first intellectual shock that Adrian, had had in 1930's when he recorded the electroencephalography of a cat put to sleep after a milk-feed. The brain seems to work overtime when it is expected to be still. Your neuraxis is on an overdrive exactly when you are fast/dead asleep. "If we took a piece of brain the size of a match head alone, there could be up to a billion (interneuronal) connections on the surface." (Susan Greenfield). Each of the billion connections is bursting with electrical energy. Adrian's co-Nobelists Sir Charles Sherrington's poesy, his reverence for the brain, merits a mention here: "A dense constellation of some thousands of nodal points bursts out every few seconds into a short phase of rhythmical flashing. At first a few lights, then more, increasing in rate and number with a deliberate crescendo to a climax, then to decline and die away. After due pause the efflorescence is repeated. With each such rhythmic outburst goes a discharge of trains of travelling lights along the stalk and out of it altogether into a number of nerve branches. What is this doing? It manages the taking of our breath the while we sleep."

What is true for every neurone, holds true for every sensory receptor and every muscle cell. [2] Flux - ceaseless - is the be-all and end-all of circuitocytic function. A circuitocyte is a sensory receptor, a neurone, or a muscle cell whose sole characteristic is establishing a circuit to be a part of the same.

Animal life, Portmann aphorized, is configured time. Every cell, plant, microbe, animal is configured water. As is a cell so is the whole body, made largely of water. The body water, through its ceaseless input and output, is in a state of constant fluidity or flux. Water moves in turns intervascular, then extracellular, intracellular, the direction reversing. The kidneys, in an average human, produce a filtrate of 150 L in a day and return 148.5 L to the body and let out 1.5 L or more as urine. Each exocrine gland is pouring out fluid all the time to let the water out and the ducts flushed. The billions of sweat glands are like rivers returning their waters to the ocean of water in the milieu exterior. The 5 L of blood has ceaseless flow between two heartbeats, its first and its last. The heart owes its contractility to the dilatation (diastole) forced upon the ventricles by the incoming blood - so-called venous return to the heart. Within physiologic limits, greater the venous return, greater the ejaculatory force of the ventricles.

The eyeball comprises water filled balls one within another where the contained water is forever in a flux. The water gives it the rounded shape and serves as the refractory medium. The fluidity of air underlies the CINE rhythm - Cyclic Inspiration N Expiration, from the lungs to the tissues and back, sans any pause. All gaseous flux.

Fluids play a major role in the locomotor system. The bones bear and transmit weight not through the hard, fragile, unbendable bony lamellae, but by and through the contained fat and marrow that are liquid at body temperature. The sole and the palm of man are capillary hemangiomas that take all the impact, helped toward this by the water in the sweat glands and the liquid-like plantar and palmar fat. The synovial fluid does not merely lubricate a joint but serves in the relay of weight transmission. When you stand or jump the fluids of the foot take the impact, pass it on to the synovial fluid of the joints, from synovial fluid to the blood and fat of the marrow right up to the scalp. That's how Ussain Bolt of Jamaica manages to finish 100 m within <10 s.

Heraclitus is right. The whole animal body is in a state of ceaseless flux, of one form or other. Flux is life. No flux is death.

All translatable weight-bearing must be on a fluid cushion. The felines have their soft adipohemal paws. The equines have a hydrated hoof overlaid by a mass of fat and a lake of blood. The elephant has a huge circular plane of hydrated keratin supported by fat and blood vessels. Even the snail -gastropod-slides on a film of blood over its so called gastropod.

All fast moving vehicles ride on the fluidity of air. Ships sail through the fluidity of water. The prime requirement is that the interface of the weight carrier (limb or tyre) and the weight-bearing surface must have the faculty of accommodation to the ever changing interface. Flux and fluidity has the ready deformability and reform ability which a solid weight-bearer misses. The pillars can be solid but the paws and hoofs must exhibit fluidity.

The fluidity of air plays a vital role on either side of the diaphragm. Above it, the air inflates the lungs to broaden the chest for giving wide anchorage to the muscles of the upper limb and to ferry oxygen and carbon dioxide. Underneath the diaphragm,

the dome of the gastric fundus houses a ball of gas that gets established within 2 h after birth and stays until death. It's a cushion of air on which the heart dances, air-cushioned as it is by the lungs on either side, in front and in the rear. It's possible that the gastric air, like the air in the swim-bladder of the fish is an active secretion by the fundic mucosa to subserve cardiac action.

One entity that is a largely viscous fluid gel is mucoid connective tissue (MCT). A non-fibrillar colloid material essentially acellular, forms the vitreous of the eye, the dental pulp and the nucleus pulposus of the intervertebral discs. [3] With a fluid's ability to be "infinitely incompressible," the MCT in the pulp at the root of the tooth takes all the impact of mastication and that of the discs gives mobility to the spine and the capacity to take impacts. MCT also forms the main substance of the umbilical cord.

The versatility, the infinite incompressibility, the ready accommodativeness of fluids - air, water, synovial fluid, fat, CSF, blood, lacrimal fluid - needs wider appreciation. A 7 microns thick (or thin) film of tear separates the eyeball from the eyelids allowing the latter to roll over the ball thousands of times a day for 100 years, the 7 microns comprising 4 of water and 3 of lipid. At a Ripley's believe it or not, in USA granite ball of 14,000 pounds could be rolled over by a single person on account of a film of water 1/254 inch, separating the ball from the trough. According to the British neurosurgeon Rowbotham, it will need 10,000 tons of pressure to reduce the brain to half its size. Fluidity is a divine gift.

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## VIEW POINT

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## Foramen-fallacy: Descriptive-delusion

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## Full Text

Adi Shankaracharya, in the 9 th century AD, and Nicolai Copernicus half-a-millennium later, declared sunrise-n-sunset as deceptions. We all - including the media - continue to swear by these terms, robbing us all in the bargain of humbling but vivid conceptual change that the sun neither sets nor rises, nor even does the earth, but it is our cursed ingenuity that has been fooling us all along.

Seeing is believing, but believing sans thinking, is deluding. The various foramina of the animal body are a case in point. The discerning Skinner in The origin of Medical Terms traces the term foramen to forare meaning "to bore a hole, to pierce". The all-time great Gray's Anatomy goes on a descriptive rampage: "A hole in bone is a foramen ; foramina are canals when lengthy. Large holes may be called apertures or, if covered largely by connective tissue, fenestrae . Clefts in or between bones are fissures ."

The whole trouble about the above, Galen-old, description is that it is nowhere near truth. Gray's synonymy between foramen-n-hole allows you to conclude that whatsoever that "passes" through a particular foramen, does so by boring a hole through the bone, or by piercing it. The confusion is worse confounded when Gray describes the "intervertebral foramina" as "the principal routes of entry and exit to and from the vertebral canal." The didactic delusion - that nerves/vessels "run through" a foramen - gets dynamically confirmed by Gray telling that "the facial nerve emerges from the stylomastoid faramen". Bones, it would seem, are already there when nerves/blood vessels arrive, which having done so "enter" into and "emerge" from the bony hole. Ditto delusion for muscles which have their "origin" in one bone and "insertion" in another.

All the modern texts on gross anatomy ail from descriptive compulsions demanding conceptual and terminological delusions. The fait accompli adult cadaver is taken as the basis of all descriptions, thereby giving a short shrift to the actual epigenetic sequence. How about, as a starting point, mulling over this statement? The foramen ovale forms round the mandibular nerve, and the foramen magnum round the neural axis. No foramen worth its name is an exception to this, very ordinary, embryological and epigenetic sequence.

The above Copernican change is a plea that the ease, elegance and the profundity of Nature's working need not be dismissed by our unappreciative temper, paucity of imagination, and poverty of parlance. Slack, in his mini-classic *From Egg to Embryo* (Cambridge Univ. Press 1983) makes a humbling generalization: "Embryogenic development is terribly complicated. It is a historical sequence of hierarchical decisions by which one state of system leads to another". The reality of vertebrate embryogenesis is that the developing body lays down the cables-and-conduits first, followed by their being surrounded/packed/cushioned by connective tissue that, after the full embryogenesis is over by the 8<sup>th</sup> IUL in humans, gets mineralized here and there to be called bones, that are a put-on on the pre-laid nerves and blood vessels, as also muscles. Not one of them traverses a bone, nor seeks "attachment" to it. But the latterly arrival of bone creates the illusion of a foramina/ canal/ fissure/ fenestration/ attachments. The utter disregard that anatomy texts hold for the "hierarchical decision" allows them deluding descriptions. Profound poetry gets replaced by pedestrian prose.

An easy metaphor for the laying down of bone around any nerve/vessel is that of a sleeve. A sleeve, from *sliv/slev/sloof/sloove* meaning to cover or to put on, looks like the most appropriate replacement for the illogical term foramen etc. The foramen magnum is an occipital sleeve around the neural axis, and so is any bony canal or bony fissure allegedly allowing a structure to pass through it. To render matter bonily more complete, all connective-sleeves that are ossified be called ossleaves or osseous sleeves.

A foramen is a ring sleeve, a fissure a flat sleeve, a short canal a short sleeve, and a long one a long sleeve. The endeavor of eusemantics aims at pertinent parlance clearly based on principles. An eusemantic term should be euphonious, and evocative. The moment you see an intervertebral foramen as a sleeve, the mind takes you effortlessly to the primacy and hierarchical priority of a spinal nerve, and the subsequent, second-thought emergence of the bony cover in the post-embryonic fetal phase. So the shift from foramen to sleeve is embryologically and anatomically epigenetic and educative.

The sleeve-magnum (hitherto, foramen magnum) is NOT the largest. The largest is sleeve-maxima, and is located in the ring of the atlas. Next is the occipital sleeve-magnum. The so-called spinal canal represents sleeve-media, the intervertebral cover the sleeve minima and the other minute sleeves should be known as sleeve-miniscula. Each of them is a put-on, an apparel, a bangle, a wrist-watch, a cuff, but none is a foramen.

That the anatomic descriptive fallacies are not just foramen-oriented, can be realized from the fact that the esophagus does NOT pass from the neck, into the thorax, to emerge into the abdomen, nor does the aorta pass through thorax to burst out in the abdomen, but that the so-called neck, thorax, and abdomen get fashioned around hierarchically prioritized oesophagus and the aorta.

The all-too-common fallacy of giving certitude to a logically wrong sequence and then confounding it by "bare-faced empiricism and embarrassingly silly terminology" (Nobelist Medawar's lament on immunology) may be called CIFOTHism - the Cart in Front Of The Horseism. CIFOTHism makes you look learned but leaves you cocooned by confusion. The extant descriptions of the anatomy and physiology of the locomotor system are CIFOTHismic, bereft as they are of self-evident epigenesis. The reader is urged to go back to Gray on the facial nerve ( vide supra ) and rethink, and then reread, the same as follows: "In the neck, the facial nerve turns visible just beyond the stylomastoid sleeve." Correct embryologically, epigenetically, anatomically, and didactically.

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## EDITORIAL

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## Fungi: Too evolved to be condemned

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## Full Text

The word fungus has an interesting etymology, being sfungus = sponge, one with many pores. Homer's Odyssey (1050-850 B.C.) refers to the 'many-pored sponges'. So, porous, sporous, spongy, sfungus, fungus. The white mold on your brown bread is porous and foretells you of the porosity of the bread that is fungal in origin. The science of fungi isn't fungology but mycology, from Gk. mycos = fungus or mushroom. The science of mycology dates back to 1677 when Hooke, a contemporary of Newton and the first to microscopically describe and name a 'cell', discovered that the yellow spots on rose-leaves consisted of filamentous fungi, the study of which he started. Saccardo, in 1906, published an 18-volume Sylloge fungorum, carrying an account of 57,660 fungi, a figure crossing 150,000 as of today. The whole antibiotic era started with the fungus *Penicillium notatum* that favored Fleming, Florey and Chain with a Nobel prize.

Let us count the blessings first: Fungi mean money, business, and quality life. They bake our bread, brew our wine, swell the idlis and dhoklas, spread the dross, offer you a number of antibiotics and even immunosuppressives, and above all, desist from harming the humans. They help humans to turn into fun-guy and fun-gal revelers. Of the nearly 1,50,000 species identified, not more than a few hundred are interested in waging any war with humans. Those that do bother are, more often than not, innocent bystanders that get converted to criminality by circumstances beyond their control, to be condemned as opportunistic, a game that only humans play. Microbes labeled opportunistic need to be exculpated by rechristening them as opportunized, a status accorded to them by iatrogeny. They do not seek to invade; medical misdeeds force them to do so.

Anthropocentric medical science has failed to emphasize the truism that the microbial biomass outweighs the

total animal biomass by a factor of 100. Microbes are the HOST, we the pampered parasites. For every single of the 10,000 billion human cells, there are 10 microbes, so that an average human has on the body a microbial mass of at least 2 KG, the microbes numbering 100,000 billion. The human skin and nasopharyngeal and gastro-intestinal mucosae are lined by an inevitable, indispensable microbial sheet that is your parabiosis, comprising a milieu surferior (intermediate between milieu exterior and interior) that as a surfinsic layer protects your skin and mucosa by intermicrobial understanding whereby most of us sail through life without a bother. To denigrate these microbial gate-keepers as saprobes or saprophytes (Gk. sapos = rotten, putrid), commensals, parasites, and worse, as pathogens is to forget that etymologically, they all comprise symbionts, meaning those that live together with you. Any microbe, that is your surfinsic neighbor, is a symbiont. The common peaceful coexistence with your microbial hosts is euparabiosis and quarrel is aneuparabiosis. It pays to bear in mind an aphorism enunciated by a text on internal medicine. Friendship between microbes and man is the rule and enmity an exception.

Enmity engendered by opportunized fungi is a consequence of antibiotically disturbed parabiosis and/or immunosuppressively induced epitheliolysis. The foregoing, coupled with inevitable fungal proliferation to replace microbes eliminated by antibiotics, forces the fungi to travel into the depth of human tissues. A small but compound fracture has an infinitely greater chance of turning osteomyelitic than a large but closed fracture, proving that it is the intact skin cover, and not your antibiotics, that are the real protectors and preventors of deeper infection.

A medical idie fixe is that microbial opportunism is a gift of immunocompromise. The snag here is that immunologists themselves, amongst them the most important being the Nobel laureate Macfarlane Burnet, do not know whether immunity is a friend or a foe. Indeed, as Glemser the American science-journalist, summarized, the science of immunology is so advanced that one immunologist cannot make out what another is talking about. Medawar, the co-laureate with Burnet ( vide supra ), diagnosed that immunology suffers from 'bare-faced empiricism and embarrassingly silly terminology'. This is so because immunity (from im=not and munis=service, meaning exemption from any duty or work) is yet to be defined so that while we go gaga over immunodeficiencies in AIDS, we keep on adding one disease after another as caused by immunity itself. Immunity, as of. 2007, is like the Big Brother in Orwell's 1984: 'tormentor, protector, inquisitor and friend'. The tissue destruction in leprosy/tuberculosis is now ascribed, not to the mycobacteria, but to the invasion that the patient's own immune system launches against the tissues that have the misfortune to house these rather inert, non-toxic microbes. Even the famed Burnetian idea of immunity eliminating cancerous clones puts paid by the suggestion that the so-called lymphocytic/immune proliferation around a cancerous focus serves as a fodder or forage for the cancer cells. Oh, Immunity, where is thy friendship? Oh, Microbes, where is your enmity?

Back to the fungi. Their decency resides in their readiness to respond to antibiotics like amphoterecin B, and to surgical excision of the fungal SOLs. As the Handbook of Clinical Neurology, dealing selectively with infections of the nervous system (Volume 35, page 392), summarizes: 'Response to appropriate therapy is generally good, and cure rates around 90% or more, have been reported. It has been said that actinomycotic brain abscesses have a better prognosis than brain abscesses of other etiologies, perhaps because of the more indolent nature of the former'. A passage of good three decades has not forced upon neurologists a different opinion.

What microbiologic-n-therapeutic lessons can neurology learn from Fungi? More faith in humility than in hubris. Given the host nature of microbes that shelter the human guest, it must be driven home that, Nature abhorring microbial vacuum, permits antibiotics to be mere microflorafluctuators that succeed in driving out some microbes to allow other 'pathogens' to take their place. Antibiotics, seen as a solution, have turned into a big problem. Raeburn of England, rued in the Lancet that 'In the years to come, the story of antibiotics may rank as Nature's most malicious trick' on mankind. Koprowski, participating in a Ciba Symposium, on Man and his future, 1968, issued a stern advice: 'If a universal antibiotic is found, immediately organize societies to

prevent its use. It should be dealt with as we should have treated, and did not treat, the atomic bomb. Use any feasible national and international deterrent to prevent it falling into the hands of stupid people who probably will still be in majority in your time as they were in mine'. No wonder that antibiotics cause aneuparabiosis, to opportunize fungi into invading the human interior. Immunosuppressors behave the same way, so that it is not so much the immune deficiency but the disturbed microbial flora, and compromised epithelia that account for mycosis in the so-called immunocompromised. The rarity of primary CNS mycosis, and the increasing frequency of the same in compromised individuals allow you to conclude that the fungi, vis-à-vis the CNS be declared as essentially innocent. Paul Davies, in his *The Fifth Miracle* traces our ancestry not to a monkey but to a microbe. The prokaryotic microbe turned eukaryotic fungus could have eventually begotten the eukaryotic human. No wonder, the joys of human fun-guys and fun-gals comes from the brew that the fungi cook, and the bread that the fungi bake.

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## EDITORIAL

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## Integrity, immunity, reactivity, restorativity: Biolessons off brain abscess

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## Full Text

A brain abscess (BA) as an ensconced pocket of pus is no more no less than an abscess on the toe or the torso. It begs to be drained along the Hiltonean maxim: wherever there is pus, let it out . It is BA's deep and 'dangerous' location that needs diagnostic and operative wizardry comprising THEOS-SLAM-AAAA. [1] THEOS (=religion) implies Technicized High Element Of (Diagnostic) Suspicion. SLAM - meaning winning all the tricks of the game- reads as Speedily Locate, Adroitly Manage, by AAAA- Aspiration and/or Ablation, Antibiotics and Antiepileptics. What biolessons could BA offer?

The term intelligence connotes 'reading between the lines', from inter = between and legere = to grasp, read, choose, pick up. BA's acknowledged uncommonness, bordering on rarity illustrates the immunity that the neuraxis exhibits against patently pyogenic microbes. The evolution and nature of BA manifests brain's reasoned reactivity , or mindful munity . The alacrity with which BA responds to timely measures exhibits the animal body's restitutivity or restorativity . And encompassing these three bioforces and a lot more is integrity . It is time that these bioforces comprising Vis Medicatrix Naturae - the Healing Power of Nature- were brought into a broader relief.

Macfarlane Burnet got his Nobel in 1960 for concepts that spawned the idea of body-cells as 'self' rejecting anything perceived as non-self. In 1962, Burnet published a mini-classic Integrity of the Body , wherein he evolved the idea that the chief function of the animal immune system is to keep intact the body's integrity or wholeness by rejecting whatever that is alien to it.

In Cellular Immunology Burnet interestingly observes: "Primitive neurons seem almost to be programmed individually, each to move and direct its axon (and dendrites) along an elaborately predetermined course". If even a single of the billions of neurons knows where to place itself during and after embryogenesis, then surely each of the 100,000 billion body-cells, coming off a single zygotic cell knows where to place itself, how and how long, given its place in a cytogalaxy where no two cells are riveted or pasted to each other and yet all stay put from conception to cremation, without denying rapid travel throughout the body to many a cell-type. Integrity is an animal's total noumenal blueprint that precedes, accompanies, and succeeds the animal body and one which knows how far to heal a wound or a gap whereby the body is restored to status quo ante as near to the original as possible. Multiple aphthous ulcers in the mouth, needing billions of cells to repair, get healed impeccably, and smoothly, leaving no rubble strewn around. Ditto for the BA, single/multiple, small/large, of whatever origin, integrity orders reactivity and restorativity to so work that the least of the brain remains compromised after the BA has been therapeutically dealt with.

Given the long and ever-expanding list of autoimmune disorders, modern medicine knows not whether immunity is a friend or a foe! Medawar, the co-Nobelist with Burnet, sums up the perverted parlance of immunology as barefaced and silly, whereas Glemser, a US journalist, sizes up modern medicine's predicament by his generalization that the science of immunology is so advanced that one immunologist can't comprehend what another is talking about. Some principled parlance is in order.

Munis means duty/service. Im - in immunity is negation, and implies freedom from service, or from having to work. Immunity, then, means non-reactivity or absence of munity. The Burnet-Medawar symphony played the tune that the human embryo, circa fourth month of intrauterine life, eliminates from its thymus clones that could possibly react against the body's cells and elements. Thereafter, the so-called immune system knows which part of the body is self, and what is not-self. A self-marker or a suimarker is endowed to each self-element, an advantage not denied to an alien unit or cell present at the time of thymic maturation. Hence the acceptance of grafts, experimentally, or in monozygotic/dizygotic twins sharing a placenta, between individuals so involved. Immunity, in its principled, etymologic sense is aristocratic non-reactivity. Brain, as a tissue, is notorious for not reacting to deliberately inoculated organisms. Hence, the rarity of BA despite so much of otitis, sinusitis, septicemias and pyemias. BA illustrates immunity by choosing not to occur, despite the all too common head-injuries, involving a lot of road muck getting into the brain, with bony sequestra strewn around.

The word munity is best understood by the close parallel between immorality versus morality, and immunity versus munity. Munity, allied to munition or arms, is synonymous with reactivity of the animal body against non-self elements. The arsenal comprises cells and humors (antibodies), and the system is best acronymized as CHRIST - Cellulo Humoral Reactivity Insuring Somatic Totality.

As and when the brain has to react against a microbial alien, the reactive or munitive forces set up a focus of inflammation (cerebritis or cerebellitis), followed by the creation of a barricade all around to form the so-called capsule of the abscess, that now lyzes body's leucocytes and co. to create a fluid-focus called an abscess, that expanding hydrodynamically is capable of finding its way to the exterior, a phenomenon as common amongst humans as amongst animals. But in the case of BA, the walls that it must penetrate through are the vital and fragile brain tissue itself. So BA asks the fibroblasts of the vessels in the capsule-wall to generate enormous armor of collagen- collagenization- that permeating the abscess makes BA into more of a tumor than a fluid-filled abscess, more of a pyoma than a pyocoele, and a pyoma so discreetly separated from the brain tissue around, that a pyomectomy can be carried out with ease, given the plane of cleavage that separates the BA from the rest of the brain. [1] It must be clear to us all that CHRIST when operative in BA exercises reasoned-reactivity, and mindful-munity, whereby the BA, indistinguishably behaving clinically and radiologically as a tumor, alerts the patient and the clinician into the triad of THEOS-SLAM-AAAA, assuring thereby rapid recovery. Even a BA thinks, reasons, and reacts to assure minimal brain damage, and rapid, maximal recovery.

The reactivity attending BA has had to be honored as reasoned, for the forces of CHRIST, of reactivity, are enormous. One has just to think of severe SLE, a form of contra-auto-reactive-syndrome (hitherto called autoimmune syndrome), and relentless graft-rejection on the other to appreciate the power that CHRIST can, and does, wield. It is, to use the framed phrase of Lord Tennyson, Nature, red in tooth and claw. The reasoned nature of CHRIST is BA, and so often as elsewhere, is functioning integrity, that converts CHRIST into a vector imparting to it direction, magnitude, modes, and a switch-off. Once the alien contents of an abscess cavity or the abscess itself are out, what is left is a mass of native neuraxial and guest reactive cells, all self, and hence no longer in need of any more reactivity. So hereafter, what sets in is the restorative or restitutive power of the animal body, albeit under the all-seeing eye of integrity.

An Oxford dictionary synonymizes the Latin phrase restituto in integrum as restoration to the uninjured state or restoration of the status quo ante , meaning the previous position. Be it bone, brain, bone-marrow, or liver or lung, integrity, having for itself the original blueprint of the body, orders the restorative powers to aim at reducing the area of injury/inflammation/wound/abscessing to its barest minimum, and then offer secure repair to almost original state. In BA, once the abscess contents/abscess itself are out, the remaining neuraxial tissue, or the walls of the BA that has been aspirated, set about working to leave behind, at the most, a fibrous cicatrix, that calls for antiepileptics for a year or two. Needless to say that integrity imparts to restorativity direction, magnitude and components and switch-off as it does to reactivity. If a liver is excised 25%, restorativity goes into action to replace whatsoever liver has been lost, no more, no less. In the neuraxis, neurons lost are lost forever. Yet integrity strives to replace the gap by reactive gliosis if need be. The attempt all the time is to restore the integrity of the brain to status quo ante .

The rarity of BA is turning into its commonness because of modern therapies 'immunocompromising' the patients, young and old. Here you see a paradox. On the one hand, you claim suppression of immunity as responsible for the setting up of inflammation, abscess, pus, et seq . On the other hand, these events proclaiming the active manifestations of the forces of 'immunity' occur widely in the body and the brain. In reality, there is no immunosuppression, or, more correctly, reactivitysuppression or CHRIST-letdown. What is at stake is the compromised skin/mucosal lining, because of the indiscriminate cytotoxic nature of the so-called immunosuppressors. The result is SICKNESS- Structural Integrity Compromised Kেমically, a state that drives the innocent bacterial symbionts deeper into where they ordinarily never are. The body has no other recourse but to request CHRIST to go into action to set up BA and what have you. Unless the body has enough reactocytes (immunocytes), how would even an abscess form! SICKness opportunizes the innocent microbes which then get condemned as opportunistic. To borrow Shakespearean felicity, "The fault, dear Brutus, is not in our microbial-friends, but the compulsion to which they are iatrogenically subject". The pancytotoxic nature of the therapeutic immunosuppressors also knocks out the elements of bone-marrow thus accounting for the various hemocytopenias. One can generalize that BA is more due to SICKness, than due to suppression.

BA is a good teacher. We better learn a lesson or two from one of the Nature's wonders called BA.

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## EDITORIAL

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## Let us not just work at the spinal level

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## Full Text

Einstein's lasting rue against the modern times was - a profusion of means, and a confusion of ends. The scenario holds good for the human spine. Modern medicine has an arsenal of imaging techniques that seem to refine themselves everyday. To complement the imaging efficiency, operative instruments are now made of the best of material- for operating and inlaying. Yet, the net outcome for the ailing spine is not very reassuring. No wonder, given the same case, diagnosis, treatment and outcome differ from one clinician to another.

A sea-change has descended on the spinal scene. A detailed consideration of the epigenetic sequence in embryology led the senior author (M.K.) to research upon and demonstrate that in the musculoskeletal system, the soft tissue is the boss, and the bones a mere inlay. The spinal bones are formed initially as a gel-like tissue, much akin to the Wharton's jelly in the umbilical cord. The jelly is replaced by vascular tissue which then spawns the bony lamellae to fashion the vertebrae that seem so prominent grossly and radiologically. The bony vertebrae are discrete islands in an uninterrupted ocean of soft tissues, of which the discs are an integral part. The foregoing may be illustrated by two epigenetically correct statements: 'The spinal cord does not pass through the foramen magnum, but the foramen gets fashioned a round the cord'. 'The spinal nerves do not pass through the intervertebral foramina. It is the foramen that develops around the preexisting nerves'. The disc is the central dorsal point of the embryonic somites, having the spinal nerves emerge in line with the disc, thus rendering, and so rightly, the vertebrae as interdiscal or interneural. The entire soft tissue architecture of the body including blood vessels and nerves are formed much earlier in the embryonic life before even a spicule of bone is formed. Likewise, the disc is much stronger than the vertebral body, which is the 'weakest' part of the spine.

The epigenetic, anatomic and physiologic primacy of the soft tissues- meaning the periosteum that forms the os case and all the soft tissues that terminate into it- makes it the mother membrane that, in health and disease, tension and trauma- fashions, begets, sustains and repairs the enclosed bone. The strength of the soft tissue, thus, becomes the strength of the spine. No wonder, that a well-toned back with radiologically 'weak' looking spine has no symptoms whereas a burgoise back, looking good, has all the problems for want of rightfully trained and toned soft tissues. In the coming years, a better understanding of the genesis, structures and function of soft tissues of the vertebral column will pave way for greater clinical dividends, conservatively and operatively.

There is another sea-change in the spinal scene, and the credit for this goes to man, the Homo technicus . Progressive refinement of material has offered to modern medicine non-reactive material that is light, of high tensile/compressive strength, and capable of replacing a lost vertebra or lost intervertebral disc. To add to this material bonanza the varied instruments and endoscopes have made spinal surgery minimally invasive to provide maximal beneficial outcome. The future, to say the least, is materially and manually quite bright.

The cytological miracle called the spinal cord and all the nerves that go into it or emanate therefrom comprise a living God where, as Sherrington showed and said, a million shuttles weave a pattern to subserve Sania's serve at the Wimbeldon or Amitabh's antics on the screen. The 3 maters, and the spinal vertebral column comprise a multilayered temple that has the honor of housing an important deity, Suffice to say, the contents of the spine - the cord and co. - are supremely important, the vertebral bony column playing a subsidiary role.

Ralph Waldo Emersen aphorized that what is NOT seen is always far more beautiful and important than what is obvious to your eyes. Roentgenian radiology naturally brought the relatively inert and unimportant bones to the fore to the neglect of soft tissues. MRI, CT and the likes have changed the scene but not our approach to the primacy that the soft tissues must be accorded. The word God is traceable to goodh (Sanskrit) meaning 'subtle'. The spinal soft tissues are subtle, therefore like God not readily seen, and thus given a short shrift. A time for a revised weltanshuaang on the spine has arrived.

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## EDITORIAL

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## Maternalizing the meninges: A pregnant Arabic legacy

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## Full Text

A few medical terms were coined in poetic reverence: Serum , is rooted in ( sarete iti ) sarita , a Sanskritic homage to the serum that flowed out from under a superficial hematoma like a sarita or a river . Vulva - 'the mother of all saints'- is traceable to a whorl made by the petals of a flower.

Dura/arachnoid/pia maters that invest the central nervous axis (CNA) are the so-called meninges that to the early Arabic observers seemed nothing less than alumm al-dimagh , meaning the mother of the brain. Meninx connoting a membrane does poor justice to the veritable womb that the maters make, all around the CNA and well-beyond in all directions. The maternal status has rightly been accorded to uterus for bearing and bestowing a baby, and hence metrium, parametrium, metrorrhagia and so on. Uterine inflammation is metritis, but meningeal inflammation has never been materitis, nor has meningeal been substituted by maternal. The Arabic reverie gets aborted the moment the misnomer meninges take over, a gaffe that usurps the forest for the trees.

The evolution of the mater-nal terms makes interesting history. The Arabic alumm al-dimagh was subdivided by Haji Abbas into alumm al-galidah/jafiyah - the hard mother, and alumm al-raqiqah -the tender/soft mother. The Latin equivalents were crassa (thick or dense) and tenuis (thin or fine). Stephen of Antioch, a monk described these in Latin as dura mater and pia mater. Pia should have been tenue, but the monk in Stephen chose the word pius (pious) or pia, which has persisted. The concept/term arachnoid was introduced by Herophilus for the spidery nature of the tissue and was described as a complete cover by the Dutch anatomist Frederick Ruysch.

Interestingly, the 3 maters cover the gray and white matters, leading one to muse over their very etymology: Mater, matter, matti, mud, matrix, metrium are all rooted in the universal ma, matru meaning mother. The suffix-ter indicates a state of being, and hence mater, laughter, neuter and so on. For convenience, mater has implied motherhood and matter has connoted materiality. In a manner of speaking, we all carry 5 mothers, within our skulls- 3 maternal and 2 material, all having been derived epigenetically from the neuroectoderm that forms in the dorsal midline of the embryonic plate, that soon dips to form the neural groove, that sinking further, turns into the neural tube that delves deeper to allow the cutaneous ectoderm to close over.

Much as the developing embryo fashions for itself, out of its own matter, its fluid-cushioned nest in the form of amniotic sac (rather flatly called the fetal membrane), the neural tube while busy forming the CNA crowns itself dorsally to form the neural crest whose versatility and reach closely compete with those of the CNA and all its offshoots called the nerves. While the CNA may be assigned the pride of place, the task of housing, protecting, propping, buoying, vascularizing, insulating the whole CNA and its ramifications is done by the neural crest cells, with the panache and perfection of a mother or a set thereof.

Dura mater-literally, the hard mother-is coextensive with the cranio-spinal axis for she houses the latter by splitting to form various coeloms each of which spawns and lodges within it the cranial/spinal bones, a sequence that explains why the same dura forms periosteum on the outer side and endosteum on the inner. The dura fashions various chambers and partitions to nestle the CNA, hence meriting the appellation nest mother whose precise projections into the cranium create the props falx cerebri 'et cerebelli' and a floor for the occipital lobes, wrongly called the tentorium cerebelli. The occipital hammock, made by the nest mater may be Latinically called the floorum occipiti . The nest mater, fashions numerous vascular coelomic spaces to accommodate the low pressure venous sinuses (venae magna) to render them patent under pressure.

The nest mater assumes a capacity consistent with the size of its contained CNA, and then fashions the bones to anchor itself afar from its contents. Eucephaly, anencephaly, aneucephaly of various shapes and/or sizes, meningocoels (rightly materoceles) are no bony defects, but a consequence of the decisions taken by the maters and the CNA. Ardrey aphorized that normality is a range, and no fixed, arbitrary average. All the aforelisted 'normal' 'abnormal' variations are but an integral part of widely encompassing normality. It is of significance that an oligocephalic (1000 ml) brain of Anatole France exercised Voltairean genius, and a brain of 2000 ml may be all dumbwit. Normality and abnormality- as yet undefined- usually reside in the eyes of the beholder.

The term arachnoid or spider mater is poorly evocative of the stellar role it plays in buoying up the whole CNA through its contained fluid, that having the same specific gravity as the neural tissue, renders the CNA essentially weightless, much as the amniotic fluid does to the fetus. A vital outcome of the buoyancy accorded to the CNA is to steer away the wider part of the medulla from pressing the vertebral vessels against the foramen magnum, a fact tragically verifiable uncommonly by instant death from medullary coning on sudden release of high-pressure cerebrospinal fluid (CSF) to the exterior. How about calling this so-called arachnoid meninge as the buoy mater , containing buoyacqua, limitedly called CSF. The buoy mater, closely abutting on the nest mater, extends well beyond the CNA, a blessing that allows the safety of ' CSF punctures' high, and low. The buoy mater sweeps past the changing contours of the CNA, thus allowing many a cistern to protect vital areas with the buoyacqua filling up the various sulci so as to cushion all the gyri. The buoyacqua space provides a fluid sleeve to all nerves going in and out of the craniospinal axis. The free communication between the buoy mater buoyacqua and the buoyacqua in the interior of the CNA provides an effective adjustment of pressures within and around the CNA. The arachnoidal septae criss-crossing the interior of the buoy mater create freely intercommunicating cavernous spaces providing fluid support to the vessels traveling to and fro. The maternal role of the buoy mater is a fascinating illustration of the functional necessities being the mother of structural innovations.

The pia or pious mater, for long, was taken as one with the buoy mater. It is a tunic that closely clings to the entire CNA, faithfully following it through every crevice small and large. It is designed to allow the CNA vasculature to branch and plexicate itself in the pia mater so as to occupy the least space in the substance of the CNA and to equitably vascularize it all over. The pia mater is the vas mater, phonetically pretty close to vas deferens.

It should not be difficult to replace the terms meningeal, meningitis, meningocele, meningioma, pachymeninges, leptomeninges by the more appropriate maternal, materistic, materocele, materoma, pachymater, and leptomater. The transition is not difficult if one recalls the many a maternal terms used for and about the uterus. Likewise, the adjectival terms nestal, buoyal, buoyaquatic, and vasal would sound as felicitous as the counter terms they hope to replace.

Put succinctly, the nest mater nestles, the buoy mater through its buoyaqua buoys, and the vas mater vascularizes the entire cerebrospinal axis and its ramifications. The new terms are euphonious, evocative and valid epigenetically. The Arabic legacy that christens them as mothers is pregnant with reverential understanding not bereft of rich scientific content.

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## EDITORIAL

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## Muscle: The eternally ecofriendly automobile

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## Full Text

It was about 4.2 billion years ago that there was a life-bang that spawned the first cell - the protocyte - that began the story of life that continues till to-date. A part of the cytoverse is myosin-actin complex that endows power to move things within, and to propel itself in relation to the milieu. Thus came into being the first - ever automobile that can move sans any pull or push. Evolutionary water flowed and begot larger, metazoans that asked the versatile zygote to beget mesoderm a part of which formed the microscopically recognizable muscle cells.

Muscle is an adaptation from L musculus, meaning a little mouse as a child's contracted biceps brachii would look like, or the rippling under the skin that one would feel when some muscles are in action. It is significant that whereas it is the biomouse (muscle) that makes a midget or a mammoth move, it is the technomouse under your palm that moves information within a computer and across the ocean and to Jupiter and back. The biomouse is ecofriendly, the technomouse and its back-up an acknowledged E-tech environmental disaster. Nonmuscle- power, namely fossil-fuel and electricity are hardly 200 years old. Muscle-power - animal and human - has spawned the greatest civilizations, boasting of Pyramids and Parthenon, Scandinavia has realized the perils of man-made power, and are reviving animal- farming. John Steinbeck, in The Grapes of Wrath, laments that the tractor deadened the neighing and hoof-beats of the horse that animated (anima - atma) one's house even when the animal was not at work. The BBC recently sought the opinion of over 12000 people spread the world-over as to the greatest invention of the last 200 years, and a whopping 67% gave the human-propelled BICYCLE the pride of place, as universally useful, ecofriendly and homofriendly. Hail, the miracle called MUSCLE CELL. By 2060, all oil reserves are expected to be over, and the humble bicycle will make

a global come-back, freeing you of the need to take any statin, or resort to a plasty or bypass.

Guy Murchie describes human body as a 'corporation of 100 organs, 200 bones, 600 muscles, trillions of cells, and octillions of atoms that are physically you, a human cosmopolis, a mysterious going concern'. The 600 muscles account for the entire human civilization, the Vedic and Voltairean manuscripts, many a men-made wonder, the grace of Birjoo Maharaj or Isadora Duncan, the verse-ability of Lata Mangeshkar, and the strokes of M.F. Hussain, not to miss out on Michael Angelo's Pieta on the one hand, and the unnamed sculptors of the Taj Mahal on the other. Muscle makes miracles. To this set of wonders, add the 3 billion+ heart-beats and 1 billion+ chestbeats you are empowered with over a span of 100 years, not to talk of a million miles traveled on the GI and GU tracts.

Claudius Galen (131-201 AD) can be held as the pioneer myologist that described over 300 muscles and gave such lasting names as platysma, cremaster, masseter, popliteus, and interossei. Then the Titanic Vesalius in 1543 botched up the issue by giving numbers in place of names, confusion worse confounded cleared by his contemporary Sylvius who once and for ever rendered muscle-naming an art - peroneus, tibialis, scaleni, rhomboidei, serrati, soleus and a lot more came from him, supplemented over the years by Riola, Winslow, Albinus, Cowper, Douglas and others.

The phylogeny and ontogeny of muscles make an interesting reading. The outermost cells of the embryonic cylinder are ectocytes comprising the ectoderm, that facing the milieu exterior, have to fashion the sensory receptors (Sensorium), neurons (Neuronium), and musculature (Motorium), the cells comprising which HAVE to be linked point-to-point as if on a printed electronic circuit, once and forever, a prime reason that endows these cells the status of postmitosis, immortality, or perenniality. These are terms coined not by any spiritualist, but by Leblond who pioneered classification of cells into Perennial, Expanding, and Renewing, in the 1960's. The world-to-us is because of our sensorium, the world-within-us is the function of our neuronium, and the world-because-of-us is the genius of our motorium or muscles. Every man-made menace or miracle is traceable to musculus, little mouse, called a muscle cell. The inherent unity between a sensory receptor, neurone and muscle cell is best illustrated by the embryonic myocardial cells that fashion the might of the heart, make its pacemakers, as also the sensory receptors that mediate all the reflexes.

Human embryogenesis is complete by 8 weeks of intrauterine life, when not a spicule of bone is around, and each of the 600+ muscles are fully fashioned. Human embryogenesis is then an unossaceous (wrongly called invertebrate) affair. Bones arrive as an afterthought, and it is they that seek 'attachment' to the preformed muscles. The bones DO NOT provide strength to the muscles but only serve to form a set of levers to deflect/direct/coordinate muscle power, or to give a spread to them like scapula and pelvis do. The three great boneless wonders that are full of might are the parturient uterus (rated by Gray as more powerful than the gluteus maximus), the heart, and the elephant's trunk. The loligo, the largest invertebrate measuring 50-80 feet, is the fastest swimmer in the ocean, capable of covering 42 Knots an hour, and outpacing the sharks and the whales, for it is the only animal that swims by jet-propulsion, offered to it by its 'visceral' muscles. The human pharynx and much of esophagus have striated musculature that is involuntary. Striation, then, in the heart or the soma, provides speed, and non-striation sustained gentle action. In fact, none of the so-called skeletal muscles is voluntary. As Gray's Anatomy elaborates, the brain knows movements, and not muscles. In any movement minor or major, precise or gross, a definite set of muscles go into action. No single muscle can be added by will, nor one deducted. The appellations voluntary/involuntary have no merit.

The now widely accepted Homoeobox (HOX) theory generalizes that Nature follows the same embryogenic/somatic model be it the smallest worm or the largest whale, wherein the muscular arrangement and working remain essentially the same, accounting thereby for 'swimming muscles of a whale that pitches five times a minute to the flight muscles of a midge that beats its wings a thousand times a second'. The aggregate muscles power of an average human can lift a weight of 25 tons. The extreme of animal power has

been recorded of a whale harpooned from a heavy whaler, dragging the same for miles into the sea, despite full throttle of the 550 HP ship in the contrary direction.

Despite the Nobel award to Huxley and Hodgkin for their theory of muscle contraction, we are still in the dark as to how we wag our little finger. A skeletal muscle is provided with sensory-musculature that we call the muscle-spindle. So any so-called motor movement demands cosmic sensory integration. It would seem that for the smallest action, 'willed' or otherwise, the entire sensory-neurono-motor complex goes into action, thus abolishing the distinctions we perceive between Sensorium, Neuronium and Motorium. So many a disorder, be it chorea or Parkinsonism, is no isolated disorder, but a concerted one. The degenerative myopathies are an antithesis to the perennial nature of muscle cells. However since most of us sail through life, without being much handicapped, we can, with due reverence and humility, generalize that all myopathies have a message that some future Nobel Laureates will decode towards our better appreciation of the little mice we all carry within ourselves.

From 1898, the first Olympics, to the recently concluded at Beijing, there has not been a single one when no records were shattered. Bolt's record sprint in 100/200 meters not only speaks of the superior musculature of a race, but also of the ever-obedient marvel called human musculature. And we have just learnt that Haile Gebrelassie of Ethiopia finished the Berlin Marathon in 123 minutes, i.e. less than 5 minutes a mile, sustained for 26 miles. The immortality that men attain through their works is engineered by the immortal muscle cells within their mortal frame.

MUSCLE as a pregnym, can mean Motor Unit Serving Circulation, Labor and Elegance. The Circulatory component subserves all the body flows and intrinsic movements whereas Labor and Elegance are manifest locomotor system.

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## EDITORIAL

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## Neuraxial healing

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## Full Text

The 2007 multinational medical Nobel to Capecchi, Evans and Smithies 'for their discoveries of principles for introducing specific gene modifications in mice by the use of embryonic stem cells' has set agog the promise-mills of medicalese and journealese ( Outlook July 9, 2007 - cover story: Miracle Cure) into envisaging an utopia, neo-neurocytogenesis for neuraxial healing not excluded. An epistemologic survey of the current scene may tell us what knockout / knockin stemocytologic technology can do and what it can't, vis-à-vis neuraxial healing.

The term neuraxis/neuraxial has been chosen with an attempt at eusemantics. Brain-n-spinal-cord, as a phrase, sounds dichotomously too long. The central nervous system (CNS) has the problem of the CNS not being exactly central, being dorso-central, located just beneath the skin for having been derived therefrom. No one can say where the spinal cord ends and the brain begins or vice versa . Elementary embryology tells us that the so-called brain is an expanded neural tube and the so-called spinal cord is the unexpanded version thereof. The term neuraxis - from the lamina-terminalis rostrally to the filum terminale caudally - evocatively encompasses the brain and the cord, without allowing any dichotomy between them. The Dorland's dictionary , like others, defines neuraxis as the CNS, as also the axon of a nerve cell (!). So much for the semantic lethargy lexicons ail from.

A panoramic dorsal view of the neuraxis shows it to be a gigantic arthropod , that has 40 limbs on either side (12+8+12+5+3) called nerves, 12 of them being cephalopods or head-limbs or the so-called cranial nerves. The body-n-tail limbs are the so-called spinal nerves. The thalidomide-tragedy drove home a point that the so-called limbs/extremities of the human body are mere extensions of the trunk. Likewise, all the nerves are mere,

uninterrupted, extremities of the neuraxis, representing its lateral spread. The entire neuraxis, from the tip of the great toe to the frontal lobes, is free from any fiber, for each so-called fiber in the brain and spinal cord as tracts and beyond them as nerves, is part and parcel of the neurone. The entire neuraxis, central and lateral is a huge syncytium, a cytoma, sans any fiber. A single neurone in man or whale may measure six feet or 100 feet in length. Such huge lengths and the highly precise point-to-point connections between any two neurones took away from them the liberty to duplicate assigning them to the class of post-mitotic/perennial/non-duplicating cells as per the classification offered by Leblond and Moorhead (circa 1961). To dream of neuronal-regeneration through stem cell adventurism smacks of Quixotic tilting at the biological windmills. Neuraxial healing is too involved a process to be viewed lightly. Hence the foregoing preamble.

There are two neoplastic processes that create and sustain life. Embryogenesis is a post-fertilizational neoplastic process wherein very precisely timed new tissue is formed to fashion a Gandhi or Godse, elephant or Einstein. The whole drama is vectorized, each cell knowing where to go and settle or to get lost through programmed apoptosis. The vector or directional element in embryogenetic neoplasm has to be cosmic so as never ever to duplicate any two fingerprints or any two neuraxes.

The other life-sustaining, neoplastic activity is, for want of any better term, called wound healing. Suffice to say that, starting with the work of Le Comte du Nuoy and Carrel over a century ago, all the research on this simplistic process has yielded a cipher. Bullough, of the Postgraduate Medical School, Hammersmith UK, chairing a Listerian symposium on Wound Healing in 1970, summarized the meet on four points:

We know nothing about wound healing. Nature has reached the zenith of perfection in wound healing. We can do nothing to accelerate wound healing. Much of what we do decelerates wound healing.

Wound healing, in invertebrates and vertebrates, is the most efficient, highly computerized fill-in-the-void activity that takes care of a shaving scratch to severe injuries, without any supervisory need, save minimalization of whatever the gap. A surgeon's presiding deity is wound healing that pardons all the forays of the surgical knife, to restore the animal body to as close to status-quo-ante as is divinely possible.

Let us go back to Leblond's pioneering classification of body cells into perennial, expanding and renewing. The perennials are sensory receptors, neurons and muscle cells, the three forming a tandem network. These cells cannot divide normally, cannot divide abnormally and hence cannot cancerate. The expanding cell population comprises blood vessels and fibroblasts, as also parenchymal cells. The expanding cell activity is an on-demand source that goes into action wherever there is a void. Hence the classical regeneration of liver and the routine wound healing at all sites through fibroblasts, their collagenous output, all backed by newly formed blood vessels. The moment the void is bridged, the process goes into a withdrawal to the point of disappearance. An occasional overshoot occurs to form a keloid that as of now remains a mystery. The reparative proliferation through expanding population has barely any vector control save bridging in a gap or restoring the mere cell number of the functioning parenchyma. The renewing cell population comprises the epithelial (skin and mucosa) cells and the hemopoietic marrow cells both of which ceaselessly divide from womb to tomb. Just as a sample, one may note that the marrow adds 500 million red cells every second; the gut spawns and jettisons a cell numbering equal to that making up the entire body in mere 22 days; the epidermal cover of the skin is renewed every 36 days. The only vector principle the foregoing follow is to provide an epidermal or mucosal integrity that crowns all wound healing.

The word healing is from Greek- holos = complete and is etymologically on par with its sister terms health, whole, holistic (the oft-repeated phrase Holistic healing like Modern medicine, is a tautology). The vectorless wound healing in the most evolved vertebrates rarely reaches the holistic promise and is beset with keloids and unseemly scars in the best of hands. That is why till today, a thyroid incision is often a subcervical and Pfannenstiel's incision a retronic one. Bullough's claim that Nature has reached the zenith of perfection in

wound healing has to be tempered by the generalization that Nature's very best isn't good enough for women featuring on Page 3.

The above account should amplify the fact that vector-free, directionless wound healing can hold very little promise for neuraxial restoration to a semblance of status-quo-ante. So neuraxial wound healing is pointless as far as the body of the axis is concerned. Its 80 limbs called nerves have the advantage of epineural covers that allow nerve-suturing and nerve-grafting with a sense of direction whereafter you fold your hands and pray. Seddon's pioneering work on peripheral nerve injury has had the blessing of vectorization that the neuraxial body, with its 10 neuroglial cells per every neurone cannot hope to have. Peripheral nerve repair and replacement is a golden-lettered triumph of surgery that the neuraxial body can only wonder at.

There is an outstanding immunological reason whereby the neuraxis may by itself or through neuroglia, block any neuronal regeneration. It needs to be underscored that during intrauterine immunologic maturation, the entire neuronal population is shielded from the thymus by way of neuroglial/Schwann cell cover. So, whatever the forbidden clones that may be there in the thymus, against one's own neuraxis, remain undestroyed, so as to be ready to let loose their terror against one's own neural tissue. One's thymus treats the neuraxis as not-self so that the latter must do its best to steer clear of the lymphocytes and its other invading allies. Following a neuraxial wound, accidental or intended, neuronal proteins can leak into the wound, travel to the thymus, excite a forbidden clone and kickstart a tragedy of autoimmune encephalomyelitis (better called neuraxitis), an event not rare following vaccination containing neuronal proteins. So one can be bold enough to suggest here and now, that the first trick that the neuroglia do is to disallow any neuronal regeneration that may spill its proteins into the circulation. This small sacrifice is for the greater good of the rest of the neuraxis.

The above danger is precisely but perversely illustrated by an immunologic disaster, rather thoughtlessly called sympathetic ophthalmitis . Injury to the uveal tract in one eye, involving the dilator pupillae and/or the pigmented layer of the iris, both neuroectodermally derived from the optic diverticulum off the developing diencephalon, sets up an auto-immune response that, a few weeks later, ravages the normal eye, to cause bilateral ophthalmitis and even blindness.

Talking in Burnetian terms, a neurone is a Forbidden clone in any wound healing. Future research may reveal that in any neuraxial wound healing, the first thing the glial cells do after an injury, is to block loose neuronal ends from exhibiting any growth. The story is fortunately different in peripheral nerve repair blessed with tissue covers that shield the neuronal elements from any proximity to the flowing bloodstream.

Medical science's hope for neuronal regeneration through implantation of stem cells or even embryonically harvested neurones or neuroectodermal cells, must contend with the above FORBIDDEN phenomenon - a sacrifice that the body actively indulges in for the greater good of the balance neuraxis.

The current bandwagon of neurogenesis through marrow stem cells implant into the neuraxial body must reckon with the complex reality of a package deal that the technique must offer. The deal is constrained by the fact that every neurone is an island, shielded from its fellow by spatially but precisely located astrocytes, oligodendrocytes and what have you, who must offer to the neurone a cellular shield of exact shape and layout. The stemcytologists will have to first figure out which stem cell will go which neuroglial way and another turns into a neurone. The whole exercise is akin to squaring a circle.

It is time now to conclude on neuraxial wound healing - anatomically, pathologically and functionally. The vasculature and the glial cells of the neuraxis comprise the expanding population that would expectedly go into action to fill in a void. The fibroblasts in the vascular adventitia could do what they do elsewhere, namely to lay down collagen that would span the gap and then contract to reduce the gap to the barest minimum. Nature is unable to treat neuraxial wound healing any different from abdominal wall, heart or kidney. The dead-bits are

removed and replaced by progressively contracting scar. Hence the tell-tale appearance of a brain with multiple senile infarcts, almost reminiscent of a nodularly scarred kidney or a cirrhotic liver.

Nature's saving grace resides in the neuronal surplus that a human brain enjoys. Given that most of us do not use much of our neuronal capacity and that too mostly on sensex, sex and nonsense, one can generalize that 95% of the human neuronal number goes unutilized throughout life. No wonder Carrell compared the brain to a tumor and Koestler called it 'The unsolicited Gift'. The functional recovery following neuraxial wound healing can be amazing. Wilder Penfield pioneered extensive ablative neuraxial surgery (hemispherectomy, hemispherectomy) to relieve children of their epilepsy, some of whom turned into mathematic wizards. Pasteur, suffered dense-total hemiplegia at 47 and then went on to make some epochal discoveries (e.g., levo/dextro-rotation of light) well into his 70s. Joseph Landau, the mathematician, was in coma for over six months, following a car crash and then returned to research and teaching. All told, neuraxial wound healing is Nature at her affectionate best, offering a reparative cuisine within the confines of biological constraints evolved over millions of years. If a la Bullough modern medicine knows nothing about wound healing, then it knows even less than nothing about neuraxial wound healing, as evidenced by the alacrity with which every Tom, Dick and Harry are jumping onto the Stem Cell Bandwagon.

It is a widely concealed fact that medical science, in its most sophisticated state, is ailing from what can be called Basic Binary blindness. A human body comprises two basic elements- a sort of binary code of 0 and 1, the former representing a cell and the latter a fiber, the two together comprising the science of cytofibernetics. In the 1960s, Muggleton and Danielli swapped nuclei amongst living cells to prove that the nebulous cytoplasm and not the well-formed nucleus is the boss. Ergo, cytology died that day, realizing that it had been ailing from nucleism, an act of searching a coin under a street lamp, although the coin had been lost elsewhere. A recent symposium on Cell led to a generalization that to claim to know a cell, given the complex array of microscopes, tantamounts to repairing a lady's wrist watch using a sledge hammer. So cytology, like genetics is tottering on a precipice and waiting for a decent burial.

There is no defined fibrology. The fibers that form the second element of cytofibernetics have their own Clock and Codes that refuse to pay any heed to science. The molecules comprising them are too complicated and cosmic as to yield to medical probing.

The day microscopy was born, half a millennium ago, thanks to von Leeuwenhoeck, we all cried 'Eureka' for what started as a roughly ground glass piece and culminated as the Electron Microscope in its elitist form, managed to MAGNIFY everything including our IGNORANCE. Albert Szent-Gyorgyi, the Nobel laureate, chairing a CIBA symposium on (note the title) Submolecular Biology of Cancer was asked a concluding question as to if he could define a cancer cell, to which he humbly replied- 'I cannot say what is a cancer cell, for I don't know what is a normal cell'. The stemocytists, ignorant of what is stem and what is cell, are, world over polyannaistically promising a cure of this and that through their stem-cell marvel. Modern medicine, having failed to swallow a gnat, is promising to swallow a camel. Neuraxial Healing is too involved a process - allowing you to wonder at it like a child and then urging you to just stop there.

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## EDITORIAL

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## Ocularizing the cavernous sinus: A teleologic tale

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## Full Text

Teleology is an urge to see meaning in whatsoever Mother Nature does. It is a search for poetry in what seems prosaic. It can't be utilitarian, but if you were to allow a pun, teleology is beautilitarian, for when rightly taken it can help you and your patients, too. Teleology is philosophy to be intellectually enjoyed without the urge to 'scientifically' verify it by hurting an animal.

To the pooh-poohers of the teleological treatise, it may benefit to listen to two physiologists, starting with the Austrian von Brucke: "Teleology is a lady without whom no biologist can live. Yet he is ashamed to show himself with her in public". Cannon, the American physiologist, who mused masterly over *The Wisdom of Human Body*, is down to earth: "My first article of belief is based on the observation, almost universally confirmed in present knowledge, that whatever happens in our bodies is directed towards a useful end."

The vertebrate head is literally filled with venous sinuses. At one spot a sinus has chosen to be cavernous even before Adam was born. The two Corpora Cavernosa Cranii, polarly matching the two Corpora Cavernosa Caudii in both Adam and Eve, lodge themselves bang behind the eye to allow it to merrily drain its veins into the cavernous sinus. The cranial and caudal are cavernous-look-alikes, raising the distinct possibility that the enormously expanded endothelial surfaces therein leave enough room for cells that secrete heparin-like substances that stall any intravascular thrombosis even when these turn turgid over extended periods of time.

The whole biological kingdom bears out a comprehensible truth: In Nature, functional necessity is the mother of structural innovation. The vertebrate eye is a series of fluid chambers held under ideal pressures to inflate the

chambers optimally, but preventing any excess of pressure therein. Towards that end, the eye would need the veins to drain into a large lake, a sump or a sluice, so that at no times the veins throw a back-pressure into the eye. The cavernous sinuses themselves heighten this assurance by interconnecting themselves round the sella turcica to create the 'Venous Circle of Relief', matching the 'Arterial Circle of Willis.'

Each cavernous sinus thus becomes the integral tail of the eye, as important to it as the tail is to a whale or a monkey. The interconnection between the two cavernous sinuses mimics the optic chiasma by uniting the two eyes into a common venous pool and allowing the venous circle of relief to be also seen as the venous chiasma.

The most beautiful eye in the animal kingdom is of the squid or loligo, as beautiful as the human eye, but measuring as much as a foot in diameter (Nobel prizes have been won by working on the giant neurons of the squids). One can postulate that the squid-head must be having mechanisms parallel to Corpora Cavernosa Cranii, which must be helping the squid as the fastest swimmer in ocean, surpassing even a whale.

This fascinating sinus that is the arch protector of all the pascalian systems of the eye- anterior chamber, lens, posterior chamber, the whole eyeball itself- deserves an acronym that sums up its raison d'etre . We have chosen to call it the ocular pascalian stability assuring system/sump/sluice (OPSAS), in short. A shorter acronym would be ocular-venous access lake (OVAL). Cavernous sinus stands ocularized, as an integral structural and functional part of the eye.

The OPSAS or OVAL has chosen to be in good company for several reasons. The contained internal carotid artery imparts its throb ceaselessly to the sinus, providing its contents with the vis-a-latere that helps the sinus drain itself into the jugular with the vigor, if not the speed of an arterial system. The ocular sensory/motor nerves-III, IV, V, VI are contained and caressed by the sinus assuring their decongestion in states of heightened venous pressure.

OPSAS not only subserves the ocular pascalian systems, but also the nerves that work for the eye and hence all the intrinsic and extrinsic muscles, not to miss the whole orbit and its other contents, including the retro-orbital pad of fat that serves as an articular cup in which the eyeball has the free-est movements.

The liver gets 80% of its oxygen from the portal vein, a mere 20% from the hepatic artery. Hepatic artery ligation - once upon a time a practiced move for combating ascitis accompanying cirrhosis - is compatible with survival of the liver (and its owner). Ligating the portal vein assuredly promises massive liver necrosis and death. So for the eye. The thrombosis of the retinal artery leads to retinoplegia, leaving the rest of the eye intact. Cavernous sinus thrombosis knocks out the whole eye -ophthalmoplegia-to throw out of action even the extrinsic eye muscles, to give the face that frightening steady stare of the swollen, edematous, waxy eyes. Here, too, the vein scores over the artery, lock, stalk and barrel.

William Boyd, the poetic pathologist, mused over the fact that despite the microbial biomass outweighing the total animal biomass by a factor of 100, most of us sail through life unbothered by the microbial ocean (They are the host; we the pampered and tolerated guest). The human nose has over 200, the mouth has over 400 species of microbes; sinusitis is universal, bad teeth a rule, conjunctivitis and the like rampant. And yet none of these manage to go up to the cavernous sinuses. Ergo, they must be somehow resisting the microbial onslaught. It must be too powerful a microbe and too poor immunity of the patient that must be giving rise to the dreaded cavernous sinus thrombosis that so very often fails to infect the opposite sinus and the eye despite the intercommunicating venous circle of relief. Viva le cavernous sinus.

If the cavernous sinus serves the eye; eye-to-the-sinus, it plays equally significant role, chest-to-the-sinus, seeing to it that the highest intrathoracic (and hence intracaval) pressure as during a deep Valsalva maneuver or an Olympian lifting a weight of 400 Kg fails to be transmitted to the eye. In the foregoing, the face swells up,

the neck veins are manifestly turgid, the sweat pours from the face, but the eyes remain serenely unbloated and functionally totally fidel. There could be a valve (like the saphenous valve) protecting the cavernous sinus from the pressure build-up in the chest and the venae cavae.

A coronal view of the sinuses, as is very colorfully available in all texts especially the Gray's Anatomy , shows them to be strategically placed just above the sphenoid sinus which opens into the attic of the nose. While the human body may be dressed from head-to-foot, this is one area that cannot be shielded from the temperature of the incoming air. The cavernous sinuses sense this temperature, balance it with the venous (their own) and arterial (carotid) temperature to guide the anterior pituitary into releasing optimum quantum of hormones to mediate, among many other things, the homeostasis of the individual; Nature has made full use of the juxtapositioning of pituitary, veins, artery and an air sinus into closest structural and therefore functional proximity. May be that this symphony also carries thermal messages to the rest of the brain to allow it to regulate its blood flow and to divert its conscious and autonomic areas towards the well-being and survival of the individual.

Some years ago, a review of embryology over the past 200 years opined that we understand precious little of this miracle, worm to whale (The hackneyed terms ecto-meso-and entoderm have been declared persona non grata, by Gray, Romer and others). There is trite statement that the cavernous sinus develops from the anterior head vein. This learned statement explains away the development of cavernous sinus, without explaining it at all. The student of embryology needs to be encouraged as to why, amongst veins known to be erratic in their embryogenesis manage to be precisely formed into a sinus on either side of sella turcica, drain the eyes and chose to be, unlike any other intracranial sinus, cavernous on the one hand and widest amongst the sinuses on the other.

Some semantic clarification is in order. Skinner, in his The Origin of Medical Terms bemoans the fact that the magnificent intracranial venous sinuses have been wrongly named, for, a sinus clearly means a pocket or sail that is inherently a cul-de-sac. Each intracranial venous sinus can be renamed as an intracranial vena magna. The cavernous sinus is this cavernous vena magna .

The cranial caverna venae magna differ from their caudal counterpart in the sense that the latter do become, during sexual excitement in both sexes, cul-de-sac to provide to the individual recurrent, reversible, cavernous hemangiomas. Such lake-like arrangement of vascular spaces is to be found in the palm and sole where a very well-defined arterial capillary hemangiomas enriches the palmar/plantar surface to form a pascalian system that bears all the pressure-shocks that these two surfaces are heir to. It's a visual treat to squeeze-out blood from them to render the palm/sole pale and then to see them refill under your vision. They also explain why the darkest skin may have the pinkest palm. Any 'abnormal' hemangioma anywhere else in the body is a mere ectopic variation of what normally prevails in the body from head-to-foot.

Ravindranath Tagore poetized that 'in the kingdom of my lord, a blade of grass is no less than the stars in heaven'. In the kingdom called the vertebrate body, the non-descript cavernous vena magna holds the key to the well-being of the body's 'most noble' (Ramon Y Cajal) sense organ-retina - on the one hand and the panoply of many important metabolic, vascular and homeostatic functions on the other.

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## EDITORIAL

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## Principilizing surgery

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## Full Text

Towards the close of the 20 th century, two leading thinkers on either side of the Atlantic - Lyall Watson and Lewis Thomas - were led to generalize that the greatest discovery of the 20 th century has been that of the profundity of human ignorance. Needless to emphasize, the state of ignorance would be profounder in a field that deals with the fragile and mysterious neuraxis.

In Socratic academia, the lessons, and discussions, were peripatetic - the teachers and students strolled together and raised questions and forged answers. A Mexican creed is "Asking we walk." Set below in brief is peripatesis off the beaten track by viewing some aspects of neurology and neurosurgery through unconventional lenses. The attempt has been not so much to claim knowledge but to discover and present hitherto unrecognized features.

In Nature's infinite book of secrecy

A little I can read.

- William Shakespeare

Antony and Cleopatra (Act 1, Sc 2, 11)

The Indian sage, Adi Shankaracharya aphorized, circa 9th century A.D. that if knowledge can be infinite, so can ignorance be. Blaise Pascal, 17th century A.D. metaphorized that knowledge is the inner surface of a sphere, whose outer surface is painted with ignorance. The more you know, yet much more you know not.

The knowledge of one's ignorance spawns admiration and a sense of wonder. What a sense of wonder brings in its wake is the double gift of humility and reverence, an affective state that finds its expression in philosophy. Alfred North Whitehead, after a full academic career of 40 years as a mathematician in England, moved to Harvard to occupy the chair of philosophy. And he explained his personal evolution thus: "Philosophy is the product of wonder... Philosophy begins in wonder. And at the end, when philosophic thought has done its best, the wonder remains." Philosophy, the dictionaries assert, is scientia scientiarum, the science of all sciences. Today, modern physics bristles more with philosophy than with physics. A similar philosophic bent can be accorded to the art of neurosurgery and the field of neurosciences. A noumenal approach going well beyond the phenomenal is overdue in the neuraxial field.

Ralph Millard's classical tome has been thoughtfully titled Principilizing Plastic Surgery. What follows is an attempt at doing so for the rapidly evolving discipline of neurosurgery. While technology surges ahead, the philosophy of neurosurgery should not lag behind.

Shakespeare's famous aphorism that "A rose by any name smells as sweet" fails to apply in many areas in medicine ailing from aneusemantics, or improper terminology. To the traditionalists who would rather rest content with age-old, "accepted," hackneyed terms, it needs to be conveyed that a term, like the proverbial tip of the iceberg, should divergently evoke the whole conceptual substratum on which it rests, and convergently should connote the same conceptual backup. So it behooves a medical thinker to strive to replace an ill-fitting term by one less ill-fitting, euphonious, and evocative. As Lavoisier expressed:

"As ideas are preserved and communicated by means of words, it necessarily follows that we cannot improve the language of any science without, at the same time, improving the science itself; neither can we, on the other hand, improve the language or the nomenclature which belongs to it. However certain the facts of any science may be, and however just the ideas we have formed of these facts, we can communicate false impressions to others while we want words by which these may be properly expressed."

Generalizing, one can daresay that scientific understanding evolves to spawn new terms which in turn improve the science itself.

While at eusemantics, let us go to a self-evident, if banal, issue of a so-called bony foramen in the craniospinal set up. The beguiling description in Gray's Anatomy (and all other anatomic/neurosurgical texts) that the mandibular nerve passes through the foramen ovale and the vertebral artery through the series of foramina transversaria loses sight of the fact that in vertebrate embryology, the nerves/vessels arrive first and the bones almost as a relaxed afterthought, much later. The logical, epigenetically impeccable statement would be that the foramen ovale forms round the mandibular nerve, much as the foramina transversaria do round the preexisting second part of the vertebral artery. This slight welcome twist in anatomic description removes the all too common error of CIFOTH - Cart in Front of the Horse. The deltoid muscle precedes the humerus, and the latter if at all should seek attachment to the deltoids, which in reality it does not. Nothing is attached to bone and vice versa, bone being overlaid on preexisting nerves, muscles, ligaments, and vessels. Bones form around nerves-n-vessels a sleeve, a ring, or a fissure. [1],[2],[3],[4],[5],[6],[7],[8],[9],[10],[11],[12],[13],[14],[15],[16],[17]

Likewise, the term cerebrospinal fluid (CSF) is too facile and too abrupt. *Neuraqua*, as a neologism, sums up the vast extent of this precious fluid, conveying its existence within, through, and around the neuraxis, extending well beyond it and most commutative with the neuraxis itself. The neuraxial tissue can be seen as configured *neuraqua*, which in turn is fluidized neuraxial tissue, both communicative and commutative with each other.

We are now justified in questioning - and suggesting a replacement - for the term craniovertebral junction. A junction conveys static juxtaposition of similar or dissimilar parts. There is no allusion therein to the co-operative role of disparate parts. How about the phrase craniovertebral coalition! The term is pregnant with anatomic distinctiveness and functional coherence. World over, democracies run through coalitions, where avowed communists (and the like) team up with manifestly capitalists (and their like) to execute the common task of running a nation. Political coalitions are necessarily chameleonic and opportunistic, engaged more in self-serving than serving the cause they agreed to coalesce for. Craniovertebral coalition is rock-like in its loyalty and represents a marriage as old as humankind.

We can now sojourn through some new physiological, pathological, microbial, immunological, and therapeutic avenues. The cavernous sinuses - *corpora cavernosa cranii* - are retro-ocular lakes of blood that are specially designed to maintain in the eyes a piezostasis of its fluid systems that fluctuate the least with pressure changes in other venous sinuses. They are endowed with a network, lined, like in the *corpora cavernosa caudii*, with cells that secrete agents that keep the blood fluid despite stasis and sustained high pressure. (How many of us appreciate that the human phallus during erection has a pressure of over 1100 mmHg, which heightens during sexual activity solo or shared!)

The meninges - *maters* - can admirably be maternalized, for their many a role not generally appreciated. *Neuraqua* studies show that the pia-arachnoid and the choroidal plexuses have a servomechanism that steps up *neuraqua* production when it is being lost, and switches off its secretion when the heightened *neuraqua* pressure so commands. The symphony between the meninges and *neuraqua* gives the neuraxis a free-floating weightlessness comparable to the amnionaut called the fetus and the astronaut in the outer space.

The very appellation intervertebral for the cushion that gives the spinal column its remarkable resilience and mobility is a classic example of CIFOTHISM. By the 8th week of intrauterine life, every single "disc" is fully manifest, without a spicule of bone in the vertebrae, which develop later. Further, each disc is coplanar with its somite, compelling you to declare that each vertebral body is interdiscal, and each so-called intervertebral foramen fashions itself around the preformed spinal nerve which in no way "enters" the foramen or "exits" therefrom. The biplanar of a "disc" has to be replaced by the 3D nature of it, urging you to call it a cushion of the back, or the pulvinot. Its collagen dutifully records the age of the person. The disc does not "degenerate" but exhibits changes consistent with age, as graying hair does. To tell a person of 70 years of age that his/her pulvinot is 70 years old is far less iatrogenic and insulting than to condemn it as degenerate.

The impartiality with which Nature treats craniovertebral coalition and its caudal counterpart is best gleamed from the fact that the so-called lumbosacral spondylolisthesis has its counterpart in TOOL - transatlantic odonto occipital listhesis. Both are "normal," for many a person with image verification of the listhesis at either end carries on remarkably undiseased through a long life. Both TOOL and LOSS (lumbar over sacral slip) illustrate a great principle - INNTOE (in nature no terror of error).

The neuraxial cytogalaxy deserves critical appreciation. Its neuronal components are the postmitotic, perennial, indivisible cells that not dividing normally cannot do so abnormally and hence cannot tumorize or cancerate. The neurons are exceptionally large cells, for the so-called nerves, cranial or spinal, are mere extensions of the body of these cells, representing as it were the neuronal veripodia (against the pseudopodia, say, of the amoeba). The so-called nerve tracts in the craniospinal axis are nothing but integral parts of neurons, making the neuraxis a gigantic syncytium, where all is but cells and no fibers. A single neurone in a whale or a squid may be 50-100 ft long. The neurons in the lumbar posterior root ganglion are 6"-8" longer than the heel-to-head height of the individual. The gigantic nature of squid neurons has been a source of Nobel awards for Sir John Eccles and his likes.

The neuroglial cells outnumber neurons tenfold. They are essentially not interneuronal glue (hence called neuroglia) but perineural to form neuron-tight insulation, and hence fit to be called insulocytes. The smaller varieties of "neuroglial" cells are intermediates between the neurone's nutrition and the proximate capillary, hence better called intermediocytes. The real glue that separates a neuron from another neuron or neuroglial cells is the universal and ubiquitous *neuroqua*. A more preferable name for neuroglia would be clinocytes (from klinos = bed) for they form a huge bed in which the neurons are clothed, rested, and nourished.

The universal commonness of head-injury and the equally surprising uncommonness of brain infections and brain abscess have enormous heuristic value. The neuraxis turns out to be highly resistant even to microbes directly inoculated into it (uncommonly) through experiments and commonly through accidents. This deliberate nonreactivity on the part of the brain to the manifest presence of microbes is its faculty of immunity. As and when a brain abscess does occur, brain exhibits reactivity that concerts with body's sense of integrity and immunity to expel the contents to the exterior, after which the faculty of reparativity and restorativity pitch in to restore the brain to status quo ante as best as possible. Abscessing and pus formation turn out to be Nature's great inventions for promoting survival in the midst of the microbial ocean that outweighs the total animal biomass - man-to-whale - by a factor of 100.

Each of us carries a microbial cover weighing 2.2 kg. Each of our body cells is outnumbered by the microbes at least ten times. This must drive home the lesson that friendship between microbes and man is a rule, enmity an exception. The so-called opportunistic infections are in reality iatrogenically opportunized infections. Our operative, antibiotic, and anticytotoxic adventures compel the commensals and symbionts to be driven into areas of the body that are not designed to house them. The microbes thus become opportunized and are in no way opportunistic - a game best played by our politicians and rulers. The much-maligned fungal infections are traceable to iatrogeny rather than fungal infectivity. Paul Davies in his classic *The Fifth Miracle* traces human ancestry not to monkeys but to microbes. A fungal cell is the earliest karyotic cell that the earth has had and for all you know if the prokaryotic microbes are our grandfathers then the karyotic fungi are our parents, too evolved and too helpful to be condemned.

Mankind, in its unbridled hubris, continues to maim humans through wars, weapons, vehicles, and machines in the vain hope that one day medical ingenuity will end in fruitful repair of neuraxial wounds with restoration of sensory and motor loss. The hope has been particularly exacerbated by the advent of stem cells as a panacea just waiting to be discovered and put to varied use.

At the Lister symposium on Wound Healing at Glasgow (1970), Bullough, the Chairman, concluded it on a fourfold note

Nature has reached the zenith of perfection in wound healing. We know nothing of wound healing, (even as of 2009). We cannot accelerate wound healing. Much of what we do decelerates wound healing.

Ambroise Pare's 16th century prayer - I dressed him, and God healed him - is as relevant today as it was many a century ago.

Wound healing in the neuraxis or elsewhere is a bridge-in-the-gap enterprise that necessitates cells doubling rapidly to fill in the gap, through multiplying fibroblasts, angioblasts, epidermal/mucosal cells, or in some cases parenchymal cells. Neuroglia (clinocytes) can multiply, neurons cannot. Any neuraxial wound healing is a blessing endowed by angioblasts, fibroblasts, and clinocytes. It is the neuronal handicap of unmultipliability that has set us searching for stem cells as a possible solution, accompanied by a lot of hype and hoopla, especially through the media and some undiscerning medical men.

What we have overlooked is the so-called immunological (more correctly reactivological) factor. When the thymus is maturing in utero, dividing cells from all over the fetus, present their credentials to the thymus, whereby it eliminates the lymphocytic clones that may unleash possible reaction against these cells in future. The lymphocytic cells so eliminated are the forbidden clones that the Nobelist Burnet first postulated in 1947, and were later proved to be so by Medawar, both getting the Nobel in 1960. Neurons being indivisible cannot placate the fetal thymus, which thus always harbors clones that can let loose a vicious reaction against one's neuronal cells to occasion the so-called auto-immune encephalomyelitis. The net outcome of this situation is that should the neuronal protein be leaked into circulation, while a neuraxial wound is healing, it can cause damage much greater than that inflicted by the injury. This is evident from sympathetic ophthalmitis where injury to one side uveal tract can lead to the reactive destruction of not only that eye but even the other uninjured eye. In most likelihood, Nature while repairing a neuraxial wound, first sees to it that no neuronal multiplication occurs whereby the thymus may have a taste of the neuraxial protein to precipitate a pan neuraxial crisis. Can it not be the reason why no neuron has direct access or proximity to capillary circulation, the two being widely separated by intermediocytes (or the smaller neuroglial cells), the stem cell dream is likely to remain a dream, and that too for the right reasons.

We can conclude this sojourn by the humility that must guide neurosurgical therapies. Sir Harold Gillies and Ralph Millard, in their classic *The Principles and Art of Plastic Surgery*, have aphorized that not much has been gained in the art of surgery after the first abscess was incised by a flint stone, and the first wound sutured by a horse hair. We today have faster moving drills and saws, and unbelievably sophisticated imaging and navigation systems but our results do not excel those of pioneers like Macewan, Horsley, and Cushing, regardless of the backup of antibiotics. Our chemotherapy and radiotherapy are unashamedly indiscriminating cytotoxic agents that kill more friendly cells than the assumed foe cells. Our gamma-knife is a different modality of cutting but no way does it evoke a response from the neural tissue any different from what an ordinary knife does. Neurosurgery is more in need of humility than hubris, modesty than machines, ideas rather than imaging techniques.

The term ethics has had a chequered etiology, coming as it does from Sanskrit Svadha, meaning a self-image, a clear conviction within that prevents you from doing anything wrong even when you are not being watched, monitored, or policed. Eric Ericsson (a famed psychiatrist), and the exponent of Gandhi's Truth, summed up ethics by quoting Talmud - Do what you would be done by. And do not do unto others what you wouldn't do to yourself or your kith and kin. Vedantic teaching has underscored this objectivity time and again. Our left brain may rejoice in our worldly successes but our older, wiser, right brain would rather opt for a clear unburdened conscience, and a soft-pillow offering undisturbed sleep, so that one is free from the need of a drug or a bottle to assuage one's conscience. For our own sake, let us be ethical.

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## EDITORIAL

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### The stem cell promise: The future of stemocytology

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### Full Text

Hixson [1] biographing "one of the greatest scientific scandals" of the 20 th century, The Patchwork Mouse, perpetrated at the famed Sloan-Kettering Institute, observed in 1976: "The American public, known to (and devotedly imitated by) the world as the originator of fads and fetishes, suffers from time to time with the preoccupation over a single disease. Today, that disease is cancer." He then quotes an eminent virologist: "I have some advice for young researchers in biology. Stay out of cancer research, because it's full of money and just about out of science."

As an intellectual exercise, put stem cell promise as a current fad and stemocytology in place of cancer research and you will no way utter a blasphemy.

The summary failure [2],[3] of Modern Medicine (MM) on all major fronts has allowed it to be very long on the promise of stemocytology, wherein the compelling cyto-realities will forever force the stemocytologists to stay short on any performance.

The very appellation stem is traceable to hemopoiesis and bone marrow transplantability. Normal hemopoiesis is the cell-child of pluripotential hemopoietic stem cell (HSC) from which all the cells of the circulatory blood are eventually derived. [4] The latest Thomson and Thomson Genetics in Medicine [5] is candid: "Only two types of stem cells are in clinical use at present: HSC, which can reconstitute the blood system after bone marrow transplantation and corneal stem cells, which are used to regenerate the corneal epithelium." The book's glossary [5] defines a stem cell as "a cell that is capable both of generating another stem cell (self-renewal) and of differentiating into specialized cells within a tissue in an entire organism." The juxtaposition of a stem cell's real scope, namely, to beget another stem cell and the promise of a stemocyte begetting altogether another specialized tissue pushes the text [5] to conclude cautiously: "The possibilities that other types of stem cells will be used clinically in the future is enormous. Although, it is easy to overstate the potential of such treatment, optimism about the long-term future is justified."

The medical air is thick with stemocytology: Neuraxial wounds will get repaired and many a deficiency redeemed. Infarcted myocardium will be regenerated. Diabetes cured. Defensive notes, however, from the icons of science journalesque, are long and scary: The Scientific American (July 2006) has a cover story posing a question: "do stem cells cause cancer?" and then goes on to epigraph the big article: "A dark side of stem cells - their potential to turn malignant - is at the root of a handful of cancers and may be the cause of many more". WiCell - the journal of stem cell discovery (Spring 2007) gives a flashy account of this fledgling science to claim, on the cover, the plans of marching "from the laboratory to the marketplace." Stemocytes may fail to provide cure, but seem sure to provide financial windfalls.

From the hype and hoopla, let us come down to some banal cyto-realities. A cell is still a 4-lettered mystery that refuses to be caged in a definition. Its so-called differentiation is more easily stated than understood. [6] The zygote - the primostemocyte - is a featureless cell that begets an eel or an Einstein by processes in the realm of the unknown and the unknowable. [7] Trying to understand or define a Hunchback of Notre Dame de Paris amongst cells - namely, the much maligned malignant cell - is like searching for the Holy Grail. Nobelist Szent-Gyorgi, [8] as chairman of a Ciba Symposium on cancer was asked, at the climax of the meet, if he could define a cancer cell: "How can I do so, when I do not know what is a normal cell." A cancer cell is, now, seen as a super differentiated normal cell.[6] When MM has remained loftily ignorant about a (so-called) normal cell or a cancer cell, what to talk of a stem cell in the body or as a therapeutic transplant.

Modern cytology, it seems, is tottering on a precipice. It thrived on overworking on a cell's most visible/isolatable part, namely, the nucleus - nucleism - to realize, for many years now, that a cell's genius basically lies in the nebulous cytoplasm, the nucleus only playing the second fiddle. This is gloriously realized [9] in the now commonplace phenomenon of cloning, successful with any goddamn diploid nucleus, provided its nesting place is the ovum's cytoplasm. The entire embryonic genius of the primostemocyte, called the zygote, resides in the cytoplasm and like the counterpoise of an elevator, only assisted by the nucleus.

A stemocyte - in the bone marrow or a corneal sheet - can beget another stem/daughter cell, but NOT a tissue. A HSC spawns off a discrete red/white/platelet cell into the circulation but no tissue. [4] A tissue is a cosmopolis comprising "coherent collections of specialized cells" [10] that is "bound together by collagen, with associated blood and lymph vessels, nerve and connective tissue cells." [11] The hemopoietic series is free from blood vessels as is an epithelial sheet of corneal cells. Asking a stemocyte to generate not just a clone of cells but a cosmopolitan tissue is trying to square a circle, in the utter absence of any knowledge about histogenesis in utero and thereafter.

Stemocytology, capable of spawning a clone or a sheet of cells, may succeed in areas that need cells, without needing the complex of supporting tissue comprising collagen network, hemal and lymphocytic vessels, if not nerves. This can be epithelial cover, a sheet of corneal cells, a hemocytopoietic focus, or a mass of cells, in say, the posterior hypophysis to secrete antidiuretic hormone.

We can conclude on the stemocytic promise vis-à-vis the neuraxis. [12],[13] The nascent embryonic ependymal zone begets the indivisible postmitotic, perennial neurons on one hand and for each neurone, 10 mitotically capable glial cells on the other. The chances are that an implanted stemocyte - from whatever - will imitate in all probability the mitotically capable

neuroglial cells, benign or malignant, proving Scientific American's fear and prophesy that stemocytes can beget a tumor.

A more important issue [12] is the reluctance of any wounded neural tissue to beget freshly made neural cells, the neuroproteins of which may well invite the thymic wrath to precipitate autoimmune encephalomyelitis. At this stage listening to Einstein seems pertinent: "If I have learned something from the speculations of a long life, then it is this that we are much longer distance away from a deep insight in the elementary processes of nature than most of the colleagues of our time believe."

The stem cell promise, neuraxially, seems too hollow to be a reality. MM, having gagged on a gnat is gearing up to gobble down a gorilla, quite reminiscent of President Nixon under "scientific pressure," floating the long defunct Conquest of Cancer Agency (14) (COCA) for an "all-out war against cancer," a fiercely funded and fought battle that went the Vietnam/Iraq/Afghanistan way. Sophistry of the kind at Biopolis (Singapore) is no solution to scientific befuddledness on some ordinary basic issues. Apples still fall down, no matter what, who and where.

At a Lister Symposium on wound healing, Glasgow, 1970, the Chairman summed up on a 4-fold note; nature has reached the zenith of perfection in the healing of a wound. MM knows nothing about it. MM in no way can accelerate it. MM often decelerates it. Next to embryologic epigenesis and organogenesis, the histopoiesis of the healing of a wound - from scratch to a car crash - is an unfathomably complex process. And this ought to be so, for MM is ailing [3] from basic binary blindness. MM knows not what cell is, nor what's really a fiber, the two comprising the 0 and 1 of the body. A stemocyte is, at best, a dividing cell implanted into a patient's body in blatant defiance of the body's laws [13] of self-versus non-self. Stemocytology is brilliant on paper, highly fundogenic and promiscopoietic, but makes little scientific sense. Spiegelman, [14] 1 of the 7 planners chosen to set up COCA compared this all-out quest of the conquest of cancer with "trying to land a man on moon without knowing Newton's laws of motion." Stemocytology is going the COCA way and must end up the same dismal way.

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**EDITORIAL****Year : 2006 | Volume : 54 | Issue : 2 | Page : 143-****The heuristics of craniospinal epidermoid tumors****Manu Kothari<sup>1</sup>, Atul Goel<sup>2</sup>,**<sup>1</sup> Department of Anatomy, King Edward Memorial Hospital & Seth G.S. Medical College, Parel, Mumbai - 400012, India<sup>2</sup> Department of Neurosurgery, King Edward Memorial Hospital & Seth G.S. Medical College, Parel, Mumbai - 400012, India**Correspondence Address:**

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'In nature's infinite book of secrecy/ A little I can read'. The characteristic humility of our dear Bard of Stratford-on-Avon can be heuristically put to use in the study of craniospinal epidermoid tumors (CET) that like any other tumors, continue to be a mystery inside an enigma with fore and backcovers of puzzle. Whitehead generalized that intelligent consciousness of one's ignorance spawns admiration, leading to a sense of wonder, culminating in reverence. CET merit our serious attention.

If beauty is skin-deep, the brain is no less. CET provide you a flashback that shows that the whole CNS is nothing but sunken skin. This is also the right moment to declare that one's brawn - posited in the muscles - is traceable to the ectoderm via the primitive streak, which is ectodermally derived. Entoderm too emanates from the ectoderm whose versatility thus is a glimpse of a cell's genius that, from its start 4.2 billion years ago, has refused to change. A 'stray' ectodermal cell, nestling in neuroectoderm, exemplifying - in Ardey's words - 'an ordered disorder', forms a nidus of slow, steady cellular accretion called epidermoid tumor. The wide array of elements that are housed in an epidermoid tumor are easily attributable to the versatility of the stray cell. It has been rightly generalized that every embryological 'anomaly' serves as a teacher, that wearing the garb of abnormality, points to the incomprehensible myriad processes that, unfailing by and large, fashion a normal tissue or a human being.

It is significant that the much-used terms normal and abnormal are as yet poorly defined. The Oxford companion to Medicine skips both the terms, for obvious reasons. Add to this the generalization that normality/abnormality concern a range and not an individual nor an average, and you realize that

normality/abnormality, like beauty/ugliness lie in the eyes of the beholder, being mere opinions and therefore, nowhere a reality. CET are beyond medical judgmentalism, being as relevant, and 'normal' as the most beautiful face around. INNTOE is an acronym that loudly proclaims In Nature No Terror Of Error .

Every epidermoid tumor, then, occurs at the behest of the herd whereby an individual bears the cross so that all others are spared, a societal mechanism as common to cleft-palate as to ALL. It's the corporate genotype that orders the phenomenon to be expressed at an individual level. So, in a person with an epidermoid tumor, there is nothing abnormal, no genetical error, no punishment of some past Karma . CET's occurrence comes to underscore the Vedic truth that we all are united by a single soul. Each epidermoid tumor, like any other tumor, asserts its tritimensional uniqueness, being unlike any other epidermoid tumor in the total past, total present, and the infinite future. It does this by conversing with all that CET that were, are, and will be. An epidermoid tumor is a cosmic event that must evoke from the beholder the reverence of a witness and the gratitude that the beholder has been saved of an epidermoid tumor by its presence in the beheld.

The cells that spawn an epidermid tumor exhibit Januine ( Janus = double faced) allegiance- The ectodermal face overseas steady multiplication, and accretion leading to 'tumor' and differentiating versatility to beget a hair here, a nail there, sebaceous glands, and what have you. The wizardry and the artistry of an epidermoid tumor is best seen, even by your naked eye, as the mother of pearls , a truly versatile mother as it were. The other, neuroectodermal allegiance of epidermoid tumor sees to it that, despite ceaseless mitosis there is no inclination to invasive cancerousness. Little wonder that every epidermoid tumor exhibits, what Brooke poignantly called, a tumors' discreet silence', sustained over years. To this gentlemanly behaviour of the guest, the CNS itself plays an accommodating host ready to distort itself, even grossly, to give more room to the guest, trying at the same time not to encroach on the person's physiology or consciousness. This symphony between an epidermoid tumor and the CNS drives home the musical note that, as and when, an epidermoid tumor needs removal, discretion should be used to attack it dis-ease far and no further. If need be, leave behind bits and pieces of the epidermoid tumor, knowing that for years they were symbiotic with the CNS. Your discretion as a surgeon becomes the better part of your valour.

Operative enthusiasm often satisfies the intellectual soul of a surgeon, but at the cost of the patient's purse and persona. An epidermoid tumor is a formidable cosmic entity, to be treaded upon gently, softly, nay, reverentially.

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## EDITORIAL

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## The so-called intervertebral disc: A 4-D reverie

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## Full Text

A Canadian physician had regretted that there is too much of "yes, sir-ring" in medical institutions. A spoken, more so a printed, word gets taken as gospel truth, an idee fixe, till ordinary logic compels you to question what has been taken for granted. The intervertebral disc (IVD) is a good example - semantically unjustified and begging for a redressal in the court of intellectual appeal.

Anatomic thinking-and-teaching, epitomized by Gray's Anatomy, is osteocentric, a clear error of putting the cart before the horse. For bones, in phylogeny and ontogeny, arrive as a relaxed afterthought. The deltoid precedes the humerus in development, so that, if at all, it is the humerus that should seek 'attachment' to the muscle. The mandibular nerve does not, nor had ever to 'pass' through the foramen ovale which fashions itself round the preformed nerve. All the IVDs are well-formed and clearly delineated, before a spicule of bone has appeared in the so-called vertebrae. Moreover, each IVD represents the centre of a somite, a fact verifiable by the emergence of every pair of spinal nerves at the level of IVD. The humility that each IVD shows by looking a radiological vacant space between two osseous prominences called the vertebrae has earned for itself the secondary status of being intervertebral. The fact is that each vertebra is interdiscal. The IVD is primary, the vertebrae playing a second fiddle to it. It may be safely generalized that, contrary to the continuing osteocentric anatomy, it is the soft tissues that lead and the bones follow - from womb to tomb, in health and disease, in situ and after surgery. Let us resolve to exile the irritating appellation 'intervertebral' once and for ever. Every so-called vertebra and every single bone, is a discrete island resting in an uninterrupted ocean of soft tissues, an ordinary fact good enough to justify the second place accorded to all bones.

Do the vertebrae deserve to be so called? The words vertebra-vertebrate are derived from Sanskrit- *verten* (hence *pariverten* ) and Latin *vertere* meaning to turn, thus also connoting a joint. Therefore a vertebrate is one who can turn at a joint, thus making the millipede the greatest vertebrate of all. The error has been to equate static osseousness with dynamic vertebrateness. The most vertebrate part of an elephant is not the massive skull or spine, but the head-foot called the trunk that is powerful and versatile sans any bone, much like in the mollusc (= soft) octopus whose ten head-feet (hence the octopus is a cephalopod) match the vertebrate agility of the boneless elephantine trunk. Vis-à-vis the human vertebral column, it is the discs that allow all the twists and turns, the vertebrae being incapable of the same and merely following whatever the discs dictate. But for the discs, there would be no ease of a ballerina nor of an ice-skater, nor the grace of the flamingo's neck, nor the multiple circlings of the reptilian body. The marvel of the human and animal locomotion is through the munificence of the so-called IVDs.

Is IVD disc at all? The lexicons define a disc as 'a circular plate, round and flattened'. In man, the IVDs contribute to more than one-third of the column length. Then what to talk of a giraffe (height 18-20 feet), whose neck is more than eight feet long, has only seven vertebrae and hence has to have some discs that are as tall as four to six inches! The human lumbosacral vertebra is two and a half times taller in front than behind and it is this height that determines the sharp lumbosacral curve that is at the root of the evolution of the erect posture. The curves of the human vertebral column are the courtesy of the varying anterior and posterior heights of the IVDs. It is a lordotic curve if the anterior height is greater and kyphotic if the posterior height of the IVDs is greater. An IVD is anything but a disc for unlike a disc, it is a three-dimensional (3-D) structure.

This journal has defined an IVD as a pulvinot (from *pulvinus* = pillow/cushion and not from *notos* = back). An IVD is a series of your back-cushions that are a marvel of engineering design. Each pulvinot is a sphere of strong fibrous tissue, better called *spherus* (and not *annulus* ) *fibrosus* , containing in its center a ball of mucoid connective tissue called *nucleus pulposus*. The two comprise a ball-within-ball joint that works on the same principle as does a pneumatic tire. The compression exerted on the *nucleus pulposus* makes it stretch the *spherus fibrosus* , the compression/stretch forces absorbing the weight impact and thus allowing a porter to carry a huge load on the head or the back without hurting either the pulvinot or the noton (the so-called vertebra). The *nucleus pulposus* belongs to the category of mucoid connective tissue that is also located at the root of each tooth, thus allowing a human or a hyena to exert a pressure as high as 500 pounds per square inch, without hurting the jaws. The enormity of the compression force that the mucoid connective tissue and the pulvinot can stand is rooted in its avascularity, an advantage the bony vertebra does not enjoy. Any pathology museum will have a specimen of an aortic aneurysm that had eaten into the centra of the vertebra (by impinging on its vascularity to make the bones ischemic), leaving the avascular and hence defiant discs, unmolested. What is true of a vascular tumor called aneurysm is true of cellular tumors, called neoplasms, as well.

Other examples of mucoid connective tissue are the vitreous of the eye and the Wharton's jelly in the umbilical cord. A high-school on physics has rightly described a fluid as infinitely incompressible. *Nucleus pulposus* belongs to that class and hence the gymnastic feats at each Olympics, in terms of weights lifted. From hand-to-foot, Nature has put a series of fluids (synovial fluid, cerebrospinal fluid, blood, *nucleus pulposus*) as shock acceptors that render the human frame essentially weightless. The strongest part of the 70,000-Kg jumbo-jet is its nitrogen-filled tires whose combination of compression of the gas and stretch of the tire-fibers makes the monster essentially weightless as and when it lands on the tarmac to give you a cushioned landing, greatly aided by the 12-14 feet column of oil in its landing gears.

The journal had questioned the validity of the term spine/spinal as connoting vertebra/vertebral and had suggested that these appellations be replaced by notal/notonal. The whole back-column could be called the pulvinotonal column, an etymological sequence in which the so-called disc enjoys primacy over the vertebra (or noton). The vertebrateness (versatility of movement) of the pulvinotonal column resides in the pulvinots and

not, in the intermediate bones.

Along Einsteinian lines, we need to accord the fourth dimension of TIME to each pulvinot (IVD). The body's march from conception to cremation is recorded time-wise not only in each cell, but in every fiber too. It is interesting that the aortic collagen of a rat of three years, dog of 12 years, horse of 60 years and man of 100 years is identical in structural evolution and very closely comparable. The disc of one's older time is not degenerate but merely evolved with the passage of time. Can we read aging as Time Instructed Morphological Evolution? That makes our aging innate, inevitable and essentially innocent. The lament that we have about our gray hair and opaque lenses is out of sync with the march of time in the warf and welt of our body. There is no need for any shame in one's aging. What is needed is grace. The autumn of life is no less beautiful than the spring and the latter should know that it itself is heading for the inevitable autumn. Don't call a pulvinot degenerate. Say, it is showing its fourth dimension, namely TIME.

No doubt that many a pulvinot ages enough to allow the escape of nucleus pulposus beyond the confines of its spheres fibrosus. But amongst innumerable such prolapses, an occasional one dis-eases the owner. Hence the essential innocence of the TIMEd pulvinot, like a TIMEd tooth. If some of us get hurt while cutting our teeth, some of us do get hurt while rotting them. Such incidental dis-easing does not sully the essential innocence of any aging process. Portmann has called the animal body as configured time, that must look disfigured in its temporal sojourn, but the anomaly lies not in the process but in the eyes of the beholder. Medical science's role is to ease whatever the dis-ease that may accrue from pulvinotal evolution, dis-ease-far and no further. So often, the total loss of a disc approximates the adjacent notons (vertebrae) to merge with one another to create a solid bony unit that allows other pulvinotal joints to carry on life, as usual.

Lewis Thomas and Lyall Watson have observed that the greatest medical discovery in the last 100 years is of its profound ignorance. How little we know of a marvel called a pulvinot (IVD)? The realization of one's cerebral limitations ushers in a sense of humility that begets a sense of wonder that spawns a reverie. Pulvinot, thou art great. No man-made disc-replacement can come anywhere near your genius.

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## EDITORIAL

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## Transatlantic odonto-occipital listhesis: The so-called basilar invagination

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## Full Text

Man has a swollen head and a shrunken, atavistic tail. Yet, in Nature's eye the two are on par. It is fascinating to realize that the well-recognized lumbosacrolisthesis has a cranial counterpart in transatlantic Odonto-Occipital Listhesis or TOOL in short. Nature's penchant for embryologically treating the hind-area (proctodeum) on par with the mind-area (stomodeum) gets reflected even in the work-a-day variations ('anomalies') of the craniovertebral axis. No wonder, the sacralization of the lumbar vertebra has its cranial image in occipitalization of the atlas. TOOL as an acronym and its extended meaning have the merit of being anatomically precise and evocative. Moreover its 'T' indicates the dentability of the neural axis from the telescoping tooth called the odontoid process.

As the juxtaposed radiograms show [Figure 1],[Figure 2], the listhesis (slipping) at the cranial end, nameable as TOOL, lends itself to be visualized as the listhesis at the other end, generally known as spondylolisthesis, - obviously an imprecise term, for therein the players' names are missing. The preferable term would be lumbosacrolisthesis for it incorporates the participant bones.

The fact that one out of every 20 human-spines exhibits lumbosacrolisthesis as a herd feature, puts this 'anomaly' as an integral normal variation, not to be looked down upon as an aberration or error. A so-called 'anomaly' is Nature's way of conveying to you the unfathomable complexity that goes behind fashioning of what poses as normal. It is good to revere Nature by the acronym INNTOE, In Nature, No Terror of Error.

The two terms normal and abnormal - the much-used, great favorites of medicos and their texts - have been

denied definition in medical lexicons. The Oxford Companion of Medicine , merrily skips the issue in her 2-volume tome. The resolution is circumlocutional- that which is not normal is abnormal and vice versa .

Robert Ardrey declared that normality is a range and not an average and that it applies always to a herd and never to any individual and that the curve of normal distribution stretching to infinity on either side gets labeled abnormal by the ignorant. We can safely summarize that both TOOL and lumbosacroliethesis are parts of normal human variation and should not be seen as either abnormal or much less, pathological. Both are compatible with symptom-free living.

The atlanto-occipital joint, in its trustable stability and amazing mobility, is comparable to the hip joint or the shoulder joint. The articulating surfaces are very large condyles, ball-n-socket like, an arrangement that ensures the foregoing. The axis in order to provide the freedom of saying 'NO' a little too freely, had had to sacrifice its body to form the odontoid pivot. Ergo , the atlantoaxial symphony must depend on the nature of apposition of the facet process, which, by the law of normal distribution must get curved enough to cross the threshold of vertical stability and hence permit some telescoping to allow the odontoid to go upward, to allow you the diagnosis of TOOL. The fact that many a head with a clear TOOL inside can carry on without a bother testifies to the essential normality of TOOL. Like its caudal counterpart, TOOL is an intercentral slide - the odontoid centrum of the axis slipping past the centrum of the occiput.

Evolutionists and embryologists now view the neck-n-head as but a limb, an assumption readily translatable into action in adult life when Peter Pele kicks the ball into the net using his head. The atlanto-occipital joint becomes a limb-joint, on par with the shoulder and the hip and capable of enjoying parallel freedoms of mobility with assured stability. Towards this end, Nature, obeying the principle that functional necessity is the mother of structural adaptation, has transformed the apposing facets into large articular surfaces almost mimicking a ball-n-socket joint.

The TOOL morale is simple. Accept it as a part of broad range of normality. And take measures to ease, if there is dis-ease, by undoing the telescoping and fixing it for good by appropriate implant or surgery. When the odontoid is digging into the cord, muscular spasm shortens the neck to minimize the stretch of the neural axis. You take away the odontoid dig and the Nature obliges by restoring the length of the neck by relaxing the massive muscles. INNTOE.

Wednesday, November 12, 2014

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**EDITORIAL**

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**Wound healing: The presiding deity of surgery**Manu Kothari<sup>1</sup>, Atul Goel<sup>2</sup>,<sup>1</sup> Department of Anatomy, K. E. M. Hospital and Seth G.S. Medical College, Parel, Mumbai, Maharashtra, India<sup>2</sup> Department of Neurosurgery, K. E. M. Hospital and Seth G.S. Medical College, Parel, Mumbai, Maharashtra, India**Correspondence Address:**

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There is little that can be called original since a sharp flint opened an abscess and some horsehair threaded through the first thorn needle sewed upon wound. Yet it all goes on, bit by bit, and the wheel of progress turns a little in man's lifetime.

Sir Harold Gilles and D. Ralph Millard in the Principles and Art of Plastic Surgery

The primitive man saw an abscess burst on its own and fully resolve itself, as also a wound-small or big, or even very big-heal on its own, and the art of surgery was born. The surgeon wields a knife that heals by wounding, be it an abscess laid open, or the abdominal or chest cavity opened up to be closed.

Surgery, however sophisticated remains an art with precious little achieved from the flint-and-horsehair times. The doyens of plastic surgery, Gilles and Maynard, have been humble enough to own up the basic nonscience ness of the art of surgery.

The science of surgery solely rests on the willingness of the body to heal after a wound from within, or more often, from without, by a process supremely efficient and inscrutably mysterious. From a shaving-scratch to a polytrauma of head-on collision, the healing of wound gets orchestrated in utter silence, in the absence of any medical wisdom or supervision and so very often despite medical interference. The body strives to restore the tissues to status quo ante wholeness, by precise sequence of healing events. The term heal is traceable to hale, hal, meaning sound, healthy, and beautiful. To heal is to restore health.

Over 200 years of research on wound healing has allowed medical science to know only the spelling of the phrase without deciphering its essence. At a Lister symposium on wound healing at Glasgow, 1970, the Chairman summed up the entire meet on four counts:

Nature has attained the zenith of perfection in wound healing. We know nothing of wound healing. We cannot accelerate it. So often, we decelerate it.

The 1970 generalization holds true to the dot now, and would for another 1000 years at the least. Today medical science, cellular science is facing a grave crisis of basic binary blindness. We don't know what a cell is. The science of cytology was centered on the nucleus as the boss, but facts have turned out to be otherwise. The so-called cytoplasm is the boss, and the cytoplasm being nebulous is beyond-science, beyond microscopes, beyond research.

A cell is

What it is

For it does

What it does

And it does

For it is

What it is.

The other aspect of medical blindness is the collagen fiber that comprising 1054 amino acids is the most complex molecule in the animal body that has its own inscrutability and its own inner clock. Collagen irrevocably ages the animal body by strictly comparable inner clock and there is no reversing the clock.

Modern medicine should climb down to earth level to accept its lofty ignorance on cell, fiber and wound healing. Wound healing is mysterious, inscrutable, almost divine, and merits being the presiding deity of the magnificent art of surgery.

The healing of the neuraxis - brain or spinal cord - needs some elaboration. The neurons, being nonmitotic perennial cells, once lost are lost forever. Neurons that die do not get replaced by neurons but by glial cells and the fibroblasts and collagen fibers off the blood vessels. Neurons, like sensory - receptors and muscle cells are nonmitotic reparatively as

tumorogenically. The cells that fill a neuraxial gap are fibroblasts, neuroglial cells and the accompanying vasculature. This neoplasm-new tissue - essentially contracts to comprise a cicatrix of minimal dimensions. Whatsoever reparatively holds true for neuraxis holds true for sense organs and muscles.

We may end here with a prayer that a surgeon ought to make, after propitiating its deity named wound healing.

Anonymous

Dear Saint Luke, friend and advisor to Saint Paul, guide my hand and eye for the sake of my patient. Steady my nerves and my scalpel; watch the microbes and the nurses; make muscles, veins, arteries and nerves behave according to the book; keep an eye on the anesthetist. Save us all from lapses of memory, fraying of tempers, confusion of bottles and instruments; miscounting of swabs, and blunders of diagnosis. If it is "kill or cure," please cure; if it is "kill or maim," please maim, but save my patient...And as there is no more time for praying, I say Amen.

The Linacre Quarterly, August 1954, "A Prayer for Surgeons"

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