

# Relevance of Medicine to Anatomy

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**Dedicated to all Anatomists-past and present--for “it is only by standing on the shoulders of giants that one can see further”. An appreciation of the wonder of Anatomy must precede the understanding of its relevance-not only to medicine but to each living individual.**

Once upon a magical moment in time, as chemical turned to creature, Anatomy, the most fluid of all sciences, was born, and in adaptation to an ever-changing environment, began to evolve. From DNA, brilliant in its simplicity, yet so diverse in complexity, arose a Drosophila, a dinosaur, a monkey and a man, simply by rearrangement of its four bases. From molecule to man, Anatomy has indeed come a long way. Moreover, the 'hand', an epitome of perfection, in terms of form and function, powered by the brain, has evolved to such an extent, that it has influenced the course of man's own evolution...

Life, as we know it, begins when a sperm, armed with the substance of its ancestors and little else, much like a rocket approaching a huge planet, penetrates the ovum (about 85,000 times larger). The resultant cell, which bears within it, a rich legacy of instructions, programmed to 'switch on' at a precise moment, begins to divide, even as it journeys through myriad passages, inexorably moving along a predestined path, like a guided missile, rarely missing its target, the enriched endometrial bed, especially designed to nurture it through the weeks that follow. Each cell, a universe unto itself, learns to 'talk' to its neighbours, by phenomenal signaling mechanisms, inducing, cajoling, stimulating, or where required, suppressing its companions, to create a multiplying, migrating, differentiating, folding, twisting, twirling, invaginating, evaginating, fusing, splitting, aligning, partitioning or connecting mass, destined to be a part of a tissue, organ or system, each working independently, yet in harmony with the whole, to emerge, nine months and trillions of cells later, a laughing, crying, talking, jumping, running individual! Groups of cells custom designed to secrete, excrete, exchange, transport, transmit, absorb, diffuse, dilute, exude, cover, line, store, connect, concentrate, contract, engulf, destroy, remodel, taste, smell, hear, see, think, remember, – exhibit a phenomenal interplay of form and function, even as they retain the capacity to replicate themselves, (except billions of neurons, but nature provides a surfeit, about 2/3 lying quiescent in a lifetime).

**“Structure determines function, function modifies structure in a marvelous, ceaseless interplay”**

The best example of the irrevocable bond between form and function is exhibited in nature by our genes, where the structure of a gene determines the type and function of a protein product. A single base substitution due to a mutation or a break in an encoding gene would alter gene structure, thus drastically, sometimes fatally, affecting the encoded protein and its function. On the other hand, genes those encode proteins which serve vital functions, have been universally conserved throughout evolution in all living species, with little change in their structure. Today, the Human Genome Project has successfully unraveled the 'anatomy' of the human genome and gene therapy aims at restoring the normal 'anatomy' and hence the function of the gene in question. **Hence, should not the practice of medicine be aimed at restoring the perfection of the human body, in terms of its form and function?** How could this be ever possible without a thorough knowledge of the wondrous nature of the human body? Would it ever suffice to treat a kidney or a pancreas, a lung or the heart in isolation, without considering its implications on the entire organism? Where else but in the halls of Anatomy, would a student be able to embark on a once-in- a life-time voyage to discover the myriad interrelationships

between tissues, organs and entire systems? The dead were never more alive in Anatomy dissection halls, and have plenty of tales to tell, only if one cared to ask 'what, where, when, who, how' and most important, 'why.'

To all ye students and medicine men, I put forth the following:

Have you ever thought of the skin as a magician's mantle, capable of being a sun-shade, overcoat, or a water-proof raincoat, able to withstand constant wear and tear, sensitive to the touch of a feather, to temperature and to pain, that, even while executing its own running repairs for four score years and ten, is a mirror to health and disease, revealing myriad conditions such as jaundice, anaemia, dehydration, poisoning, to name only a few? The 'anatomy' of the skin alone could fill volumes! How could one even begin to 'heal' the skin without knowing every aspect of its 'anatomy' and 'physiology'?

Did you ever think of your muscles as the best examples of molecular motors in man? Did you take the trouble to note their varied, unique architecture, each fibre packaged to perfection in precise compartments, tapering down to tendons for economy of attachment and range of function, exhibiting a harmony of movement, encompassing power and precision unmatched in nature? Did you try and discover the meaning in their myriad names?

When you held a bone in your hand, did you think of the elements that fashioned it? Did you realize that bones are a vibrant factory, being remodeled all the time? Tendons with the tensile strength of steel leaving their mark, would tell you much about the individual, only if one cared to feel a bone as a blind man would. Every facet would have a story to tell. Have you ever thought of the arched foot as a marvel of architectural design, built to bear the weight of a sumo wrestler, as well as execute the graceful nuances of movement of a ballet dancer? The science of orthopedics would be meaningless if not applied to anatomical principles governing the musculoskeletal system.

Did you know that the lungs if spread out, would occupy an area the size of a tennis court, and that an RBC, ferrying its precious cargo, travels through 60,000 miles of blood vessels, that are designed to not only conduct, distribute or resist blood flow, but also develop self-controlling mechanisms, resulting in uni-directional blood flow or where needed, its complete reversal?

Have you ever wondered about the miracle of that little heart tube which begins to beat precisely on the 21<sup>st</sup> day of your life, in response to that first impulse fired from a specific area of the myocardium, allowing 'blood' to circulate through it, even as it folds, rotates or is partitioned—the streams charting their own course, continuing to beat ceaselessly 70-80 times/min. from womb to tomb? How would the practice of cardiology be relevant, unless applied to imitate/repair this untiring pump? Had we understood its anatomy, we would have built another to replace it! (So also for the brain, liver, kidney etc.)

How could one ever know all there is to know about the human body, at the macro, micro and the molecular level? How would the 'practice' of medicine ever match the perfection of the human body? Must not medicine then be always relevant to the Anatomy we know and understand, and not vice versa? Is not the complete unraveling of form and function the ultimate aim of medical research on which would be based the relevant modifications in therapy?

### **To make medicine relevant-**

Rediscover anatomy- by appreciating the anatomy of skin incisions; teach the anatomical basis of suturing and wound healing; Relearn/teach, the anatomical basis of bandaging a wound, positioning a limb or puncturing a vein, introducing a catheter, applying a cast, or creating a prosthesis—the list is endless—every investigation, surgical procedure or medical treatment, is aimed at restoring the harmony of form and function. Learn the 'anatomy' of pain, an inflammation, a cough, a cancer or a crisis- understand the anatomy of a body ill at ease or in

dis-ease and the path to the relevant treatment would light up for you. Know this form to perfection, and 'practice' the medicine as relevant to it, only then would you truly heal.

Only sound anatomical principles could enable the successful separation of the layers of the cornea which resulted in a single corneal graft being shared by two or three individuals-a vital breakthrough in our country. Is not all reconstructive surgery based on principles of Anatomy, and an attempt to imitate and restore the perfection of the human form?

Imaging techniques are but a reflection of the human form - Does not the interpretation of these images require a firm anatomical base, in order to recognize, not only solid/fluid/ air but variations in their densities, and learn to discover the abnormal? An X-ray, an ultrasonograph, an echocardiogram, a Doppler, coloured or otherwise, a CT, an MRI or a PET are but an attempt to image Anatomy.

Histopathology, would not be a diagnostic tool, were it not for the 'anatomy' of the normal cell/tissue. How else could a cell be designated as 'abnormal' without understanding what constitutes the 'normal'?

Hence, is not the practice of every branch of medicine directed at restoring, correcting, copying, imaging, constructing, grafting, treating, modifying, excising, transplanting, introducing, and even cloning Anatomy? Are not all efforts directed at attempting to measure up to Nature at its zenith of creation – the human form? Must not the practice of all medicine be addressed to the restoration of gross/microscopic/developmental/radiological/ regional/systemic/ surface/living anatomy?

Are not all scopies, graphies, centeses, biopsies, tissue cultures, ectomies, otomies, ostomies, resections, amputations, anastomoses, grafts, etc. and the entire gamut of Recombinant DNA technology, gene manipulation, gene therapy, to name a few, based on principles of Anatomy? How would medicine serve its purpose, unless practiced as relevant to Anatomy?

Therefore, it is the '**Relevance of Medicine to Anatomy**' and **not** the 'Relevance of Anatomy to Medicine' that must be understood, appreciated, taught, and practiced- the world over. Perhaps when Anatomy, this most elusive of all sciences, reveals itself completely, a day would dawn when the mystery of

- an agenesis, an asthma, an alkaptonuria, an Alzheimer or an AIDS,
  - a Bright's disease, a Bloom syndrome or a Burkitt's lymphoma
  - the 'seven Cs', in the words of Dr. M. L. Kothari, a cell, a cancer, the cerebrum, a coronary or a cardiac condition, collagen, cartilage or the common cold
- would be unraveled, and medicine would provide not only therapeutic but preventive solutions.

Finally, it is hoped that a day would dawn when enlightened souls would effectively integrate and incorporate Anatomical principles into the art and science of healing and that the lives and legacies of Galen and Gray, Hunter and Harvey, Vesalius and Vinci would not have been in vain.

PS: I am honored to be asked to step into the shoes of my father, Dr. S. M. Bhatnagar, which, though several sizes too big, shall be worn with pride.