dear residents

Mental Models **September 17, 2023**

Dear Residents,

Happy **Rosh Hashanah** to those who celebrate. May the New Year be full of happiness.

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When I began medical school in 1980 my mental model was that every disease was probably a monogenic disorder just awaiting genetic characterization. It was only over time that I moved away from the seductive one gene – one protein – one disease hypothesis that was driven by the awe of learning about hemoglobin S and the evolutionary pressures that selected this gene. This was a vividly illustrated example in Stryer's textbook of biochemistry. A single base-pair mutation caused a profound conformational change resulting in sickle cell disease. It was only later that I came to appreciate the phenotypic variations in disease expression and outcome even in monogenic diseases.

My mental models evolved beyond Mendelian biology to an appreciation of polygenic traits and subsequently began to incorporate the ideas of gene suppressors, gene promoters, variable penetrance and expressivity and the influence of epigenetics. More recently I have begun to fully appreciate the role of social determinates of health with the realization that the Zip Code is more powerful that the Genetic Code.

I initially thought that the natural sciences would have all the answers, only to realize that other great branches of knowledge - economics, sociology, and the arts play a big role in medicine. **As physicians in training, your inevitable expansion of mental models will transform the way you think of disease and illness** – the former ever so complex in what drives pathogenesis and the latter with regard to how so much shapes the human and societal experience of disease (illness). There are three main reasons we fail to spot the interconnectedness of the great branches of knowledge. The first is perspective, especially that of our immediate environment. We may be unaware of that which quietly surrounds us (much like fish may be oblivious that they are immersed in water). The second is our ego. We may be unwilling to learn that which is new or contradictory to our beliefs. The third is distance. The further we are away from the consequences of our decisions, the less we are in a position to modify our actions or update our views. Exploring mental models arising from the great branches of learning can help illuminate how you think and understand the world.

There are numerous mental models we can learn from, and they emerge from every branch of learning. I encourage you to explore a few of them here: https://fs.blog/mental-models/#what_are_mental_models.

The design of residency training has greatly evolved over the years – from an apprenticeship to a competency-based model of education, from actually residing in the hospital to closely regulated work hours, from passive learning models (pedagogy) to interdependent models of learning (andragogy and heutagogy). And in the changing nature of our relationships from hierarchical order to team science which has reordered us from subordinates to peers. None of this resulted from one branch of learning (and certainly not from science alone). These changes have been informed, among others, by economics, mathematics, neuroscience, sociology, and psychology.

Our system of training is designed to assure society that we will be competent when we cross the threshold to independent practice – we have proxies to assess this – milestones, board exams, quality of care, patient satisfaction, etc. Yet, we struggle to define what a good doctor is and what competency really means especially since it involves more than medical knowledge and clinical judgement. Medical students often ask me what our residency program values the most in an applicant. That's always a tough question for me. I tend to think of conscientiousness as the most important quality – being organized, planning well, using time efficiently, seeing tasks through to completion, being reliable, self-directed, etc. There are clearly other attributes (which are hard to assess) – compassion, empathy, kindness and other "social lubricants" which are increasingly viewed as equally important qualities. To grow, adapt and continuously learn from your experience, while updating your closely held views, emerges as the attribute that will ensure your continued relevance and success in medicine. This "openness to change" in a rapidly changing world will prove to be critical.

We have thought of residency training as occurring in an impervious tube – a rite of passage which you entered on July 1 and will emerge from on June 30, three years hence. In reality it is not impervious – there are energetic forces both within and outside of this tube (better thought of a semipermeable membrane with bidirectional flow). You change the milieu, and it changes you. The social determinants of health are complemented by the social factors of residency training (yet to be fully articulated but often thought of in terms of their negative consequences such as disengagement, emotional exhaustion, and physical fatigue). A residency training program is a living organism of sorts, and together we are its inhabitants committed to the greater good and open to changing how we do business. It's not the strongest or the biggest who survive – it's the most adaptable ones that do so.

Thank you for being thoughtful, open, adaptable, committed, and curious.

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