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Book Review

Review of *Where Medicine Went Wrong: Rediscovering the Path to Complexity*, by Bruce J. West. Singapore: World Scientific, 2006. 338 pages + xiii.

The history of modern western medicine and medical education can be traced to the late 19th century. Due to the success of methods based on the germ theory of disease, antiseptic surgery, clean water systems, and so on, and a need to "professionalize" the practice of medicine, it was felt that medical schools should teach and use the best scientific knowledge available and that requirements for entry to medical school should be raised to something beyond a high school education. It was recommended that schools that do not follow these recommendations be closed. By the early 1930's, medical education had been transformed.

In this book, West suggests that the fundamental assumptions that have shaped modern medicine, based primarily on a mechanical ("physics") view of the biology involved, are fundamentally flawed. He presents two related ideas to illustrate this observation: (a) the fractal nature of many physiological signals and (b) the erroneous expectation of the bell-shaped curve in measurements. West notes that these observations result in a failure to recognize the true nature of biological systems under medical study, leading to errors in treatment and diagnosis. The book contains many specific examples, most of them from groundbreaking published work of the author and co-workers, to illustrate these points. Central to this effort is Chapter 5 on Fractal Physiology, West's term for the presence of fractal properties of physiological time series. In this chapter, the fractal nature of the cardiovascular network (fractal heartbeat intervals), the respiratory network (fractal breathing), motorcontrol network (gate), the regulation of the gut (gastric electrical activity), neural discharge (EEG), and the thermal regulatory network are described. The discussions in each case are complete and compelling.

The second point, errors in measurement (usually from the mean) in the presence of a chaotic regulatory system will fail to be Gaussian, is illustrated through a long historical discussion of the origin – in physical systems – of the observation and expectation of Gaussian errors. The failure of those assumptions in biological systems is based on the discussion above, that the observed fractal nature of data from biological networks results in distributions different from random variations about a mean predicted by the Central Limit Theorem.

From West's analysis, disease is often the result of a disruption in a fractal physiological system that provides the necessary control (through an attractor) to maintain "health." In many systems, this state can be detected

through a loss of complexity (e.g. reduction in fractal dimension) in some measurement from the system. Medicine, then, should be about detecting and restoring the systems and their control. The cost of failure to understand the basic nature of the systems is illustrated by the author in several ways, including referring to Buchman's example (Buchman, 2006) of MODS (multiple organ dysfunction syndrome) often seen in intensive care units. In this example, "fix the number" is often used to guide treatment (if a test reveals a low number, raise the number by adding the deficit substance as "treatment"). In MODS that approach can lead to an increase in mortality.

It is one thing to observe this failing in the viewpoint and basic assumptions of medicine, it is quite another matter to describe how these observations could be used to propel changes in the practice of medicine and medical education. On this aspect, the book is almost silent, except to recommend that the profession "should relinquish its reliance on averages for understanding wellness and disease, and add measures of fluctuations to its diagnostic repertoire of bedside medicine." However, the situation is more complicated than the author describes in this book as hormones and neuropeptides can simultaneously affect and orchestrate collections of (chaotic) systems. It is also the case that West's view may only be a variation of that that is seen as wrong in this book, namely, that a patient is a machine that generates data. The only difference in his eyes is that the machine generates data that is more complicated than earlier recognized.

Nonetheless, it is possible to deduce some necessary direction of change in medicine in light of the argument in this book. It seems that teaching humility in medical school might be an obvious first step, to acknowledge that the disruptions to systems as seen in disease can be complicated, somewhat unpredictable, and possibly beyond the complete understanding of the physician. Observing the patient and the patient's own observations are also valuable in this situation where the numbers from medical tests cannot tell one what best to put in the IV. Listening, careful observation, along with intuition and experience, then, begins to play a larger and necessary role in diagnosis and treatment. West has made the argument that Medicine is much more complicated and may be more of an art than was thought.

REFERENCES

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