Weaving the web of clinical advance

Science and technology in medicine: An illustrated account based on ninety-nine landmark publications from five centuries

Andras Gedeon, New York, 2006, Springer-Verlag. 558 pages. $76.46. ISBN: 038727875.

You might call this a coffee table book. It is large, heavy, and more space is given over to pictures than text. It costs more than your average paperback too. It is exactly the sort of book that as a student and resident I could only look at in the shops. Middle age, alongside photodamage, has allowed more flexible finances, or alternatively an occasional free review copy. Anybody interested in clinical medicine and clinical science should delve into this book, both to marvel at what we know and how we came to know it and to ponder whether we really should be confident about the direction academic medicine is moving in.

Andras Gedeon has chosen and pulled together 99 discoveries and inventions in science and technology spanning 5 centuries that have contributed to medical advance. Each is presented over a few pages, with relevant plates, frequent facsimiles of the original publication, and some supporting text that puts the advance in context. Most of the discoveries are allowed—and do—speak for themselves and it is left for the reader to rediscover the wonder of each. The examples span 5 centuries from Dürer (mathematics applied to human proportions) through to the contemporary, for instance Brånemark's discovery of the use of titanium implants. Along the way we visit the work of Wren (controlled techniques of infusion), Davy (properties of nitrous oxide and its use in surgery), Pasteur (germ theory), Mendel (heredity), Ehrlich (selective chemotherapy in the form of Salvarsan), and Kolff (artificial kidney). Remember, most of these vignettes are about individuals, frequently driven individuals, monomaniacs even, not large laboratory teams or genome centers. There is no "management," nor are there mission statements; the geniuses had yet to be elbowed aside by the accountants.

Dermatology gets a mention, featuring as one of the chosen applications of lasers with the (early) use of coherent light in photodynamic therapy with the assessment of therapeutic response using scanning laser Doppler flowmetry. Of course the problem of what to include and what to pass over is most tricky for the recent past when the lens of history has not brought into focus our intellectual foreground. For instance, the most recent example, from 1975, is that of PET (positron emission tomography) scanning. MRI (magnetic resonance imaging, Paul Laterbur), and Godfrey Hounsfield's computed tomographic scanning also receive a mention. Reminders that it is technology more than grand theory[1] that often drives medicine; medicine is more engineering than science.

Yet it is the penultimate choice, 98 of 99, dating from 1974, that fascinates me and where I think the author has been both brave and insightful. The relevant names are those of Vinton Cerf and Robert Khan—names I would guess that do not slip off the tongue of the average physician as easily as those of Watson and Crick, or Goldstein and Brown. Yet, it was Cerf and Khan's invention, the packet switching protocol that underpins the modern Internet, which in turn allowed Tim Berners-Lee's majestic invention more than a decade later of the World Wide Web (my choice for inclusion in the next edition as invention 100). Let me digress to justify what may seem a bold claim.

David Margolis,[2] writing in the Archives of Dermatology a few years ago commented as follows:

> It seems too natural to me to suggest that medicine is rapidly changing. I went to medical school in the early 1980s and was impressed by the rapid progress in our supposed understanding of disease mechanisms. These advances were primarily advances in "wet lab [laboratory]" sciences, such as immunology and molecular biology. In the 1990s there has been a swift movement toward unlocking the genetic mechanism of disease. Therapeutically, there have even been attempts at altering the genetic makeup of an individual or their cells to cure or alter the progression of a disease. Yet, it seems to me as a clinician that no change has been as dramatic as the changing landscape of who is primarily responsible for patient care and who pays the bill.

Most of us (like Margolis) have traditionally thought of medicine as an application of biomedical science. It is this paradigm that underpins most medical education and medical research. This traditional approach is necessary but, as Margolis observes, it is not sufficient. To return to the real significance of Cerf and Kahn's invention, the dominant intellectual question for medicine in the next quarter century is to what degree medicine is capable

of codification. To what extent is it possible to produce rules and scripts that both reflect and in turn order medical practice? What is it that doctors "do" and how can it be achieved more efficiently. What skills underpin practice and how could we script those activities such that they could be done by a machine or a less educated worker? The goal that now faces academic medicine is not just to understand, or even replicate, current clinical practice, but to simulate it.

This is not a new phenomenon. It is just that some of us have grown up thinking of medical advance as something external to us—technologies developed by wet-bench workers. Now we are realizing that we are not external agents wielding our knowledge, but subjects of study ourselves. (Problems with the Health Service? "It's the doctors, stupid," is the cry of most UK politicians.) Run the clock back 400 years when annuities were first sold. How did a seller determine the price? By clinical judgment: he looked at you, saw the quality of the cloth you wore, how you spoke, what society you kept. What do we do now? Click on a Web page, fill in one's age, smoking status, age at death of one's parents, and a few other details, and obtain a quote. What was once clinical judgment has been reduced to a few items of information that have been codified such that a machine can undertake them. And it works without any fancy artificial intelligence, just high school level mathematics. Roll the clock back a couple of centuries when the Luddites rebelled because their jobs were being replaced by machines. They were right and their jobs did disappear. The march of industrialization went hand in hand with the march of codification—the ability to script or produce procedural rules that replaced what was once considered human skill. And the machines were better.

It is this historical trend that Cerf and Kahn's invention empowers. The Internet and its parent, digital computing, provide a technological leap as great as that of Gutenberg to allow the exteriorization of memory, to exploit and record the regularities in human behavior and practice, and to emulate and control that practice. So, much as biomedical science is fundamental to medical discovery, another set of intellectual disciplines is fundamental to clinical practice. The nascent interest in evidence (for therapies, diagnostic tests, etc), studies of patient benefit, and questions of how traditional models of medical practice can be fragmented, such as they can be done by generic workers with less training using scripted protocols, is where academia must now move. Gedeon is right to celebrate the past: if we stand on the shoulders of giants we see further, even where the road might fork.

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The structure of the human hair follicle

David A. Whiting, Fairfield, New Jersey, 2004, Canfield Publishing. 32 pages. $74.00. ISBN: 0-964-7749-5-X.

This atlas-style text is aesthetically pleasing, with photomicrographs of excellent quality, sharp images, and diagrams. Bullet-point text is featured, allowing easy reading, yet systematically covering pertinent details. The best sections highlight human hair follicle anatomy, with crisp histopathologic images compared side by side with diagrammatic sketches. Another section on follicular counts with precise labeling and figure legends is particularly instructive. Perhaps the biggest attraction of this book is its "flip-open" style that facilitates its use adjacent to the microscope. The innovative style of presentation, combined with Dr Whiting's meticulously laid-out vertically and horizontally sectioned slides make *The Structure of the Human Hair Follicle* a truly great atlas of the human hair follicle.

As the title of the book makes clear, this textbook highlights hair structure rather than diverse diseases featuring alopecia and therefore does not serve as a histopathologic primer for diagnosing alopecia. It does, however, provide a background that is indispensable. We believe that it is a "must-have" for both practicing dermatologists and dermatopathologists alike.

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