EDITORIAL

Self-Correcting

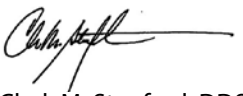
The recent awarding of the Nobel prize to the scientists who discovered that small segments of RNA ("micro-RNAs") are master regulators of developmental biology, growth, and development has had me thinking. In high school, I was taught the "central dogma" that DNA encodes our genetic code, from which an RNA copy is made of a segment that is then sliced and diced to create an mRNA, which is then translated into a protein before the mRNA dissolves because it's done its magical job. In short, DNA is king and RNA is simply a newsboy. Boy, was that short-sighted, and here was the most significant scientific award being given to a group that essentially disproved this linear thinking of the genetic code.

This got me thinking about implant dentistry. As clinicians we assess our patients and try to judiciously use the best current evidence to prescribe or deploy a therapy or treatment. We know over the course of our career that we have evolved with science and have self-corrected earlier assumptions that were thought to be true. The advent of portals of communication, from the oral tradition to print to the web and now AI, have each accelerated the dissemination of information. As mentioned in previous editorials, data is not information unless there is a scale (eg, think measures of temperature), and information is not knowledge without context (eg, average temperature in Chicago in July). There is a simplistic information bias that makes us believe that the curation of more and more data will somehow address issues of inaccurate information and, in the end, the truth will prevail. Unfortunately, this is rarely the case. The outcomes we see when using AI large learning models (LLMs) are information those LLMs create to validate their own conclusions (a form of hallucination).

One of the most important advances in science occurred when the communication of information could be reviewed and openly challenged with a spirt of collaboration (and sometimes competition). While it took time, the ability to challenge, question, and change "central dogmas," which leads to truths, was a key part of the scientific and medical revolution of the last 150 years. The ability to trust was essential, and trust only arises in self-correcting institutions. If institutions have core beliefs that are infallible and should never be questioned (or leaders who think they are), they are more religious than scientific.1 Ironically, this is why most of the major discoveries in science prior to WWII were made by scientists outside of universities. Interestingly, this is also why scientific and medical societies were created to establish forums and publications where information could be debated outside of conventional institutions such as the infallible church or royal halls. Yes, in time some monarchies realized the economic value of science and created royal academies (still, of course, under the control of the monarch), but they found it better to keep the free thinkers close to the royal gowns, so to speak.

The ability to self-correct is important because, at its core, scientific thought is inherently skeptical. Skepticism is at the root of the process of peer review. The journal you are reading is one form of peer review where an independent set of content experts who are unaware of the authors or institution behind the article evaluates its purpose, approach, results, and interpretations using a lens of skepticism to strip the assumptions to their essence or core truth. The value of this repeated sifting of data and information is to determine if a prediction (ie, a theory used to predict a future state) makes sense or not in a new context. Most importantly, it means even though a paper was published recently or 40 years ago, the results and conclusions will always be preliminary and need multiple triangulations with other parameters to determine if, in time, the underlying theory is "correct."

In clinical implant dentistry, we have seen this evolution of thinking in our approaches to implant design, in the application of staging of healing, and in addressing the adverse events that appear to occur when we systematically turn our attention to these events and question "why"—thus the conversations around peri-implantitis. While earlier I said that more data and information is not necessarily the answer, what I mean is that the collection of data must be judicious, guided by theory, and evaluated so the theory can be modified or discarded. A theory is simply a prediction of a future state, and to state that a specific implant protocol will always provide a certain result lies more in a religious faith than in science. This is why we must be judicious and skeptical as we apply and use emerging tools such as AI-based LLMs to provide predictive data for diagnostics and treatment planning. As the human provider of care, we want to be sure that we are not a victim of the confirmation bias that the outcome of our care is good. Outcomes most likely have more to do with our patient than with us.



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*This editorial was not composed in any LLM model.

REFERENCE

1. Harari YN. Nexus: A Brief History of Information Networks from the Stone Age to AI. Random House, 2024.

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