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COMMENTARY: UNCERTAINTY IN THE ART AND SCIENCE OF MEDICINE AND BIOTECHNOLOGY

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"Medicine is a science of uncertainty and an art of probability."[1]

It has been said that nothing is certain but death and taxes, yet how often do we neglect that truism when confronted with medical or bioethical decisions? Our lives are shrouded in uncertainty, colored not merely in black and white (which we find much more palatable) but in many shades of gray. In both medicine and technology, this fact is largely underappreciated and its consequences disregarded as the promise of technology is promoted while its perils and uncertainty are ignored.

Science does not leap ahead as rapidly as we would prefer; new developments happen slowly, prolonging uncertainty, and uncertainty does not make for a good news story. Researchers, public relations departments, and the media are all a bit to blame for hyping the hope suggested in the results of the research studies while ignoring the fact of uncertainty.[2]

The certainty of uncertainty became clear to me recently as I cradled the head of my beloved black lab in my lap. Everything was shrouded in uncertainty, including her age. While we had her for 8 years, she was an abandoned "rescue," age unknown. The last year had been difficult for her as she began accumulating a long list of diagnoses. I knew that she was declining yet that did not make a sudden change in status any less of a surprise. Hadn't we just been on a road trip with her days before? Now she could barely stand, much less walk, had a high fever and her liver enzymes were 10 times normal. What was the etiology? With a sullen face, the veterinarian said, "*Probably* a malignancy." She looked so peaceful lying on my lap, but would she respond to conservative treatment? Would she live until we returned from a brief trip? As I contemplated the decision before me with regard to my dog, I could not help but wonder with horror how anyone could make such decisions in the midst of uncertainty for another human being.

Despite the advances in scientific knowledge and technology and the claims of "evidenced-based" or "precision" medicine, uncertainty and ambiguity are inherent in and pervade all aspects of contemporary medical care from diagnosis to therapy and prognosis. Technological advances have changed the content of medical uncertainty and altered its contours, but uncertainty has not been eliminated.[3] The proclamation that medicine is a science neglects the fact that medicine is also an art—a moral art—dependent not simply on scientific data but on human judgment regarding the good of the person who has presented for care. This is no less true of biotechnology whose development is grounded in science, but whose application is also a moral art. Uncertainty is located in the amalgam of the unreliability of human knowledge, the fallibility of human judgment, and the complexity and contingencies of the human person.

The unreliability of our knowledge is a fact. More than three decades in the medical profession regularly demonstrated to me the inadequacy of medical "evidence" as new research often contradicted the previous prevailing scientific facts. Examples abound: whether it is the relationship of butter, salt, and red wine to health or of childhood exposure to nuts and the subsequent development of peanut allergy, the pendulum too often swings from one extreme to the other and back again as a result of new studies or the reinterpretation of old ones.

While scientific studies provide data, that data requires interpretation to be useful; and interpretation is a matter of human judgment which is subject to bias, thus adding another layer of fallibility to diagnostic and therapeutic uncertainty. Clinically, uncertainty is often cloaked in the phrase "cannot rule out . . ." that regularly accompanies the results of medical imaging and pathological diagnoses. In other words, "the data fit this diagnosis but we can't be sure that it isn't consistent with this alternative diagnosis." So the worst-case scenario must always be ruled out first, requiring more invasive testing to confirm or negate that diagnosis in an attempt to arrive at greater clarity. Interpretive uncertainty, therefore, adds another layer of ambiguity.

Susan Haack, "Commentary: Uncertainty in the Art and Science of Medicine and Biotechnology," *Dignitas* 24, no. 3 (2017): 1–2.

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In the era of highly technological laboratory and imaging studies, we have forgotten that a diagnosis originally began as a "differential diagnosis"—a list of possible diagnoses that were more or less consistent with the signs, symptoms, and laboratory values that had been obtained. Arriving at a more precise diagnosis involved a process of elimination, an acknowledgement of the complexity and uniqueness of the human individual who could not be counted on to respond as predicted to a particular disease process.

Besides diagnostic uncertainty, there is therapeutic uncertainty. Human beings are highly integrated organisms—bio-psycho-social beings—who function as complex wholes. A change in one system has a ripple effect—if not a cascading one—on other systems within the being. Even with a relatively certain diagnosis, the response to therapy is highly contingent upon the individual, their particular manifestation of disease, and the bodily environment in which it exists. Comorbidities—the individual's accompanying health issues and diagnoses—also impact the response of the individual to any particular therapy. Therapeutic efficacy has been improved for some illnesses by the recent introduction of molecular studies (given the deceptive pseudonym of "personalized" medicine) that determine the responsiveness of a particular tumor or disease to a specific drug. But uncertainty remains, for what the testing does not indicate is the response of the patient to the therapeutic modality. Will the treatment adversely impact the other organ systems? Will the patient be able to tolerate the side effects, or will the "cure" be worse than the disease?

The uncertainty inherent in both diagnosis and therapy is compounded in prognosis, which is contingent upon diagnostic fallibilities, therapeutic ambiguities, and individual idiosyncrasies. Prognostic algorithms, developed from patient populations, are frequently consulted; but such algorithms perform best across patient populations, a fact that is generally neglected when interacting with the individual patient. Flesh and bones do not fit into our templates and algorithm boxes no matter how hard we try to force them to do so.

Finally, for the Christian there is the issue of spiritual uncertainty. Even though the goal—our final destiny—is known and assured in Christ, and despite the fact that Jesus is Himself the "Way" to that goal, "ground fog" often obscures our immediate next steps. Scripture does not give us specific guidelines for addressing the medical and bioethical problems we face today, only God-honoring principles that again are subject to human interpretation. Furthermore, as sinful human beings, even our prayerful decisions are not free from contamination by our own selfish desires and will. Can we ever be certain that what we have decided is God's will? Despite our best discerning efforts, our decisions often do not work out as we had planned or hoped. It is as if we acted in ignorance. Yet God repeatedly uses the ignorant actions of His children to advance His purposes and plans for their lives and for His Kingdom (i.e. Acts 3:17–18). For the will of God is hidden in a Being whose thoughts are not our thoughts nor are His ways our ways (Isaiah 55:8). This does not abdicate us of our responsibility for seeking God's will, but by His grace absolves us of guilt when we are faced with making decisions in the midst of human fallibility, ignorance, and uncertainty.

Uncertainty is a pervasive fact of life as well as of medicine and biotechnology. An acknowledgment of the many facets of uncertainty that surround our medical and bioethical decision-making should ease the anxiety-laden task of making the "right" decision and enable us to hold lightly and humbly to what we know in light of the "more" that we do not know.

1 William Osler, Robert Bennett Bean, and William Bennett Bean, *Aphorisms from His Bedside Teachings and Writings* (Springfield, IL: Thomas, 1961), 125.

2 Julie Beck, "Of all the Categories of Fake News Health News is the Worst," *The Atlantic*, June 25, 2017, https://www.theatlantic.com/health/archive/2017/06/of-all-the-categories-of-fake-news-health-news-is-the-worst/531540/?utm_source=twb (accessed June 28, 2017).

3 Tham Soon Kit and Choi Kwok Pui, *Uncertainty of Medicine*, Proceedings from the 14th National Undergraduate Research Opportunities Programme Congress, February 18, 2009, National University of Singapore, http://www.nus.edu.sg/nurop/2009/FoS/14th%20NUROP%20Congress_FoS/Statistics/Tham%20Soon%20Kit_U042324M.pdf (accessed June 2, 2017).

Editor's Note: It was with great sadness that we learned that Dr. Susan Haack was taken home to be with the Lord in late December. Dr. Haack was a long-time friend of the Center, frequent paper presenter at our annual summer conference, and regular author for the Center's various publications. In addition to her distinguished professional career in obstetric medicine, she was a former MDiv intern for the Center and later an Associate Fellow of CBHD's Academy of Fellows. Susan's infectious intellectual curiosity and passion for theology will be deeply missed.

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