

## From the Editor

### The Fall of Sardis: The Power of Observation

The Greek historian Herodotus' account of the capture of Sardis in the sixth century BC is a powerful reminder of the important role of careful observation. The city of Sardis was a strategic but impenetrable fortress, endowed with 1500 foot vertical, seemingly unassailable walls (1). The Persian emperor, Cyrus, sought to capture Sardis and promised a reward to the first man to discover a way to scale the wall. One day, Hyeroedes, a soldier in Cyrus' army, spotted a Lydian soldier who accidentally dropped his helmet over the fortification and down the slope. He observed the sentinel's descent from the fortress to retrieve the fallen helmet and the ease of his ascent. Hyeroedes made a mental note of the route. Subsequently, a platoon of Persian soldiers followed him into the fortress at night-fall via the sentinel's route and the city was easily seized. Careful observation exposed a pathway across a significant barrier that resulted in victory.

In this issue, Newland and colleagues report on an effort that leverages the power of careful observation with a broad collaborative research network. They used an electronic data acquisition system to build comprehensive records of cardiopulmonary bypass (CPB) procedures performed at centers in Australia and New Zealand. These records, containing thousands of continuous measurements during a procedure, were then organized into a powerful database. The database provided the opportunity to capture procedural characteristics and to also measure the extent of unwanted variation such as hypotension (defined as blood pressure less than 50 mmHg) and low blood flow rate index (index blood flow less than 1.6 l/min/m<sup>2</sup>). They learned that patients were exposed to a median of 12.5 minutes of arterial hypotension and 3.5 minutes of low blood flow per procedure. This work provides a level of assessment of cardiopulmonary bypass that will have an important role for identifying patterns in physiologic variation that occurs; it will ultimately identify best practices and perhaps reveal opportunities to reduce the occurrence of unwanted variation, both within and across centers.

Observations where the center is the unit of analysis may also be extremely valuable. In this issue of the *Journal*, Lawson and colleagues provide us with their observations from a recent survey completed by 103 North American centers that provide ECMO support to neonate patients and also participate in the Extracorporeal Life Support Organization registry. This work reveals a trend of increased use of: centrifugal pumps, micro-



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porous polypropylene and polymethyl pentene hollow fiber oxygenators, and increased use of monitoring and other safety devices. They also note the multidisciplinary composition of the ECMO teams surveyed. Surveys, such as this one, document the diffusion of innovation in clinical practice and reveal areas of variation in practice where there is uncertainty and perhaps a need for further study (2).

The article in this issue by O'Rullian and colleagues is a fascinating case report that reminds us of the value of reporting our observations and experiences in rare and extreme cases. This report of a high risk fourth time redo aortic and mitral valve replacement that required nearly ten hours of CPB and seven hours of aortic cross clamp time. It was a remarkable feat, and a classical example of how sometimes unique experiences may challenge conventional thinking. Could this be a glimpse of the future of myocardial protection? Milos Jenicek, in his book, *Clinical Case Reporting in Evidence Based Medicine*, stresses the important role of the case report and case series. He asserts that, while case reports and case series may be the "lowest" or the "weakest" level of evidence, they are often the "first line of evidence" and the place where everything begins (3,4). Philosopher Carl Popper has also noted that casual observations strike us when they are unexpected and often are refutations of our previously held beliefs and will lead to new conjectures—new ideas and new theories (5). This was the case with Pantico and Neptune's first reported use of a crystalloid prime for cardiopulmonary bypass in 1959 (6). Their report was based on experience with low hematocrit that occurred in several cases where it was necessary to return to CPB emergently and there was not sufficient time to obtain more donor blood to prime the CPB circuit. Their anecdotal experience ushered in the era of hemodilution that was subsequently reported by many, most notably Cooley and colleagues at the Texas Heart Institute, and which soon became standard practice (7).

In the early 1990s, James Bryant Quinn, a professor of economics at the Tuck Business School, decided to systematically observe some of the world's best organizations including Federal Express, Mary Kay Cosmetics, McDonald's, and Nordstrom's (8). The aim of his observation was to determine why these organizations enjoyed exponential growth, high profit margins, excellent reputations, and loyal customers. He discovered that these highly performing companies relentlessly focused on the front line interface, where the company connected with the customers, what he referred to as the "smallest replicable unit." Quinn learned that intelligent companies provide information to the front line and empower the front line to constantly redesign; based on iterative learning.

More recently, Donaldson and Mohr used a similar approach; they identified and observed 43 of the most successful healthcare units in the nation to determine what core competencies enabled them to become the best of the best (9). Like Quinn, they discovered that it was a focus on the frontline interface, where patients and providers come together. Leading healthcare systems possessed a constancy of purpose. They invested in improvement, staff satisfaction, information technology, and outcomes. Their work gave birth to an innovative way of understanding, organizing, and improving healthcare called clinical microsystem thinking (10). Could this be a fallen helmet for healthcare?

We would do well to follow in the footsteps of Heroedes, Newland, Lawson, O'Rullian, Pantico, Neptune, Donaldson, Mohr, and Quinn by carefully scanning the horizon, making note of our observations (the drop of a helmet), and carefully reflecting on what we observe.

*"There are three principal means of acquiring knowledge. . . observation of nature, reflection, and experimentation. Observation collects facts; reflection combines them; experimentation verifies the result of that combination. . . . Our observation of nature must be diligent, our reflection profound, and our experiments exact."*

*Denis Diderot (1713–1784)*

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