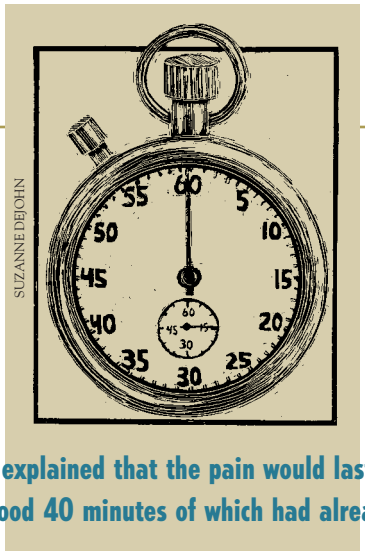
Pain in the pneumothorax

By Megan McAndrew Cooper


SUZANNE DEJOHN

The doctor explained that the pain would last for about an hour, a good 40 minutes of which had already elapsed.

Two years ago, I took up riding horses again, after a 35-year hiatus. I had just gone through a particularly difficult period in my life, and riding proved a remarkable antidote to the lingering sadness of pain and loss. I have learned all over again how lovely it is to put my face against the warm side of a horse's neck, how exhilarating it is to canter up a hillside, how satisfying it is to share a passion with a teenage daughter. Unfortunately, I have also learned that 52-year-old bodies are different from those of 15-year-olds: we don't, as more than one person has observed, bounce the way we used to.

I confirmed this observation twice last year. The first time, in January of 2002, I lost my balance and fell off a very tall horse, hitting the dirt of the indoor arena hard enough to break four ribs on my right side. The second time, in October, I fell off a much smaller horse and became involved with a tree on my way to the ground, breaking a rib on my left side.

Medical vocabulary: Along the way, I expanded my medical vocabulary: I can now use the word "pneumothorax" in a sentence. But please don't ask why this keeps happening. It just does.

What's been interesting (aside from learning that the reinflation of a lung is the only pain even remotely rivaling that of childbirth) is how different the experience of being injured, and in the hospital, can be—even when the injury is more or less the same. And what's even more interesting is that what makes a difference is not how kind people are (they are almost always kind) or what the accommodations are like (the food is rarely a high point) or how much pain you're in (it hurts either a lot or really, really, really a lot), but how much control you feel you have over what's happening to you. Really.

To begin with, it's the difference between having to ask for pain medication and being able to give yourself more when you want it. During my first hospitalization, I stayed overnight in DHMC's Coronary Care Unit (CCU). In the CCU, I had an intravenous line and I could ask the machine for a bolus of morphine if I thought the pain was worse. Every time my nurse, Betsy Maislen, came to check on me, she told me I could ask for more or ask more often, but I didn't need more—probably because I knew it was right there if I did want it.

Dreadful hour: On my second hospitalization—which was much less dramatic in some ways—I was admitted to a medical floor. There, a machine in the hall refused to dispense my drugs until the prescribed four hours had passed. For two days, there was, over and over, a long, dreadful hour between when the last dose had begun to wear off and when the next dose would be available. If I wanted more morphine, I had to ask a nurse, who had to go ask a doctor. I hated asking, and I'm sure they hated the sight of me at the nursing desk.

There had been a *really* bad hour in the CCU when my lung was reinflated by means of suction applied through a chest tube. I vocalized a good deal during this time, and eventually my friend Carolyn, embarrassed, went out into the hall, collared a doctor, and asked him to please do something. The doctor came in to my room and stood at the end of my bed. He told me what was happening. He acknowledged that it was extremely painful. He explained that the pain would last for about an hour, a good 40 minutes of which had already elapsed. And he told me that the only way he could relieve my pain entirely would involve intubating me—which he'd do if I wanted.

His explanation didn't make the pain any better, but it made *me* better. I had less than 20 minutes to go, and I definitely didn't want to be intubated. I was involved in the decision, or at least felt as if I was. I felt I could have said, "Go ahead, intubate me." (I don't know if he would have, but I *believed* I'd made a choice. It worked.)

A night nurse in the CCU also showed me how to disconnect my chest tube so I could get out of bed myself to go to the bathroom. I'm the world's worst bedpan-user, so both the nurses and I benefited from my mobility, which didn't require asking anyone for help. I was judged competent to do something that seemed exotic to me.

Decisions: In the CCU, the person I saw most was Betsy Maislen, who seemed to be able to decide whether I needed oxygen (we agreed that I'd get along without it), when I could go home, what monitoring was necessary and what wasn't any more. On the medical ward, it seemed necessary for all those decisions to come from somewhere else; everything took a long time, and I cried a lot.

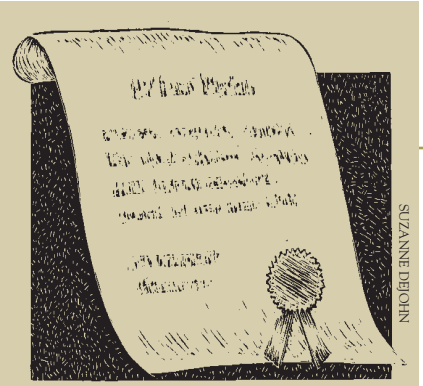
I work with a very nice man who believes that the solution to much of what's wrong with American medicine could be cured by shared decision-making—that is, doctors and patients sharing solid information about what to expect from various treatment options, and then making an informed decision as a team about what to do. But I think it should go a little further—I'd like shared *power*. When I controlled my own pain-management in the CCU, I used less morphine than they expected. When I had to ask the nurse, every four hours, for more pills, I demanded as much as was prescribed and wanted a great deal more. The difference is that in the first situation, I could do something for myself, and in the second, I had to ask someone else to do it for me. I wasn't part of the team taking care of me.

I know that not every patient, and not every situation, lends itself to shared power—there are emergencies, and people are stressed, and hospitals have systems. But most of the time, even if I don't get to be the quarterback, I'd like to be part of my own team. ■

"Point of View" provides a personal perspective on some issue in medicine. Although Cooper is the editor of the Dartmouth Atlas of Health Care *and a frequent contributor to* Dartmouth Medicine, *she writes here not as a journalist but as a patient.*

Recognizing teachers

By David Bauer



SUZANNE DEJOHN

If you visit the offices of these outstanding members of the faculty, you'll find their awards displayed with pride.

Trying to master all of the facts that medical school requires students to learn is like trying to put together a thousand-piece jigsaw puzzle without seeing the picture on the cover of the box. Students want to see the big picture and to understand how all the disparate facts fit together. A good teacher helps to make that understanding happen.

Dartmouth Medical School has a long tradition of recognizing outstanding teachers. For many years, each graduating class has presented two faculty teaching awards, one in the basic sciences and one in the clinical sciences. The recipients are invited to participate in the hooding ceremony at Class Day. But why wait four years to let someone know how much their teaching is appreciated?

In the spring of 2001, the first-year Class of '04 decided that it would be nice to give more immediate recognition for great teaching. And so they presented Dr. Elmer Pfefferkorn with an award for his ability to help students learn virology. That impulse has since morphed into the annual "Excellence in Teaching Awards."

Kudos: The basic and clinical science awards are still presented by the graduating students at Class Day, but the new awards give underclass students a chance to offer some kudos as well. The '04s had a barbeque in the spring of 2001 to honor the winners—Dr. Pfefferkorn, as well as Dr. Matthew Heintzelman, who teaches histology, and Dr. Lee Witters, who teaches biochemistry—and presented them with certificates, full-size photos of the professors' faces attached to amusing bodies, as well many verbal thank-yous. If you visit their offices, you'll find their awards displayed with pride.

The following fall, when my Class of '05 entered DMS, we assumed that these teaching awards were traditional. So we wasted no time in electing the professors who had been our best guides through the treacherous terrain of first year. Last spring, the second annual barbeque was held to honor the winners selected by the first-years as well as the members of the second-year class.

But what exactly *is* it that makes a good teacher? Dr. Martha Regan-Smith, coordinator of faculty development, explored that question in her thesis for her Ed.D. at Harvard. She interviewed hundreds of medical students to identify what they considered to be the most helpful teaching strategies. They turned out to be clarity, thinking about content, relevance, motivation to learn, and teacher respect. "Clarity" is achieved when facts are presented, a few at a time, slowly enough for students to learn them. "Thinking about content" means presenting the material in a way that allows students to put it in context. "Relevance" involves connecting new knowledge with students' prior experience and understanding. "Motivation to learn" is enhanced when teachers inspire students by conveying the beauty, awe, and wonder of medicine in a way that reminds us of why we entered the field in the first place. "Teacher respect" means teachers treat students as people likely to succeed. This has a powerful influence on learning. Students gain self-confidence, are more motivated to learn, and will probably want to emulate teachers who respect their abilities.

Respectful: There's something else going on here, too. In the process of recognizing our teachers, we hope to build a medical community that is supportive, comfortable, and respectful. Dr. Joseph O'Donnell, senior advising dean, agrees. It's like giving people a pat on the back for a job well done—a simple gesture, but one that is often overlooked. Sue Ann Hennessy, assistant dean for student affairs, describes graduate schools of management that encourage future leaders to praise their colleagues as a way of recognizing what they do well. This idea is not often implemented in medical schools. But, for DMS students, thanking those who help us in our path to becoming physicians is central to the Excellence in Teaching Awards.

This year, because of the importance the awards have assumed, the DMS Student Government decided to formalize the process and give even greater recognition to these outstanding individuals. This does not mean the awards will be less fun, but it will give more public acknowledgment to the winners. Winners' pictures will be displayed at the Medical School and at Dartmouth-Hitchcock Medical Center. The reason for a public exhibition is to emphasize that teaching is one of the main focuses of DMS.

Focus on teaching: Awards will be given to an outstanding lecturer by both the first- and the second-year class; to an outstanding small-group leader for the first- and second-year class; and to an outstanding educator who works with students in many areas, including those unrelated to class work. The third- and fourth-year students are also in the process of developing awards for individuals who are critical to their education on the wards.

Where do we go from here? This spring the nomination process begins for the 2003 Excellence in Teaching Awards, and in the fall the awards honoring our outstanding teachers will be displayed. We will proudly present awards to those teachers who have best distilled hundreds of years of medical information (all those pieces of the jigsaw puzzle) into clear, relevant concepts for their students. But we hope the awards will be a beginning, not an end. The real goal is to start a trend of giving each other unsolicited pats on the back and thank-yous. That will be an important step toward a more supportive, comfortable, and respectful medical community. ■

"Student Notebook" (formerly titled "Student Perspective") shares word of the activities or opinions of students and trainees. Bauer is a member of the Dartmouth Medical School M.D. Class of 2005 and serves on the teaching awards committee about which he writes in this essay. He earned his undergraduate degree at the University of Denver.

Why chaos matters

By Athos J. Rassias, M.D.

SUZANNE DEJOHN

Mathematical modeling implies that a system needs to be complex in order to adapt to external perturbations.

When I was a medical student, I was browsing through the Dartmouth Bookstore one day and chanced on a title that hit me at a visceral level—*From Clocks to Chaos: The Rhythms of Life*—so I bought and read it. Two McGill physiologists, Leon Glass and Michael Mackey, described nonlinear dynamics and its then nascent application to biological systems. They caught my imagination with their fresh description of how the mathematics and physics of nonlinear dynamics, also known as chaos, apply to biological systems.

The *Oxford English Dictionary* defines "chaos" as 1) the formless void of primordial matter, the great deep or abyss out of which the cosmos or order of the universe was evolved, and 2) a state resembling that of primitive chaos, utter confusion, and disorder (the latter being the more common use). One might think, then, that a chaotic system is a random one. But it's not.

Underlying patterns: A chaotic system is, however, so complex that it appears random. Theoretically, if we could understand the initial condition of a chaotic system and the underlying patterns and laws that guide it, we could predict its behavior.

The French mathematician Henri Poincaré noted early in the 20th century that "a very small cause which escapes our notice determines a considerable effect that we cannot fail to see and then we say that the effect is due to chance." This principle was further articulated by meteorologist Edward Lorenz and popularized in 1987 by James Gleick in *Chaos: Making of a New Science*, a national bestseller. The analogy Lorenz developed was that the tiny perturbation of a butterfly flapping its wings in South America could lead to a dramatic change in the North American weather pattern. The minute alterations in the underlying conditions (or initial conditions) caused by a butterfly's wings can have a large effect on weather conditions because the physical rules determining weather events are highly complex.

Concept of chaos: This concept of chaos, when applied to biological systems, can be unsettling to physicians. We learned in medical school that if we make every physiological parameter normal, then a sick patient should improve. But, according to chaos theory, all the systems of the human body are involved in complex, seemingly random, ongoing interactions. Mathematical modeling implies that a system needs to be complex in order to maintain equilibrium. Otherwise it is less able to adapt to external perturbations.

Claude Bernard, a 19th-century French physician whose words still resonate in hospital wards, wrote: *"La fixité du milieu intérieur est la condition de la vie libre, indépendante"* ("The constancy of the internal environment is a precondition of the free and independent life"). That one could maintain health in the face of constant and severe perturbations must imply that the body works hard to preserve homeostasis. One hundred years later, American physiologist Walter Canon expressed the same concept: "Our bodies . . . are composed of highly unstable material. They are subjected frequently to disturbing conditions. The maintenance of a constant state within them is evidence that agencies are acting or are ready to act to maintain this constancy."

From slow beginnings in the 1980s, applications of nonlinear dynamics to the biological sciences have grown exponentially. Chaotic systems have been observed in every area of medicine, including variability in the heart rate, brain wave frequencies, hormone levels, and gait control. Furthermore, a reduction in the complexity (a measure of how chaotic a system is) of biological rhythms is associated with disease. For example, heart attack patients who experience a reduction in the complexity of their heartbeat time intervals are more apt to develop lethal arrhythmias.

Mark Yeager, my research mentor at DMS, and I were intrigued by a Washington University study showing that the complexity, or variability, of the heart rate is reduced in response to inflammation. We often care for patients who suffer from sepsis, a severe and sometimes fatal inflammation usually caused by infection or tissue trauma. As the immune, hormonal, and autonomic nervous systems respond to inflammation in the body, they all show reductions in complexity. The hormone cortisol, the cellular immune system, and heart rate variability are dramatically affected by inflammation; as complexity decreases, the body breaks down.

Sepsis: According to a prominent researcher, Steven Pincus, a reduction in a system's complexity implies that it has lost appropriate interactions with other systems. So in the body, a loss of complexity in any one system can compromise the entire body's ability to fight infection and thus lead to a high mortality rate for severe sepsis.

Can chaos be restored to an altered system? Would this be a good thing? Several researchers have applied techniques, initially developed in the nonbiological sciences, to control chaos in biological systems. For example, an appropriately timed electrical impulse can return a preparation of cardiac pacemaker cells from a pathological rhythm to a normal rhythm.

Could we save the lives of those who might die of sepsis by restoring chaos? We would first have to analyze the degree of complexity and then perturb the system to restore it to its "normal" state. We'd be providing patients with a way to adapt to the stress of inflammation.

In the meantime, we all need to remember that the hallmark of health is chaos—appropriate chaos, that is. ■

"Bench to Bedside" explores the research underlying advances in clinical medicine. Rassias, a DMS '89, is an associate professor of anesthesiology and critical care medicine.