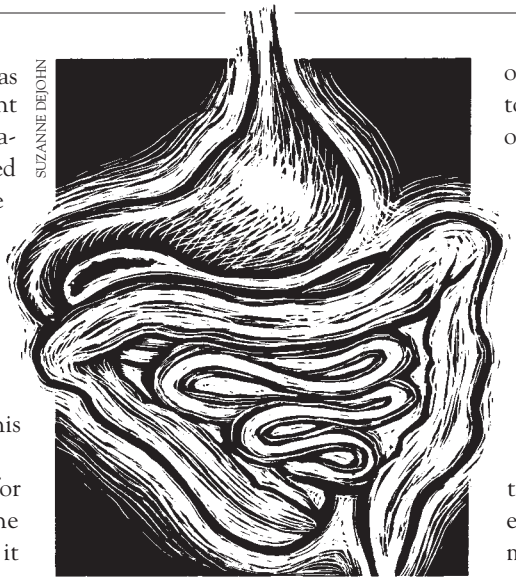
A link to the living

By Patsy Garlan



SUZANNE DEJOHN

You can imagine how startling it was when my daughter the medical student inquired, "Would you like to see my cadaver?" A glance at her eager young face filled with cheerful expectancy made me soften the fervor of my denial to "Oh, no, darling, no—I don't think so. No. No."

Ye gods. But then I thought better of my negative reaction. How often does a person, a layperson, have an opportunity like this—to look inside the body of another human being? You'll be forever sorry if you pass up this chance, I thought to myself.

I glanced at her again. She was waiting for me to come round. As she always did—the way all kids do. "Well," I said, "what would it be like?"

Queasiness: So off we went, into the warm dusk of the New Hampshire evening. I found myself fighting my apprehension and hoping that I would be able to control my queasiness.

As we descended the stairs heading deep, deep into the cavernous basement of the medical-school building where the anatomy lab was housed, she began to prepare me. "It will be cold," she explained, "because . . . you know. And there will be a smell of formaldehyde," she added. "Don't mind it," she said, "you'll get used to it."

We entered the dimly lit lab. I want to say that we crossed a threshold, like Dante following his guide and mentor Virgil into the underworld—although no sign above the entrance warned "Abandon all hope, ye who enter here." And although she never took my hand, I felt as if she had.

We wound our way among the sleek gurneys with their sheet-shrouded burdens. Not another soul breathed in that vast space. The smell of formaldehyde was an assault. The silence was thick—as if the bodies had absorbed all the sound, like flannel. Like blankets. Like snow.

Body parts: She showed me first the trays of body parts: stainless-steel basins of raw things—one full of kidneys, another of livers—like offerings in a meat market. She spoke in hushed tones, as if we were in an intensive-care room or a nursery.

Then we approached the gurney that bore the cadaver she had been dissecting for many weeks. Slowly, gently, she turned back the cover—first from the thin, white feet and legs. "We'll start here," she said. "The head is so very personal." I knew she was allowing me time to prepare for the intimacy of that encounter.

She pointed to a clipboard on a nearby low wall, where the history of her cadaver was detailed. He was an old man—and an old cadaver, it seemed, having been in storage for many months. I don't remember what it said he had died of.

In some medical schools' anatomy labs, she explained, the students make dark jokes about death and horse around, probably in an effort to handle their feelings. She was grateful that the attitude here at Dartmouth was different—one of respect for this, a human presence.

She had been working on a section of colon, I think it was. I was astonished to see that our bodies' essential parts are all neatly organized, many in their own little membranes—like plastic-wrapped leftovers in a well-maintained refrigerator.

She raised the sheet from the lower torso, which was laid open like a display package. She had been working on a section of colon, I think it was. I was astonished to see that our bodies' essential parts are all neatly organized, many in their own little membranes—like plastic-wrapped leftovers in a well-maintained refrigerator. I had always assumed, I guess, that the coils of the intestines, the stomach, the liver, the spleen, would be all jumbled up together—resembling more the inner workings of a radio. The tidiness of the reality before me was strangely satisfying.

Awe: By now my curiosity and, yes, my awed fascination with everything in that room had fully taken hold. "It is so important to us as students to have this experience of dissecting an actual body," she said. "And if people are willing to donate their bodies so we can do this, we must . . . must give them due respect." I felt very strong as she carefully removed the covering from the head.

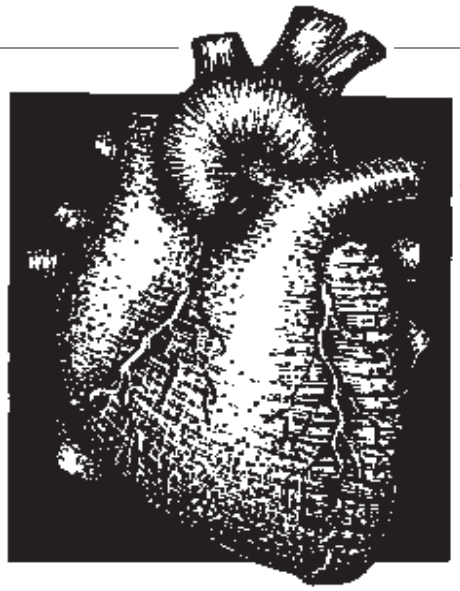
I gazed down upon the small face of an old man, an old man who somehow linked my daughter and me and all human flesh together, in the semidarkness, in this timeless moment. He was nothing and yet everything to me.

Then up we went into the freshness of the evening—where green, growing leaves gleamed softly under a star-studded sky—full of a sense of the enduring connectedness of all living things, and of the child who becomes the parent and the parent the child. ■

Patsy Garlan is a much-published author who has written poetry, memoirs, stories, college texts, and a musical play. She is the mother of Sarah Garlan Johansen, a 1990 graduate of Dartmouth Medical School. Johansen—who also did her residency training at Dartmouth, from 1990 to 1993, and is now the medical director for emergency services at New London, N.H., Hospital—points out that the rules as to whom students were permitted to bring into the anatomy lab were much looser when she was a student at Dartmouth than they are today. This essay is copyright 2000 by Patsy Garlan; it was first published in the May 2000 issue of the Atlantic Monthly *magazine.*

Understanding heart failure

By Arnold M. Katz, M.D.



SUZANNE DEJOHN

Thomas Kuhn, in *The Structure of Scientific Revolutions*, describes scientific discovery as a series of paradigm shifts: when "anomalies" violate the expectations of an existing "normal science," a paradigm shift occurs to encompass new data and explain the anomalies. Our understanding of heart failure is in the midst of such a paradigm shift—one as remarkable as that which followed William Harvey's discovery of circulation.

Hippocrates, in fifth-century B.C. Greece, described patients who suffered from shortness of breath and edema, including those with heart failure, and attributed this syndrome to an excess of "phlegm" (the "cold humor") moving from the brain to the chest. This view persisted for almost 2,000 years, until 1628, when Harvey discovered how blood circulates. But Harvey's finding only explained how the impaired pumping of a diseased heart might cause breathlessness, not the accompanying accumulation of fluid.

The new paradigm sees heart failure not just as a weakened pump, but also as accelerated cardiac myocyte death.

In the 1920s, when the diuretic properties of organic mercurials were identified, the focus of heart failure research shifted to the kidneys. Researchers learned how altered renal function causes salt and water retention, an abnormality that is part of the neurohumoral response—the body's way of compensating for reduced cardiac output. Over the next few decades, other components of this response, including vasoconstriction and stimulation of the heart, became clear.

Fluid: When orally administered diuretics were developed in the 1950s and 1960s, the clinical picture in heart failure changed again; patients no longer suffered from fluid accumulation, but instead were troubled by weakness and fatigue. In the 1970s, investigators realized that arteriolar vasoconstriction reduces cardiac output and overloads the failing heart, so they introduced vasodilator therapy. Then they found that levels of norepinephrine, a key mediator of the neurohumoral response, were elevated in patients with heart failure and contributed to fluid retention and vasoconstriction. Soon, abnormal levels of other neurohumoral mediators were found in such patients—including the vasoconstrictor peptide angiotensin II, which also causes hypertension. Clinical trials showed that ACE inhibitors, which retard the formation of angiotensin II, cause a short-term improvement in heart failure symptoms and also increase long-term survival.

The discovery in 1967 that heart muscle contraction, or contractility, is weakened in failing hearts stimulated efforts to develop inotropes, drugs that increase contractility. By the mid-1980s, there was consensus that the judicious use of diuretics, vasodilators, and inotropes could solve most of the problems associated with heart failure. According to this paradigm, the use of beta-blockers is misguided because they weaken contractility.

By the late 1980s, it was clear that the prognosis for patients with heart failure was worse than for those with most cancers, with fewer than 50% surviving five years. At the same time, most vasodilator trials and virtually all trials using inotropic drugs yielded an anomalous result: in spite of short-term clinical improvement, long-term survival was reduced. The clinical use of most vasodilators and of all inotropes was thus abandoned. ACE inhibitors were an exception because their survival benefit was so dramatic. Even more surprising was the recent demonstration that beta-blockers prolong long-term survival, even though they initially worsen heart failure by blocking the stimulant effect of norepinephrine. This anomaly has undermined the paradigm that heart failure is simply a pumping disorder.

Hypertrophy: The current explanation for these anomalous findings is that the neurohumoral response, which stimulates the heart to enlarge (a condition known as hypertrophy), also damages the muscle cells (called cardiac myocytes). Following hypertrophy, cardiac myocytes assume molecular characteristics formerly seen in the fetal heart. This reversion to the fetal phenotype was described by Shakespeare in *As You Like It*, with "the infant, mewling and puking in the nurse's arms" giving way eventually to "second childishness and mere oblivion—sans teeth, sans eyes, sans taste, *sans cardiac output*, sans everything." (The italic addition is mine!)

Second childhood is not an exact replica of the first, and the same is true for the failing heart. Adult cardiac myocytes can live for more than 100 years, but they cannot be replaced. When stimulated to grow larger, however, they wear out sooner. Neurohumoral mediators like norepinephrine and angiotensin II stimulate the failing heart to grow, but also cause myocytes to die prematurely, so that the failing heart is like an overloaded car with a fragile engine. When there's one heavy foot on the accelerator and another on the brake, both the engine and the drive train wear out quickly.

Search: So the new paradigm sees heart failure not just as a weakened pump, but also as accelerated cardiac myocyte death, with growth stimuli as a major cause of premature death. Now the search is under way for better methods to stop these molecular processes. ■

Katz, a visiting professor of medicine at Dartmouth since 1995, is also a professor of medicine emeritus and former chief of cardiology at the University of Connecticut.