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A Feeling for Pain

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Several years ago I placed an epidural in a woman who was in labor. She was very specific about what she wanted. She did not want to feel "too much" pain, but she did want to feel enough pain to "experience" the birthing process. For the entire evening, in seesaw fashion, I found myself alternatively raising and then lowering her drug infusion in her quest for the perfect epidural. She never reached nirvana, complaining every hour, although in the end she delivered a healthy baby boy.

I never had a chance of success with this patient, not because she was difficult, but because "feeling" itself is an altogether confusing phenomenon. My patient could never really get a handle on how she felt. Nor was her feeling a steady state; it was always being perturbed by some factor or other. Yet science aspires to understand feeling.

Anesthesiology—the study and practice of producing an absence of feeling in a body—has perfected the elimination of the pain sensation to an impressive degree. Yet anesthesiology is intimately tied to large and unanswered scientific and philosophical questions about what consciousness is and how it relates to the body. The scientific approach that makes the practice of anesthesiology possible—separating the human experience into distinct categories and learning to control them—can create the misperception that we truly understand the pain experience itself and that we may even have a window into the mystery of consciousness. But control over the parts does not mean understanding of the whole; in the case of anesthesiology, some of the terms used to explain the parts can actually make understanding the whole more difficult. A brief reflection on some of the workings of anesthesiology today provides an opportunity to reflect more broadly on how scientific ways of understanding our bodies can diverge from our own experience—with medicine necessarily straddling the divide.

The Complicated Nature of Pain

On one occasion some years ago, a patient flared as I struggled with her intravenous line. "Ouch! Darn it, doctor, can't you numb me first?" she yelled.

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Putting an IV in very old patients is usually easy, since the lack of fat underneath their skin causes their veins to shine through to the surface. But my 93-year-old patient had tiny veins, and I didn't want the bump that a local anesthetic injection would produce to conceal the vein in my sights, so I decided against numbing her for the IV. Still, her intravenous was baby-sized, and her complaint of pain when I put it in surprised me.

The science of anesthesia gave me no explanation for her heightened sensitivity. On the contrary, it suggested the opposite—that she should be less sensitive. A famous graph published in 1969 in the journal *Anesthesiology* shows that the amount of anesthetic gas needed to keep a patient still during an operation decreases with age. Although the downward sloping line on the graph ends at age 92, which was the age of the oldest patients studied, the line, if extrapolated, would touch the x-axis at around age 105. One might think, therefore, that a surgeon should be able to cut on a completely awake 105-year-old without eliciting a fidget, and that I should be able to insert a needle in my patient without eliciting much of a complaint.

In reality, of course, old people hurt as much as young people do when cut on. True, elderly people need very little anesthesia to be rendered unconscious, and once unconscious, they need very little anesthesia for surgery. But so long as they are conscious, elderly people will feel pain if poked with a needle or cut with a knife. This suggests that pain is a property of consciousness, which young and old people share alike.

But another observation complicates this notion: unconscious bodies react to stimuli in a way that suggests the pain sensation is more a property of the body than of the conscious mind. When a surgeon slices into tissue or drills into bone, an unconscious patient's heart rate and blood pressure will often rise, his forehead will grow dank with sweat, and his eyes will begin to tear. The stronger the stimulus, the more intense the body's response, just as the stronger the stimulus in an awake patient, the louder the patient screams. When viewing an anesthetized body reacting to a scalpel cut, one senses, however faintly and feebly, a mysterious presence—the pain of a still-sentient being. How can the pain experience be a property of consciousness if an unconscious patient's body also reacts to pain?

Equally plausible is the notion that pain is a property of neither body nor mind, since tissues and cells exhibit pain reactions even when the body as a whole no longer does. A patient can be completely unconscious during surgery, and maintained at a level of anesthetic depth that keeps heart rate and blood pressure unchanged, while nevertheless exhibiting a stress response called a "catabolic state," in which hormones preventing

protein synthesis are secreted, causing generalized tissue breakdown. This stress response is common after injury and surgery, and can last for several months after an operation; it helps to explain the weakness and muscle wasting that some patients experience even after minor surgery. Who or what "feels" pain in this situation? Not the conscious mind, since the patient is unconscious. Not the unconscious body as a whole, since vital signs remain stable and obvious physical expressions of pain are absent. Do the tissues themselves "feel" pain when cut? It would seem so.

Anesthesiologists cannot resolve these vexing questions and contradictions raised by their work. All they can do is parse them, by making a distinction between what people experience in consciousness ("pain") and what the unconscious body experiences ("a response to noxious stimuli"). Yet even this distinction is surrounded by confusion.

I encountered this firsthand during my residency. One day, I put a woman under general anesthesia for the removal of a cyst from her breast. During the operation she moved in response to the surgeon's knife. I reached over to increase the anesthetic gas, but my professor stayed my hand. When he asked me to explain my action, I said I wanted to raise the dose because the patient seemed to be in pain. He replied that because the patient was unconscious and therefore unable feel pain, and because the surgeon had not complained of the patient moving, there was no reason to increase the amount of gas.

Later the same day, I put under general anesthesia a burn patient whose dressing was being changed. When the patient moved and the surgeon failed to complain, I left things alone. When my professor asked me why I had not increased the dose, I answered with the explanation he had given me earlier. My professor was appalled at my ignorance. He glared at me and barked, "Do you know what it's like for a burn patient to get dressing changes without adequate anesthesia?" He then reached over and increased the anesthetic dose on his own.

As my professor's inconsistency illustrates, anesthesiologists may have enshrined the distinction between conscious pain and unconscious reflexes, but at times they privately doubt it. They have good reason to. A patient can experience a noxious stimulus while under anesthesia, and then later, after waking up, recall the event in the form of a painful memory. This is the phenomenon known as "awareness under anesthesia." We do not know how the experience of the body under general anesthesia can sometimes cross the boundary between unconsciousness and consciousness to become a memory. But such instances of recall have been the basis of lawsuits.

We should not be surprised that our labels for conscious "pain" and unconscious "responses to noxious stimuli" fail to work neatly in every circumstance or to fit with the everyday meanings of words. It is a fairly typical problem with scientific labels. In a 2002 article, University of Colorado philosopher of science Carol Cleland and Princeton astrobiologist Christopher Chyba noted that science offers several competing definitions of life that are all incomplete in one way or another. They also conflict with our everyday understanding of what life is. Cleland and Chyba compare this situation to the way scientists formerly struggled to define water. Once scientists discovered water's molecular formula H_2O, defining water was easy. Still, the molecular formula failed to capture the everyday meaning of the term "water," which is not precisely H_2O. Rather than capture the meaning of "water," the molecular formula simply represented a scientific discovery about the nature of water. Scientists understood water one way while everyone else continued to see water in a number of other ways.

Similarly, there is no clear definition of pain, and anesthesiologists' attempt to provide one sometimes runs up against the everyday understanding all of us have of our own experience. A typical feature of scientific definitions is the separation of the thing to be defined into subcategories. In the case of anesthesiology, pain is subdivided into different sensations, each with a different name. *Hyperesthesia* is discomfort arising from oversensitivity to normal sensory stimuli. *Paresthesia* is a burning or pricking feeling. *Dysesthesia* is a feeling of numbness or tingling resulting from impairment of sensitivity. These and similar terms can be useful and can shed light on the different components of the pain experience. But they also give the illusion of clear knowledge and precise control in a discipline where things are still very murky. Pain as a whole we know only from our own conscious experience; it is something that each person experiences differently and in a way that is indivisible from himself or herself.

Pain, Memory, and Awareness

Several years ago, after I had sedated a morbidly obese patient, another anesthesiologist wandered into the operating room to say hello. (Anesthesiologists often do this; indeed, they tend to treat operating rooms as if they were rooms in their own homes.) Although motionless, the patient was only lightly sedated, but the surgical drape hovering above the patient's neck folded slightly in over the head, concealing this fact. After patting me on the back and greeting the surgeon, the visiting anesthesiologist stared

at the patient, then, rubbing his hands and tasting the pleasure of a little humor, exclaimed: "My God! How did you move that fatty onto the table? With a crane?" I whispered to him to keep quiet, as the patient might be able to hear. But my mask muffled my words, and the doctor merrily went on: "We ought to start billing these patients by the pound. You know—"

He stopped talking the instant I pulled my mask down and told him the patient was half-awake. Realizing his error, and knowing that patients today are quick to take offense, his mind immediately filled with dread. He reached for a medication called Versed, a Valium-like drug that both sedates and causes amnesia. I knew what he was thinking: that if he gave the patient the drug, the patient might not remember the insult, despite having already heard it. I reminded him that Versed causes *anterograde* amnesia, not *retrograde* amnesia; that patients who get the drug fail to consolidate into their memories events that immediately follow injection, but leave untouched events already in memory, including those just registered. The doctor trudged toward the door, worried about the repercussions of his loose tongue. Fortunately, the patient recalled nothing of the operation or the exchange preceding it.

Memory is one of the three elements of consciousness that anesthesiologists focus on when they administer general anesthesia. The other two are awareness and pain. A general anesthetic must address all three to be successful.

Inhaled anesthetics, or gases, dull all three elements as if by scattershot. They are the easiest and most cost-effective method of maintaining general anesthesia. (During my residency in San Diego, an anesthetic composed solely of gas was sometimes called "Mexican anesthesia," because American anesthesiologists who crossed the border to treat children at free clinics typically brought their own anesthetic agents with them, at their own expense, which meant cheap bottles of anesthetic gas.) Most general anesthetics incorporate at least some inhaled gas, but they are infrequently used as the sole anesthetic agent (except in children), since the high concentration of gas needed risks cardiovascular instability. Also, high levels of anesthetic gas increase the risk of post-operative nausea.

By contrast, intravenous agents are more selective in regard to which elements of consciousness they dull. Their selectivity suggests that memory, awareness, and pain are separate components of conscious experience, perhaps layered upon one another. For example, if I give a patient Versed, the patient may remain conscious during his surgery, such that I can carry on a conversation with him. If he feels pain he will complain. But after surgery the patient will remember neither our conversation nor his pain.

Indeed, he cannot feel quite certain that he really *had* an operation. The Versed selectively obliterates his memory while leaving his capacity for pain and awareness intact.

Sodium Pentothal, on the other hand, causes a loss of awareness without affecting either memory or pain. (If anything, Pentothal can heighten people's sensitivity to pain.) If an anesthesiologist gives a patient a small dose of this drug for a short procedure—for example, popping a dislocated shoulder back into joint—the patient may physically respond to the noxious stimulus and recall that stimulus as pain after waking up; yet during the procedure he will have been unaware of his surroundings.

Narcotics obliterate pain while leaving memory and awareness intact. They do not rid a person of pain so much as they cause a person to become indifferent to his or her pain. At high doses of narcotics patients cease to feel pain, yet for the purposes of general anesthesia awareness and memory must still be eliminated, otherwise there is a risk that a patient will be aware during the operation and remember the events afterwards. This sometimes happened during heart surgery in the 1980s, when anesthesiologists used enormous doses of the potent narcotic Fentanyl as their sole anesthetic agent. When used alone, the drug provides good stability of the cardiovascular system, an important concern when blood flow to a sick heart muscle is tenuous. Patients drugged solely with Fentanyl feel no pain, and are technically unconscious, but they sometimes remain aware of events and can remember them afterwards. Anesthesiologists using total narcotic anesthesia must address awareness and memory separately, usually with intravenous agents targeting one mental faculty or the other, or by cracking open a small amount of anesthetic gas.

Pain, memory, and awareness are sufficiently separable that an anesthesiologist can selectively knock out two elements while leaving the third intact. For example, anesthesiologists use the drug ketamine, a derivative of phencyclidine (PCP, or "angel dust"), to induce what resembles a cataleptic, or zombie-like, state. At low doses patients feel little pain and fail to remember events that occur for about an hour after initial injection, but their eyes remain open and they sometimes retain the capacity to converse. The drug is often used for short procedures in patients with full stomachs who risk aspiration if they lose consciousness altogether. When using ketamine on such patients, I purposely maintain voice contact with them to ensure they remain "awake"—the meaning of the word becomes somewhat ambiguous—and can clear their airways if they start to regurgitate. Although responsive, they feel no pain and can recall nothing of their operation afterwards.

An anesthesiologist can also inject small doses of Versed and a drug called etomidate to wipe out memory and awareness, respectively, all while leaving the patient's capacity to feel pain intact. Sometimes this is necessary during life-saving operations, when pulse and blood pressure have started to sag in critically ill patients. These patients *need* to feel pain, because it is only their pain, and the body's outpouring of adrenalin in response to it, that keeps pulse and blood pressure up, buying the surgeon time to fix the underlying problem. Rob these patients of their pain and they might go into cardiac arrest. Etomidate makes these patients only dimly aware of their pain, while Versed keeps them from remembering their pain afterwards.

The ability of intravenous agents selectively to affect pain, memory, and awareness suggests that these three are distinct aspects of consciousness. Science prefers this approach—organizing phenomena by dividing them into categories—over one that seeks to understand consciousness as a whole. Doing so certainly gives us a sense of control, and, in the case of anesthesia, helps spell out the actual control anesthesiologists have over consciousness.

But once again, the divisions reveal flaws. In a conscious, suffering patient, pain, awareness, and memory are so interwoven that separating them conceptually is inconceivable—that is to say, once we do separate them the terms no longer have their common meanings, and their new meanings are rather unclear.

The patient is aware of his pain. That is why he is complaining. So pain and awareness seem obviously linked. He dwells on his pain, including how long he has been suffering; indeed, the memory of his pain comprises a large part of his pain. Memory and pain thus seem connected as well. In turn, his memory of pain is inseparable from his present awareness of his pain. Memory and awareness also seem connected. To put it all together, an awareness of pain is to be *in* pain, while pain is *in* the memory of the person who feels the pain, and memory is *in* the awareness of the person aware of his pain. Pain, memory, and awareness, so easily controlled as seemingly separate elements in the unconscious patient, are tightly interwoven in a conscious one.

Scientific Superstitions

The scientific approach of dividing and conquering—of distinguishing elements and naming them, even when that means sacrificing to some extent the common meanings of those names—is clearly useful in anesthesiology. It assists in our remarkable control over consciousness and

the body. But the fact that this distinguishing and naming obscures the relationships these elements have with each other shows that control is not synonymous with knowledge, although it is certainly true that the anesthesiologist knows something about what he controls. Equally important, our own experience as conscious selves—being aware of pain and remembering it—cannot easily be split up into parts, quantified, and controlled, because it is a whole that each of us knows internally, and one that cannot be known in the same way from the outside.

This brief survey of clinical anesthesia puts a spotlight on two forms of what we might call superstition that are all too common in the popular understanding of science, and that are most pervasive in the "soft" sciences, such as psychology and sociology.

The first superstition is that scientific language is categorically superior to everyday language, especially in its explanatory power. Scientific language increasingly supplants common language about many basic life issues, including pain, feeling, and the mind. In psychology, for example, a nuisance or annoyance is called a "psychosocial stressor." In sociology, figuring out what makes a good leader is called "leadership categorization theory." In anthropology, a fake version of something is called a "simulacrum." Many laypeople eager to understand these matters, and quite capable of doing so, fall silent when scientists intervene with their arcane words. The scientific terms sound strange, and their very strangeness is a source of their power. But this labeling and separating can lead to incoherence, as clinical anesthesia demonstrates. It is also, frankly, pretentious, as when people stick inflated Latinate words into everyday speech to impress others—for example, when using "retrieve" instead of "get," or "utilize" instead of "use."

Scientific language can stifle discussion and cow laypeople into thinking they do not have anything important to offer on the subject. When I tell people that someone has pain, they feel like they are on my level and we can have a normal conversation; when I tell the same people that someone has a "dysesthesia," I am suddenly an expert whose assessment brooks no further discussion. When I tell people that someone is half-asleep, they nod their heads in agreement; when I tell the same people that someone is in the "second stage of anesthesia," they think my understanding profound. This is not to say that precise language and technical meanings are not sometimes useful, especially for communication between people well-versed in the jargon. But unqualified veneration for scientific language can make clear communication more difficult, especially with laypeople; it also conceals the reality that this language is often no more,

and sometimes even less, helpful for understanding the subject matter than everyday language might be.

A second superstition is that scientific generalizations can replace knowledge of particulars. When scientists study human life, they typically study not any one individual life but rather many lives so as to arrive at sweeping generalizations that apply as broadly as possible. This detached, even lofty vantage serves an important purpose: it promises greater explanatory power and wider applicability. But science's uncompromising elevation of the generalized view demands a vast sacrifice in understanding of particulars. The scientific ideal of explaining life provides the highest view of all, but it has no depth. Science prefers to explain its objects in terms of least common denominators, leaving out life's quirky aspects, its subtleties and nuances. This approach may be acceptable when dealing with aircraft engines and laundry detergent, but not when investigating life. Life has to be examined up close to understand it. All the odd details and imperfections have to be factored in and not out. Yet few laymen recognize that scientific explanations of life are generalizations that usually leave out many details.

The practice of medicine, however, fundamentally differs from science. Medicine is informed by science, and depends on science for its tools, but the method of medicine is to pay careful attention to life on an individual scale—to look for all the particularities and irregularities and unusual details, and to understand them for what they are. The doctor is not a scientist so much as someone who is constantly defining the very important, the less important, and the unimportant in science in relation to a particular human being.

Anesthesiologists know that every human body and mind reacts slightly differently to drugs and that prescribed dosages to achieve certain anesthetic depths are only ever approximations. Similarly, the ability to control pain, awareness, and memory requires careful attention to individual patients; relying entirely on generalizations could have disastrous effects. If I have learned anything as an anesthesiologist, it is how imprecise, uncertain, and surprising human life can be—how human lives resist being studied according to abstract principles or names or categories, but rather demand and deserve to be understood one person at a time.