

Sense and Sense-Ability:
The Artful Science of Hands-On Medicine

by

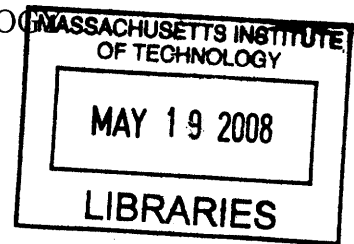
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Allyson T. Collins

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ABSTRACT

Listening to lung sounds, feeling the pulse, observing posture and gait—these are just a few of the examinations that doctors perform on their patients. A physical exam exists for every organ, from the brain to the bones of the feet, each carried out with the physician's senses.

For thousands of years, humans had been solely responsible for this exam ritual, until the emergence of diagnostic equipment—CT scans, MRI scans, ultrasounds, echocardiograms, mammograms, and more. In some cases, these devices replaced the physical exam.

But in areas of the world where technology is unavailable, and even in places where it exists, many physicians and healthcare professionals cannot or will not to cede their tasks to tools. Their goal: to maintain an environment in which technology and the learned senses can coexist; an environment in which the physical exam remains an integral part of medicine.

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DEDICATION

To my biggest fans and the source of my strength—Marnie, Dad, Jonathan, Nate, Grammy, Nani, Aunt Ann, and Uncle Joe. To everyone who kept a bit of sunshine in my Boston life—Andrea, Jana, Genny, Kate, and Rosella. To my Boston crew—Brigitte, Jaclyn, Megan, Danielle, and Adam. To my lovely ladies—Amy and Nicole. To everyone who made me who I am today—especially Daddy, Papa, and Grammy Roman. And to the one who listened every night, put me in my place, saved my sanity, and told me that the best investment I could ever make was in myself...

Gambell, Alaska, perches on the northwest corner of St. Lawrence Island, overlooking the Bering Sea. On a clear day in Sivuqaq, as the town is called in the native Yupik language, visitors can gaze beyond the invisible International Date Line to catch a glimpse of what tomorrow looks like in Siberia, only thirty-six miles away.

Among the gray boxy homes, just a short four-wheeler or snowmobile ride from the airport—the only route in and out of the village—sits a faded-red, trailer-like building: the medical clinic. Here, Gambell's five hundred forty-nine residents seek treatment from four community health aides and one physician assistant, Jim Ferguson. However, Ferguson spends five weeks in the clinic and the next three weeks at home in Oregon, leaving the health aides as the sole providers for nearly half of the time.

The nearest doctor? One hundred fifty-six miles to the northeast in the mainland city of Nome. Weather permitting, it's a one-hour journey via \$7,000 medical evacuation (medevac) plane or one of two daily passenger flights. In Nome, patients can get x-rays of bones and selected internal organs, but a trip to Anchorage is necessary to receive more complex diagnostic scans, such as computed tomography (CT) or magnetic resonance imaging (MRI).

Ferguson and his team of health aides rely primarily on their senses—touch, sight, smell, and hearing—to identify medical conditions. As the physician-writer Lewis Thomas proclaimed in his 1983 book *The Youngest Science: Notes of a Medicine-Watcher*: “To watch a master of physical diagnosis in the execution of a complete physical examination is something of an aesthetic experience, rather like observing a great ballet dancer or a concert cellist.” Though it may appear simple or old fashioned compared to sleek diagnostic

technology, this sophisticated, nuanced practice requires years to learn and often a lifetime to perform well.

During the past two hundred years, medicine has evolved from doctors making house-calls with simple bags of tools and remedies, to equipment-aided physicians carrying stethoscopes, thermometers, and blood pressure cuffs, to often technology-dependent healthcare professionals having an array of diagnostic tests at their fingertips—fingertips they once used to palpate their patients. Indeed, Thomas pointed out: “Medicine is no longer the laying on of hands, it is more like the reading of signals from machines.”

Recently at Brigham and Women’s Hospital in Boston, Brigitte Richards, a young physician assistant, reported to the cardiac surgery department for her first day on the job, wearing a stethoscope around her neck. She still remembers her shock at what happened next: a physician colleague, appalled at her accessory, told her to remove it immediately, and never arrive at work with it again. If he wanted to examine someone’s heart, he advised her, he would order an echocardiogram; if he wanted to check someone’s lungs, he would order a chest x-ray. And so, as his new employee, should she.

Though an extreme example, this sentiment is not uncommon. As more and more medical machinery emerges, some physicians question the merits of physical examination, claiming it to be less reliable and less scientifically accurate than the highly technical tools available. They say the exam falls short. Each individual doctor’s capabilities and biases factor into its performance; the neutral instrument is, therefore, superior. Over time, certain elements of the exam have also been deemed obsolete, their responsibilities relinquished to technology. A type of sinusitis is best detected through a CT scan. Only a throat culture test

can determine whether a bacteria or virus causes a sore throat. An analysis of lung function is more sensitive than most physicians in identifying mild or moderate lung disease.

Doctors devoted to the physical exam are also free to acknowledge the benefits of diagnostic tests. On a typical afternoon in Nome's hospital, Dr. Karen O'Neill and physician assistant John Salmon receive a picture via telemedicine from Unalakleet, an Alaskan village to the southeast. They sit at a computer to examine a man's ankle, its bones hidden within the swollen joint. Because the ankle is straight, O'Neill decides it is not dislocated, but the patient should still take the next flight to Nome for treatment. An hour later, though, the health aides in the village send a digital x-ray showing two fractures in the man's leg—invisible without a look inside the body. Change of plans: he will fly to a larger medical center in Anchorage instead. "See, it's nice to have an x-ray machine out there. He can go directly to definitive care," Salmon comments. O'Neill smiles. "There is a place for technology. Technology in association with a good exam is a good thing." Nodding, Salmon replies, "But it doesn't supplant the first part, which is a good exam."

In rural Alaska, examination is often the ultimate means for diagnosis. Of course, in areas where tools are readily available, many say that physicians overlook the exam. It could be called a dying art. Money is wasted if a doctor or hospital spends tens of thousands of dollars on cutting-edge machines that go unused, according to John Gittinger, an ophthalmologist and director of residency training at Boston University Medical Center. He equates the result—an overzealous use of imaging methods such as x-ray, CT scanning, and MRI scanning—to this: "If the only tool you have is a hammer, everything looks like a nail. If you have \$100,000 worth of high-tech equipment, you'll point it at everything you can think of."

Today, technology occupies a prominent place in both medical training and practice, which has led to an altered educational format. Instead of learning the exam at a patient's bedside, students spend more time in the classroom. Two separate studies published in the *Journal of Medical Education* revealed that seventy-five percent of medical-school teaching took place at the bedside in the 1960s, compared to less than sixteen percent in 1978. The percentage may be even lower today.

Not surprisingly, exam skills have been fading. In 1997, a study in the *Journal of the American Medical Association* found that medical residents recognized just twenty percent of abnormal heart sounds—signs of heart disease; and *Academic Medicine* published a 1998 study in which third-year medical students detected only about forty-four percent of breast lumps during the physical examination.

Machines are not always available to spot these types of conditions. Even sometimes when they are, medical professionals may be better served by recalling their fundamental training, and trusting their own bodies to detect the workings within another's. "Physical diagnosis skills are critical," Ferguson says about working not only in remote areas of Alaska, but in cities as well. "They help generate ideas for what technology you want to use. Without physical diagnostic skills and a foundation of medical knowledge, you don't know what you're looking for...They are your bread and butter, the foundation of everything."

To maintain enthusiasm for the exam, its advocates have called for a change in attitudes toward the craft by portraying it as an enlightening journey, not a burden best left to impersonal instruments. In a 1980 article in *Forum on Medicine*, Dr. Faith Fitzgerald likened clinical diagnosis to a type of detective story, with disease as a criminal who leaves clues that can be gleaned through the history and physical exam by the physician, a

Holmesian figure. Disease, like other crooks, marks its movements with fingerprints, which the doctor can use to build his or her case for a certain condition and treatment. Fitzgerald even suggested including *The Adventures of Sherlock Homes* as required reading in medical school. “We will recognize success...when the clinical examination is seen by students as the basic tool in solving the challenge of disease,” she wrote, “the most exciting, interesting, and gratifying intellectual exercise in all of clinical medicine.”

Sixteen years later, in an article entitled, “Physical Diagnosis in the 1990s: Art or Artifact?”, Drs. Salvatore Mangione and Steven J. Peitzman expressed a similar sentiment, writing that, “Other benefits will occur as physicians spend more time with their patients, or rediscover the occasional Sherlockian gratification of a good call made with only one’s senses and a few simple aids to them.”

These physicians practice alongside many medical experts who believe in maintaining an environment in which the physical examination can coexist with technology, with the exam serving as the precursor to testing, or in some cases supplanting it completely. They face a daily struggle of educating both new medical professionals and their experienced counterparts to increase their confidence in these delicate, yet significant skills. In effect, they rally behind Thomas’s call for increased reliance on physical diagnosis: “This uniquely subtle, personal relationship has roots that go back into the beginnings of medicine’s history, and needs preserving.”

“Just Look”

William Taylor works as a primary-care doctor, the first contact for a person who has a medical problem. He sees patients at Beth Israel Deaconess Medical Center in Boston, but his office is just a short walk away at Harvard Medical School. For the past eight years he has served as director of the Patient-Doctor II course on physical examination, taught to second-year students. It is part didactic, part hands-on, and all unfamiliar for these future physicians who have spent the previous twelve months learning the organ systems and the methods for interviewing patients about their medical histories. It's time to get close to the body.

In conversation, Taylor takes long pauses to ponder lessons from his nearly thirty years of experience. Once he speaks, his medical philosophies seem to flow effortlessly. “When people ask why we still teach physical diagnosis, I say, ‘Do you want students to just be limited so they can't practice on ninety or ninety-five percent of people in the world?’” he says. While medical technology may be readily available to wealthy urbanites in industrialized societies, the majority of others are not so fortunate.

At the beginning of the nineteenth century, though, medicine even in the industrialized world seemed bare—no stethoscopes, thermometers, or blood pressure cuffs, let alone imaging options. Changes in the previous two hundred years had taken place primarily in physicians' thoughts about disease, not in the manner of detecting it. During the seventeenth century, physicians relied on the appearance and behavior of a patient, as well as the patient's own description of symptoms, to diagnose a condition. Though doctors might guide questioning, a physical exam carried little weight, if used at all. A patient's subjective account, though possibly distorted by emotions or memory, served as the primary

source of diagnostic information. Both parties resisted touch as an intrusion, a violation, a breach of the contract that had solely required verbal and visual interaction.

In the 1800s, “symptoms” only perceptible by a patient were distinguished from “signs,” marks of disease that a physician could actually observe through his senses, including body temperature, tenderness, and abnormal masses beneath the skin’s surface. The stimulus for this change may have been the work of the Italian anatomist Giovanni Battista Morgagni, who wrote an exhaustive paper in 1761 about the locations and causes of diseases as he observed them through anatomy. He did not learn the secrets of the body when it was alive, but uncovered them after death, performing more than seven hundred autopsies. His work encouraged physicians to dissect bodies, study markers of disease, and connect these markers with symptoms that living patients experience. The insides of one person who had chest pain revealed a blood clot in the heart. Cyanosis, or bluish skin, could be traced to a narrowed valve between the heart and the artery that supplies the lungs with deoxygenated blood, a condition known as pulmonary stenosis. “The practice of dissecting bodies to find physical evidence of disease began to transform some eighteenth-century physicians from word-oriented, theory-bound scholastics to touch-oriented, observation-bound scientists,” Stanley Joel Reiser wrote in *Medicine and the Reign of Technology*.

The same year that Morgagni announced his research, the Viennese Leopold Auenbrugger published a booklet describing percussion: striking the body with the fingers to generate sounds that indicate whether an underlying organ is healthy or diseased. His work, however, was nearly ignored until after the turn of the century, when Napoleon’s personal physician translated it from Latin into French and taught percussion to his medical students,

including Rene Laennec. He went on to revolutionize the field of medicine in 1816 with an invention, the stethoscope, which made it possible to eavesdrop on the heart and lungs.

The device was borne from Laennec's desire to detect signals directly from the heart of a woman who had a rare disease. Modesty prevented him from placing his ear to her chest. More than a century later in 1943, an advertisement in *This Week* magazine compared his tool to Bayer Aspirin, naming both among the "great triumphs in medical history." The ad described Laennec's dramatic moment of discovery as such: "Suddenly, without a word, the doctor grasped some sheets of paper...rolled them into a cylinder...applied one end to the patient's chest...the other to his ear. SIGNALS...he heard enough to make his *own* heart pound!"

Laennec soon moved from using a paper stethoscope to employing a nine-inch-long wooden cylinder, orienting the single earpiece toward himself and the chest piece toward the patient. Three years after this invention, Laennec wrote his own essay—a more comprehensive nine hundred twenty-eight pages compared to Auenbrugger's ninety-five—on auscultation, a word that originates from the Latin verb *auscultare*, "to listen." His attention to detail may have led to the more ready acceptance of this practice by the medical community. But it was Hippocrates who had first vividly described the basic process of auscultation in his *De Morbis*: "You shall know by this that the chest contains water and not pus, if in applying the ear during a certain time on the side, you perceive a noise like that of boiling vinegar."

During the next few decades of the nineteenth century, stethoscopy evolved into a common practice, and the stethoscope became the trademark of the modern medical professional. Though this invention enhanced a physician's ability to hear the sounds of the

chest, it also served as a barrier between doctor and patient. “It was the earliest device of many still to come, one new technology after another, designed to increase that distance,” Lewis Thomas wrote. It seems that as soon as physicians were willing to accept the sense of touch as necessary for diagnosis, they erected a new barrier in the form of technology.

The advances continued during the second half of the 1800s and the early 1900s with the thermometer, the x-ray, and the blood pressure cuff. The last was initially resisted because doctors were convinced that by directly feeling a patient’s pulse they could gain more information about the fullness, tension, rate, rhythm, and force of blood flow. But that sentiment quickly faded, and today, with electrocardiograms, ultrasounds, CT scans, and MRI scans, Reiser lamented, “The physician has become a prototype of technological man.”

Many, however, say that doctors and patients should be *thankful* that tools have allowed a more exact science to partially replace physician subjectivity. Dr. J. W. Carhart, in an 1895 editorial about the thermometer, wrote that such inventions have eliminated “the shadowy veil that for centuries obscured [medicine’s] beauty.” Carhart warned, though, that enthusiasm for these instruments should come with great caution. Reverence for and training of the educated touch must be maintained. “The modern sewing-machine, with its marvelous capacities, is a monument of our civilization,” he wrote, “but it can never wholly usurp the place of the delicate needle in the deft fingers of an intelligent woman.”

Endeavoring to keep the faculties of the hands, eyes, ears, and nose sharp in an era that elevates equipment, William Taylor stands from his desk chair in his Harvard office, and though he will not be examining patients, grabs his white coat and slips it on. That garment and the stethoscope in his pocket are an attempt to “look the part” of a doctor, and to “remind them why they’re here,” he says, referring to the one hundred seventy-five

Patient-Doctor II students he is about to address. It's time for the Monday afternoon lecture and small-group practice of a selected portion of the physical examination. Today: musculoskeletal exam of the shoulder and wrist.

He heads across the hall into an amphitheater, still only a fraction filled, and strides down the stairs toward the front of the room. Within minutes, as the clock slips past the starting time, the group swells to the full number of students, who prepare for the lecture by flipping through anatomy textbooks or leafing through the day's agenda. As others sneak in the last few bites of their lunches, one amused student waves a reflex hammer, a holdover from a previous neurology exam.

After Taylor makes a few introductions, another professor notes the short-sleeved clothing choices of the students, despite the forty-five-degree temperature outside. "I'm glad to see that a lot of you are prepared," he comments; it's easier to access the shoulder joint with direct skin contact. He turns the conversation over to the first speaker, Arun Ramappa, a sports-medicine specialist who wears a tan sport coat in lieu of the more traditional white doctor's garb. Ramappa quickly gets down to business.

"The basis for the physical exam is what?" he asks, and before the students can respond, he answers his own question. "It's anatomy." The two main points to remember for the orthopedic exams are to keep a picture of the body's anatomy in your head, and to consistently perform the parts of the exam in the same order. Translation: practice. "When you go through something, do the same thing every time so it becomes rote," he says. (Across town at Tufts University School of Medicine, Elisabeth Wilder, an internal medicine doctor, teaches students a similar lesson with a slight twist: practicing on healthy

patients. “Every time you look at a normal ear, you’re going to be quicker to recognize an abnormal ear,” she says.)

As Ramappa continues to instruct on maneuvering the shoulder to test its range of motion, students scribble on anatomical maps of the body and jot notes on the back of the day’s agenda. Just when the PowerPoint slides with sketches and photographs of the movements begin to seem repetitive, he jolts the crowd to life with a video clip intended to illustrate the accuracy allowed by this complex joint: onscreen, Major League pitcher Randy Johnson delivers a fastball toward home plate. Before the batter can swing, a dove flies in the path of the ball, and meets its demise in an explosion of white feathers. A second of silent shock gives way to a burst of laughter and, encouraging the liveliness, Ramappa plays the video again, and then once more. That, he all but says, is what the shoulder can do.

“Anytime you do an exam, you look, you inspect,” he reminds them. “The next thing you do is palpate, you touch,” he says, turning to projected pictures of him performing a shoulder examination on a female athlete. In the images, he lifts and lowers the arm, first to the front, and then to the side of the body, and at different angles until the woman’s raised hand indicates “enough”; her motion has reached its limit.

In the beginning, the process of physical diagnosis seems overwhelming. Textbooks divide it into four methods—inspection, palpation, percussion, and auscultation—requiring its practitioners to look, feel, and listen to sounds produced by internal organs when the body is tapped and to noises of bodily processes, such as heartbeat and breathing.

In fact, a truly comprehensive physical examination is never performed. It would take hours, even days, as the exhaustive list of possible exams is as long as the litany of body parts—face, eyes, ears, nose, mouth, throat, neck, shoulder, arms, hands, chest, back,

heart, lungs, abdomen, legs, feet, genitalia—and each requires its own set of intricate maneuvers. “What’s right, however, is to think about what the patient might have,” Taylor says, based on information from the patient’s medical history, and then focus the exam to determine which conditions are likely to be the culprit of certain symptoms.

The exam is, therefore, custom-built for the patient. If the patient’s wrist is swollen, assessing her brain function is futile. *Unless*, of course, she braced herself as she fell in a fit of dizziness. This elaborate process is thus complicated by the nature of the body, in which seemingly unconnected parts and events can be intimately related.

Illustration: a male patient in his sixties enters the doctor’s office. His chart shows high blood pressure, diabetes, and high cholesterol, all risk factors for atherosclerosis, or hardening of the arteries. If he has atherosclerosis, his blood may not circulate properly. To check for evidence of this, one of the best places to look is...his foot, and its pulses. These peripheral vessels may reveal a blockage in an artery upstream, closer to the heart.

To inspect the “dorsalis pedis” pulse, first find the firm tendon that extends from the big toe, on the top of the foot. Approach the foot from the instep, and place the thumb on the sole, and the three forefingers on the top. The forefingers should be positioned away from the ankle and next to the tendon, more toward the second toe. If no pulsation is found, move the fingers slightly to the left and right, and up and down the foot. If still not detected, the pulse is graded a zero, so an artery may be completely blocked; if barely felt, it’s a 1+, which may mean that an artery is narrowed; a normal pulse is a 2+; a strong, bounding pulse is a 3+; and a pulse that balloons out with each beat is a 4+, which might indicate an aneurysm, a weak and bulging blood vessel on the verge of bursting. Now, move to the next artery in the foot for the “posterior tibial” pulse.

To learn such exams, students must develop new psychomotor skills as well as the capacity for mental multitasking. They aim to simultaneously observe with individual senses and process the significance of a finding, such as feeling the pulse and grading it. The stomach that echoes when tapped reveals that it is filled with gas. The lungs that swiftly expel air and produce a “cracked pot” sound when the chest is struck indicate tuberculosis. The heart that makes a rumbling, “grrrrr dup” noise through the stethoscope signifies the backflow of blood through a valve.

“You train your ears to hear just the way you train your fingers to feel,” says Katharine Treadway, an associate professor at Harvard Medical School and a primary-care doctor. “It’s like learning to read. You start by sounding out the letters, then you focus on figuring out the words.” While learning the exam, doctors first try to identify sounds and visual clues, and then decipher their meaning. This, in turn, leads to a constant inner conversation by the physician, asking and answering his or her own questions as each area is checked off the list. Is the breathing normal? Is that an irregular mole on her arm? Is his abdomen tender to the touch?

According to Taylor, uniting the language of examination with this diagnostic thinking requires specialized reasoning. Doctors must consider both the information gained from the examination as well as past observations of conditions; hence Wilder’s emphasis on performing exams on healthy patients. Based on information from the patient’s history and past experiences, doctors zero in on a list of possible diagnoses from the start, and use the exam to reason whether a certain disease is more or less likely to be the culprit. If the first set of potential diagnoses doesn’t identify the problem, a physician then revises the possibilities, and continues this process until the most likely candidate is found.

Recently, Taylor's office received a call from an eighty-year-old woman who had been experiencing pain in the left side of her neck for the past two weeks. At times, it shot up to her ear and down to her chest. The nurse who spoke to her was concerned about a heart attack, so she suggested that the woman drive straight to the emergency room. She refused, but agreed to be examined by Taylor at his office. He listened to her tell of pain when carrying her groceries, noticed that her arm hurt when she moved it in certain directions, and zeroed in on tenderness in one area. Diagnosis: a strained tendon. Treatment: pain-reliever and a heating pad.

She did eventually undergo a chest x-ray and electrocardiogram to rule out a heart problem undetectable through physical examination. But Taylor's patient still avoided an unnecessary trip to the emergency room—the result of a careful exam.

Katharine Treadway tells of a patient she had followed for years who came in for a routine check-up of his heart murmur. He had no symptoms, but through her stethoscope Treadway detected a change in the murmur's sound; it had become more pronounced. She sent him for an imaging test, an echocardiogram, which found a narrowing of the aortic valve, through which blood flows from the heart to the rest of the body—grounds for surgery. If Treadway had not noticed this abnormality, the patient might have returned home and suffered a heart attack.

“Part of what a good doctor does during the interview is think of ways that the physical exam is going to help provide direction in the diagnostic process,” Taylor says. As in Treadway's case, the history and physical can lead to the next step: a turn to technology. In his book, *The Birth of the Clinic*, Michel Foucault wrote that “observation and experiment are opposed but not mutually exclusive: it is natural that observation should lead to

experiment,” as long as the experiment targets a specific finding from the exam. Some diagnoses are clinically silent, or impervious to the physical exam, such as a small lung tumor. Other times, a doctor might identify a neurological problem during the exam and know which part of the brain is responsible, but need an MRI scan to determine whether the culprit is a tumor or a stroke.

An hour passes in Harvard’s amphitheater, signaling the next portion of the afternoon: small-group instruction. The students disperse into classrooms, followed by eighteen doctors who will lead the following two-hour segment. In one room, four men and four women gather around a table and await their next lesson. They talk quietly until the boisterous Tom Holovacs enters and steps to the front—“Don’t call me Dr. Holovacs,” he says, by way of introduction. He’s a sports-medicine specialist from Massachusetts General Hospital. Ignoring the three chalkboards and television screen, he rolls up his sleeves to teach with his hands.

Though he offers the students a packet of notes (“You can chuck it when you leave, but take it and make it look like you want it”), he gives them the opportunity to decide on the teaching method. They vote for the “quick and dirty” approach of flipping through the handout and asking questions, so he begins.

“This course, I think, is designed to divorce the history from the physical exam,” he says, but “you really shouldn’t try to separate them. As you elicit the history, you’re also watching the patient and how they’re doing things to give some idea of what you’ll see on the physical exam.” Watch how they take their shirts off—are they in pain? Are they straining? Look at their faces, he tells them. “It gives you a perspective on why it’s

important to do a history and physical exam together.” It’s about how you observe, not just how you touch.

Once doctors are able to interpret the language of symptoms, they can begin using several senses at once, which both Holovacs and Wilder encourage of their students. When she teaches in the clinic, Wilder makes sure that students appreciate the subtleties of performing the exam. “You’re always observing. When you’re talking to someone, you observe their symmetry, skin tone, facial expression,” she says. “I want them to notice skin abnormalities when they’re doing a sinus exam. That’s when they might pick up skin cancer. Obviously that doesn’t come quickly, but that’s something I expose them to.”

Next, Holovacs, like Ramappa earlier, emphasizes anatomy. “You can’t understand what you can’t see,” he says. “If you can’t see a picture of the shoulder in your head,” you won’t know what to look for when you’re examining a patient. “When you look at someone, it tells a lot about the diagnosis.” To demonstrate, he calls for a volunteer.

A thin, muscular woman in front raises her hand. She takes off a button-down shirt to reveal a tank top. “Sorry to do this to you,” Holovacs apologizes, but immediately begins probing her shoulder joint. He points to and names the muscles and bones—the trapezius, the deltoid, the humerus, the scapula. One student removes her crimson Harvard sweatshirt to feel the tendons and gaps of the joint, and another slips off a black cardigan to do the same. The male students explore over their own shirts, mimicking Holovacs’s actions. They look back and forth between their bodies and the model in front of them, fingers moving around slowly, unsure. They touch one shoulder, then the other, attempting to pinpoint the correct spots.

Holovacs refers to the back of the volunteer's shoulder. If she were lacking muscle bulk, he explains, it would look like a sinkhole, indicating atrophy. "That's inspection," he says. "It's easy. Just look."

They move on to the biceps muscle. "Everyone can feel it on themselves. I'll show it to everybody," he offers, walking around the room. He moves from student to student. "It's hard on big guys," he tells one muscular male. "That's your biceps right there. Feel it? That little thing right there."

Their pensive gazes gradually turn to more confident looks, as they nod in turn after Holovacs shows them the target. They are preparing for their time in the hospital and clinic, when they will be on their own, needing to identify the muscle on a patient in pain during their first professional shoulder examinations.

“Learned at the Bedside”

Hundreds of years before the emergence of diagnostic technology, the intricacies of diagnosis were learned through observation—observation, that is, of the most successful practitioner who could be found. A man who aspired to be a physician worked as an apprentice. He followed his mentor on house calls, watched his every move, noted the successes and failures of treatments, and stored this knowledge until his first opportunity to lay hands on a patient.

This form of apprenticeship, of learning at the bedside, may have originated with Hippocrates, and appeared again in more modern times; a physician named Montanus instituted the practice in the 1500s in Padua, Italy, and Hermann Boerhaave brought it to the University of Leyden in the Netherlands during the next century. Boerhaave required his students to propose diagnoses and treatment plans after examining patients.

In 1820s America, more than a decade after the founding of Massachusetts General Hospital, administrators were still reluctant to allow students to walk the wards and study ill patients for educational purposes. MGH’s co-founders even set forth a list of ten rules for the “admission and conduct of pupils”—an all-but hands-off policy. Number five: “On the regular days of visiting the pupils are not to remain at the Hospital longer than is absolutely necessary for the visits. They are not to converse with the patients or nurses.” And number six: “In all cases, in which it will be proper for the pupils to make any personal examination of a patient, such as feeling the pulse, examining a tumour, &c. an intimation to that effect will be given them by the physician or surgeon. It must be obvious that the greatest inconveniences must arise, if such examination were commonly made by the pupils.”

After the advent of bedside examining tools such as the stethoscope and the ophthalmoscope for viewing the back of the eye, this began to change. Clinical instruction moved from a passive to an active exercise under one of the greatest clinical teachers in history: Canadian-born, English-trained Sir William Osler.

For many, Osler was and remains the ideal diagnostician. His vision served as his most keen sense. He began by gazing into a patient's eyes, then scanning every inch of the body. In Michael Bliss's biography entitled, *William Osler: A Life in Medicine*, Bliss wrote of both children and adults who "remembered that [Osler] seemed to be able to look inside them or through them." In the late 1890s at the newly established Johns Hopkins University School of Medicine, Osler encouraged the presence of medical students in the hospital, and was known to have said: "Medicine is learned at the bedside and not in the classroom." The hospital and the clinic became places where students and residents could "round" to observe and examine a number of patients, and to develop standard profiles of symptoms and diseases. During rounds, the classroom is the hospital, and the textbook is a patient who presents with a health problem, a mystery waiting to be solved. From Osler's time on, bedside teaching became a cornerstone of American medical education, in which students learned from patients and role models—attending physicians.

Though still used in the twenty-first century, the method has gradually diminished in importance. Just two decades after Osler's institution of bedside teaching, Dr. Alfred Worcester bemoaned the changing instruction of physicians in a 1912 article in *Boston Medical and Surgical Journal*. He referred to the "old days" in which a student would study under a doctor and "instinctively imitate his teacher's methods."

The mid-1900s saw medical students training in better-equipped hospitals with more highly educated professors, but the apprenticeship aspect continued to decrease. The environment was complicated—patients began spending less time in the hospital, resulting in fewer opportunities for student learning; as diseases were researched in more detail, more time was necessary for studying information to yield the proper diagnosis; and with the emergence of diagnostic technology, less time was spent examining patients when a test could produce similar results. In the time crunch, something had to give; namely, time spent teaching, which led a 1992 article in the *Journal of the American Medical Association* to comment about today’s clinicians:

...they have little time to spend at the bedside exercising and maintaining their clinical skills. As the latter atrophy, so too does their ability and inclination to investigate, much less model and teach, medical history taking and physical examination. It thus should come as no surprise to find that those they teach mimic their reliance on the diagnostic laboratory and their interest in its biologic insights...

With this reasoning, students cannot be blamed. The responsibility for change rests with leaders of medical education programs, not those who emerge from them. In his preface to *Evidence-Based Physical Diagnosis*, Dr. Steven McGee wrote, “One can hardly fault a student who, caring for a patient with pneumonia, does not talk seriously about crackles and diminished breath sounds when all of the teachers are focused on the subtleties of the patient’s chest radiograph.”

Physician-writer Sandeep Jauhar editorialized his own learning experience during the past fifteen years in a 2006 article in the *New England Journal of Medicine*. Jauhar explained his encounters with physical diagnosis by first describing his mentor: “Even as he went through the motions of physical diagnosis, he appeared to be dismissing it... We residents were apt to regard the physical exam as an arcane curiosity... Technology ruled the day, permitting diagnosis at a distance.” On the other hand, he went on, “...there were a few physicians—old souls? lost souls?—who proselytized on behalf of physical diagnosis, ascribing to it an almost mystical power.”

One of the “old souls” at Boston University is not so old. Dr. Subha Ramani has been practicing for only about twenty years herself, yet is still one to highlight the virtues of bedside diagnosis. Ramani trained in internal medicine in India, and identifies more with Hippocrates and Osler than with their modern, technology-based counterparts. “I come from a very different style of medicine,” she says. “We didn’t have the ready access to technology that people here have. We really depended on our clinical skills to make decisions.”

After finishing her residency, Ramani moved to the States to find a starkly different environment. “I saw so much conference room-based teaching and such technologically dependent clinical care,” she remembers. “I realized that clinical skills contribute so much to patient care that people depending on technology don’t realize.”

When she began working at Boston University in 1998, she emphasized Osler’s principles of bedside instruction in an attempt to resuscitate clinical-skills teaching. In 2006, however, she found that residents still scored under sixty percent on multiple-choice and practical assessments of physical exam abilities. She showed these results to the chairman,

who created a new position for her—director of clinical skills development for the residency program.

Today, she and her colleagues use both lecture and bedside rounds to review with residents the techniques from the first and second years of medical school. They round with groups of fewer than twelve residents, to ensure more personalized instruction. As she describes the program, her dark eyes widen with excitement at the opportunity to translate concepts from her Indian training to American healthcare. “I incorporate the old-world medicine and ask trainees to justify why investigations are ordered,” she explains. And in the spirit of Osler—“I teach at the bedside.”

This morning, nine internal medicine residents, four or five years senior to the Harvard students, search their lists of patients for a suitable contender for rounds. As the chief resident explains, “Every patient has findings,” those idiosyncrasies that can be detected through the physical examination, such as an inflamed eardrum, an enlarged thyroid, or an abnormal blood vessel growing in the eye. “But some have better than others,” he says. Those “better” findings are the symptoms that are more noticeable and easier to identify, more conducive to the educational experience for the residents.

But learning the physical exam involves more than just recognizing the obvious. It also includes becoming comfortable with every aspect of the process, and developing confidence in one’s own skills. Dr. Lorraine Stanfield at Boston University School of Medicine points out, “The less comfortable our graduates are at the physical exam, the less comfortable the residents are, the less comfortable the attendings are, and the attendings in turn teach the students, so it becomes a self-fulfilling prophecy.” Ramani examined this trend in a group of Boston University doctors and discovered that many established

physicians feel uneasy instructing at the bedside because they lack faith in their own skills. “People don’t necessarily feel that their physical exam skills are sharp enough to pick up what they want to pick up, so they just think they can use technology to answer questions,” she says.

And consequently, the young physician, taught by an “unskilled tyro,” overlooks the crucial significance of a slight change in coloring or tenderness of the abdomen, noted Dr. R. H. Kampmeier in a *Southern Medical Journal* article from twenty years ago.

“Inexperienced, and failing any certainty or confidence in what he has learned from examination, the young clinician throws up his hands and capitulates to technology.”

Many in the field, novice and experienced, have argued for rebellion against excessive use of tools for diagnosis, and for rekindling of respect for the senses and of faith in the ability to distinguish between technology as a necessity and technology as a lazy practice. Dr. James B. Herrick, in his 1928 lecture to the Alpha Omega Alpha medical society, roused the audience with a call to revive physician authority: “The practitioner, while properly in a state of humility before the many scientific diagnostic procedures, need not be in a state of humiliation. He may still retain self-respect as he realizes that no x-ray apparatus or other instrument is at once witness, jury and judge. He, the practitioner, still has something to say as a witness, more as a jurymen, and still more as a judge.”

This crusade is, of course, easier communicated than achieved. Countless hours, resources, and bodies—of both physicians and patients—are necessary to teach just one student the fundamentals of and respect for the exam. And learning does not stop after medical school, or even after residency. It extends throughout the entire career of a physician. It requires a lifetime of work, dependent on each physician’s desire to persist in

mastering the skills. “You have to train yourself over years and years and years to get good at this,” Harvard’s Dr. Taylor says. “If we short-circuit that process by failing to train people adequately, then we’ll have people in the system who don’t appropriately trust the exam.”

Taylor smiles as he remembers his days at the University of Pennsylvania School of Medicine more than thirty years ago, and his own physical exam education—it was quick, briefly tacked on after two years of studying anatomy and physiology. “I didn’t learn it very well,” he admits, which made him concentrate on improving his exam skills during residency training. Taylor says that at sixty years old he continues to learn when watching Ramappa and others teach the students. “My physical exam has a way to go,” he says, the grin fading to a serious expression. “I’ve only been working on it for a few decades.”

Taylor has a head start on Ramani, but this does not deter her mission to educate her successors. She arrives at the eighth-floor resident’s lounge at Boston Medical Center with the information for morning rounds: “We have a patient with a good cardiac exam on 6 North, and another gentleman with a lymphatic exam on 7 West,” she reads from scribbles on her makeshift notepad—a napkin. The residents respond excitedly to the lymphatic exam, and file down the stairs. Before entering the patient’s room, they slip on turquoise gauze masks—the man may have tuberculosis. After a few moments of preparation, the nine file inside and begin the medical ritual.

They stand in a semi-circle around the bed with Ramani near the head. With their white coats on and stethoscopes in place around their necks, they take turns introducing themselves to the patient, whose gloomy gaze sweeps the room. As Ramani guides him, the bare-chested man swings his frail legs over the edge of the mattress, sitting up gingerly to

leave the bandage under his left armpit undisturbed. He grants permission for the exercise, but sits motionless, hands in fists, fixing his stare downward toward his arms.

“Who would like to start us off?” Ramani asks. “And then we’ll all jump in.” Her coal-colored eyes search for a volunteer to lead the lymph-node exam. Silence. The crowd is hesitant—are they afraid to hurt the patient? Are they uncomfortable with their skills? To ease the tension, Ramani jokes, “Someone once said, ‘The definition of a volunteer is a person who didn’t understand the question.’” They smile, and soon a female resident steps forward.

“I’m not great at this,” the woman begins, but reaches toward him with both hands. She probes his neck with her index and middle fingers. Her circular motions move the skin at one particular position; after a few moments, she shifts her fingers to explore the tissues beneath another section of skin. The lymphatic system helps fight infections as part of the body’s natural immune defenses. Abnormal lymph nodes serve as physical evidence of an infection, though many people have throat problems or allergies that can lead to slightly enlarged lymph nodes. The resident checks for any suspicious changes—tenderness, substantial enlargement (beyond the size of the tip of the pinkie), nodes that aren’t shaped spherically, and nodes that don’t move when prodded. She names each of the glands she detects: the submental, under the chin; the submandibular, below the jaw; the posterior auricular, behind the ear. “Does anyone want to supplement? Add? Subtract?” Ramani asks. They fill in a few additional nodes—upper cervical, supraclavicular—as she draws a diagram of their locations on a piece of paper.

Then, Ramani walks around the bed. “It’s best to examine certain nodes from the back,” she explains, for easier access. She quietly asks the patient to look straight ahead and

relax. “I promise I won’t go anywhere near your bandage,” she reassures him as he hesitates. Her dark brown hands prod his long, pale neck. While Ramani explains her maneuvers to the residents and the patient, he sits silently, staring off into space.

After Ramani’s demonstration, the next resident moves into place behind the patient. He begins a bit roughly, applying greater pressure than Ramani, but relaxes in a moment, slowing his movements and feeling more carefully, conscious of each of the different nodes. A minute or so later, another resident takes a turn, closing his eyes as his fingers move gently, lingering on each intricacy below the skin. When he finishes, he pats the patient on the shoulder in silent gratitude. They continue, and this time a female resident’s fingers move gracefully along the neck as if she’s playing the piano, and she verbalizes her thanks. “Are you still doing OK?” the next resident asks as she steps behind him. “It’s like a little massage,” she comments, and at last, he smiles.

He remains quiet, however, as each of the nine scrutinize his “classic findings,” eventually moving downward from the neck to assess the axillary nodes in the armpits. After forty-five minutes, they file out, headed toward the cardiac exam on 6 North, leaving their volunteer to relax.

“The Body Never Lies”

On a winter afternoon in Nome, Alaska, no patients are in sight. At just past one o'clock, the sun is barely two hours in the sky for the day, its light prompting the snowy rooftops to glisten as if covered with diamonds. Outside, it is minus eighteen degrees; inside, where the heat is cranked to eighty, three women crowd around a desktop computer, listening to a moaning sound reminiscent of a graveyard scene in a Halloween movie.

The leader of the group, Dawyn Sawyer, a physician assistant, moves her hand up and down in the air with the rising and falling noise. She inhales with each lift and exhales with each drop of her arm to mimic the respiratory phases emitted from the speakers. Her female students shrug their shoulders in synch with the breathing as they attempt to identify the abnormal lung sound. This is an auditory encounter with a mock patient.

“It’s eerie sounding almost,” Sawyer says, and confirms the noise in question: lung crackles and wheezing. After a few more squeaks and whines to test their diagnostic abilities, they move across the hall to the trauma room to practice examining each other’s respiratory systems.

These are not medical students, but they are learning to perform nearly all aspects of the physical exam. When they leave Nome’s Health Aide Training Center in a few weeks, they will return to other “bush” villages, located off the road system and accessible only by plane, often to serve as sole providers of medical care for a few hundred citizens. Whereas Nome boasts doctors, nurses, and an x-ray machine, the remote towns have a hard time recruiting even physician assistants to take their turn at physical diagnosis, owing to the whipping winds, isolation, and high cost of living. To prevent their neighbors from living without healthcare entirely, these health aides will complete fifteen weeks of formal training

and additional practical instruction in both the physical exam and emergency services. After nearly two years of preparation, they will deliver care by following a Community Health Aide Manual step-by-step, progressing through a history, exam, assessment, and plan developed for hundreds of possible complaints.

Walter Johnson, a physician who practiced in the western town of Bethel in the mid-1950s, encouraged this type of practice. Frustrated with the lack of care available in the doctor-less towns, Johnson wrote to the area's medical director, explaining the urgent need for trained medical aides in villages: "It is not a question of whether the villages shall be treated by completely qualified medical personnel or by persons with less than full qualifications, but a question of whether they shall be treated by persons with limited qualifications or go untreated altogether."

In the late 1960s, medical aides began working as the "eyes and ears of the physician" by educating the locals about hygiene and sanitation, and then started delivering chemotherapy and other medications. Today, one hundred seventy-six bush villages have medical clinics staffed primarily by health aides, who number more than five hundred.

In Nome, Sawyer instructs two of them during their fourth and final level of training. "I like the physical exam. You've got your own cheat-sheet," she points out, referring to her hands and the sense of touch. "It's all in our ability to understand what the body is trying to tell us." As she considers her philosophy of the physical examination, she repeats her own medical mantra: "The body never lies."

Alaska-native Dr. David Baines of rural Dutch Harbor in the Aleutian Islands has another explanation. "You develop an intuition when you don't have all those fancy bells

and whistles around,” he says, referring to advanced diagnostic technology. “They always wonder how I do it,” he continues with a chuckle, “but I just call it Indian magic.”

A plane flight away in the St. Lawrence Island town of Gambell, physician assistant Jim Ferguson works his own magic, basing his diagnoses on years of wisdom gleaned from examining patients. Ferguson, who is originally from Canada and still bears the accent, studied in the physician assistant program at Bowman Gray School of Medicine (now Wake Forest) in the late 1980s. At that time, he never thought he would use the basic skills he learned—drawing blood, manually processing complete blood count tests, and reading urine dipsticks. “Up here in Alaska, in the bush, a lot of these types of skills come in handy,” he says.

With the help of several health aides, he runs these simple tests and communicates daily with doctors in Nome on the telephone during “radio traffic” (the name a relic of short-wave radio days) and as needed through telemedicine by sending images and video clips. Though he and the health aides do their best to treat patients without access to advanced diagnostics, “technology makes your job easier when you have it,” he says. The staff just dug a digital x-ray machine out of storage where it had been for the past two years. Ferguson looks hopefully at the computer screens on his desk where the images will eventually be displayed, but only after he trains to use the equipment.

Though not opposed to using imaging methods, especially with broken bones or chronic illnesses such as cancer or heart disease, Ferguson hopes to impart to every student and health aide the work that goes into making a diagnosis. “Don’t just run the test,” he says. “Think about what it is you’re doing. Once you order a lab, you are responsible for justifying it,” and backing it up with evidence from your examination.

He shares this philosophy with the medical students, residents, nurses, and physician assistants who spend a few weeks or months at a time rotating through Gambell's clinic. They are most certainly adventurous, as they consent to living in the back room of the clinic, listening to the howling wind, eating mainly pre-packaged foods, and answering emergency calls in the middle of the night. However, their most important asset is confidence in basing nearly every diagnosis on the physical exam. Ferguson remembers that it was such exotic conditions that drew him to the area, when he responded to an appealing job posting—

Wanted: physician assistant in remote Alaska town; communicate with nearest hospital via radio. After working for years in scrubs in a general surgery department, he now wears flannel shirts and rides to the clinic on a red four-wheeler, complete with a "We Love Our Health Aides" bumper sticker.

"This is as much of a developing country as Ecuador," he explains. "To live in a place like this, you need to have well-trained people who can rely on physical diagnosis, and at the same time recognize something that really needs to be sent outside the village. You need to know what you can treat on site and know how to do it, and know what can't be dealt with here."

Back in Nome at dusk, the sun, which barely rose above the horizon all day, has passed out of sight and left an orange-red burst of light in its wake. A few blocks from the hospital, I enter a one-story house that doubles as a store. Its floor, walls, and even ceiling display hand-painted Russian religious icons from across the Bering Sea, and ivory and fur trinkets made by Natives. The white-haired owner emerges from the kitchen—his office—with a cup of coffee in hand, slurping every few minutes as he chats with me. His wire-

rimmed glasses have slipped to the edge of his nose, and when he speaks, he barely opens his mouth.

When I tell him that I'm in town to observe medical care without diagnostic technologies, he smiles. "You came to the right place," he says. He pauses for a moment to think, and resumes with an anecdote. One of his sons, he explains, recently suffered a construction injury, and will probably be crippled for the rest of his life. The doctors in Nome misdiagnosed the man three times, according to his father, and due to a long waiting list, they could not send him on a free flight to Anchorage for additional testing. Finally, he paid out of his own pocket for the flight. An MRI scan revealed a "floating disc" in his back. He now takes methadone, the only drug that seems to ease the pain.

* * *

Without advanced imaging capabilities in Nome, this man's son plainly paid a price. But in hospitals and clinics across America where access to technology is more than ample, another element is missing: Doctors are losing touch, and patients are forgetting what it means to be cared for by perceptive hands rather than by machines. In a 2003 study in the *Archives of Internal Medicine*, nearly one quarter of patients requested diagnostic tests from their doctors. So physicians are now being forced to explain their decisions for not using technology—a double-edged sword. For some doctors, this may present an opportunity to justify their own diagnostic skills and highlight the exam's significance; others may find it less troublesome to merely order the test than argue with adamant patients.

Newspapers and websites also advertise full-body CT scans, in which patients entrust their insides to a series of x-ray slices, hoping to get a clean bill of health or detect a latent tumor before it spreads. These incidental findings, known to doctors as

“incidentalomas,” can lead to additional tests, expenses, and radiation exposure just to prove that a set of microscopic cells are benign—cells that never would have been identified or called into question by a physical examination. This trust in quick-use tools is strikingly similar to our love affair with other technologies, with typed emails replacing handwritten letters, one-touch microwaves trumping slow-cooking ovens, and Wikipedia supplanting bound volumes of *Encyclopedia Britannica*.

Patients may find it difficult to accept the role of physical diagnosis when even medical professionals struggle to give it a proper place—is it an art or a science? For hundreds of years, it seemed the practice fell into the former category. Customizing an exam for a patient and perceiving the often unseeable requires a set of artistic attributes, including curiosity, creativity, and originality. Even in a 1982 article in *Southern Medical Journal*, Dr. R. H. Kampmeier referred to a physician with these qualities as a “practitioner of the Art.”

In recent years, the artistic quality of the exam has noticeably suffered. John Salmon, one of Nome’s physician assistants, mentions that one hundred years ago, doctors might listen to a patient’s chest for an hour, meticulously recording the sound’s attributes. “The development of the x-ray partially made this thing”—he waves the stethoscope around his neck—“obsolete.” Today, it is used more as a screening tool whose findings may lead a physician to consult more advanced technology.

Many equate seemingly definitive diagnostic technologies with science and cast aside physical diagnosis as *merely* an art, but Harvard’s Dr. Taylor offers another take. He insists that performing the exam is not an art. It *is* science. “What’s art about it?” he asks, shaking his head. He believes that the art takes place in the laboratory, where scientists creatively generate hypotheses and strategies for testing them. Clinical doctors, he argues,

train their minds and senses to practice the scientific work of doctoring, by consulting data and adopting a questioning attitude.

“We’re not talking creativity here,” he insists, referring to his own medical practice. “I don’t want a creative doctor, do you? I want a doctor who follows the rules, who knows how to think, has the skills, knows how to listen, and takes me seriously when I have a problem. That’s not art.”

As diagnostic tools emerged and were widely used after the turn of the twentieth century, the art of medicine had no choice but to evolve into a scientific art. Doctors were forced, for the better, to add scientific methods to their artist’s palette; to broaden their scope of possibilities in diagnosing a patient. And so, even with Taylor’s rationale, it seems impossible and irrational to separate the art from the science. Physical diagnosis is, thankfully, both.

Today and in the future, in many areas of the world, medical technology remains inevitable. X-rays, MRI scans, CT scans, electrocardiograms, mammograms, angiograms, and ultrasounds will remain, or give way to even more advanced tools. But patients and professionals are equally responsible for maintaining the credibility of the physical exam. For trusting in fellow man. For understanding that technology does not always trump the learned senses.

On my last day in Nome, Dawyn Sawyer is on her own in the outpatient clinic, practicing the physical diagnosis skills she teaches to community health aides. She enters a room to check on a fourteen-year-old Native girl who is experiencing sharp chest pains. The teenager sits on the examination table, hunched over, her red-streaked brown hair covering her face. She looks up, her forehead scrunched with pain, and rocks back and forth as she

answers Sawyer's questions; she tries to stay tough as she swings her feet, wearing black Vans sneakers dotted with white skulls.

Sawyer asks her to describe the pain. When the girl remains silent, her parents urge her to answer the question. "Tell her how long it's been since you've eaten," her mother insists. A day or two, though she's been drinking tea, which calms her stomach. Sawyer scribbles on a chart as she elicits answers to her clinical history questions. The girl is an occasional soda-drinker and gum-chewer, with pain when she eats and sometimes during the night as well.

"Let me do my exam on you, lady," Sawyer finally says, satisfied with the responses. She washes her hands, and moves her stethoscope into position, looking toward the ground as she concentrates on the sounds. Next, as she taught the health aides a few days earlier, she braces the girl's shoulder as she probes her chest and back, pinpointing the pain.

Her parents and I step behind a curtain as Sawyer performs a rectal examination. Her father, an Alaska Airlines employee, jokes with me about my flight to Anchorage that night. It's a blizzard outside, but he promises I will leave on time.

After the exam, his daughter sits up again, and everyone looks to Sawyer for the verdict. She explains her findings—musculoskeletal pain in the side of the girl's ribs (she shows the location on her own body), and epigastric pain, touching her sternum. She knows the girl's heart is fine, but she recommends blood tests on the off chance that there is a problem with her liver or kidneys.

"I'm going to treat this musculoskeletal pain with Ibuprofen for inflammation," Sawyer explains, touching the teenager's foot as she whimpers from the pain. And without

consulting test results, she makes her diagnosis—"I think you've got a bit of reflux," she says.

"We're going to get you feeling better. Let's see you back next week. And, I want you to try something. If it's really bad, take liquid milk of magnesia. It's cheap. Just give her a heaping teaspoon," she says, turning toward the parents. "If it's reflux, that will knock it right out. It will help us figure out if that's what it is."

The family leaves the office at five o'clock, and three hours later the girl's father is busy checking in passengers at the Nome airport. When I arrive at the counter, he laughs that he told me so—an on-time departure is scheduled. He drags my suitcase away for the security check. When he turns back to me, he pauses and changes the subject.

"You know that cheap stuff that she told us to try?" he says, referring to the milk of magnesia. "It knocked the pain right out after all these days." He shakes his head, baffled by the simple diagnosis, and simple cure. "She took it tonight, and the pain is gone."

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INTERVIEWS
**(Including cited and background interviews,
e-mail follow-up correspondence, and observational meetings)**

- Baines, David. Family Practice Physician, Iliuliuk Family Health Services, Unalaska, Alaska. Phone interview.
- Ferguson, Jim. Physician Assistant, Bessie A. Kaningok Gambell Health Clinic, Gambell, Alaska. Personal interviews.
- Gittinger, John. Professor of Ophthalmology, Boston University School of Medicine; Director of Neuro-ophthalmology Service, Boston University Medical Center. Telephone interviews.
- Holovacs, Tom. Instructor in Orthopedic Surgery, Harvard Medical School; Orthopedic Surgeon. Observation of Patient-Doctor II Lesson, Harvard Medical School.
- Jones, David. Associate Professor of the History of Science, Program in Science, Technology, and Society; Director of the Center for the Study of Diversity of Science, Technology, and Medicine, Massachusetts Institute of Technology. Personal interview.
- Nnoli, Aisha. Obstetrics/Gynecology Resident, University of California, Los Angeles. Phone interview.
- O'Neill, Karen. Emergency Medicine Physician, Family Practice Physician, General Internist, Norton Sound Health Corporation; Medical Director, Health Aide Training Center, Nome, Alaska. Personal and phone interviews.
- Podolsky, Scott. Director, Center for the History of Medicine, Countway Library of Medicine. Personal interviews.
- Ramani, Subha. Associate Professor of Medicine, Director of Clinical Skills Development for Internal Medicine Residency Program, Boston University School of Medicine; General Internist. Personal and telephone interviews.
- Ramappa, Arun. Instructor in Orthopedic Surgery, Harvard Medical School; Orthopedic Surgeon. Observation of Patient-Doctor II Lesson, Harvard Medical School.
- Richards, Brigitte. Physician Assistant, Brigham and Women's Hospital, Boston, Massachusetts. Personal interview.
- Salmon, John. Physician Assistant, Norton Sound Health Corporation, Nome, Alaska. Personal interview.

Sawyer, Dawyn. Physician Assistant, Norton Sound Health Corporation; Health Aide Trainer, Health Aide Training Center, Nome, Alaska. Personal interviews.

Stanfield, Lorraine. Director of Clinical Skills and Simulation Center, Boston University School of Medicine; General Internist. Personal and telephone interviews.

Taylor, William. Associate Professor of Medicine, Director of Patient-Doctor II Course, Harvard Medical School; General Internist. Personal interviews.

Treadway, Katharine. Assistant Professor of Medicine, Harvard Medical School; General Internist. Personal interview.

Wilder, Elisabeth. Assistant Professor of Medicine, Tufts University School of Medicine; General Internist. Personal interviews.