details" (paragraph 4). Choose one section of this essay and mark the passages you would describe as taking broad views and the passages you would describe as taking narrow views. What is the effect of Tisdale's going back and forth between them? How does she manage transitions?

2. "We are too busy to chew over ethics" (paragraph 21), Tisdale observes. What does she mean by ethics? Does she engage with what you consider ethical issues in this essay? Explain.

3. Although Tisdale takes a pro-choice position, a pro-lifer could use parts of her essay against her. What parts? What are the advantages and disadvantages of including material that could be used in support of the opposition?

4. Write a pro-choice or pro-life essay of your own. Include material that could be used in support of the opposition. You may use Tisdale's essay, but you need not.

ATUL GAWANDE *When Doctors Make Mistakes*

I—CRASH VICTIM

AT 2 A.M. ON A CRISP FRIDAY in winter, I was in sterile gloves and gown, pulling a teenage knifing victim's abdomen open, when my pager sounded. "Code Trauma, three minutes," the operating-room nurse said, reading aloud from my pager display. This meant that an ambulance would be bringing another trauma patient to the hospital momentarily, and, as the surgical resident on duty for emergencies, I would have to be present for the patient's arrival. I stepped back from the table and took off my gown. Two other surgeons were working on the knifing victim: Michael Ball, the attending (the staff surgeon in charge of the case), and David Hernandez, the chief resident (a general surgeon in his last of five years of training). Ordinarily, these two would have come later to help with the trauma, but they were stuck here. Ball, a dry, imperturbable forty-two-year-old Texan, looked over to me as I headed for the door. "If you run into any trouble, you call, and one of us will peel away," he said.

I did run into trouble. In telling this story, I have had to change significant details about what happened (including the names of the participants and aspects of my role), but I have tried to stay as close to the actual events as I could while protecting the patient, myself, and the rest of the staff. The way that things go wrong in medicine is normally unseen and, consequently, often misunderstood. Mistakes do happen. We think of them as aberrant; they are anything but.

First published in the "Annals of Medicine" section of the New Yorker *(February 1, 1999), then in Gawande's first book,* Complications: A Surgeon's Notes on an Imperfect Science *(2002). He has continued the theme of medical error in* Better: A Surgeon's Notes on Performance *(2007) and* The Checklist Manifesto: How to Get Things Right *(2009).*

The emergency room was one f
I arrived just as the emergency me
appeared to be in her thirties and to
lay motionless on a hard orange pl
blood running out of her nose. A n
an examination room outfitted like
toring devices, and space for portab
bed and then went to work. One nu
Another took vital signs. A third i
her right arm. A surgical intern pu
emergency-medicine attending was S
man in his fifties. He was standing t
which was a sign that I could go ahe

If you're in a hospital, most of th
from residents—physicians receivir
exchange for their labor. Our respo
but we're never entirely on our own
our decisions. That night, since Joh
for the patient's immediate manager
a surgeon, and so he relied on me fo

"What's the story?" I asked.

An E.M.T. rattled off the detail
driver in high-speed rollover. Ejectec
Pulse a hundred, B.P. a hundred ove

As he spoke, I began examining
patient is always the same. It doesn
times or crushed by a truck or burne
make sure that the patient can breat
were shallow and rapid. An oximeter
measured the oxygen saturation of he
ninety-five percent for a patient brea
face mask with oxygen turned up full

"She's not oxygenating well," I
up-when-something-interesting-happ
about three months into residency. V
any object in her mouth that would
confirmed that neither lung had coll
clear facepiece over her nose and m
balloon with a one-way valve, shootir
sion. After a minute or so, her oxyg

1. A thin tube inserted into the bladder

2. Ichabod Crane, the fictional hero of V
is described as "tall, but exceedingly lan
hands that dangled a mile out of his slee
his whole frame most loosely hung togetl

:his essay and mark the passages you would
ages you would describe as taking narrow
ck and forth between them? How does she

aragraph 21), Tisdale observes. What does
what you consider ethical issues in this

ion, a pro-lifer could use parts of her essay
:ages and disadvantages of including mate-
)sition?

r own. Include material that could be used
:dale's essay, but you need not.

)octors Make Mistakes

Friday in winter, I was in sterile gloves
g a teenage knifing victim's abdomen
pager sounded. "Code Trauma, three
)erating-room nurse said, reading aloud
display. This meant that an ambulance
:inging another trauma patient to the
:al resident on duty for emergencies, I
; arrival. I stepped back from the table
ns were working on the knifing victim:
'geon in charge of the case), and David
al surgeon in his last of five years of
ive come later to help with the trauma,
nperturbable forty-two-year-old Texan,
oor. "If you run into any trouble, you
id.
is story, I have had to change signifi-
ding the names of the participants and
stay as close to the actual events as I
elf, and the rest of the staff. The way
nally unseen and, consequently, often
'e think of them as aberrant; they are

:tion of the* New Yorker *(February 1, 1999),*
A Surgeon's Notes on an Imperfect Science
l error in Better: A Surgeon's Notes on Per-
:o: How to Get Things Right *(2009).*

The emergency room was one floor up, and, taking the stairs two at a time, I arrived just as the emergency medical technicians wheeled in a woman who appeared to be in her thirties and to weigh more than two hundred pounds. She lay motionless on a hard orange plastic spinal board—eyes closed, skin pale, blood running out of her nose. A nurse directed the crew into Trauma Bay 1, an examination room outfitted like an O.R., with green tiles on the wall, monitoring devices, and space for portable X-ray equipment. We lifted her onto the bed and then went to work. One nurse began cutting off the woman's clothes. Another took vital signs. A third inserted a large-bore intravenous line into her right arm. A surgical intern put a Foley catheter[1] into her bladder. The emergency-medicine attending was Samuel Johns, a gaunt, Ichabod Crane–like[2] man in his fifties. He was standing to one side with his arms crossed, observing, which was a sign that I could go ahead and take charge.

If you're in a hospital, most of the "moment to moment" doctoring you get is from residents—physicians receiving specialty training and a small income in exchange for their labor. Our responsibilities depend on our level of training, but we're never entirely on our own: there's always an attending, who oversees our decisions. That night, since Johns was the attending and was responsible for the patient's immediate management, I took my lead from him. But he wasn't a surgeon, and so he relied on me for surgical expertise.

"What's the story?" I asked.

An E.M.T. rattled off the details: "Unidentified white female unrestrained driver in high-speed rollover. Ejected from the car. Found unresponsive to pain. Pulse a hundred, B.P. a hundred over sixty, breathing at thirty on her own . . ."

As he spoke, I began examining her. The first step in caring for a trauma patient is always the same. It doesn't matter if a person has been shot eleven times or crushed by a truck or burned in a kitchen fire. The first thing you do is make sure that the patient can breathe without difficulty. This woman's breaths were shallow and rapid. An oximeter, by means of a sensor placed on her finger, measured the oxygen saturation of her blood. The "O_2 sat" is normally more than ninety-five percent for a patient breathing room air. The woman was wearing a face mask with oxygen turned up full blast, and her sat was only ninety percent.

"She's not oxygenating well," I announced in the flattened-out, wake-me-up-when-something-interesting-happens tone that all surgeons have acquired by about three months into residency. With my fingers, I verified that there wasn't any object in her mouth that would obstruct her airway; with a stethoscope, I confirmed that neither lung had collapsed. I got hold of a bag mask, pressed its clear facepiece over her nose and mouth, and squeezed the bellows, a kind of balloon with a one-way valve, shooting a litre of air into her with each compression. After a minute or so, her oxygen came up to a comfortable ninety-eight

1. A thin tube inserted into the bladder to drain urine.

2. Ichabod Crane, the fictional hero of Washington Irving's "Legend of Sleepy Hollow," is described as "tall, but exceedingly lank, with narrow shoulders, long arms and legs, hands that dangled a mile out of his sleeves, feet that might have served for shovels, and his whole frame most loosely hung together."

percent. She obviously needed our help with breathing. "Let's tube her," I said. That meant putting a tube down through her vocal cords and into her trachea, which would insure a clear airway and allow for mechanical ventilation.

Johns, the attending, wanted to do the intubation. He picked up a Mac 3 laryngoscope, a standard but fairly primitive-looking L-shaped metal instrument for prying open the mouth and throat, and slipped the shoehornlike blade deep into her mouth and down to her larynx. Then he yanked the handle up toward the ceiling to pull her tongue out of the way, open her mouth and throat, and reveal the vocal cords, which sit like fleshy tent flaps at the entrance to the trachea. The patient didn't wince or gag: she was still out cold.

"Suction!" he called. "I can't see a thing."

He sucked out about a cup of blood and clot. Then he picked up the endotracheal tube—a clear rubber pipe about the diameter of an index finger and three times as long—and tried to guide it between her cords. After a minute, her sat[3] started to fall.

"You're down to seventy percent," a nurse announced.

Johns kept struggling with the tube, trying to push it in, but it banged vainly against the cords. The patient's lips began to turn blue.

"Sixty percent," the nurse said.

Johns pulled everything out of the patient's mouth and fitted the bag mask back on. The oximeter's luminescent-green readout hovered at sixty for a moment and then rose steadily, to ninety-seven percent. After a few minutes, he took the mask off and again tried to get the tube in. There was more blood, and there may have been some swelling, too: all the poking down the throat was probably not helping. The sat fell to sixty percent. He pulled out and bagged her until she returned to ninety-five percent.

When you're having trouble getting the tube in, the next step is to get specialized expertise. "Let's call anesthesia," I said, and Johns agreed. In the meantime, I continued to follow the standard trauma protocol: completing the examination and ordering fluids, lab tests, and X-rays. Maybe five minutes passed as I worked.

The patient's sats drifted down to ninety-two percent—not a dramatic change but definitely not normal for a patient who is being manually ventilated. I checked to see if the sensor had slipped off her finger. It hadn't. "Is the oxygen up full blast?" I asked a nurse.

"It's up all the way," she said.

I listened again to the patient's lungs—no collapse. "We've got to get her tubed," Johns said. He took off the oxygen mask and tried again.

Somewhere in my mind, I must have been aware of the possibility that her airway was shutting down because of vocal-cord swelling or blood. If it was, and we were unable to get a tube in, then the only chance she'd have to survive would be an emergency tracheostomy: cutting a hole in her neck and inserting a breathing tube into her trachea. Another attempt to intubate her might even

3. Abbreviation for saturation, as in O_2 sat.

trigger a spasm of the cords and
exactly what did happen.

If I had actually thought this
ill-prepared I was to do an emerge
it's true, I had the most experience
ing much. I had been the assistan
all but one of them had been nor
that were not designed for speed.
trache I had done on a goat. I sh
backup. I should have got the trac
ile instruments—just in case. Inste
intubated because of a mild drop i
wait until I had help nearby. I might
losing her airway. Then I could hav
tracheostomy while things were still
slowly. But for whatever reasons—h
tation, or the uncertainty of the mo

Johns hunched over the patient
her vocal cords. When her sat once
and put the mask back on. We stared
ing up. Her lips were still blue. John
oxygen in.

"I'm getting resistance," he said

The realization crept over me: t
airway," I said. "Trache kit! Light! S
up here!"

People were suddenly scurrying
and not let panic take hold. I told th
gloves on. I took a bactericidal solut
of yellow-brown liquid on the patien
tomy kit—a sterilized set of drapes a
new pair of gloves while trying to thi
I tried to tell myself. At the base of t
little gap in which you find a thin
membrane. Cut through that and—v
the hole a four-inch plastic tube shap
to oxygen and a ventilator, and she's

I threw some drapes over her b
as thick as a tree. I felt for the bony
I couldn't feel anything through the
where should I cut? should I make
hated myself for it. Surgeons never c

"I need better light," I said.

Someone was sent out to look fo

"Did anyone get Ball?" I asked.

"He's on his way," a nurse said.

:h breathing. "Let's tube her," I said.
ıer vocal cords and into her trachea,
w for mechanical ventilation.
e intubation. He picked up a Mac 3
ɛ-looking L-shaped metal instrument
slipped the shoehornlike blade deep
ıen he yanked the handle up toward
ay, open her mouth and throat, and
tent flaps at the entrance to the tra-
vas still out cold.
ıg."
ıd clot. Then he picked up the endo-
the diameter of an index finger and
between her cords. After a minute,

ırse announced.
ving to push it in, but it banged vainly
to turn blue.

ient's mouth and fitted the bag mask
ɛadout hovered at sixty for a moment
ent. After a few minutes, he took the
n. There was more blood, and there
ɔoking down the throat was probably
ɛ pulled out and bagged her until she

the tube in, the next step is to get
ia," I said, and Johns agreed. In the
ard trauma protocol: completing the
ɛs, and X-rays. Maybe five minutes

inety-two percent—not a dramatic
ɛnt who is being manually ventilated.
ff her finger. It hadn't. "Is the oxygen

—no collapse. "We've got to get her
mask and tried again.
ɔeen aware of the possibility that her
al-cord swelling or blood. If it was,
he only chance she'd have to survive
ing a hole in her neck and inserting a
attempt to intubate her might even

trigger a spasm of the cords and a sudden closure of the airway—which is exactly what did happen.

If I had actually thought this far along, I would have recognized how ill-prepared I was to do an emergency "trache." Of the people in the room, it's true, I had the most experience doing tracheostomies, but that wasn't saying much. I had been the assistant surgeon in only about half a dozen, and all but one of them had been non-emergency cases, employing techniques that were not designed for speed. The exception was a practice emergency trache I had done on a goat. I should have immediately called Dr. Ball for backup. I should have got the trache equipment out—lighting, suction, sterile instruments—just in case. Instead of hurrying the effort to get the patient intubated because of a mild drop in saturation, I should have asked Johns to wait until I had help nearby. I might even have recognized that she was already losing her airway. Then I could have grabbed a knife and started cutting her a tracheostomy while things were still relatively stable and I had time to proceed slowly. But for whatever reasons—hubris, inattention, wishful thinking, hesitation, or the uncertainty of the moment—I let the opportunity pass.

Johns hunched over the patient, intently trying to insert the tube through her vocal cords. When her sat once again dropped into the sixties, he stopped and put the mask back on. We stared at the monitor. The numbers weren't coming up. Her lips were still blue. Johns squeezed the bellows harder to blow more oxygen in.

"I'm getting resistance," he said.

The realization crept over me: this was a disaster. "Damn it, we've lost her airway," I said. "Trache kit! Light! Somebody call down to O.R. 25 and get Ball up here!"

People were suddenly scurrying everywhere. I tried to proceed deliberately, 25
and not let panic take hold. I told the surgical intern to get a sterile gown and gloves on. I took a bactericidal solution off a shelf and dumped a whole bottle of yellow-brown liquid on the patient's neck. A nurse unwrapped the tracheostomy kit—a sterilized set of drapes and instruments. I pulled on a gown and a new pair of gloves while trying to think through the steps. This is simple, really, I tried to tell myself. At the base of the thyroid cartilage, the Adam's apple, is a little gap in which you find a thin, fibrous covering called the cricothyroid membrane. Cut through that and—voilà! You're in the trachea. You slip through the hole a four-inch plastic tube shaped like a plumber's elbow joint, hook it up to oxygen and a ventilator, and she's all set. Anyway, that was the theory.

I threw some drapes over her body, leaving the neck exposed. It looked as thick as a tree. I felt for the bony prominence of the thyroid cartilage. But I couldn't feel anything through the rolls of fat. I was beset by uncertainty—where should I cut? should I make a horizontal or a vertical incision?—and I hated myself for it. Surgeons never dithered, and I was dithering.

"I need better light," I said.

Someone was sent out to look for one.

"Did anyone get Ball?" I asked. It wasn't exactly an inspiring question.

"He's on his way," a nurse said. 30

There wasn't time to wait. Four minutes without oxygen would lead to permanent brain damage, if not death. Finally, I took the scalpel and cut. I just cut. I made a three-inch left-to-right swipe across the middle of the neck, following the procedure I'd learned for elective cases. I figured that if I worked through the fat I might be able to find the membrane in the wound. Dissecting down with scissors while the intern held the wound open with retractors, I hit a vein. It didn't let loose a lot of blood, but there was enough to fill the wound: I couldn't see anything. The intern put a finger on the bleeder. I called for suction. But the suction wasn't working; the tube was clogged with the clot from the intubation efforts.

"Somebody get some new tubing," I said. "And where's the light?"

Finally, an orderly wheeled in a tall overhead light, plugged it in, and flipped on the switch. It was still too dim; I could have done better with a flashlight.

I wiped up the blood with gauze, then felt around in the wound with my fingertips. This time, I thought I could feel the hard ridges of the thyroid cartilage and, below it, the slight gap of the cricothyroid membrane, though I couldn't be sure. I held my place with my left hand.

35 James O'Connor, a silver-haired, seen-it-all anesthesiologist, came into the room. Johns gave him a quick rundown on the patient and let him take over bagging her.

Holding the scalpel in my right hand like a pen, I stuck the blade down into the wound at the spot where I thought the thyroid cartilage was. With small, sharp strokes—working blindly, because of the blood and the poor light—I cut down through the overlying fat and tissue until I felt the blade scrape against the almost bony cartilage. I searched with the tip of the knife, walking it along until I felt it reach a gap. I hoped it was the cricothyroid membrane, and pressed down firmly. Then I felt the tissue suddenly give, and I cut an inch-long opening.

When I put my index finger into it, it felt as if I were prying open the jaws of a stiff clothespin. Inside, I thought I felt open space. But where were the sounds of moving air that I expected? Was this deep enough? Was I even in the right place?

"I think I'm in," I said, to reassure myself as much as anyone else.

"I hope so," O'Connor said. "She doesn't have much longer."

40 I took the tracheostomy tube and tried to fit it in, but something seemed to be blocking it. I twisted it and turned it, and finally jammed it in. Just then, Ball, the surgical attending, arrived. He rushed up to the bed and leaned over for a look. "Did you get it?" he asked. I said that I thought so. The bag mask was plugged onto the open end of the trache tube. But when the bellows were compressed the air just gurgled out of the wound. Ball quickly put on gloves and a gown.

"How long has she been without an airway?" he asked.

"I don't know. Three minutes."

Ball's face hardened as he registered that he had about a minute in which to turn things around. He took my place and summarily pulled out the trache tube.

"God, what a mess," he said. "I can't
if you're in the right place. Can we
tubing was found and handed to hi
went to work.

The patient's sat had dropped
it anymore. Her heart rate began sl
to the forties. Then she lost her p
her chest, locked my elbows, leane
pressions.

Ball looked up from the patient
get her an airway in time," he said.
Essentially, he was admitting my fa
pointless—just something to do in
and concentrated on doing chest cc
over, I thought.

And then, amazingly, O'Conn
pediatric-size endotracheal tube thro
oxygen being manually ventilated th
at a hundred and twenty beats a mi
climbed. Another thirty seconds a
people in the room exhaled, as if th
and I said little except to confer abou
downstairs to finish working on the

We eventually identified the wc
was thirty-four years old and lived a
on arrival had been three times the l
her unconsciousness. She had a conc
soft-tissue damage. But X-rays and
crash. That night, Ball and Hernan
a proper tracheostomy. When Ball c
told them of the dire condition she w
had had getting access to her airway
she had gone without oxygen, and th
function she still possessed. They list
them to do but wait.

II—THE BANALITY OF ERROR

To much of the public—and certai
error is a problem of bad physicians.
one, a general surgeon left a large
where it tore through the bowel and
cer surgeon biopsied the wrong part
her diagnosis of cancer for months.
step during a heart-valve operation,
a man racked with abdominal pain ir

tes without oxygen would lead to
ly, I took the scalpel and cut. I just
across the middle of the neck, fol-
e cases. I figured that if I worked
embrane in the wound. Dissecting
wound open with retractors, I hit
ıere was enough to fill the wound:
ger on the bleeder. I called for suc-
be was clogged with the clot from

l. "And where's the light?"
verhead light, plugged it in, and
I could have done better with a

felt around in the wound with my
el the hard ridges of the thyroid
cricothyroid membrane, though I
't hand.
all anesthesiologist, came into the
the patient and let him take over

ike a pen, I stuck the blade down
t the thyroid cartilage was. With
cause of the blood and the poor
t and tissue until I felt the blade
earched with the tip of the knife,
oped it was the cricothyroid mem-
e tissue suddenly give, and I cut an

t as if I were prying open the jaws
open space. But where were the
is deep enough? Was I even in the

lf as much as anyone else.
have much longer."
to fit it in, but something seemed
nd finally jammed it in. Just then,
ıed up to the bed and leaned over
that I thought so. The bag mask
tube. But when the bellows were
vound. Ball quickly put on gloves

vay?" he asked.

he had about a minute in which to
ımarily pulled out the trache tube.

"God, what a mess," he said. "I can't see a thing in this wound. I don't even know if you're in the right place. Can we get better light and suction?" New suction tubing was found and handed to him. He quickly cleaned up the wound and went to work.

The patient's sat had dropped so low that the oximeter couldn't detect it anymore. Her heart rate began slowing down—first to the sixties and then to the forties. Then she lost her pulse entirely. I put my hands together on her chest, locked my elbows, leaned over her, and started doing chest compressions.

Ball looked up from the patient and turned to O'Connor. "I'm not going to get her an airway in time," he said. "You're going to have to try from above." Essentially, he was admitting my failure. Trying an oral intubation again was pointless—just something to do instead of watching her die. I was stricken, and concentrated on doing chest compressions, not looking at anyone. It was over, I thought. 45

And then, amazingly, O'Connor: "I'm in." He had managed to slip a pediatric-size endotracheal tube through the vocal cords. In thirty seconds, with oxygen being manually ventilated through the tube, her heart was back, racing at a hundred and twenty beats a minute. Her sat registered at sixty and then climbed. Another thirty seconds and it was at ninety-seven percent. All the people in the room exhaled, as if they, too, had been denied their breath. Ball and I said little except to confer about the next steps for her. Then he went back downstairs to finish working on the stab-wound patient still in the O.R.

We eventually identified the woman, whom I'll call Louise Williams; she was thirty-four years old and lived alone in a nearby suburb. Her alcohol level on arrival had been three times the legal limit, and had probably contributed to her unconsciousness. She had a concussion, several lacerations, and significant soft-tissue damage. But X-rays and scans revealed no other injuries from the crash. That night, Ball and Hernandez brought her to the O.R. to fit her with a proper tracheostomy. When Ball came out and talked to family members, he told them of the dire condition she was in when she arrived, the difficulties "we" had had getting access to her airway, the disturbingly long period of time that she had gone without oxygen, and thus his uncertainty about how much brain function she still possessed. They listened without protest; there was nothing for them to do but wait.

II—THE BANALITY OF ERROR

To much of the public—and certainly to lawyers and the media—medical error is a problem of bad physicians. Consider some other surgical mishaps. In one, a general surgeon left a large metal instrument in a patient's abdomen, where it tore through the bowel and the wall of the bladder. In another, a cancer surgeon biopsied the wrong part of a woman's breast and thereby delayed her diagnosis of cancer for months. A cardiac surgeon skipped a small but key step during a heart-valve operation, thereby killing the patient. A surgeon saw a man racked with abdominal pain in the emergency room and, without taking

a C.T. scan, assumed that the man had a kidney stone; eighteen hours later, a scan showed a rupturing abdominal aortic aneurysm, and the patient died not long afterward.

How could anyone who makes a mistake of that magnitude be allowed to practice medicine? We call such doctors "incompetent," "unethical," and "negligent." We want to see them punished. And so we've wound up with the public system we have for dealing with error: malpractice lawsuits, media scandal, suspensions, firings.

50 There is, however, a central truth in medicine that complicates this tidy vision of misdeeds and misdoers: *All* doctors make terrible mistakes. Consider the cases I've just described. I gathered them simply by asking respected surgeons I know—surgeons at top medical schools—to tell me about mistakes they had made just in the past year. Every one of them had a story to tell.

In 1991, *The New England Journal of Medicine* published a series of landmark papers from a project known as the Harvard Medical Practice Study—a review of more than thirty thousand hospital admissions in New York State. The study found that nearly four percent of hospital patients suffered complications from treatment which prolonged their hospital stay or resulted in disability or death, and that two-thirds of such complications were due to errors in care. One in four, or one percent of admissions, involved actual negligence. It was estimated that, nationwide, a hundred and twenty thousand patients die each year at least partly as a result of errors in care. And subsequent investigations around the country have confirmed the ubiquity of error. In one small study of how clinicians perform when patients have a sudden cardiac arrest, twenty-seven of thirty clinicians made an error in using the defibrillator; they may have charged it incorrectly or lost valuable time trying to figure out how to work a particular model. According to a 1995 study, mistakes in administering drugs—giving the wrong drug or the wrong dose, say—occur, on the average, about once for every hospital admission, mostly without ill effects, but one percent of the time with serious consequences.

If error were due to a subset of dangerous doctors, you might expect malpractice cases to be concentrated among a small group, but in fact they follow a uniform, bell-shaped distribution. Most surgeons are sued at least once in the course of their careers. Studies of specific types of error, too, have found that repeat offenders are not the problem. The fact is that virtually everyone who cares for hospital patients will make serious mistakes, and even commit acts of negligence, every year. For this reason, doctors are seldom outraged when the press reports yet another medical horror story. They usually have a different reaction: *That could be me.* The important question isn't how to keep bad physicians from harming patients; it's how to keep good physicians from harming patients.

Medical-malpractice suits are a remarkably ineffective remedy. Troyen Brennan, a Harvard professor of law and public health, points out that research has consistently failed to find evidence that litigation reduces medical-error rates. In part, this may be because the weapon is so imprecise. Brennan led

several studies following up on
Study. He found that fewer than
substandard care ever filed suit.
patients who did sue had in fa
patient's likelihood of winning
her outcome was, regardless of w
unavoidable risks of care.

The deeper problem with n
demonizing errors they prevent
them publicly. The tort system m
pushes each to offer a heavily sla
it's almost impossible for a phys
takes. Hospital lawyers warn do
patients about complications tha
were at fault, lest the "confessio
black-and-white morality tale. At
didn't go as well as we had hoped

There is one place, however
mistakes, if not with patients, th
Morbidity and Mortality Confere
place, usually once a week, at n
This institution survives becaus
discovery have stayed on the bool
Surgeons, in particular, take th
behind closed doors to review t
occurred on their watch, determ
differently next time.

III—SHOW AND TELL

At my hospital, we convene eve
amphitheatre lined with oil porti
we're meant to live up to. All surg
to the chairman of surgery; we'r
surgery "rotation." An M. & M. c
in, pick up a photocopied list of c
front row is occupied by the most
their scrubs and in dark suits, line
chairman is a leonine presence ir
from which each case is presente
gical attending; these tend to be
chief residents have put on long
join the mass of other residents,
pants, occupying the back rows.

For each case, the chief resi
cular, trauma, and so on—gath

several studies following up on the patients in the Harvard Medical Practice Study. He found that fewer than two percent of the patients who had received substandard care ever filed suit. Conversely, only a small minority among the patients who did sue had in fact been the victims of negligent care. And a patient's likelihood of winning a suit depended primarily on how poor his or her outcome was, regardless of whether that outcome was caused by disease or unavoidable risks of care.

The deeper problem with medical-malpractice suits, however, is that by demonizing errors they prevent doctors from acknowledging and discussing them publicly. The tort system makes adversaries of patient and physician, and pushes each to offer a heavily slanted version of events. When things go wrong, it's almost impossible for a physician to talk to a patient honestly about mistakes. Hospital lawyers warn doctors that, although they must, of course, tell patients about complications that occur, they are never to intimate that they were at fault, lest the "confession" wind up in court as damning evidence in a black-and-white morality tale. At most, a doctor might say, "I'm sorry that things didn't go as well as we had hoped."

There is one place, however, where doctors can talk candidly about their mistakes, if not with patients, then at least with one another. It is called the Morbidity and Mortality Conference—or, more simply, M. & M.—and it takes place, usually once a week, at nearly every academic hospital in the country. This institution survives because laws protecting its proceedings from legal discovery have stayed on the books in most states, despite frequent challenges. Surgeons, in particular, take the M. & M. seriously. Here they can gather behind closed doors to review the mistakes, complications, and deaths that occurred on their watch, determine responsibility, and figure out what to do differently next time. 55

III—Show and Tell

At my hospital, we convene every Tuesday at five o'clock in a steep, plush amphitheatre lined with oil portraits of the great doctors whose achievements we're meant to live up to. All surgeons are expected to attend, from the interns to the chairman of surgery; we're also joined by medical students doing their surgery "rotation." An M. & M. can include almost a hundred people. We file in, pick up a photocopied list of cases to be discussed, and take our seats. The front row is occupied by the most senior surgeons: terse, serious men, now out of their scrubs and in dark suits, lined up like a panel of senators at a hearing. The chairman is a leonine presence in the seat closest to the plain wooden podium from which each case is presented. In the next few rows are the remaining surgical attending; these tend to be younger, and several of them are women. The chief residents have put on long white coats and usually sit in the side rows. I join the mass of other residents, all of us in short white coats and green scrub pants, occupying the back rows.

For each case, the chief resident from the relevant service—cardiac, vascular, trauma, and so on—gathers the information, takes the podium, and

tells the story. Here's a partial list of cases from a typical week (with a few changes to protect confidentiality): a sixty-eight-year-old man who bled to death after heart-valve surgery; a forty-seven-year-old woman who had to have a reoperation because of infection following an arterial bypass done in her left leg; a forty-four-year-old woman who had to have bile drained from her abdomen after gall-bladder surgery; three patients who had to have reoperations for bleeding following surgery; a sixty-three-year-old man who had a cardiac arrest following heart-bypass surgery; a sixty-six-year-old woman whose sutures suddenly gave way in an abdominal wound and nearly allowed her intestines to spill out. Ms. Williams's case, my failed tracheostomy, was just one case on a list like this. David Hernandez, the chief trauma resident, had subsequently reviewed the records and spoken to me and others involved. When the time came, it was he who stood up front and described what had happened.

Hernandez is a tall, rollicking, good old boy who can tell a yarn, but M. & M. presentations are bloodless and compact. He said something like: "This was a thirty-four-year-old female unrestrained driver in a high-speed rollover. The patient apparently had stable vitals at the scene but was unresponsive, and brought in by ambulance unintubated. She was G.C.S. 7 on arrival." G.C.S. stands for the Glasgow Coma Scale, which rates the severity of head injuries, from three to fifteen. G.C.S. 7 is in the comatose range. "Attempts to intubate were made without success in the E.R. and may have contributed to airway closure. A cricothyroidotomy[4] was attempted without success."

These presentations can be awkward. The chief residents, not the attendings, determine which cases to report. That keeps the attending honest—no one can cover up mistakes—but it puts the chief residents, who are, after all, underlings, in a delicate position. The successful M. & M. presentation inevitably involves a certain elision of detail and a lot of passive verbs. No one screws up a cricothyroidotomy. Instead, "a cricothyroidotomy was attempted without success." The message, however, was not lost on anyone.

60 Hernandez continued, "The patient arrested and required cardiac compressions. Anesthesia was then able to place a pediatric E.T. tube and the patient recovered stable vitals. The tracheostomy was then completed in the O.R."

So Louise Williams had been deprived of oxygen long enough to go into cardiac arrest, and everyone knew that meant she could easily have suffered a disabling stroke or been left a vegetable. Hernandez concluded with the fortunate aftermath: "Her workup was negative for permanent cerebral damage or other major injuries. The tracheostomy was removed on Day 2. She was discharged to home in good condition on Day 3." To the family's great relief, and mine, she had woken up in the morning a bit woozy but hungry, alert, and mentally intact. In a few weeks, the episode would heal to a scar.

4. An emergency incision through the cricothyroid membrane to secure a patient's airway during an emergency—described in paragraphs 31–46.

But not before someon
ately thundered, "What do
out success?'" I sank into m

"This was my case," Dr
attending begins, and that
all the talk in business sch
"flat organizations," surge
When things go wrong, th
makes no difference whet
ated an aorta; it doesn't ma
a nurse gave a wrong dose
sibility falls on the attendi

Ball went on to descri
liams and his own failure
He described the bad lighti
make those sound not like
attending shook their head
clarify certain details. Thr
the air of a CNN newscast

As always, the chairm
service, asked the final qu
done differently? Well, Ba
patient under control in th
up to the E.R. at that poin
self came up. People nodd

At no point during the
for help sooner or why I
needed. This is not to say t
hierarchy, addressing my e
had caught me in the hall
than angry as he went thr
emergency tracheostomy it
that would have kept me
something I should have
much easier time getting h
than mere ignorance, he d
were clear signs of airway
to be better prepared for s

Even after Ball had g
of shame like a burning u
you have done somethin
wrong. And yet I also kne
one thing to be aware of

5. The capital of Malaysia; i
1990s when the deputy prim

But not before someone was called to account. A front-row voice immediately thundered, "What do you mean, 'A cricothyroidotomy was attempted without success?'" I sank into my seat, my face hot.

"This was my case," Dr. Ball volunteered from the front row. It is how every attending begins, and that little phrase contains a world of surgical culture. For all the talk in business schools and in corporate America about the virtues of "flat organizations," surgeons maintain an old-fashioned sense of hierarchy. When things go wrong, the attending is expected to take full responsibility. It makes no difference whether it was the resident's hand that slipped and lacerated an aorta; it doesn't matter whether the attending was at home in bed when a nurse gave a wrong dose of medication. At the M. & M., the burden of responsibility falls on the attending.

Ball went on to describe the emergency attending's failure to intubate Williams and his own failure to be at her bedside when things got out of control. He described the bad lighting and her extremely thick neck, and was careful to make those sound not like excuses but merely like complicating factors. Some attending shook their heads in sympathy. A couple of them asked questions to clarify certain details. Throughout, Ball's tone was objective, detached. He had the air of a CNN newscaster describing unrest in Kuala Lumpur.[5]

As always, the chairman, responsible for the over-all quality of our surgery service, asked the final question. What, he wanted to know, would Ball have done differently? Well, Ball replied, it didn't take long to get the stab-wound patient under control in the O.R., so he probably should have sent Hernandez up to the E.R. at that point or let Hernandez close the abdomen while he himself came up. People nodded. Lesson learned. Next case. 65

At no point during the M. & M. did anyone question why I had not called for help sooner or why I had not had the skill and knowledge that Williams needed. This is not to say that my actions were seen as acceptable. Rather, in the hierarchy, addressing my errors was Ball's role. The day after the disaster, Ball had caught me in the hall and taken me aside. His voice was more wounded than angry as he went through my specific failures. First, he explained, in an emergency tracheostomy it might have been better to do a vertical neck incision; that would have kept me out of the blood vessels, which run up and down—something I should have known at least from my reading. I might have had a much easier time getting her an airway then, he said. Second, and worse to him than mere ignorance, he didn't understand why I hadn't called him when there were clear signs of airway trouble developing. I offered no excuses. I promised to be better prepared for such cases and to be quicker to ask for help.

Even after Ball had gone down the fluorescent-lit hallway, I felt a sense of shame like a burning ulcer. This was not guilt: guilt is what you feel when you have done something wrong. What I felt was shame: *I* was what was wrong. And yet I also knew that a surgeon can take such feelings too far. It is one thing to be aware of one's limitations. It is another to be plagued by self-

5. The capital of Malaysia; it was hit by economic crisis and political unrest in the late 1990s when the deputy prime minister, Dato' Seri Anwar Ibrahim, was fired.

doubt. One surgeon with a national reputation told me about an abdominal operation in which he had lost control of bleeding while he was removing what turned out to be a benign tumor and the patient had died. "It was a clean kill," he said. Afterward, he could barely bring himself to operate. When he did operate, he became tentative and indecisive. The case affected his performance for months.

Even worse than losing self-confidence, though, is reacting defensively. There are surgeons who will see faults everywhere except in themselves. They have no questions and no fears about their abilities. As a result, they learn nothing from their mistakes and know nothing of their limitations. As one surgeon told me, it is a rare but alarming thing to meet a surgeon without fear. "If you're not a little afraid when you operate," he said, "you're bound to do a patient a grave disservice."

The atmosphere at the M. & M. is meant to discourage both attitudes—self-doubt and denial—for the M. & M. is a cultural ritual that inculcates in surgeons a "correct" view of mistakes. "What would you do differently?" a chairman asks concerning cases of avoidable complications. "Nothing" is seldom an acceptable answer.

70 In its way, the M. & M. is an impressively sophisticated and human institution. Unlike the courts or the media, it recognizes that human error is generally not something that can be deterred by punishment. The M. & M. sees avoiding error as largely a matter of will—of staying sufficiently informed and alert to anticipate the myriad ways that things can go wrong and then trying to head off each potential problem before it happens. Why do things go wrong? Because, doctors say, making them go right is hard stuff. It isn't damnable that an error occurs, but there is some shame to it. In fact, the M. & M.'s ethos can seem paradoxical. On the one hand, it reinforces the very American idea that error is intolerable. On the other hand, the very existence of the M. & M., its place on the weekly schedule, amounts to an acknowledgment that mistakes are an inevitable part of medicine.

But why do they happen so often? Lucian Leape, medicine's leading expert on error, points out that many other industries—whether the task is manufacturing semiconductors or serving customers at the Ritz-Carlton—simply wouldn't countenance error rates like those in hospitals. The aviation industry has reduced the frequency of operational errors to one in a hundred thousand flights, and most of those errors have no harmful consequences. The buzzword at General Electric these days is "Six Sigma," meaning that its goal is to make product defects so rare that in statistical terms they are more than six standard deviations away from being a matter of chance—almost a one-in-a-million occurrence.

Of course, patients are far more complicated and idiosyncratic than airplanes, and medicine isn't a matter of delivering a fixed product or even a catalogue of products; it may well be more complex than just about any other field of human endeavor. Yet everything we've learned in the past two decades—from cognitive psychology, from "human factors" engineering, from studies of

disasters like Three Mile Is
not only do all human bein
patterned ways. And system
exacerbating rather than eli

The British psychologis
that our propensity for certa
remarkable ability to think a
sory information that const
work through every situatio
tion present what Reason ca
cine teems with examples.
that relies on memory and a
a physician will sometimes
when the prescription is wri
(Computerized ordering sys
only a small minority of h
which manufacturers often
area rife with latent errors:
when they use cardiac defibi
You can also make the case
inadequate team communic

James Reason makes ar
ply occur; they evolve. In co
Human beings are impres
apparent, and systems ofter
and nurses routinely check a
not always become apparer
result of latent errors. A ph
scriptions. A machine's ala
surgeon available gets stuck
usually because a series of f

The M. & M. takes non
see it as a rather shabby appr
in medicine. It isn't enough
differently so that he and oth
the final actor in a chain of
therefore, believe that it's th
closer examination and corr
cine. And they can already c
ogy, which has adopted thei

6. In 1979 there was a partial
Island Nuclear Generating St
disaster occurred in Decembe
Madhya Pradesh, India, expos

disasters like Three Mile Island and Bhopal[6]—has yielded the same insights: not only do all human beings err but they err frequently and in predictable, patterned ways. And systems that do not adjust for these realities can end up exacerbating rather than eliminating error.

The British psychologist James Reason argues, in his book *Human Error,* that our propensity for certain types of error is the price we pay for the brain's remarkable ability to think and act intuitively—to sift quickly through the sensory information that constantly bombards us without wasting time trying to work through every situation anew. Thus systems that rely on human perfection present what Reason calls "latent errors"—errors waiting to happen. Medicine teems with examples. Take writing out a prescription, a rote procedure that relies on memory and attention, which we know are unreliable. Inevitably, a physician will sometimes specify the wrong dose or the wrong drug. Even when the prescription is written correctly, there's a risk that it will be misread. (Computerized ordering systems can almost eliminate errors of this kind, but only a small minority of hospitals have adopted them.) Medical equipment, which manufacturers often build without human operators in mind, is another area rife with latent errors: one reason physicians are bound to have problems when they use cardiac defibrillators is that the devices have no standard design. You can also make the case that onerous workloads, chaotic environments, and inadequate team communication all represent latent errors in the system.

James Reason makes another important observation: disasters do not simply occur; they evolve. In complex systems, a single failure rarely leads to harm. Human beings are impressively good at adjusting when an error becomes apparent, and systems often have built-in defenses. For example, pharmacists and nurses routinely check and counter-check physicians' orders. But errors do not always become apparent, and backup systems themselves often fail as a result of latent errors. A pharmacist forgets to check one of a thousand prescriptions. A machine's alarm bell malfunctions. The one attending trauma surgeon available gets stuck in the operating room. When things go wrong, it is usually because a series of failures conspire to produce disaster.

The M. & M. takes none of this into account. For that reason, many experts 75
see it as a rather shabby approach to analyzing error and improving performance in medicine. It isn't enough to ask what a clinician could or should have done differently so that he and others may learn for next time. The doctor is often only the final actor in a chain of events that set him or her up to fail. Error experts, therefore, believe that it's the process, not the individuals in it, which requires closer examination and correction. In a sense, they want to industrialize medicine. And they can already claim one success story: the specialty of anesthesiology, which has adopted their precepts and seen extraordinary results.

6. In 1979 there was a partial meltdown of a pressurized water reactor at Three Mile Island Nuclear Generating Station near Harrisburg, Pennsylvania; the Bhopal Gas disaster occurred in December 1984 at the Union Carbide pesticide plant in Bhopal, Madhya Pradesh, India, exposing 500,000 people to dangerous chemicals.

IV—NEARLY PERFECT

At the center of the emblem of the American Society of Anesthesiologists is a single word: "Vigilance." When you put a patient to sleep under general anesthesia, you assume almost complete control of the patient's body. The body is paralyzed, the brain rendered unconscious, and machines are hooked up to control breathing, heart rate, blood pressure—all the vital functions. Given the complexity of the machinery and of the human body, there are a seemingly infinite number of ways in which things can go wrong, even in minor surgery. And yet anesthesiologists have found that if problems are detected they can usually be solved. In the nineteen-forties, there was only one death resulting from anesthesia in every twenty-five hundred operations, and between the nineteen-sixties and the nineteen-eighties the rate had stabilized at one or two in every ten thousand operations.

But Ellison (Jeep) Pierce had always regarded even that rate as unconscionable. From the time he began practicing, in 1960, as a young anesthesiologist out of North Carolina and the University of Pennsylvania, he had maintained a case file of details from all the deadly anesthetic accidents he had come across or participated in. But it was one case in particular that galvanized him. Friends of his had taken their eighteen-year-old daughter to the hospital to have her wisdom teeth pulled, under general anesthesia. The anesthesiologist inserted the breathing tube into her esophagus instead of her trachea, which is a relatively common mishap, and then failed to spot the error, which is not. Deprived of oxygen, she died within minutes. Pierce knew that a one-in-ten-thousand death rate, given that anesthesia was administered in the United States an estimated thirty-five million times each year, meant thirty-five hundred avoidable deaths like that one.

In 1982, Pierce was elected vice-president of the American Society of Anesthesiologists and got an opportunity to do something about the death rate. The same year, ABC's "20/20" aired an exposé that caused a considerable stir in his profession. The segment began, "If you are going to go into anesthesia, you are going on a long trip, and you should not do it if you can avoid it in any way. General anesthesia [is] safe most of the time, but there are dangers from human error, carelessness, and a critical shortage of anesthesiologists. This year, six thousand patients will die or suffer brain damage." The program presented several terrifying cases from around the country. Between the small crisis that the show created and the sharp increases in physicians' malpractice-insurance premiums at that time, Pierce was able to mobilize the Society of Anesthesiologists around the problem of error.

He turned for ideas not to a physician but to an engineer named Jeffrey Cooper, the lead author of a ground-breaking 1978 paper entitled "Preventable Anesthesia Mishaps: A Study of Human Factors." An unassuming, fastidious man, Cooper had been hired in 1972, when he was twenty-six years old, by the Massachusetts General Hospital bioengineering unit, to work on developing machines for anesthesiology researchers. He gravitated toward the operating room, however, and spent hours there observing the anesthesi-

ologists, and one of th
machines were design
the concentration of
increased the concent
nique called "critical
nineteen-fifties to an
equipment might be c
built around carefully
detail as possible abou
and what factors contr
for patterns among dif

Getting open, hon
tration has a formalized
incidents, and its enorm
nerstones. Pilots who re
nity from punishment,
which has no interest
Jeffrey Cooper, it was p
physician, so that anes
interviewer.

The result was the
detailed analysis of thr
profession unlike anythi
assumption that the sta
anesthesiologists learne
thesia, when vigilance
errors in maintaining th
of an undetected discon
takes in managing the a
as important, Cooper er
equate experience, inade
among team members, h

The study provoked
was no concerted effor
Through the anesthesiol
he started, Pierce direct
Cooper had identified,
from around the world,
discussions.

It all worked. Hour
facturers began redesig
mind. Dials were standa
to prevent accidental ad
were changed so that ox

Where errors could
looking for reliable mea

ologists, and one of the first things he noticed was how poorly the anesthesia machines were designed. For example, a clockwise turn of a dial decreased the concentration of potent anesthetics in about half the machines but increased the concentration in the other half. He decided to borrow a technique called "critical incident analysis"—which had been used since the nineteen-fifties to analyze mishaps in aviation—in an effort to learn how equipment might be contributing to errors in anesthesia. The technique is built around carefully conducted interviews, designed to capture as much detail as possible about dangerous incidents: how specific accidents evolved and what factors contributed to them. This information is then used to look for patterns among different cases.

Getting open, honest reporting is crucial. The Federal Aviation Administration has a formalized system for analyzing and reporting dangerous aviation incidents, and its enormous success in improving airline safety rests on two cornerstones. Pilots who report an incident within ten days have automatic immunity from punishment, and the reports go to a neutral, outside agency, NASA, which has no interest in using the information against individual pilots. For Jeffrey Cooper, it was probably an advantage that he was an engineer, and not a physician, so that anesthesiologists regarded him as a discreet, unthreatening interviewer. 80

The result was the first in-depth, scientific look at errors in medicine. His detailed analysis of three hundred and fifty-nine errors provided a view of the profession unlike anything that had been seen before. Contrary to the prevailing assumption that the start of anesthesia ("takeoff") was the most dangerous part, anesthesiologists learned that incidents tended to occur in the middle of anesthesia, when vigilance waned. The most common kind of incident involved errors in maintaining the patient's breathing, and these were usually the result of an undetected disconnection or misconnection of the breathing tubing, mistakes in managing the airway, or mistakes in using the anesthesia machine. Just as important, Cooper enumerated a list of contributory factors, including inadequate experience, inadequate familiarity with equipment, poor communication among team members, haste, inattention, and fatigue.

The study provoked widespread debate among anesthesiologists, but there was no concerted effort to solve the problems until Jeep Pierce came along. Through the anesthesiology society at first, and then through a foundation that he started, Pierce directed funding into research on how to reduce the problems Cooper had identified, sponsored an international conference to gather ideas from around the world, and brought anesthesia-machine designers into safety discussions.

It all worked. Hours for anesthesiology residents were shortened. Manufacturers began redesigning their machines with fallible human beings in mind. Dials were standardized to turn in a uniform direction; locks were put in to prevent accidental administration of more than one anesthetic gas; controls were changed so that oxygen delivery could not be turned down to zero.

Where errors could not be eliminated directly, anesthesiologists began looking for reliable means of detecting them earlier. For example, because the

trachea and the esophagus are so close together, it is almost inevitable that an anesthesiologist will sometimes put the breathing tube down the wrong pipe. Anesthesiologists had always checked for this by listening with a stethoscope for breath sounds over both lungs. But Cooper had turned up a surprising number of mishaps—like the one that befell the daughter of Pierce's friends—involving undetected esophageal intubations. Something more effective was needed. In fact, monitors that could detect this kind of error had been available for years, but, in part because of their expense, relatively few anesthesiologists used them. One type of monitor could verify that the tube was in the trachea by detecting carbon dioxide being exhaled from the lungs. Another type, the pulse oximeter, tracked blood-oxygen levels, thereby providing an early warning that something was wrong with the patient's breathing system. Prodded by Pierce and others, the anesthesiology society made the use of both types of monitor for every patient receiving general anesthesia an official standard. Today, anesthesia deaths from misconnecting the breathing system or intubating the esophagus rather than the trachea are virtually unknown. In a decade, the over-all death rate dropped to just one in more than two hundred thousand cases—less than a twentieth of what it had been.

85 And the reformers have not stopped there. David Gaba, a professor of anesthesiology at Stanford, has focused on improving human performance. In aviation, he points out, pilot experience is recognized to be invaluable but insufficient: pilots seldom have direct experience with serious plane malfunction anymore. They are therefore required to undergo yearly training in crisis simulators. Why not doctors, too?

Gaba, a physician with training in engineering, led in the design of an anesthesia-simulation system known as the Eagle Patient Simulator. It is a life-size, computer-driven mannequin that is capable of amazingly realistic behavior. It has a circulation, a heartbeat, and lungs that take in oxygen and expire carbon dioxide. If you inject drugs into it or administer inhaled anesthetics, it will detect the type and amount, and its heart rate, its blood pressure, and its oxygen levels will respond appropriately. The "patient" can be made to develop airway swelling, bleeding, and heart disturbances. The mannequin is laid on an operating table in a simulation room equipped exactly like the real thing. Here both residents and experienced attending physicians learn to perform effectively in all kinds of dangerous, and sometimes freak, scenarios: an anesthesia-machine malfunction, a power outage, a patient who goes into cardiac arrest during surgery, and even a cesarean-section patient whose airway shuts down and who requires an emergency tracheostomy.

Though anesthesiology has unquestionably taken the lead in analyzing and trying to remedy "systems" failures, there are signs of change in other quarters. The American Medical Association, for example, set up its National Patient Safety Foundation in 1997 and asked Cooper and Pierce to serve on the board of directors. The foundation is funding research, sponsoring conferences, and attempting to develop new standards for hospital drug-ordering systems that could substantially reduce medication mistakes—the single most common type of medical error.

Even in surgery
instance, operating on
been a recurrent, if r
geon. Recently, howe
the body's bilateral s
American Academy o
ing them: make it sta
body part to be cut be

The Northern N
at Dartmouth, is anot
sort of in-depth inves
shown what can be d
belong to this consor
wound infections, unc
and tries to identify va
there were relatively
after bypass surgery,
The fluid used to "prin
diluted a patient's bloc
the greater the effect.
solutions to the proble
made mistakes in "ha
people in the operatin
a pilot's checklist for
duced a greater degre
those six hospitals fro
That meant two hund
England cardiac grou
exception; hard inform
hodgepodge of eviden
to surgical errors: the
the hospital's inexperi
thin staffing, poor tea
porate medicine, and
still don't know. Surge

V—GETTING IT RI

It was a routine gallbl
was a mother in her f
her round, antiseptic-
of bile like a deflated
gallstones form, as thi
of pain. Once we rem

There are risks t
decade ago, surgeons

it is almost inevitable that an
ıg tube down the wrong pipe.
istening with a stethoscope for
urned up a surprising number
: of Pierce's friends—involving
more effective was needed. In
ır had been available for years,
w anesthesiologists used them.
vas in the trachea by detecting
other type, the pulse oximeter,
ı early warning that something
Prodded by Pierce and others,
th types of monitor for every
l standard. Today, anesthesia
n or intubating the esophagus
In a decade, the over-all death
red thousand cases—less than

ɜ. David Gaba, a professor of
:oving human performance. In
:ognized to be invaluable but
:e with serious plane malfunc-
ndergo yearly training in crisis

ering, led in the design of an
e Patient Simulator. It is a life-
e of amazingly realistic behav-
that take in oxygen and expire
ninister inhaled anesthetics, it
:ate, its blood pressure, and its
atient" can be made to develop
:s. The mannequin is laid on an
:xactly like the real thing. Here
:icians learn to perform effec-
'reak, scenarios: an anesthesia-
ıt who goes into cardiac arrest
tient whose airway shuts down

taken the lead in analyzing and
;ns of change in other quarters.
ɔle, set up its National Patient
nd Pierce to serve on the board
h, sponsoring conferences, and
tal drug-ordering systems that
—the single most common type

Even in surgery there have been some encouraging developments. For instance, operating on the wrong knee or foot or other body part of a patient has been a recurrent, if rare, mistake. A typical response has been to fire the surgeon. Recently, however, hospitals and surgeons have begun to recognize that the body's bilateral symmetry makes these errors predictable. Last year, the American Academy of Orthopedic Surgeons endorsed a simple way of preventing them: make it standard practice for surgeons to initial, with a marker, the body part to be cut before the patient comes to surgery.

The Northern New England Cardiovascular Disease Study Group, based at Dartmouth, is another success story. Though the group doesn't conduct the sort of in-depth investigation of mishaps that Jeffrey Cooper pioneered, it has shown what can be done simply through statistical monitoring. Six hospitals belong to this consortium, which tracks deaths and complications (such as wound infections, uncontrolled bleeding, and stroke) arising from heart surgery and tries to identify various risk factors. Its researchers found, for example, that there were relatively high death rates among patients who developed anemia after bypass surgery, and that anemia developed most often in small patients. The fluid used to "prime" the heart-lung machine caused the anemia, because it diluted a patient's blood, so the smaller the patient (and his or her blood supply) the greater the effect. Members of the consortium now have several promising solutions to the problem. Another study found that a group at one hospital had made mistakes in "handoffs"—say, in passing preoperative lab results to the people in the operating room. The study group solved the problem by developing a pilot's checklist for all patients coming to the O.R. These efforts have introduced a greater degree of standardization, and so reduced the death rate in those six hospitals from four percent to three percent between 1991 and 1996. That meant two hundred and ninety-three fewer deaths. But the Northern New England cardiac group, even with its narrow focus and techniques, remains an exception; hard information about how things go wrong is still scarce. There is a hodgepodge of evidence that latent errors and systemic factors may contribute to surgical errors: the lack of standardized protocols, the surgeon's inexperience, the hospital's inexperience, inadequately designed technology and techniques, thin staffing, poor teamwork, time of day, the effects of managed care and corporate medicine, and so on and so on. But which are the major risk factors? We still don't know. Surgery, like most of medicine, awaits its Jeff Cooper.

V—Getting It Right

It was a routine gallbladder operation, on a routine day: on the operating table 90
was a mother in her forties, her body covered by blue paper drapes except for her round, antiseptic-coated belly. The gallbladder is a floppy, finger-length sac of bile like a deflated olive-green balloon tucked under the liver, and when gallstones form, as this patient had learned, they can cause excruciating bouts of pain. Once we removed her gallbladder, the pain would stop.

There are risks to this surgery, but they used to be much greater. Just a decade ago, surgeons had to make a six-inch abdominal incision that left

patients in the hospital for the better part of a week just recovering from the wound. Today, we've learned to take out gallbladders with a minute camera and instruments that we manipulate through tiny incisions. The operation, often done as day surgery, is known as laparoscopic cholecystectomy, or "lap chole." Half a million Americans a year now have their gallbladders removed this way; at my hospital alone, we do several hundred lap choles annually.

When the attending gave me the go-ahead, I cut a discreet inch-long semicircle in the wink of skin just above the belly button. I dissected through fat and fascia until I was inside the abdomen, and dropped into place a "port," a half-inch-wide sheath for slipping instruments in and out. We hooked gas tubing up to a side vent on the port, and carbon dioxide poured in, inflating the abdomen until it was distended like a tire. I inserted the miniature camera. On a video monitor a few feet away, the woman's intestines blinked into view. With the abdomen inflated, I had room to move the camera, and I swung it around to look at the liver. The gallbladder could be seen poking out from under the edge.

We put in three more ports through even tinier incisions, spaced apart to complete the four corners of a square. Through the ports on his side, the attending put in two long "graspers," like small-scale versions of the device that a department-store clerk might use to get a hat off the top shelf. Watching the screen as he maneuvered them, he reached under the edge of the liver, clamped onto the gallbladder, and pulled it up into view. We were set to proceed.

Removing the gallbladder is fairly straightforward. You sever it from its stalk and from its blood supply, and pull the rubbery sac out of the abdomen through the incision near the belly button. You let the carbon dioxide out of the belly, pull out the ports, put a few stitches in the tiny incisions, slap some Band-Aids on top, and you're done. There's one looming danger, though: the stalk of the gallbladder is a branch off the liver's only conduit for sending bile to the intestines for the digestion of fats. And if you accidentally injure this main bile duct, the bile backs up and starts to destroy the liver. Between ten and twenty percent of the patients to whom this happens will die. Those who survive often have permanent liver damage and can go on to require liver transplantation. According to a standard textbook, "injuries to the main bile duct are nearly always the result of misadventure during operation and are therefore a serious reproach to the surgical profession." It is a true surgical error, and, like any surgical team doing a lap chole, we were intent on avoiding this mistake.

95 Using a dissecting instrument, I carefully stripped off the fibrous white tissue and yellow fat overlying and concealing the base of the gallbladder. Now we could see its broad neck and the short stretch where it narrowed down to a duct—a tube no thicker than a strand of spaghetti peeking out from the surrounding tissue, but magnified on the screen to the size of major plumbing. Then, just to be absolutely sure we were looking at the gallbladder duct and not the main bile duct, I stripped away some more of the surrounding tissue. The attending and I stopped at this point, as we always do, and discussed the anatomy. The neck of the gallbladder led straight into the tube we were eying. So it had to be the right duct. We had exposed a good length of it without a sign

of the main bile duct. Ev
attending said.

I slipped in the clip
clips onto whatever you p
about to fire when my eye
top of the duct. That wasn
look right. With the tip of
a little globule, a whole la
we saw that the duct had
extra fastidiousness, I wo

Here was the parad
and assiduous effort to in
surgeons need never cut
error. At the same time,
inflict this terrible injury
another way, I may have
that, no matter how har
least once in the course c

But the story doesn't
industrial-error experts h
in anesthesiology, it's clea
after the process, not the
trial cure, however neces
be deadly for us, the indi
ibility. The statistics may
but each time I go into a
and effort I can beat the o
part of good medicine, ev
that lap chole have taught
me something else: effort
details can save you.

This may explain wh
problems," "continuous qu
the dry language of struct
too, demands an acknowl
mate culpability. Go back
I stood, knife in hand, ove
bloody, and suddenly clos
some useful changes. Perh
and better light more easil
me better for such crises
more goats. Perhaps eme
cumstances that an autor
job. But the could-haves
worn her seat belt, or hac
these factors latent errors

of the main bile duct. Everything looked perfect, we agreed. "Go for it," the attending said.

I slipped in the clip applier, an instrument that squeezes V-shaped metal clips onto whatever you put in its jaws. I got the jaws around the duct and was about to fire when my eye caught, on the screen, a little globule of fat lying on top of the duct. That wasn't necessarily anything unusual, but somehow it didn't look right. With the tip of the clip applier, I tried to flick it aside, but, instead of a little globule, a whole layer of thin unseen tissue came up, and, underneath, we saw that the duct had a fork in it. My stomach dropped. If not for that little extra fastidiousness, I would have clipped off the main bile duct.

Here was the paradox of error in medicine. With meticulous technique and assiduous effort to insure that they have correctly identified the anatomy, surgeons need never cut the main bile duct. It is a paradigm of an avoidable error. At the same time, studies show that even highly experienced surgeons inflict this terrible injury about once in every two hundred lap choles. To put it another way, I may have averted disaster this time, but a statistician would say that, no matter how hard I tried, I was almost certain to make this error at least once in the course of my career.

But the story doesn't have to end here, as the cognitive psychologists and industrial-error experts have demonstrated. Given the results they've achieved in anesthesiology, it's clear that we can make dramatic improvements by going after the process, not the people. But there are distinct limitations to the industrial cure, however necessary its emphasis on systems and structures. It would be deadly for us, the individual actors, to give up our belief in human perfectibility. The statistics may say that someday I will sever someone's main bile duct, but each time I go into a gallbladder operation I believe that with enough will and effort I can beat the odds. This isn't just professional vanity. It's a necessary part of good medicine, even in superbly "optimized" systems. Operations like that lap chole have taught me how easily error can occur, but they've also showed me something else: effort does matter; diligence and attention to the minutest details can save you.

This may explain why many doctors take exception to talk of "systems problems," "continuous quality improvement," and "process reëngineering." It is the dry language of structures, not people. I'm no exception: something in me, too, demands an acknowledgment of my autonomy, which is also to say my ultimate culpability. Go back to that Friday night in the E.R., to the moment when I stood, knife in hand, over Louise Williams, her lips blue, her throat a swollen, bloody, and suddenly closed passage. A systems engineer might have proposed some useful changes. Perhaps a backup suction device should always be at hand, and better light more easily available. Perhaps the institution could have trained me better for such crises, could have required me to have operated on a few more goats. Perhaps emergency tracheostomies are so difficult under any circumstances that an automated device could have been designed to do a better job. But the could-haves are infinite, aren't they? Maybe Williams could have worn her seat belt, or had one less beer that night. We could call any or all of these factors latent errors, accidents waiting to happen.

100 But although they put the odds against me, it wasn't as if I had no chance of succeeding. Good doctoring is all about making the most of the hand you're dealt, and I failed to do so. The indisputable fact was that I hadn't called for help when I could have, and when I plunged the knife into her neck and made my horizontal slash my best was not good enough. It was just luck, hers and mine, that Dr. O'Connor somehow got a breathing tube into her in time.

There are all sorts of reasons that it would be wrong to take my license away or to take me to court. These reasons do not absolve me. Whatever the limits of the M. & M., its fierce ethic of personal responsibility for errors is a formidable virtue. No matter what measures are taken, medicine will sometimes falter, and it isn't reasonable to ask that it achieve perfection. What's reasonable is to ask that medicine never cease to aim for it.

QUESTIONS

1. Gawande states flatly: "*All* doctors make terrible mistakes" (paragraph 50), and then proceeds to analyze why. What are the main reasons he offers?

2. In section IV, "Nearly Perfect," Gawande discusses attempts by different medical groups to eliminate or reduce error. What approaches have been effective? What are the limits of these approaches?

3. Although it incorporates significant research, this essay fits the genre of the personal narrative. At the beginning and end, Gawande narrates two of his experiences in the operating room. Are these examples similar or different? Does the rhetorical purpose of the anecdote stay the same, or does it change as Gawande moves through his discussion of medical error? Explain.

4. Narrate a personal experience in which you made a serious error. Try, like Gawande, to incorporate the research or advice of others who might help you understand the reasons for your error.