

# The Conscious Mind

**Karen Ann Quinlan case yields surprising scientific data**

By KATHY A. FACKELMANN

*I think, therefore I am.* — René Descartes

**S**eventeenth-century French philosopher and mathematician Descartes believed that the body, with its mechanical inner workings, is distinct from the mind, which holds the essence of a human being.

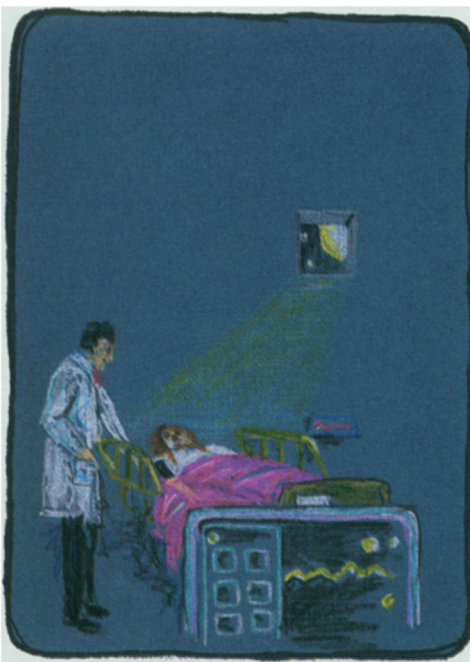
Modern neuroscientists still struggle with the definition of the human mind. Is it merely a collection of neurons firing electrical impulses, or is it a good deal more than that?

The literature on Karen Ann Quinlan, who died in the mid-1980s, harkens back to that age-old dichotomy between the body and the mind. A research team may now have closed the final chapter on Quinlan's remarkable story, though not on the mind-body split. Their investigation reveals a surprising anatomical location for the damage that left Quinlan in a persistent vegetative state, a condition in which her body continued to function but her mind never fully awakened.

Descartes believed that the root of the human mind lies in the pineal gland, a small clump of endocrine tissue resting in the very center of the brain. The new study, which relied on sophisticated computer techniques, shows he wasn't too far off.

**K**aren Ann Quinlan had been drinking gin and tonics with friends on April 14, 1975. She had also been taking the tranquilizer Valium and the pain-killing drug Darvon. The combination proved nearly lethal.

The drug-alcohol mixture stopped Quinlan's heart and her respiration. Para-



medics revived her within the hour, but she had already lapsed into a state of profound unconsciousness, or coma.

At this stage, Quinlan, like other comatose patients, showed few outward signs of life. Her eyes were closed.

The lack of oxygen during Quinlan's cardiopulmonary arrest had permanently damaged her brain. Soon after the accident, physicians told her family that she would never recover. But because they feared a malpractice suit, the doc-

tors refused to take Quinlan off the ventilator that was helping her breathe (SN: 10/4/75, p.213). So her parents, Joseph and Julia Quinlan, petitioned a New Jersey court to have their daughter's ventilator shut off.

The court granted their request, and doctors removed the ventilator in 1976. By that time, Karen Ann Quinlan had entered a different level of unconsciousness—a persistent vegetative state.

She continued to breathe without any mechanical assistance. Her heart continued to beat. Her body even went through normal sleep and wake cycles. Upon “waking up” in the morning, Quinlan opened her eyes, but the environment around her didn't register.

Although her body roused itself from sleep each day, the conscious, or aware, part of Quinlan's mind never returned to think, speak, or feel emotion. She had entered a 20th-century no-man's-land. She remained in this persistent vegetative state for a decade after the accident, dying in 1985 of massive infections.

Robert Goode of the New Jersey Medical Examiner's Office performed the autopsy. At that time, Goode removed Quinlan's brain and preserved it in formalin, a standard fixative.

**T**he next phase of this story began in 1988, when Goode asked Hannah C. Kinney, a pathologist at Children's Hospital in Boston, if she would be interested in studying Quinlan's brain. Kinney had done previous work on the brainstem, the region of the brain that connects the spinal cord with the cerebrum, the thinking part of the brain.

Like a detective who searches the scene long after a car crash, Kinney had to try to piece together what had happened to Quinlan after that fateful April day some 13 years before.

Kinney knew previous studies had shown that people in a persistent vegetative state suffer extensive damage to the cerebral cortex, the gray matter that forms the outer layer of the human brain. The gray matter is thought to be important in memory, thought, language, and intellect.

The research team scientist reasoned that in Quinlan's brain the damage would prove no different. But when Kinney examined sections of Quinlan's cerebral cortex under the microscope, she found it relatively intact. Kinney began to wonder if the critical damage to Quinlan's brain lay elsewhere.

To find out, she first prepared Quinlan's brain for a more thorough study by embedding it in paraffin, a waxy substance. Next, she made very thin slices of the entire brain and spinal cord and mounted them on slides for study. Kinney then paired the pathologist's time-honored tool — the microscope — with a computer and began the painstaking process of hunting for signs of damaged tissue.

"Basically, I looked for areas of neuronal loss or scarring," she says.

Using the computer to outline discrete areas of tissue, she charted regions of Quinlan's brain. In the end, she had a three-dimensional map of the precise locations of the lesions, or injuries, in Quinlan's brain.

Surprisingly, the most striking damage to neurons occurred in the thalamus, two oval-shaped areas deep within the brain that lie not far from the pineal gland.

Indeed, Kinney says, it was as if someone had taken a laser and wiped out both regions of the thalamus without doing any substantial injury to important nearby areas.

One function of the thalamus in the healthy brain is to act as a kind of switching station, explains neurologist Julius Korein of the New York University Medical Center in New York City. Korein was one of the physicians who examined Quinlan in preparation for her parents' court hearing.

"Every sensory input except smell goes through the thalamus to get to the cortex," notes Kinney.

Thus, when a person spies a rose, the information travels from the eye to the thalamus and then on to the cortex, where the separate properties of shape and color may register.

But to recognize the rose as a rose, the person needs another part of the thalamus. Researchers believe that part, the pulvinar region, helps humans integrate the disparate bits of information coming in from the senses. The pulvinar may help the cortex piece together color,

shape, and other rose characteristics to come up with a coherent picture of the whole flower.

Kinney found that both the relay and the integrating areas of the thalamus had sustained extensive damage. That neuronal death had cut Quinlan off from the outside world. Most sensory information that came into the thalamus never made it to the cortex.

---

## **This study, and others like it, may help scientists understand the nature of human consciousness.**

---

The study revealed another important fact: The part of Quinlan's brain responsible for respiration, heart rate, and other automatic bodily functions had sustained less of a hit. That finding correlates with the fact that Quinlan continued

to breathe on her own after doctors removed the mechanical ventilator.

Kinney, Korein, Goode, and their colleagues report their findings in the May 26 *NEW ENGLAND JOURNAL OF MEDICINE* (NEJM).

The researchers can't explain why some areas of Quinlan's brain suffered severe injury and others appeared less damaged. Although Quinlan's entire body received insufficient oxygen during her cardiopulmonary arrest, Kinney speculates that a swelling in the brain might have completely cut off blood flow to the thalamus and other key regions. By the time Quinlan's breathing was restored, neurons in those areas had already died in mass numbers.

**W**hile it is well known that damage to the cerebral cortex can lead to persistent vegetative state, the new study suggests for the first time that targeted injury to the thalamus can also cause this condition.

These findings argue against the traditional view of the thalamus as simply a relay station in the brain, Korein says. The new study and other research indicate that the thalamus does more substantive work. In fact, this brain region may play a key role, along with the cerebral cortex, in human awareness.

What's more, this study, and others like it, may help scientists understand the nature of human consciousness — and how, or whether, the healthy human brain becomes something more than the sum of its parts. □

---

## **Right To Die**

Of course, the brain-dead standard does not apply to patients in a persistent vegetative state, who have lost just higher cognitive functions.

Yet thanks to Joseph and Julia Quinlan, there now exists a legal consensus that family members may authorize doctors to discontinue life-sustaining treatment for such patients.

Today, the debate has shifted to cases in which the family wants to continue medical treatment, even when no recovery is possible.

"Instead of families like the Quinlans asking to stop life-sustaining treatment over the objections of doctors or hospitals, we are seeing doctors who wish to stop treatment over the objections of the family," Angell says.

Such cases are wending their way through the nation's legal system now. Angell believes more public debate is necessary before society can come up with solutions to these heart-wrenching situations.

"This is not just a medical matter," she says. — *K.A. Fackelman*