The recent news about smoking was sensational: some people with damage to a prune-size slab of brain tissue called the insula were able to give up cigarettes instantly.

Suppose scientists could figure out how to tweak the insula without damaging it. They might be able to create that famed and elusive free lunch — an effortless way to kick the cigarette habit.

That dream, which may not be too far off, puts the insula in the spotlight. What is the insula and how could it possibly exert such profound effects on human behavior?

According to neuroscientists who study it, the insula is a long-neglected brain region that has emerged as crucial to understanding what it feels like to be human.

They say it is the wellspring of social emotions, things like lust and disgust, pride and humiliation, guilt and atonement. It helps give rise to moral intuition, empathy and the capacity to respond emotionally to music.

Its anatomy and evolution shed light on the profound differences between humans and other animals.

The insula also reads body states like hunger and craving and helps push people into reaching for the next sandwich, cigarette or line of cocaine. So insula research offers new ways to think about treating drug addiction, alcoholism, anxiety and eating disorders.

Of course, so much about the brain remains to be discovered that the insula’s role may be a minor character in the play of the human mind. It is just now coming on stage.

The activity of the insula in so many areas is something of a puzzle. “People have had a hard time conceptualizing what the insula does,” said Dr. Martin Paulus, a psychiatrist at the University of California, San Diego.

If it does everything, what exactly is it that it does?

For example, the insula “lights up” in brain scans when people crave drugs, feel pain, anticipate pain, empathize with others, listen to jokes, see disgust on someone’s face, are shunned in a social settings, listen to music, decide not to buy an item, see someone cheat and decide to punish them, and determine degrees of preference while eating chocolate.

Damage to the insula can lead to apathy, loss of libido and an inability to tell fresh food from rotten.

The bottom line, according to Dr. Paulus and others, is that mind and body are integrated in the insula. It
provides unprecedented insight into the anatomy of human emotions.

Of course, like every important brain structure, the insula — there are actually two, one on each side of the brain — does not act alone. It is part of multiple circuits.

The insula itself is a sort of receiving zone that reads the physiological state of the entire body and then generates subjective feelings that can bring about actions, like eating, that keep the body in a state of internal balance. Information from the insula is relayed to other brain structures that appear to be involved in decision making, especially the anterior cingulate and prefrontal cortices.

The insula was long ignored for two reasons, researchers said. First, because it is folded and tucked deep within the brain, scientists could not probe it with shallow electrodes. It took the invention of brain imaging techniques, such as functional magnetic resonance imaging, or fMRI, to watch it in action.

Second, the insula was “assigned to the brain’s netherworld,” said John Allman, a neuroscientist at the California Institute of Technology. It was mistakenly defined as a primitive part of the brain involved only in functions like eating and sex. Ambitious scientists studied higher, more rational parts of the brain, he said.

The insula emerged from darkness a decade ago when Antonio Damasio, a neuroscientist now at the University of Southern California, developed the so-called somatic marker hypothesis, the idea that rational thinking cannot be separated from feelings and emotions. The insula, he said, plays a starring role.

Another neuroscientist, Arthur D. Craig at the Barrow Neurological Institute in Phoenix, went on to describe exactly the circuitry that connects the body to the insula.

According to Dr. Craig, the insula receives information from receptors in the skin and internal organs. Such receptors are nerve cells that specialize in different senses. Thus there are receptors that detect heat, cold, itch, pain, taste, hunger, thirst, muscle ache, visceral sensations and so-called air hunger, the need to breathe. The sense of touch and the sense of the body’s position in space are routed to different brain regions, he said.

All mammals have insulas that read their body condition, Dr. Craig said. Information about the status of the body’s tissues and organs is carried from the receptors along distinct spinal pathways, into the brain stem and up to the posterior insula in the higher brain or cortex.

As such, all mammals have emotions, defined as sensations that provoke motivations. If an animal is hot, it seeks shade. If hungry, it looks for food. If hurt, it licks the wound.

But animals are not thought to have subjective feelings in the way that humans do, Dr. Craig said. Humans, and to a lesser degree the great apes, have evolved two innovations to their insulas that take this system of reading body states to a new level.

One involves circuitry, the other a brand new type of brain cell.

In humans, information about the body’s state takes a slightly different route inside the brain, picking up even more signals from the gut, the heart, the lungs and other internal organs. Then the human brain takes
an extra step, Dr. Craig said. The information on bodily sensations is further routed to the front part of the insula, especially on the right side, which has undergone a huge expansion in humans and apes.

It is in the frontal insula, Dr. Craig said, that simple body states or sensations are recast as social emotions. A bad taste or smell is sensed in the frontal insula as disgust. A sensual touch from a loved one is transformed into delight.

The frontal insula is where people sense love and hate, gratitude and resentment, self-confidence and embarrassment, trust and distrust, empathy and contempt, approval and disdain, pride and humiliation, truthfulness and deception, atonement and guilt.

People who are better at reading these sensations — a quickened heart beat, a flushed face, slow breathing — score higher on psychological tests of empathy, researchers have found. The second major modification to the insula is a type of cell found in only humans, great apes, whales and possibly elephants, Dr. Allman said. Humans have by far the greatest number of these cells, which are called VENs, short for Von Economo neurons, named for the scientist who first described them in 1925. VENs are large cigar-shaped cells tapered at each end, and they are found exclusively in the frontal insula and anterior cingulate cortex.

Exactly what VENs are doing within this critical circuit is not yet known, Dr. Allman said. But they are in the catbird seat for turning feelings and emotions into actions and intentions.

The human insula, with its souped-up anatomy, is also important for processing events that have yet to happen, Dr. Paulus said. “When you decide to go outside on a cold day, your body gets ready before you hit the cold air,” he said. “It starts pumping blood to where you need it and adjusts your metabolism. Your insula tells you what it will feel like before you step outside.”

The same goes for drug addicts. When an addict is confronted with sights, sounds, smells, situations or other stimuli associated with drug use, the insula is activated before using the drug.

“If you give cocaine to an addict, you are affecting their brain’s reward system, but this is not what drives the person to keep using cocaine,” Dr. Paulus said. The craving is what gets people to use.

For example, smokers enjoy whole-body effects, said Nasir Naqvi, a student at the University of Iowa Medical Scientist Training Program, who was the lead author of the recent article on smoking. It is not just nicotine binding to parts of the brain, he said, but sensations — heart rate, blood pressure, a tickle in the lungs, a taste in the mouth, the position of the hands, all the rituals.

The insula’s importance makes it an ideal target for many kinds of treatment, Dr. Paulus said, including drugs and sophisticated biofeedback. But methods to quell insular activity must be approached carefully, he said. People might lose the craving to smoke, drink alcohol or take other drugs, but they could simultaneously lose interest in sex, food and work.

As clinicians explore the possibilities, Dr. Craig is thinking about the insula in grander terms.

For example, lesions in the frontal insula can wipe out the ability to appreciate the emotional content of music. It may also be involved in the human sense of the progress of time, since it can create an anticipatory signal of how people may feel as opposed to how they feel now. Intensely emotional moments can affect our
sense of time. It may stand still, and that may be happening in the insula, a crossroads of time and desire.