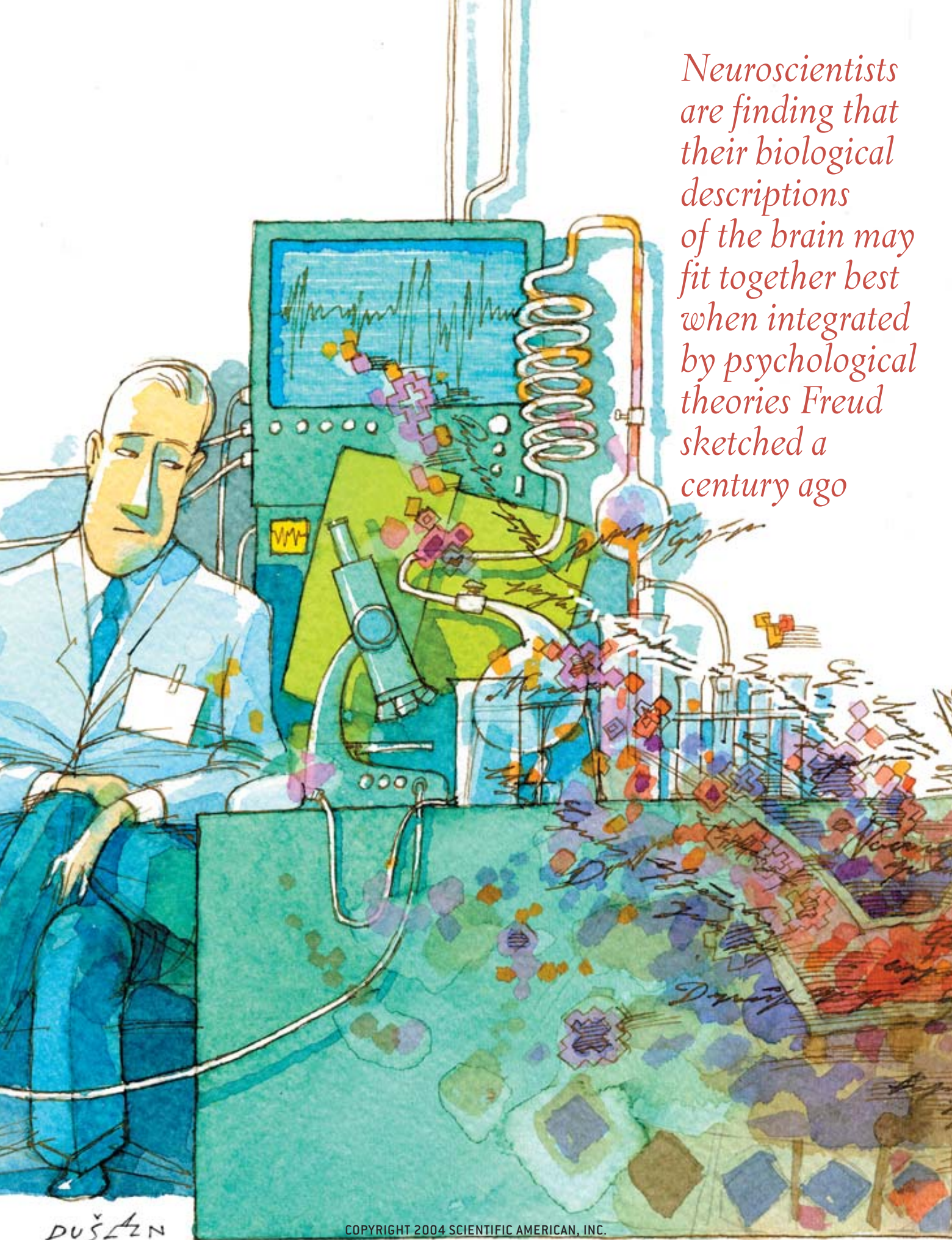
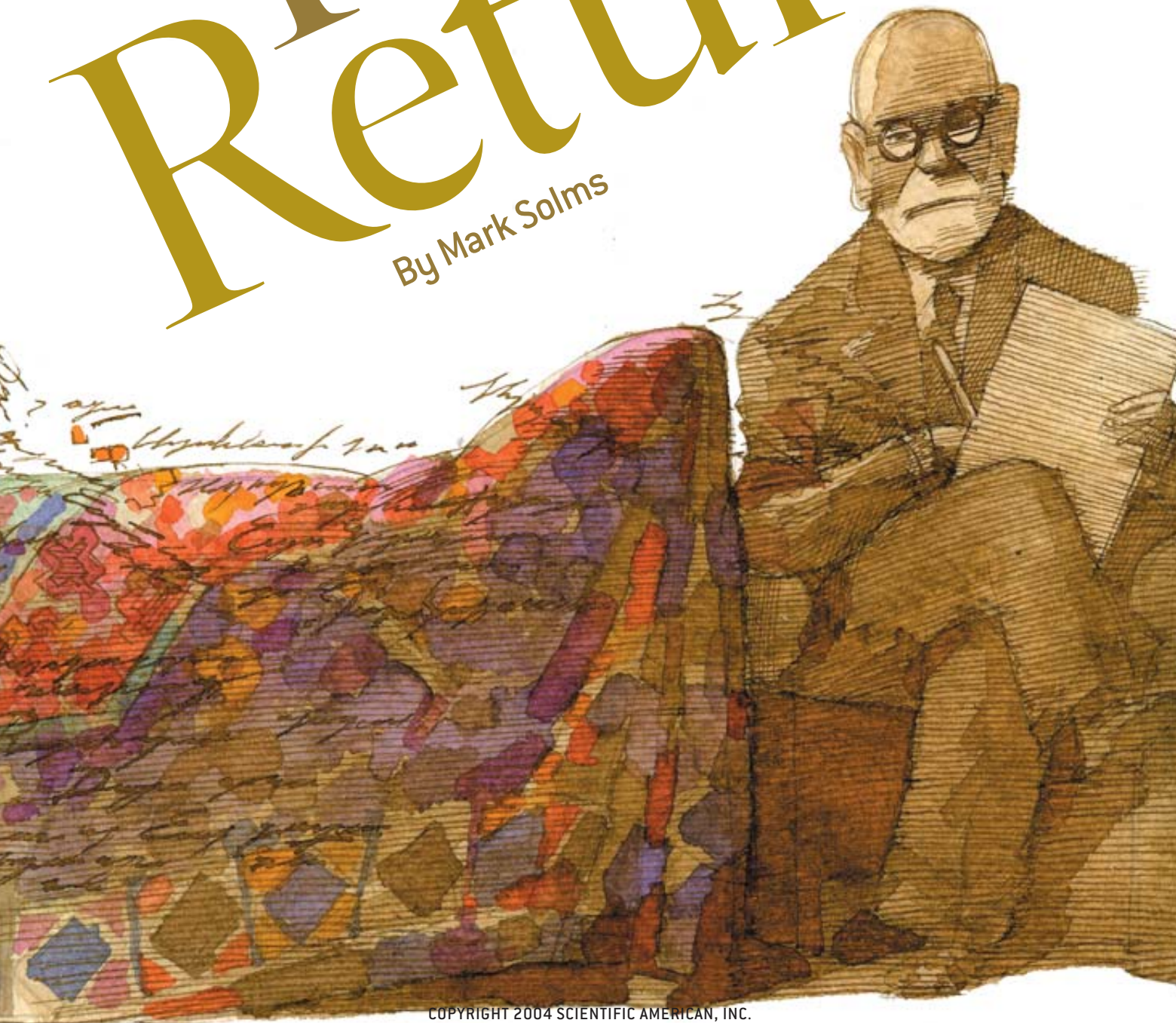


Neuroscientists
are finding that
their biological
descriptions
of the brain may
fit together best
when integrated
by psychological
theories Freud
sketched a
century ago



Freud Returns

By Mark Solms





YOUNG FREUD,
circa 1891

By the 1980s the notions of ego and id were considered hopelessly antiquated, even in some psychoanalytical circles. Freud was history. In the new psychology, the updated thinking went, depressed people do not feel so wretched because something has undermined their earliest attachments in infancy—rather their brain chemicals are unbalanced. Psychopharmacology, however, did not deliver an alternative grand theory of personality, emotion and motivation—a new conception of “what makes us tick.” Without this model, neuroscientists focused their work narrowly and left the big picture alone.

Today that picture is coming back into focus, and the surprise is this: it is not unlike the one that Freud outlined a century ago. We are still far from a consensus, but an increasing number of diverse neuroscientists are reaching the same conclusion drawn by Eric R. Kandel of Columbia University, the 2000 Nobel laureate in physiology or medicine: that psychoanalysis is “still the most coherent and intellectually satisfying view of the mind.”

Freud is back, and not just in theory. Interdisciplinary work groups uniting the previously divided and often antagonistic fields of neuroscience and psychoanalysis have been formed in almost every major city of the world. These networks, in turn, have come together as the International Neuro-Psychoanalysis Society, which organizes an annual congress and publishes the successful journal *Neuro-Psychoanalysis*. Testament to the renewed respect for Freud’s ideas is the journal’s editorial advisory board, populated by a who’s who of experts in contemporary behavioral neuroscience, including Antonio R. Damasio, Kandel, Joseph E. LeDoux, Benjamin Libet, Jaak Panksepp, Vilayanur S. Ramachandran, Daniel L. Schacter and Wolf Singer.

Together these researchers are forging what Kandel calls a “new intellectual framework for psychiatry.” Within this framework, it appears that Freud’s broad brushstroke organization of the mind is destined to play a role similar to the one Darwin’s theory of evolution

FOR THE FIRST HALF OF THE 1900S,

the ideas of Sigmund Freud dominated explanations of how the human mind works. His basic proposition was that our motivations remain largely hidden in our unconscious minds. Moreover, they are actively withheld from consciousness by a repressive force. The executive apparatus of the mind (the ego) rejects any unconscious drives (the id) that might prompt behavior that would be incompatible with our civilized conception of ourselves. This repression is necessary because the drives express themselves in unconstrained passions, childish fantasies, and sexual and aggressive urges.

Mental illness, Freud said until his death in 1939, results when repression fails. Phobias, panic attacks and obsessions are caused by intrusions of the hidden drives into voluntary behavior. The aim of psychotherapy, then, was to trace neurotic symptoms back to their unconscious roots and expose these roots to mature, rational judgment, thereby de-

priving them of their compulsive power.

As mind and brain research grew more sophisticated from the 1950s onward, however, it became apparent to specialists that the evidence Freud had provided for his theories was rather tenuous. His principal method of investigation was not controlled experimentation but simple observations of patients in clinical settings, interwoven with theoretical inferences. Drug treatments gained ground, and biological approaches to mental illness gradually overshadowed psychoanalysis. Had Freud lived, he might even have welcomed this turn of events. A highly regarded neuroscientist in his day, he frequently made remarks such as “the deficiencies in our description would presumably vanish if we were already in a position to replace the psychological terms by physiological and chemical ones.” But Freud did not have the science or technology to know how the brain of a normal or neurotic personality was organized.

Overview/*Mind Models*

- For decades, Freudian concepts such as ego, id and repressed desires dominated psychology and psychiatry’s attempts to cure mental illnesses. But better understanding of brain chemistry gradually replaced this model with a biological explanation of how the mind arises from neuronal activity.
- The latest attempts to piece together diverse neurological findings, however, are leading to a chemical framework of the mind that validates the general sketch Freud made almost a century ago. A growing group of scientists are eager to reconcile neurology and psychiatry into a unified theory.

served for molecular genetics—a template on which emerging details can be coherently arranged. At the same time, neuroscientists are uncovering proof for some of Freud's theories and are teasing out the mechanisms behind the mental processes he described.

Unconscious Motivation

WHEN FREUD INTRODUCED the central notion that most mental processes that determine our everyday thoughts, feelings and volitions occur unconsciously, his contemporaries rejected it as impossible. But today's findings are confirming the existence and pivotal role of unconscious mental processing. For example, the behavior of patients who are unable to consciously remember events that occurred after damage to certain memory-encoding structures of their brains is clearly influenced by the "forgotten" events. Cognitive neuroscientists make sense of such cases by delineating different memory systems that process information "explicitly" (consciously) and "implicitly" (unconsciously). Freud split memory along just these lines.

Neuroscientists have also identified unconscious memory systems that mediate emotional learning. In 1996 at New York University, LeDoux demonstrated the existence under the conscious cortex of a neuronal pathway that connects perceptual information with the primitive brain structures responsible for generating fear responses. Because this pathway bypasses the hippocampus—which generates conscious memories—current events routinely trigger unconscious remembrances of emotionally important past events, causing conscious feelings that seem irrational, such as "Men with beards make me uneasy."

Neuroscience has shown that the major brain structures essential for forming conscious (explicit) memories are not functional during the first two years of life, providing an elegant explanation of what Freud called infantile amnesia. As Freud surmised, it is not that we forget our earliest memories; we simply cannot recall them to consciousness. But this inability does not preclude them from affecting adult feelings and behavior. One

would be hard-pressed to find a developmental neurobiologist who does not agree that early experiences, especially between mother and infant, influence the pattern of brain connections in ways that fundamentally shape our future personality and mental health. Yet none of these experiences can be consciously remembered. It is becoming increasingly clear that a good deal of our mental activity is unconsciously motivated.

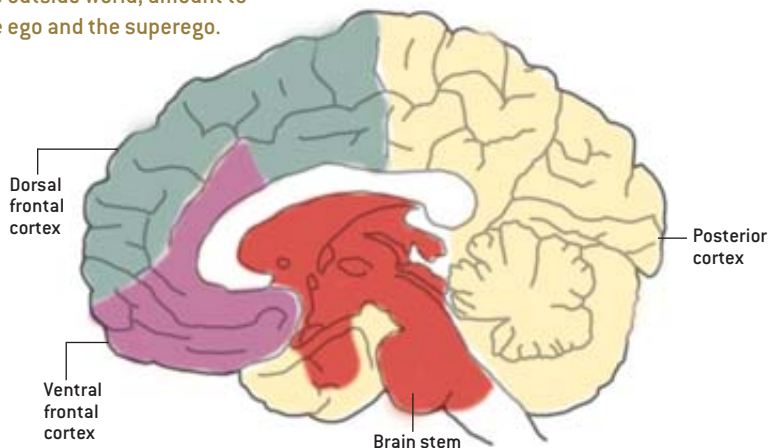
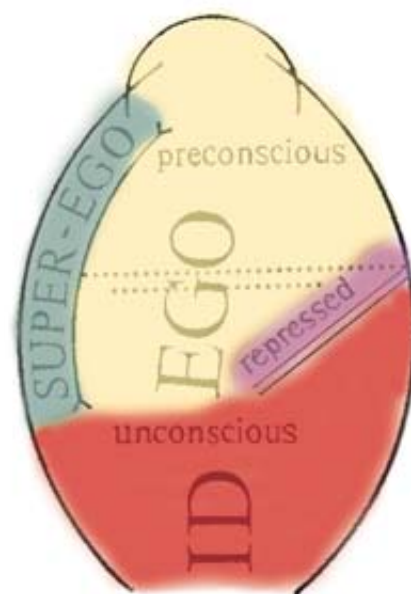
Repression Vindicated

EVEN IF WE ARE MOSTLY driven by unconscious thoughts, this does not prove anything about Freud's claim that we actively repress unpalatable informa-

tion. But case studies supporting that notion are beginning to accumulate. The most famous one comes from a 1994 study of "anosognosic" patients by behavioral neurologist Ramachandran of the University of California at San Diego. Damage to the right parietal region of these people's brains makes them unaware of gross physical defects, such as paralysis of a limb. After artificially activating the right hemisphere of one such patient, Ramachandran observed that she suddenly became aware that her left arm was paralyzed—and that it had been paralyzed continuously since she had suffered a stroke eight days before. This showed that she was capable of recog-

MIND AND MATTER

Freud drew his final model of the mind in 1933 (right; color has been added). Dotted lines represented the threshold between unconscious and conscious processing. The superego repressed instinctual drives (the id), preventing them from disrupting rational thought. Most rational (ego) processes were automatic and unconscious, too, so only a small part of the ego (bulb at top) was left to manage conscious experience, which was closely tied to perception. The superego mediated the ongoing struggle between the ego and id for dominance. Recent neurological mapping (below) generally correlates to Freud's conception. The core brain stem and limbic system—responsible for instincts and drives—roughly correspond to Freud's id. The ventral frontal region, which controls selective inhibition, the dorsal frontal region, which controls self-conscious thought, and the posterior cortex, which represents the outside world, amount to the ego and the superego.



nizing her deficits and that she had unconsciously registered these deficits for the previous eight days, despite her conscious denials during that time that there was any problem.

Significantly, after the effects of the stimulation wore off, the woman not only reverted to the belief that her arm was normal, she also forgot the part of the interview in which she had acknowledged that the arm was paralyzed, even though she remembered every other detail about

Like “split-brain” patients, whose hemispheres become unlinked—made famous in studies by the late Nobel laureate Roger W. Sperry of the California Institute of Technology in the 1960s and 1970s—anosognosic patients typically rationalize away unwelcome facts, giving plausible but invented explanations of their unconsciously motivated actions. In this way, Ramachandran says, the left hemisphere manifestly employs Freudian “mechanisms of defense.”

Durham neuropsychologist Aikaterini Fotopoulou recently studied a patient of this type in my laboratory. The man failed to recall, in each 50-minute session held in my office on 12 consecutive days, that he had ever met me before or that he had undergone an operation to remove a tumor in his frontal lobes that caused his amnesia. As far as he was concerned, there was nothing wrong with him. When asked about the scar on his head, he confabulated wholly implausible explana-

Freud himself anticipated the day when neurological data would round out his psychological ideas.

the interview. Ramachandran concluded: “The remarkable theoretical implication of these observations is that memories can indeed be selectively repressed.... Seeing [this patient] convinced me, for the first time, of the reality of the repression phenomena that form the cornerstone of classical psychoanalytical theory.”

Analogous phenomena have now been demonstrated in people with intact brains, too. As neuropsychologist Martin A. Conway of Durham University in England pointed out in a 2001 commentary in *Nature*, if significant repression effects can be generated in average people in an innocuous laboratory setting, then far greater effects are likely in real-life traumatic situations.

The Pleasure Principle

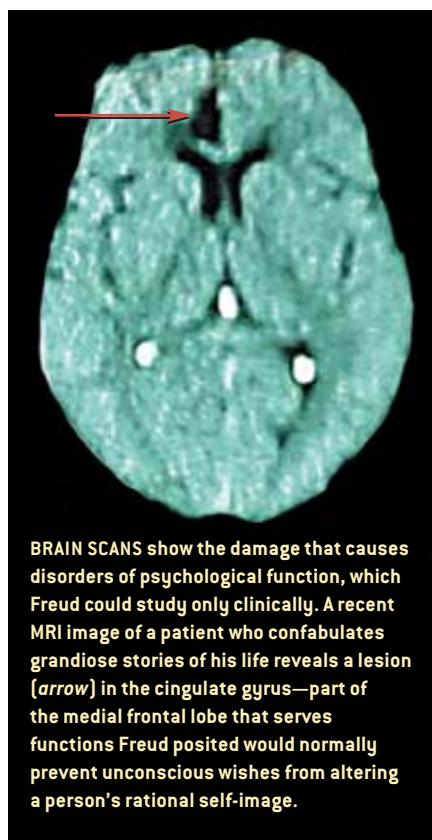
FREUD WENT EVEN further, though. He said that not only is much of our mental life unconscious and withheld but that the repressed part of the unconscious mind operates according to a different principle than the “reality principle” that governs the conscious ego. This type of unconscious thinking is “wishful”—and it blithely disregards the rules of logic and the arrow of time.

If Freud was right, then damage to the inhibitory structures of the brain (the seat of the “repressing” ego) should release wishful, irrational modes of mental functioning. This is precisely what has been observed in patients with damage to the frontal limbic region, which controls critical aspects of self-awareness. Subjects display a striking syndrome known as Korsakoff’s psychosis: they are unaware that they are amnesic and therefore fill the gaps in their memory with fabricated stories known as confabulations.

tions: he had undergone dental surgery or a coronary bypass operation. In reality, he had indeed experienced these procedures—years before—and unlike his brain operation, they had successful outcomes.

Similarly, when asked who I was and what he was doing in my lab, he variously said that I was a colleague, a drinking partner, a client consulting him about his area of professional expertise, a teammate in a sport that he had not participated in since he was in college decades earlier, or a mechanic repairing one of his numerous sports cars (which he did not possess). His behavior was consistent with these false beliefs, too: he would look around the room for his beer or out the window for his car.

What strikes the casual observer is the wishful quality of these false notions, an impression that Fotopoulou confirmed objectively through quantitative analysis of a consecutive series of 155 of his confabulations. The patient’s false beliefs were not random noise—they were generated by the “pleasure principle” that Freud maintained was central to unconscious thought. The man simply recast reality as he wanted it to be. Similar observations have been reported by others, such as Martin Conway of Durham and Oliver Turnbull of the University of Wales. These investigators are cognitive neuroscientists, not psychoanalysts, yet they interpret their findings in Freudian



BRAIN SCANS show the damage that causes disorders of psychological function, which Freud could study only clinically. A recent MRI image of a patient who confabulates grandiose stories of his life reveals a lesion (arrow) in the cingulate gyrus—part of the medial frontal lobe that serves functions Freud posited would normally prevent unconscious wishes from altering a person’s rational self-image.

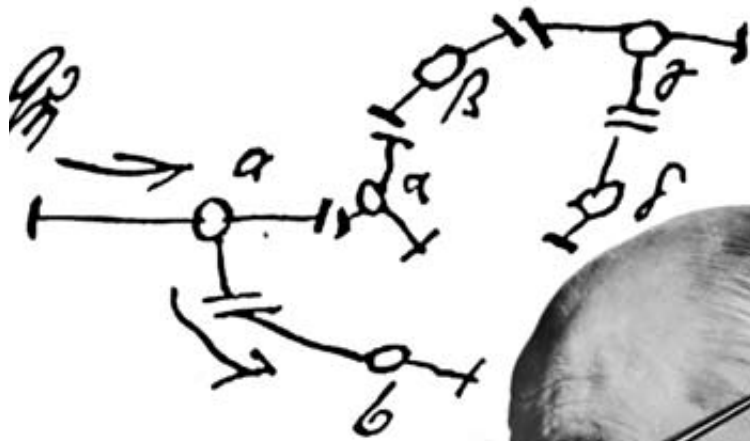
terms, claiming in essence that damage to the frontal limbic region that produces confabulations impairs cognitive control mechanisms that underpin normal reality monitoring and releases from inhibition the implicit wishful influences on perception, memory and judgment.

Animal Within

FREUD ARGUED THAT the pleasure principle gave expression to primitive, animal drives. To his Victorian contemporaries, the implication that human behavior was at bottom governed by urges that served no higher purpose than carnal self-fulfillment was downright scandalous. The moral outrage waned during subsequent decades, but Freud's concept of man-as-animal was pretty much sidelined by cognitive scientists.

Now it has returned. Neuroscientists such as Donald W. Pfaff of the Rockefeller University and Jaak Panksepp of Bowling Green State University believe that the instinctual mechanisms that govern human motivation are even more primitive than Freud imagined. We share basic emotional-control systems with our primate relatives and with all mammals. At the deep level of mental organization that Freud called the id, the functional anatomy and chemistry of our brains is not much different from that of our favorite barnyard animals and household pets.

Modern neuroscientists do not accept Freud's classification of human instinctual life as a simple dichotomy between sexuality and aggression, however. Instead, through studies of lesions and the effects of drugs and artificial stimulation on the brain, they have identified at least four basic mammalian instinctual circuits, some of which overlap. They are the "seeking" or "reward" system (which motivates the pursuit of pleasure); the "anger-rage" system (which governs angry aggression but not predatory aggression); the "fear-anxiety" system; and the "panic" system (which includes complex instincts such as those that govern social bonding). Whether other instinctual forces exist, such as a rough-and-tumble "play" system, is also being investigated. All these brain sys-



FREUD SKETCHED a neuronal mechanism for repression (above) in 1895, as part of his hope that biological explanations of the mind would one day replace psychological ones. In his scheme, an unpleasant memory would normally be activated by a stimulus ["Qn," far left] heading from neuron "a" toward neuron "b" (bottom). But neuron "alpha" (to right of "a") could divert the signal and thus prevent the activation if other neurons (top right) exerted a "repressing" influence. Note that Freud (shown later in life) drew gaps between neurons that he predicted would act as "contact barriers." Two years later English physiologist Charles Sherrington discovered such gaps and named them synapses.



tems are modulated by specific neurotransmitters, chemicals that carry messages between the brain's neurons.

The seeking system, regulated by the neurotransmitter dopamine, bears a remarkable resemblance to the Freudian "libido." According to Freud, the libidinal or sexual drive is a pleasure-seeking system that energizes most of our goal-directed interactions with the world. Modern research shows that its neural equivalent is heavily implicated in almost all forms of craving and addiction. It is interesting to note that Freud's early experiments with cocaine—mainly on himself—convinced him that the libido must have a specific neurochemical foundation. Unlike his successors, Freud saw no reason for antagonism between psychoanalysis and psychopharmacology. He enthusiastically anticipated the day when

"id energies" would be controlled directly by "particular chemical substances." Today treatments that integrate psychotherapy with psychoactive medications are widely recognized as the best approach for many disorders. And brain imaging shows that talk therapy affects the brain in similar ways to such drugs.

Dreams Have Meaning

FREUD'S IDEAS ARE also reawakening in sleep and dream science. His dream theory—that nighttime visions are partial glimpses of unconscious wishes—was discredited when rapid-eye-movement (REM) sleep and its strong correlation with dreaming were discovered in the 1950s. Freud's view appeared to lose all credibility when investigators in the 1970s showed that the dream cycle was regulated by the pervasive brain chemi-

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cal acetylcholine, produced in a “mindless” part of the brain stem. REM sleep occurred automatically, every 90 minutes or so, and was driven by brain chemicals and structures that had nothing to do with emotion or motivation. This discovery implied that dreams had no meaning; they were simply stories concocted by the higher brain to try to reflect the random cortical activity caused by REM.

But more recent work has revealed

with impunity—that dream content has no primary emotional mechanism.

Finishing the Job

NOT EVERYONE IS enthusiastic about the reappearance of Freudian concepts in the mainstream of mental science. It is not easy for the older generation of psychoanalysts, for example, to accept that their junior colleagues and students now can and must subject conventional wisdom to

zine, for neuroscientists who are enthusiastic about the reconciliation of neurology and psychiatry, “it is not a matter of proving Freud right or wrong, but of finishing the job.”

If that job can be finished—if Kandel’s “new intellectual framework for psychiatry” can be established—then the time will pass when people with emotional difficulties have to choose between the talk therapy of psychoanalysis, which

If scientists can reconcile neurology and psychology, then patients could receive more integrated treatment.

that dreaming and REM sleep are dissociable states, controlled by distinct, though interactive, mechanisms. Dreaming turns out to be generated by a network of structures centered on the forebrain’s instinctual-motivational circuitry. This discovery has given rise to a host of theories about the dreaming brain, many strongly reminiscent of Freud’s. Most intriguing is the observation that others and I have made that dreaming stops completely when certain fibers deep in the frontal lobe have been severed—a symptom that coincides with a general reduction in motivated behavior. The lesion is exactly the same as the damage that was deliberately produced in prefrontal leukotomy, an outmoded surgical procedure that was once used to control hallucinations and delusions. This operation was replaced in the 1960s by drugs that dampen dopamine’s activity in the same brain systems. The seeking system, then, might be the primary generator of dreams. This possibility has become a major focus of current research.

If the hypothesis is confirmed, then the wish-fulfillment theory of dreams could once again set the agenda for sleep research. But even if other interpretations of the new neurological data prevail, all of them demonstrate that “psychological” conceptualizations of dreaming are scientifically respectable again. Few neuroscientists still claim—as they once did

an entirely new level of biological scrutiny. But an encouraging number of elders on both sides of the Atlantic are at least committed to keeping an open mind, as evidenced by the aforementioned eminent psychoanalysts on the advisory board of *Neuro-Psychoanalysis* and by the many graying participants in the International Neuro-Psychoanalysis Society.

For older neuroscientists, resistance to the return of psychoanalytical ideas comes from the specter of the seemingly indestructible edifice of Freudian theory in the early years of their careers. They cannot acknowledge even partial confirmation of Freud’s fundamental insights; they demand a complete purge [see box on opposite page]. In the words of J. Allan Hobson, a renowned sleep researcher and Harvard Medical School psychiatrist, the renewed interest in Freud is little more than unhelpful “retrofitting” of modern data into an antiquated theoretical framework. But as Panksepp said in a 2002 interview with *Newsweek* maga-

may be out of touch with modern evidence-based medicine, and the drugs prescribed by psychopharmacology, which may lack regard for the relation between the brain chemistries it manipulates and the complex real-life trajectories that culminate in emotional distress. The psychiatry of tomorrow promises to provide patients with help that is grounded in a deeply integrated understanding of how the human mind operates.

Whatever undreamed-of therapies the future might bring, patients can only benefit from better knowledge of how the brain really works. As modern neuroscientists tackle once more the profound questions of human psychology that so preoccupied Freud, it is gratifying to find that we can build on the foundations he laid, instead of having to start all over again. Even as we identify the weak points in Freud’s far-reaching theories, and thereby correct, revise and supplement his work, we are excited to have the privilege of finishing the job. SA

MORE TO EXPLORE

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FREUD RETURNS? LIKE A BAD DREAM

By J. Allan Hobson

Sigmund Freud's views on the meaning of dreams formed the core of his theory of mental functioning. Mark Solms and others assert that brain imaging and lesion studies are now validating Freud's conception of the mind. But similar scientific investigations show that major aspects of Freud's thinking are probably erroneous.

For Freud, the bizarre nature of dreams resulted from an elaborate effort of the mind to conceal, by symbolic disguise and censorship, the unacceptable instinctual wishes welling up from the unconscious when the ego relaxes its prohibition of the id in sleep. But most neurobiological evidence supports the alternative view that dream bizarreness stems from normal changes in brain state. Chemical mechanisms in the brain stem, which shift the activation of various regions of the cortex, generate these changes. Many studies have indicated that the chemical changes determine the quality and quantity of dream visions, emotions and thoughts. Freud's disguise-and-censorship notion must be discarded; no one believes that the ego-id struggle, if it exists, controls brain chemistry. Most psychoanalysts no longer hold that the disguise-censorship theory is valid.

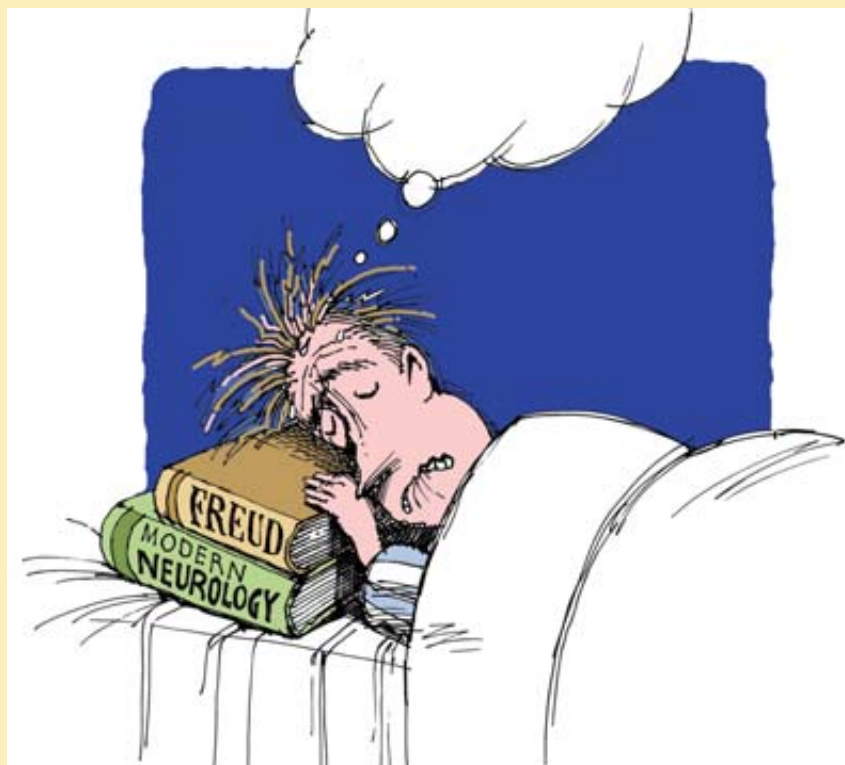
Without disguise and censorship, what is left of Freud's dream theory? Not much—only that instinctual drives could impel dream formation. Evidence does indicate that activating the parts of the limbic system that produce anxiety, anger and elation shapes dreams. But these influences are not “wishes.” Dream analyses show that the emotions in dreams are as often negative as they are positive, which would mean that half our “wishes” for ourselves are negative. And as all dreamers know, the emotions in dreams are hardly disguised. They enter into dream plots clearly, frequently bringing unpleasant effects such as nightmares. Freud was never able to account for why so many dream emotions are negative.

Another pillar of Freud's model is that because the true meaning of dreams is hidden, the emotions they reflect can be revealed only through his wild-goose-

chase method of free association, in which the subject relates anything and everything that comes to mind in hopes of stumbling across a crucial connection. But this effort is unnecessary, because no such concealment occurs. In dreams,

during non-REM sleep, but nothing in the chemical activation model precludes this case; the frequency of dreams is simply exponentially higher during REM sleep.

Psychoanalysis is in big trouble, and no amount of neurobiological tinkering



what you see is what you get. Dream content is emotionally salient on its face, and the close attention of dreamers and their therapists is all that is needed to see the feelings they represent.

Solms and other Freudians intimate that ascribing dreams to brain chemistry is the same as saying that dreams have no emotional messages. But the statements are not equivalent. The chemical activation-synthesis theory of dreaming, put forth by Robert W. McCarley of Harvard Medical School and me in 1977, maintained only that the psychoanalytic explanation of dream bizarreness as concealed meaning was wrong. We have always argued that dreams are emotionally salient and meaningful. And what about REM sleep? New studies reveal that dreams can occur

can fix it. So radical an overhaul is necessary that many neuroscientists would prefer to start over and create a neurocognitive model of the mind. Psychoanalytic theory is indeed comprehensive, but if it is terribly in error, then its comprehensiveness is hardly a virtue. The scientists who share this view stump for more biologically based models of dreams, of mental illness, and of normal conscious experience than those offered by psychoanalysis.

*J. Allan Hobson, professor of psychiatry at Harvard Medical School, has written extensively on the brain basis of the mind and its implications for psychiatry. For more, see Hobson's book *Dreaming: An Introduction to the Science of Sleep* (Oxford University Press, 2003).*