disposition, with no single gene locus, that could explain the disorder. Some genes that are involved in the metabolism of the biogenic amines, serotonin and dopamine, as well as some genes encoding for intracellular signal transduction, may possibly show aberrations in bipolar disorder. There is also accumulating evidence that intracellular alterations that impact neuron durability may play a crucial role in the long-term prognosis of bipolar disorder; some commonly used medications such as lithium or anticonvulsants have demonstrated positive effects on cellular survival.

Psychological explanations for the basis of mood disorders include cognitive, behavioral, and psychoanalytic theories; however, their main focus is depression, whereas mania remains largely unexplained. Only a few promoters of deep psychology (that is, psychological approaches to therapy and research that take the unconscious into account) have developed theories on mania; they mainly suggest that the role of mania is to fight back and suppress depression.

Social and environmental factors are also recognized as important contributors to the actual manifestation of bipolar disorder. First episodes of both depression and mania frequently manifest themselves in times of increased stress (positive or negative). The importance of a stressor for consecutive episodes, however, seems to decrease to a point where the timing of a new episode appears to become unpredictable.

Treatment of bipolar disorder. Current treatment of bipolar disorder is based on two areas of expertise: (1) biological treatment, which includes both medication and, if indicated, physical treatments (for example, electroconvulsive therapy); and (2) psychotherapy, including psychoeducation (wherein the patient is provided with knowledge about the psychological condition, the causes of that condition, and the reasons why a particular treatment might be effective for reducing symptoms). Additionally, any necessary social support should be arranged to attenuate the level of stress that may otherwise compromise treatment success.

Biological treatment can be roughly divided into acute treatment of mania, mixed states, or depression, and long-term prophylactic treatment that aims to prevent a recurrence. Expert opinion and research evidence both support the need for a mood stabilizer (a substance with both acute and prophylactic efficacy) to be used throughout the course of the disorder. Depending on the prevalent polarity (either more manic or depressive episodes), the choice includes lithium or various anticonvulsants (for example, valproate, carbamazepine, or lamotrigine) as commonly accepted mood stabilizers. Some so-called atypical antipsychotics have also demonstrated efficacy both against acute episodes and for maintaining a stable mood (these are designated as "atypical" because they are usually more recent, second-generation antipsychotics with fewer side effects than "typical," or first-generation, antipsychotics). Two of them (namely, quetiapine and olanzapine) have demonstrated bimodal efficacy in controlled studies, meaning that they treat and prevent both manic and depressive episodes. The use of typical antipsychotics and of antidepressants, however, remains controversial. Typical antipsychotics (for example, haloperidol) may be highly effective in mania, but at the expense of extrapyramidal (motor system) side effects such as stiffness and tremor, and may lack prophylactic efficacy. On the other hand, some antidepressants may increase the risk of a switch into a manic episode without necessarily providing additional benefit for the treatment of acute depression.

Biological treatment has a reasonable evidence base for adults with bipolar I disorder. However, there is little evidence investigating specific treatments in bipolar II patients. There is also a paucity of controlled studies on the treatment of this condition in the elderly and in children and adolescents; these age groups differ from adults in their rate of metabolism and thus may show differences in efficacy and tolerability of a given medication. It is only recently that controlled studies with some mood stabilizers and atypical antipsychotics have been conducted in adolescents.

Psychological treatments in bipolar disorder mainly follow a cognitive-behavioral approach. In combination with medication, they have demonstrated additional benefit in treating depressive episodes and maintaining mood stability. A technique with proven prophylactic effects, psychoeducation, can be administered in groups, making it also more cost-effective than single face-to-face psychotherapy.

For background information *see* AFFECTIVE DISORDERS; ANXIETY DISORDERS; ATTENTION DEFICIT HYPERACTIVITY DISORDER; BEHAVIOR GENETICS; BRAIN; ELECTROCONVULSIVE THERAPY; NEUROBIOLOGY; PSYCHOPHARMACOLOGY; PSYCHOSIS; PSYCHOTHERAPY in the McGraw-Hill Encyclopedia of Science & Technology.

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Body self-perception

When we look at ourselves, we immediately recognize our body as our own. The question of how this comes to be has been discussed by philosophers and psychologists for centuries. Recently, cognitive neuroscience studies have begun to identify the perceptual processes and brain mechanisms involved in body self-perception. This includes experiments investigating how we feel ownership of our limbs and our entire bodies, why we experience that we are "inside" our physical body, and how the brain distinguishes between sensory signals from objects in the external world and from parts of the body. This research is important because the understanding of how we recognize our own bodies is a significant first step for understanding self-awareness more generally. Furthermore, it can also lead to important new medical and industrial applications. For example, in building prosthetic limbs that feel more like real limbs, and simulated bodies in virtual reality (the computer-generated simulation of an environment) that feel just like real bodies.

Investigations of mechanisms and processes. The first evidence that specific mechanisms are involved in body self-perception came from the clinical literature. Patients who have suffered a stroke affecting the frontal and parietal regions, mainly in the right hemisphere of the brain, can develop conditions with disturbed perception of their own body. Some of these patients perceive parts of their bodies as belonging to someone else (a condition known as somatoparaphrenia) or develop asomatognosia (a condition in which the patient develops a deficit in body awareness that can take the form of denying, ignoring, forgetting, disowning, or misperceiving the body). Although these cases indicate that the frontal and parietal association cortices are associated with body perception, they do not pinpoint the specific brain mechanisms involved because typically the lesions are large and affect multiple areas, including the underlying white matter tissue (the axonal compartment of myelinated nerve fibers).

Behavioral and brain imaging studies in healthy individuals can directly aid in investigations of the perceptual and neuronal processes underlying body self-perception. However, experimentally manipulating body self-perception is a challenge because "the body is always there," as the American psychologist and philosopher William James remarked over a century ago. One method of tackling this issue is to use perceptual illusions. The study of illusions is a classical approach adopted in psychology to learn more about the basic processes that underlie normal perception. One particularly informative illusion is the "rubber hand illusion," where people experience a prosthetic hand as their own hand. When synchronous touches are applied to a rubber hand that is in full view and the real hand, which is hidden behind a screen, most individuals will sense the touches on the rubber hand and experience the artificial limb as their own. There are two commonly used objective tests for this effect. First, when people who are experiencing the illusion are asked to close their eyes and point toward their stimulated hand using their other hand, they tend to point toward the rubber hand rather than the real hand. Second, physical threats to the rubber hand are scary to the participants and result in increased sweating of the palms, which can be registered with "skin conductance responses" (SCRs). Importantly, the illusion breaks down if the touches applied to the two hands are asynchronous, if the rubber hand is not aligned in parallel with the person's real hidden arm, if the rubber hand is replaced by an object that does not resemble a limb, or if the direction of the strokes applied to the two hands is not the same. These observations show that spatially and temporally congruent visual and tactile signals in arm-centered reference frames are crucial for the feeling of ownership of a limb.

Recent experiments. The self-attribution of entire bodies seems to depend on similar processes, as demonstrated by recent experiments. In one experiment, people experienced an illusion that they were outside their real body ("out-of-body illusion"). The participants wore head-mounted displays (HMDs, display devices that are worn on the head in front of their eyes) that were connected to two closed-circuit television cameras placed about 1.5 m behind them. The two cameras provided a stereoscopic image, and the participants could thus see themselves from the point of view of the cameras, that is, from the back. The experimenter then jabbed a rod toward a location just below the cameras while simultaneously touching the participant's chest, which was out of view. The visual impressions of a hand approaching a point below the cameras and the felt touches on the chest led the participants to experience the illusion of being located 1.5 m behind their real body. Interestingly, many individuals reported the feeling that their real body, which they observed from the back, belonged to someone else; that is, they seemed to experience a partial loss of self-identification with that body (**Fig. 1**). Similar to the rubber hand illusion, physical threats to the "illusory body" below the cameras produced enhanced SCRs. This study illustrates how the perception of where one is located in space is determined by the visual first-person perspective in combination with

Fig. 1. Experimental setup to induce an out-of-body experience.

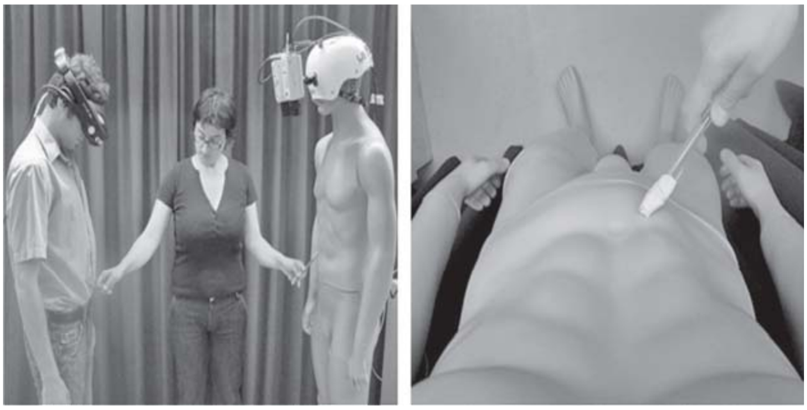

Fig. 2. Experimental setup to induce the perceptual illusion of having a new artificial body (left panel); the view from the cameras (right panel).

correlated visual and tactile signals in body-centered reference frames.

A subsequent study demonstrated more directly that people can perceive a new body as their own. In these experiments, the two cameras were attached to a helmet worn by a life-size mannequin and positioned so that they were looking down on the mannequin's body. Thus, when the participants wore the HMDs connected to these cameras and looked down, they saw the mannequin's body where they would expect to see their own real body (**Fig. 2**). When the experimenter used a couple of pens to simultaneously touch the mannequin's belly and the person's belly at corresponding sites for a minute, the majority of the participants began to experience the artificial body as their own. Importantly, this "body-swap illusion" works only when a humanoid body is used; when the mannequin is replaced with a rectangular block of wood, the illusion breaks down immediately.

The body-swap illusion can easily be produced with another human individual simply by attaching the cameras to a helmet worn by another person. In one dramatic example of this, the test person experienced "owning" the scientist's body, which was facing his or her real body, while shaking hands with it. The cameras were mounted on the scientist's head and connected to the HMDs worn by the participants, who then looked at themselves from the scientist's perspective. When the scientist and the participant repeatedly squeezed their hands in a synchronized fashion, most participants experienced an illusion of being "inside" the scientist's body and owning the scientist's hand (**Fig. 3**). Strikingly, people were more scared when they saw a knife close to the scientist's arm than when the knife approached their own real arm during the illusion, as indexed by the SCRs.

Taken together, these observations demonstrate that there are a number of factors that contribute to the perception of an object as one's own body. First, the object has to look sufficiently similar to a human body. Second, visual, tactile, proprioceptive, and other sensory signals from the body must be temporally and spatially correlated in coordinate systems centered on the body. Third, when executing voluntary movements, the sensory feedback must match the expected sensory feedback from the intended movements. Fourth and last, the visual information from the first-person perspective plays an important role in establishing the location of the perceived body relative to environmental landmarks and in defining the "origin" of the body-centered reference frame. The perception of one's body is thus continuously constructed on the basis of the available sensory evidence guided by these principles, demonstrating a remarkable dynamic nature of the body representation.

Brain and neuronal involvement. Brain imaging studies in humans and neurophysiological studies in nonhuman primates suggest that the neuronal substrates of body self-perception involve multisensory areas in the frontal and parietal lobes that receive convergent visual, tactile, and proprioceptive afferent inputs. Of particular interest are neurons in the ventral premotor cortex and areas in the intraparietal cortex that integrate multisensory information in limb-centered reference frames from the space near the body. These neurons are strong candidates for mediating the perception of a limb as one's own because human functional magnetic resonance imaging experiments have found significantly increased activation in these areas when people experience the rubber hand illusion. Furthermore, the stronger the activity in these areas, the stronger the participants report that they are experiencing the illusion, and the stronger the neuronal responses in areas related to pain anticipation when the rubber hand has been injured. It is likely that ownership of entire bodies

Fig. 3. Experimental setup to induce the illusion of swapping bodies with another individual.

involves similar multisensory mechanisms, perhaps with the addition of spatial processing in the right inferior parietal cortex related to the identification of where the body is located in the environment.

Outlook. Understanding the perceptual and brain basis of body self-perception represents a major advance in the study of body awareness and self-consciousness. Moreover, the clarification of the principles that determine whether or not an object is perceived as oneself can contribute to the development of new clinical and industrial applications where the self-perception of the body is deliberately manipulated. For example, some data indicate that one could use the rubber hand illusion to enhance the feeling of ownership of artificial limbs used by amputees. Furthermore, the projection of ownership onto simulated bodies represents a new direction in virtual reality research, which could enhance user control, realism, and the feeling of "presence" in industrial, educational, and entertainment applications.

For background information *see* BRAIN; COGNITION; COMPUTER VISION; CONSCIOUSNESS; INFORMATION PROCESSING (PSYCHOLOGY); NERVOUS SYSTEM (VERTEBRATE); PERCEPTION; PSYCHOLOGY; PSYCHOPHYSICAL METHODS; SENSATION; VIRTUAL REALITY in the McGraw-Hill Encyclopedia of Science & Technology.

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Brand security in packaging

Brands are developed and supported to provide consumers with a trusted experience or expected quality level, which is expected to result in repeat sales and a premium price over unknown products. The protection of brands from attacks, illegal infringement, or risks is called brand security and is also sometimes referred to as brand protection, brand integrity, or product protection.

Packaged and bulk consumer products include food and beverages, consumer packaged goods (CPGs), consumer electronics, automotive parts, pharmaceuticals and healthcare products, clothing and accessories, toys, and tobacco. Brand security covers a wide range of threats including counterfeiting, diversion/parallel trade, tampering, child resistance, wholesale theft, shoplifting, warranty fraud, and return fraud. Counterfeit threats do not include currency counterfeiting, document forgery, copyright piracy, or artwork forgery. In a corporation, the packaging and brand integrity functions work together to implement solutions that leverage current strengths and directly address specific risks. With a strategic focus and an understanding of the root causes of the threat, usually a packaging component or supply chain process can provide security for multiple types of threats. A major focus of brand security has been on anticounterfeit and antidiversion strategy, and in authentication of product.

Definitions. When considering brand security and anticounterfeiting, it is important to consider the risks to the brand and the motivations of the fraudsters.

Counterfeiting. Counterfeiting is the copying of a product or package to deceive others into believing the product or package is genuine. Counterfeit products are also called knockoffs or fakes. Michigan State University research defined counterfeiting as both a macro term for this whole category of actions as well as a micro term, where everything about the product, package, documentation, and supply chain are fraudulent. The types of counterfeiting include adulteration, tampering, theft, unauthorized production (including licensee fraud, used-product remanufacturing, illegal repackaging, and unauthorized refilling), diversion (including illegal parallel trade, smuggling, and origin laundering), simulation, and full counterfeiting. An example of adulteration-type counterfeiting is adding melamine, a counterfeit additive, to pet food. Counterfeiting is illegal because it is an intellectual property rights infringement consisting of the unauthorized use of the trademark (such as a logo or brand name) or a patent (such as a recipe or design).

Diversion. Diversion is the distribution of a genuine product outside of its intended market. It is also referred to as parallel trade, gray market, secondary market, product arbitrage, or smuggling. Depending on local laws and the specific activity, diversion is not usually illegal. Nevertheless, it creates a transfer of the ownership of product, which is a major opportunity for counterfeit product to be introduced into the supply chain.

Piracy. A term often incorrectly used and interchanged with counterfeiting, piracy is the unauthorized use of a copyrighted work such as a song, a movie, a book, or computer software.

Counterfeiting. The root motivation for counterfeiting is economic gain, and vulnerabilities include profit potential, a product that is cheap and easy to copy, unsatisfied market demand, difficulties in detection or proof, and lack of deterrent laws or enforcement. Reasons for the growth in counterfeiting include:

1. Availability and growth of technology.
2. Increased globalization.
3. Low legal penalties.
4. The influence and prevalence of organized crime.

Scope and scale. Because of the clandestine nature of counterfeiting, a precise quantitative measurement of product counterfeiting is not only unknown but also unknowable. Even though we have data on the value of counterfeit products seized at U.S. borders, with the increased stealth and production