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Acquiring Tastes and Loves

What Neuroplasticity Teaches Us _About Sexual Attraction and Love

A. was a single, handsome young man who came to me because he was depressed. He had just gotten involved with a beautiful woman who had a boyfriend, and she had begun to encourage him to abuse her. She tried to draw A. into acting out sexual fantasies in which she dressed up as a prostitute, and he was to “take charge” of her and become violent in some way. When A. began to feel an alarming wish to oblige her, he got very upset, broke it off, and sought treatment. He had a history of involvement with women who were already attached to other men and emotionally out of control. His girlfriends had either been demanding and possessive or castratingly cruel. Yet these - were the women who thrilled him. “Nice” girls, thoughtful, kind women, bored him, and he felt that any woman who fell in love with him in a tender, uncomplicated way was defective.

His own mother was a severe alcoholic, frequently needy, seductive, and given to emotional storms and violent rages throughout his childhood. A. recalled her banging his sister’s head against the radiator and burning his stepbrother’s fingers as a punishment for playing with matches. She was frequently depressed, often threatening suicide, and his role was to be on the alert, calm her, and prevent her. His relationship with her was also highly sexualized. She wore see-through nighties and talked to him as though he -

were a lover. He thought he recalled her inviting him into her bed when he was a child and had an image of himself sitting with his foot in her vagina while she masturbated. He had an exciting but furtive feeling about the scene. On the rare occasions when his father, who had retreated from his wife, was home, A. recalled himself as “perpetually short of breath,” and trying to stop fights between his parents, who eventually divorced.

A. spent much of his childhood stifling his rage at both parents and often felt like a volcano about to burst. Intimate relationships seemed like forms of violence, in which others threatened to eat him alive, and yet by the time he had passed through childhood, it was for women who promised to do just that, and them alone, that he had acquired an erotic taste.

Human beings exhibit an extraordinary degree of sexual plasticity compared with other creatures. We vary in what we like to do with our partners in a sexual act. We vary where in our bodies we experience sexual excitement and satisfaction. But most of all we vary in whom or what we are attracted to. People often say they find a particular “type” attractive, or a “turn-on,” and these types vary immensely from person to person.

For some, the types change as they go through different periods and have new experiences. One homosexual man had successive relations with men from one race or ethnic group, then with those from another, and in each period he could be attracted only to men in the group that was currently “hot.” After one period was over, he could never be attracted to a man from the old group again. He acquired a taste for these “types” in quick succession and seemed more smitten by the person’s category or type (i.e., “Asians” or “African-Americans”) than by the individual. The plasticity of this man’s sexual taste exaggerates a general truth: that the human libido is not a hardwired, in-variable biological urge but can be curiously fickle, easily altered by our psychology and the history of our sexual encounters. And our libido can also be finicky. Much scientific

writing implies otherwise and depicts the sexual instinct as a biological imperative, an ever-hungry brute, always demanding satisfaction—a glutton, not a gourmet. But human beings are more like gourmets and are drawn to types and have strong preferences; having a "type" causes us to defer satisfaction until we find what we are looking for, because attraction to a type is restrictive: the person who is "really turned on by blondes" may tacitly rule out brunettes and redheads.

Even sexual preference can occasionally change. Though some scientists increasingly emphasize the inborn basis of our sexual preferences, it is also true that some people have heterosexual attractions for part of their lives—with no history of bisexuality—and then "add on" a homosexual attraction and vice versa.

Sexual plasticity may seem to have reached its height in those who have had many different partners, learning to adapt to each new lover; but think of the plasticity required of the aging married couple with a good sex life. They looked very different in their twenties, when they met, than they do in their sixties, yet their libidos adjust, so they remain attracted.

But sexual plasticity goes further still. Fetishists desire inanimate objects. The male fetishist can be more excited by a high-heeled shoe with a fur trim, or by a woman's lingerie, than by a real woman. Since ancient times some human beings in rural areas have had intercourse with animals. Some people seem to be attracted not so much to people as to complex sexual scripts, where partners play roles, involving various perversions, combining sadism, masochism, voyeurism, and exhibitionism. When they place an ad in the personals, the description of what they are looking for in a lover often sounds more like a job description than like that of a person they would like to know.

Given that sexuality is an instinct, and instinct is traditionally defined as a hereditary behavior unique to a species, varying little from one member to the next, the variety of our sexual tastes is curious. Instincts generally resist change and are thought to have a

clear, nonnegotiable, hardwired purpose, such as survival. Yet the human sexual "instinct" seems to have broken free of its core purpose, reproduction, and varies to a bewildering extent, as it does not in other animals, in which the sexual instinct seems to behave itself and act like an instinct.

No other instinct can so satisfy without accomplishing its biological purpose, and no other instinct is so disconnected from its purpose. Anthropologists have shown that for a long time humanity did not know that sexual intercourse was required for reproduction. This "fact of life" had to be learned by our ancestors, just as children must learn it today. This detachment from its primary purpose is perhaps the ultimate sign of sexual plasticity.

Love too is remarkably flexible, and its expression has changed through history. Though we speak of romantic love as the most natural of sentiments, in fact the concentration of our adult hopes for intimacy, tenderness, and lust in one person until death do us part is not common to all societies and has only recently become widespread in our own. For millennia most marriages were arranged by parents for practical reasons. Certainly, there are unforgettable stories of romantic love linked to marriage in the Bible, as in the Song of Songs, and linked to disaster in medieval troubadour poetry and, later, in Shakespeare. But romantic love began to gain social approval in the aristocracies and courts of Europe only in the twelfth century—originally between an unmarried man and a married woman, either adulterous or unconsummated, usually ending badly. Only with the spread of democratic ideals of individualism did the idea that lovers ought to be able to choose spouses for themselves take firmer hold and gradually begin to seem completely natural and inalienable.

It is reasonable to ask whether our sexual plasticity is related to neuroplasticity. Research has shown that neuroplasticity is neither ghettoized within certain departments in the brain nor confined to the sensory, motor, and cognitive processing areas we have already explored. The brain structure that regulates instinctive behaviors, including sex, called the hypothalamus, is plastic, as is the amygdala, the structure that processes emotion and anxiety. While some parts of the brain, such as the cortex, may have more plastic potential because there are more neurons and connections to be altered, even noncortical areas display plasticity. It is a property of all brain tissue. Plasticity exists in the hippocampus (the area that turns our memories from short-term to long-term ones) as well as in areas that control our breathing, process primitive sensation, and process pain. It exists in the spinal cord—as scientists have shown; actor Christopher Reeve, who suffered a severe spinal injury, demonstrated such plasticity, when he was able, through relentless exercise, to recover some feeling and mobility seven years after his accident.

Merzenich puts it this way: “You cannot have plasticity in isolation_._._._it’s an absolute impossibility.” His experiments have shown that if one brain system changes, those systems connected to it change as well. The same “plastic rules”—use it or lose it, or neurons that fire together wire together—apply throughout. Different areas of the brain wouldn’t be able to function together if that weren’t the case.

Do the same plastic rules that apply to brain maps in the sensory, motor, and language cortices apply to more complex maps, such as those that represent our relationships, sexual or otherwise? Merzenich has also shown that complex brain maps are governed by the same plastic principles as simpler maps. Animals exposed to a simple tone will develop a single brain map region to process it. Animals exposed to a complex pattern, such as a melody of six tones, will not simply link together six different

map regions but will develop a region that encodes the entire melody. These more complex melody maps obey the same plastic principles as maps for single tones.

"The sexual instincts," wrote Freud, "are noticeable to us for their plasticity, their capacity for altering their aims." Freud was not the first to argue that sexuality was plastic—Plato, in his dialogue on love, argued that human Eros took many forms—but Freud laid the foundations for a neuroscientific understanding of sexual and romantic plasticity.

One of his most important contributions was his discovery of critical periods for sexual plasticity. Freud argued that an adult's ability to love intimately and sexually unfolds in stages, beginning in the infant's first passionate attachments to its parents. He learned from his patients, and from observing children, that early childhood, not puberty, was the first critical period for sexuality and intimacy, and that children are capable of passionate, protosexual feelings—crushes, loving feelings, and in some cases even sexual excitement, as A. was. Freud discovered that the sexual abuse of children is harmful because it influences the critical period of sexuality in childhood, shaping our later attractions and thoughts about sex. Children are needy and typically develop passionate attachments to their parents. If the parent is warm, gentle, and reliable, the child will frequently develop a taste for that kind of relationship later on; if the parent is disengaged, cool, distant, self-involved, angry, ambivalent, or erratic, the child may seek out an adult mate who has similar tendencies. There are exceptions, but a significant body of research now confirms Freud's basic insight that early patterns of relating and attaching to others, if problematic, can get "wired" into our brains in childhood and repeated in adulthood. Many aspects of the sexual script that A. played out when he first came to see me were repetitions of his traumatic childhood situation, thinly disguised—such as his being attracted to an unstable woman who crossed normal sexual

boundaries in furtive relationships, where hostility and sexual excitement were merged, while the woman's official partner was cuckolded and threatening to reenter the scene.

The idea of the critical period was formulated around the time Freud started writing about sex and love, by embryologists who observed that in the embryo the nervous system develops in stages, and that if these stages are disturbed, the animal or person will be harmed, often catastrophically, for life. Though Freud didn't use the term, what he said about the early stages of sexual development conforms to what we know about critical periods. They are brief windows of time when new brain systems and maps develop with the help of stimulation from the people in one's environment.

Traces of childhood sentiments in adult love and sexuality are detectable in everyday behaviors. When adults in our culture have tender foreplay, or express their most intimate adoration, they often call each other "baby" or "babe." They use terms of endearment that their mothers used with them as children, such as "honey" and "sweetie pie," terms that evoke the earliest months of life when the mother expressed her love by feeding, caressing, and talking sweetly to her baby—what Freud called the oral phase, the first critical period of sexuality, the essence of which is summed up in the words "nurturance" and "nourish"—tenderly caring for, loving, and feeding. The baby feels merged with the mother, and its trust of others develops as the baby is held and nurtured with a sugary food, milk. Being loved, cared for, and fed are mentally associated in the mind and wired together in the brain in our first formative experience after birth.

When adults talk baby talk, using words such as "sweetie pie" and "baby" to address each other, and give their conversation an oral flavor, they are, according to Freud, "regressing," moving from mature mental states of relating to earlier phases of life. In terms of plasticity, such regression, I believe, involves unmasking old neuronal pathways that then trigger all the associations of that earlier phase. Regression can be pleasant

and harmless, as in adult foreplay, or it can be problematic, as when infantile aggressive pathways are unmasked and an adult has a temper tantrum.

Even “talking dirty” shows traces of infantile sexual stages. After all, why should sex be thought “dirty” at all? This attitude reflects a child’s view of sex from a stage when it is conscious of toilet training, urination, and defecation and is surprised to learn that the genitals, which are involved in urination, and so close to the anus, are also involved in sex, and that Mommy permits Daddy to insert his “dirty” organ in a hole that is very close to her bottom. Adults are not generally bothered by this, because in adolescence they have gone through another critical period of sexual plasticity in which their brains reorganized again, so that the pleasure of sex becomes intense enough to override any disgust.

Freud showed that many sexual mysteries can be understood as critical-period fixations. After Freud, we are no longer surprised that the girl whose father left her as a child pursues unavailable men old enough to be her father, or that people raised by ice--queen mothers often seek such people out as partners, sometimes becoming “icy” themselves, because, never having experienced empathy in the critical period, a whole part of their brains failed to develop. And many perversions can be explained in terms of plasticity and the persistence of childhood conflicts. But the main point is that in our critical periods we can acquire sexual and romantic tastes and inclinations that get wired into our brains and can have a powerful impact for the rest of our lives. And the fact that we can acquire different sexual tastes contributes to the tremendous sexual variation between us.

The idea that a critical period helps shape sexual desire in adults contradicts the currently popular argument that what attracts us is less the product of our personal history than of our common biology. Certain people—models and movie stars, for -

instance—are widely regarded as beautiful or sexy. A certain strand of biology teaches us that these people are attractive because they exhibit biological signs of robustness, which promise fertility and strength: a clear complexion and symmetrical features mean a potential mate is free from disease; an hourglass figure is a sign a woman is fertile; a man's muscles predict he will be able to protect a woman and her offspring.

But this simplifies what biology really teaches. Not everyone falls in love with the body, as when a woman says, "I knew, when I first heard that voice, that he was for me," the music of the voice being perhaps a better indication of a man's soul than his body's surface. And sexual taste has changed over the centuries. Rubens's beauties were large by current standards, and over the decades the vital statistics of Playboy centerfolds and fashion models have varied from voluptuous to androgynous. Sexual taste is obviously influenced by culture and experience and is often acquired and then wired into the brain.

"Acquired tastes" are by definition learned, unlike "tastes," which are inborn. A baby needn't acquire a taste for milk, water, or sweets; these are immediately perceived as pleasant. Acquired tastes are initially experienced with indifference or dislike but later become pleasant—the odors of cheeses, Italian bitters, dry wines, coffees, patés, the hint of urine in a fried kidney. Many delicacies that people pay dearly for, that they must "develop a taste for," are the very foods that disgusted them as children.

In Elizabethan times lovers were so enamored of each other's body odors that it was common for a woman to keep a peeled apple in her armpit until it had absorbed her sweat and smell. She would give this "love apple" to her lover to sniff at in her absence. We, on the other hand, use synthetic aromas of fruits and flowers to mask our body odor from our lovers. Which of these two approaches is acquired and which is natural is not so easy to determine. A substance as "naturally" repugnant to us as the urine of cows is used by the Masai tribe in East Africa as a lotion for their hair—a direct consequence of the cow's importance in their culture. Many tastes we think "natural" are acquired

through learning and become “second nature” to us. We are unable to distinguish our “second nature” from our “original nature” because our neuroplastic brains, once rewired, develop a new nature, every bit as biological as our original.

The current porn epidemic gives a graphic demonstration that sexual tastes can be acquired. Pornography, delivered by high-speed Internet connections, satisfies every one of the prerequisites for neuroplastic change.

Pornography seems, at first glance, to be a purely instinctual matter: sexually explicit pictures trigger instinctual responses, which are the product of millions of years of evolution. But if that were true, pornography would be unchanging. The same triggers, bodily parts and their proportions, that appealed to our ancestors would excite us. This is what pornographers would have us believe, for they claim they are battling sexual repression, taboo, and fear and that their goal is to liberate the natural, pent-up sexual instincts.

But in fact the content of pornography is a dynamic phenomenon that perfectly illustrates the progress of an acquired taste. Thirty years ago “hardcore” pornography usually meant the explicit depiction of sexual intercourse between two aroused partners, displaying their genitals. “Softcore” meant pictures of women, mostly, on a bed, at their toilette, or in some semiromantic setting, in various states of undress, breasts revealed.

Now hardcore has evolved and is increasingly dominated by the sadomasochistic themes of forced sex, ejaculations on women’s faces, and angry anal sex, all involving scripts fusing sex with hatred and humiliation. Hardcore pornography now explores the world of perversion, while softcore is now what hardcore was a few decades ago, explicit sexual intercourse between adults, now available on cable TV. The comparatively tame softcore pictures of yesteryear—women in various states of undress—now show up on

mainstream media all day long, in the pornification of everything, including television, rock videos, soap operas, advertisements, and so on.

Pornography's growth has been extraordinary; it accounts for 25 percent of video rentals and is the fourth most common reason people give for going online. An MSNBC.com survey of viewers in 2001 found that 80 percent felt they were spending so much time on pornographic sites that they were putting their relationships or jobs at risk. Softcore pornography's influence is now most profound because, now that it is no longer hidden, it influences young people with little sexual experience and especially plastic minds, in the process of forming their sexual tastes and desires. Yet the plastic influence of pornography on adults can also be profound, and those who use it have no sense of the extent to which their brains are reshaped by it.

During the mid- to late 1990s, when the Internet was growing rapidly and pornography was exploding on it, I treated or assessed a number of men who all had essentially the same story. Each had acquired a taste for a kind of pornography that, to a greater or lesser degree, troubled or even disgusted him, had a disturbing effect on the pattern of his sexual excitement, and ultimately affected his relationships and sexual potency.

None of these men were fundamentally immature, socially awkward, or withdrawn from the world into a massive pornography collection that was a substitute for relationships with real women. These were pleasant, generally thoughtful men, in reasonably successful relationships or marriages.

Typically, while I was treating one of these men for some other problem, he would report, almost as an aside and with telling discomfort, that he found himself spending more and more time on the Internet, looking at pornography and masturbating. He might try to ease his discomfort by asserting that everybody did it. In some cases he would begin by looking at a Playboy-type site or at a nude picture or video clip that someone

had sent him as a lark. In other cases he would visit a harmless site, with a suggestive ad that redirected him to risqué sites, and soon he would be hooked.

A number of these men also reported something else, often in passing, that caught my attention. They reported increasing difficulty in being turned on by their actual sexual partners, spouses or girlfriends, though they still considered them objectively attractive. When I asked if this phenomenon had any relationship to viewing pornography, they answered that it initially helped them get more excited during sex but over time had the opposite effect. Now, instead of using their senses to enjoy being in bed, in the present, with their partners, lovemaking increasingly required them to fantasize that they were part of a porn script. Some gently tried to persuade their lovers to act like porn stars, and they were increasingly interested in “fucking” as opposed to “making love.” Their sexual fantasy lives were increasingly dominated by the scenarios that they had, so to speak, downloaded into their brains, and these new scripts were often more primitive and more violent than their previous sexual fantasies. I got the impression that any sexual creativity these men had was dying and that they were becoming addicted to Internet porn.

The changes I observed are not confined to a few people in therapy. A social shift is occurring. While it is usually difficult to get information about private sexual mores, this is not the case with pornography today, because its use is increasingly public. This shift coincides with the change from calling it “pornography” to the more casual term “porn.” For his book on American campus life, I Am Charlotte Simmons, Tom Wolfe spent a number of years observing students on university campuses. In the book one boy, Ivy Peters, comes into the male residence and says, “Anybody got porn?”

Wolfe goes on, “This was not an unusual request. Many boys spoke openly about how they masturbated at least once every day, as if this were some sort of prudent maintenance of the psychosexual system.” One of the boys tells Ivy Peters, “Try the third

floor. They got some one-hand magazines up there." But Peters responds, "I've built up a tolerance to magazines_._._._I need videos." Another boy says, "Oh, f'r Chrissake, I.P., it's ten o'clock at night. In another hour the cum dumpsters will start coming over - here to spend the night_._._._And you're looking for porn videos and a knuckle fuck." Then Ivy "shrugged and turned his palms up as if to say, 'I want porn. What's the big deal?'"

The big deal is his tolerance. He recognizes that he is like a drug addict who can no longer get high on the images that once turned him on. And the danger is that this tolerance will carry over into relationships, as it did in patients whom I was seeing, leading to potency problems and new, at times unwelcome, tastes. When pornographers boast that they are pushing the envelope by introducing new, harder themes, what they don't say is that they must, because their customers are building up a tolerance to the content. The back pages of men's risqué magazines and Internet porn sites are filled with ads for Viagra-type drugs—medicine developed for older men with erectile problems related to aging and blocked blood vessels in the penis. Today young men who surf porn are tremendously fearful of impotence, or "erectile dysfunction" as it is euphemistically called. The misleading term implies that these men have a problem in their penises, but the problem is in their heads, in their sexual brain maps. The penis works fine when they use pornography. It rarely occurs to them that there may be a relationship between the pornography they are consuming and their impotence. (A few men, however, tellingly described their hours at computer porn sites as time spent "masturbating my brains out.")

One of the boys in Wolfe's scene describes the girls who are coming over to have sex with their boyfriends as "cum dumpsters." He too is influenced by porn images, for "cum dumpsters," like many women in porn films, are always eager, available receptacles and therefore devalued.

The addictiveness of Internet pornography is not a metaphor. Not all addictions are to drugs or alcohol. People can be seriously addicted to gambling, even to running. All addicts show a loss of control of the activity, compulsively seek it out despite negative consequences, develop tolerance so that they need higher and higher levels of stimulation for satisfaction, and experience withdrawal if they can't consummate the addictive act.

All addiction involves long-term, sometimes lifelong, neuroplastic change in the brain. For addicts, moderation is impossible, and they must avoid the substance or activity completely if they are to avoid addictive behaviors. Alcoholics Anonymous insists that there are no "former alcoholics" and makes people who haven't had a drink for decades introduce themselves at a meeting by saying, "My name is John, and I am an alcoholic." In terms of plasticity, they are often correct.

In order to determine how addictive a street drug is, researchers at the National Institutes of Health (NIH) in Maryland train a rat to press a bar until it gets a shot of the drug. The harder the animal is willing to work to press the bar, the more addictive the drug. Cocaine, almost all other illegal drugs, and even nondrug addictions such as running make the pleasure-giving neurotransmitter dopamine more active in the brain. Dopamine is called the reward transmitter, because when we accomplish something—run a race and win—our brain triggers its release. Though exhausted, we get a surge of energy, exciting pleasure, and confidence and even raise our hands and run a victory lap. The losers, on the other hand, who get no such dopamine surge, immediately run out of energy, collapse at the finish line, and feel awful about themselves. By hijacking our dopamine system, addictive substances give us pleasure without our having to work for it.

Dopamine, as we saw in Merzenich's work, is also involved in plastic change. The same surge of dopamine that thrills us also consolidates the neuronal connections

responsible for the behaviors that led us to accomplish our goal. When Merzenich used an electrode to stimulate an animal's dopamine reward system while playing a sound, dopamine release stimulated plastic change, enlarging the representation for the sound in the animal's auditory map. An important link with porn is that dopamine is also released in sexual excitement, increasing the sex drive in both sexes, facilitating orgasm, and activating the brain's pleasure centers. Hence the addictive power of pornography.

Eric Nestler, at the University of Texas, has shown how addictions cause permanent changes in the brains of animals. A single dose of many addictive drugs will produce a protein, called iFosB (pronounced "delta Fos B"), that accumulates in the neurons. Each time the drug is used, more iFosB accumulates, until it throws a genetic switch, affecting which genes are turned on or off. Flipping this switch causes changes that persist long after the drug is stopped, leading to irreversible damage to the brain's dopamine system and rendering the animal far more prone to addiction. Nondrug addictions, such as running and sucrose drinking, also lead to the accumulation of iFosB and the same permanent changes in the dopamine system.

Pornographers promise healthy pleasure and relief from sexual tension, but what they often deliver is an addiction, tolerance, and an eventual decrease in pleasure. Paradoxically, the male patients I worked with often craved pornography but didn't like it.

The usual view is that an addict goes back for more of his fix because he likes the pleasure it gives and doesn't like the pain of withdrawal. But addicts take drugs when there is no prospect of pleasure, when they know they have an insufficient dose to make them high, and will crave more even before they begin to withdraw. Wanting and liking are two different things.

An addict experiences cravings because his plastic brain has become sensitized to the drug or the experience. Sensitization is different from tolerance. As tolerance develops, the addict needs more and more of a substance or porn to get a pleasant effect; as sensitization develops, he needs less and less of the substance to crave it intensely. So sensitization leads to increased wanting, though not necessarily liking. It is the accumulation of iFosB, caused by exposure to an addictive substance or activity, that leads to sensitization.

Pornography is more exciting than satisfying because we have two separate pleasure systems in our brains, one that has to do with exciting pleasure and one with satisfying pleasure. The exciting system relates to the “appetitive” pleasure that we get imagining something we desire, such as sex or a good meal. Its neurochemistry is largely dopamine-related, and it raises our tension level.

The second pleasure system has to do with the satisfaction, or consummatory pleasure, that attends actually having sex or having that meal, a calming, fulfilling pleasure. Its neurochemistry is based on the release of endorphins, which are related to opiates and give a peaceful, euphoric bliss.

Pornography, by offering an endless harem of sexual objects, hyperactivates the appetitive system. Porn viewers develop new maps in their brains, based on the photos and videos they see. Because it is a use-it-or-lose-it brain, when we develop a map area, we long to keep it activated. Just as our muscles become impatient for exercise if - we’ve been sitting all day, so too do our senses hunger to be stimulated.

The men at their computers looking at porn were uncannily like the rats in the cages of the NIH, pressing the bar to get a shot of dopamine or its equivalent. Though they didn’t know it, they had been seduced into pornographic training sessions that met all the conditions required for plastic change of brain maps. Since neurons that fire together

wire together, these men got massive amounts of practice wiring these images into the pleasure centers of the brain, with the rapt attention necessary for plastic change. They imagined these images when away from their computers, or while having sex with their girlfriends, reinforcing them. Each time they felt sexual excitement and had an orgasm when they masturbated, a "spritz of dopamine," the reward neurotransmitter, consolidated the connections made in the brain during the sessions. Not only did the reward facilitate the behavior; it provoked none of the embarrassment they felt purchasing Playboy at a store. Here was a behavior with no "punishment," only reward.

The content of what they found exciting changed as the Web sites introduced themes and scripts that altered their brains without their awareness. Because plasticity is competitive, the brain maps for new, exciting images increased at the expense of what had previously attracted them—the reason, I believe, they began to find their girlfriends less of a turn-on.

The story of Sean Thomas, first published in England's Spectator, is a remarkable account of a man descending into a porn addiction, and it sheds light on how porn changes brain maps and alters sexual taste, as well as the role of critical-period plasticity in the process. Thomas wrote, "I never used to like pornography, not really. Yes, in my teens in the Seventies I used to have the odd copy of Playboy under my pillow. But on the whole I didn't really go for skin mags or blue movies. I found them tedious, repetitive, absurd, and very embarrassing to buy." He was repelled by the bleakness of the porn scene and the garishness of the mustachioed studs who inhabited it. But in 2001, shortly after he first went online, he got curious about the porn everyone said was taking over the Internet. Many of the sites were free—teasers, or "gateway sites," to get people into the harder stuff. There were galleries of naked girls, of common types of sexual fantasies and attractions, designed to press a button in the brain of the

surfer, even one he didn't know he had. There were pictures of lesbians in a Jacuzzi, cartoon porn, women on the toilet smoking, coeds, group sex, and men ejaculating over submissive Asian women. Most of the pictures told a story.

Thomas found a few images and scripts that appealed to him, and they "dragged me back for more the next day. And the next. And the next." Soon he found that whenever he had a spare minute, he would "start hungrily checking out Net Porn."

Then one day he came across a site that featured spanking images. To his surprise, he got intensely excited. Thomas soon found all sorts of related sites, such as "Bernie's Spanking Pages" and the "Spanking College."

"This was the moment," he writes, "that the real addiction set in. My interest in spanking got me speculating: What other kinks was I harboring? What other secret and rewarding corners lurked in my sexuality that I would now be able to investigate in the privacy of my home? Plenty, as it turned out. I discovered a serious penchant for, inter alia, lesbian gynecology, interracial hardcore, and images of Japanese girls taking off their hotpants. I was also into netball players with no knickers, drunk Russian girls exposing themselves, and convoluted scenarios where submissive Danish actresses - were intimately shaved by their dominant female partners in the shower. The Net had, in other words, revealed to me that I had an unquantifiable variety of sexual fantasies and quirks and that the process of satisfying these desires online only led to more interest."

Until he happened upon the spanking pictures, which presumably tapped into some childhood experience or fantasy about being punished, the images he saw interested him but didn't compel him. Other people's sexual fantasies bore us. Thomas's experience was similar to that of my patients: without being fully aware of what they - were looking for, they scanned hundreds of images and scenarios until they hit upon an image or sexual script that touched some buried theme that really excited them.

Once Thomas found that image, he changed. That spanking image had his focused attention, the condition for plastic change. And unlike a real woman, these porn images - were available all day, every day on the computer.

Now Thomas was hooked. He tried to control himself but was spending at least five hours a day on his laptop. He surfed secretly, sleeping only three hours a night. His girlfriend, aware of his exhaustion, wondered if he was seeing someone else. He became so sleep deprived that his health suffered, and he got a series of infections that landed him in a hospital emergency room and finally caused him to take stock. He began inquiring among his male friends and found that many of them were also hooked.

Clearly there was something about Thomas's sexuality, outside his awareness, that had suddenly surfaced. Does the net simply reveal quirks and kinks, or does it also help create them? I think it creates new fantasies out of aspects of sexuality that have been outside the surfer's conscious awareness, bringing these elements together to form new networks. It is not likely that thousands of men have witnessed, or even imagined, submissive Danish actresses intimately shaved by their dominant female partners in the shower. Freud discovered that such fantasies take hold of the mind because of the individual components in them. For instance, some heterosexual men are interested in porn scenarios where older, dominant women initiate younger women into lesbian sex. This may be because boys in early childhood often feel dominated by their mothers, who are the "boss," and dress, undress, and wash them. In early childhood some boys may pass through a period when they strongly identify with their mothers and feel "like a girl," and their later interest in lesbian sex can express their residual unconscious female identification. Hardcore porn unmasks some of the early neural networks that formed in the critical periods of sexual development and brings all these early, forgotten, or repressed elements together to form a new network, in which all the features are wired

together. Porn sites generate catalogs of common kinks and mix them together in images. Sooner or later the surfer finds a killer combination that presses a number of his sexual buttons at once. Then he reinforces the network by viewing the images repeatedly, masturbating, releasing dopamine and strengthening these networks. He has created a kind of “neosexuality,” a rebuilt libido that has strong roots in his buried sexual tendencies. Because he often develops tolerance, the pleasure of sexual discharge must be supplemented with the pleasure of an aggressive release, and sexual and aggressive images are increasingly mingled—hence the increase in sadomasochistic themes in hardcore porn.

Critical periods lay the groundwork for our types, but falling in love in adolescence or later provides an opportunity for a second round of massive plastic change. Stendhal, the nineteenth-century novelist and essayist, understood that love could lead to radical changes in attraction. Romantic love triggers such powerful emotion that we can reconfigure what we find attractive, even overcoming “objective” beauty. In On Love Stendhal describes a young man, Alberic, who meets a woman more beautiful than his mistress. Yet Alberic is far more drawn to his mistress than to this woman because his mistress promises him so much more happiness. Stendhal calls this “Beauty Dethroned by Love.” Love has such power to change attraction that Alberic is turned on by a minor defect on his mistress’s face, her pockmark. It excites him because “he has experienced so many emotions in the presence of that pockmark, emotions for the most part exquisite and of the most absorbing interest, that whatever his emotions may have been, they are renewed with incredible vividness at the sight of this sign, even observed on the face of another woman_._._._in this case ugliness becomes beauty.”

This transformation of taste can happen because we do not fall in love with looks alone. Under normal circumstances finding another person attractive can prompt a readiness to fall in love, but that person's character and a host of other attributes, including his ability to make us feel good about ourselves, crystallize the process of falling in love. Then being in love triggers an emotional state so pleasurable that it can make even pockmarks attractive, plastically rewiring our aesthetic sense. Here is how I believe it works.

In 1950 "pleasure centers" were discovered in the limbic system, a part of the brain heavily involved in processing emotion. In Dr. Robert Heath's experiments on humans—an electrode was implanted into the septal region of the limbic system and turned on—these patients experienced a euphoria so powerful that when the researchers tried to end the experiment, one patient pleaded with them not to. The septal region also fired when pleasant subjects were discussed with the patients and during orgasm. These pleasure centers were found to be part of the brain's reward system, the mesolimbic dopamine system. In 1954 James Olds and Peter Milner showed that when they inserted electrodes into an animal's pleasure center while teaching it a task, it learned more easily because learning felt so pleasurable and was rewarded.

When the pleasure centers are turned on, everything we experience gives us pleasure. A drug like cocaine acts on us by lowering the threshold at which our pleasure centers will fire, making it easier for them to turn on. It is not simply the cocaine that gives us pleasure. It is the fact that our pleasure centers now fire so easily that makes whatever we experience feel great. It is not just cocaine that can lower the threshold at which our pleasure centers fire. When people with bipolar disorder (formerly called - manic depression) begin to move toward their manic highs, their pleasure centers begin firing more easily. And falling in love also lowers the threshold at which the pleasure centers will fire.

When a person gets high on cocaine, becomes manic, or falls in love, he enters an enthusiastic state and is optimistic about everything, because all three conditions lower the firing threshold for the appetitive pleasure system, the dopamine-based system associated with the pleasure of anticipating something we desire. The addict, the manic, and the lover are increasingly filled with hopeful anticipation and are sensitive to anything that might give pleasure—flowers and fresh air inspire them, and a slight but thoughtful gesture makes them delight in all mankind. I call this process “globalization.”

Globalization is intense when falling in love and is, I believe, one of the main reasons that romantic love is such a powerful catalyst for plastic change. Because the pleasure centers are firing so freely, the enamored person falls in love not only with the beloved but with the world and romanticizes his view of it. Because our brains are experiencing a surge of dopamine, which consolidates plastic change, any pleasurable experiences and associations we have in the initial state of love are thus wired into our brains.

Globalization not only allows us to take more pleasure in the world, it also makes it harder for us to experience pain and displeasure or aversion. Heath showed that when our pleasure centers fire, it is more difficult for the nearby pain and aversion centers to fire too. Things that normally bother us don’t. We love being in love not only because it makes it easy for us to be happy but also because it makes it harder for us to be unhappy.

Globalization also creates an opportunity for us to develop new tastes in what we find attractive, like the pockmark that gave Alberic such pleasure. Neurons that fire together wire together, and feeling pleasure in the presence of this normally unappealing pockmark causes it to get wired into the brain as a source of delight. A similar mechanism occurs when a “reformed” cocaine addict passes the seedy alleyway where he first took the drug and is overwhelmed with cravings so powerful that he goes back to

it. The pleasure he felt during the high was so intense that it caused him to experience the ugly alleyway as enticing, by association.

There is thus a literal chemistry of love, and the stages of romance reflect the changes in our brain during not only the ecstasies but also love's throes. Freud, one of the first people to describe the psychic effects of cocaine and, as a young man, the first to discover its medical uses, got a glimpse of this chemistry. Writing to his fiancée, Martha, on February 2, 1886, he described taking cocaine while composing the letter. Because cocaine acts on the system so quickly, the letter, as it unfolds, gives us a marvelous window into its effects. He first describes how it makes him talkative and confessional. His initial self-deprecatory remarks vanish as the letter goes on, and soon he feels fearless, identifiying with his brave ancestors defending the Temple in Jerusalem. He likens cocaine's ability to cure his fatigue to the magical cure he gets from being with Martha romantically. In another letter he writes that cocaine reduces his shyness and depression, makes him euphoric, enhances his energy, self-esteem, and enthusiasm, and has an aphrodisiac effect. He is describing a state akin to "romantic intoxication," when people feel the initial high, talk all night, and have increased energy, libido, self--esteem, and enthusiasm, but because they think everything is good, they may also have impaired judgment—all of which occurs with a dopamine-promoting drug like cocaine. Recent fMRI (functional magnetic resonance imaging) scans of lovers looking at photos of their sweethearts show that a part of the brain with great concentrations of dopamine is activated; their brains looked like those of people on cocaine.

But the pains of love also have a chemistry. When separated for too long, lovers crash and experience withdrawal, crave their beloved, get anxious, doubt themselves, lose their energy, and feel run-down if not depressed. Like a little fix, a letter, an e-mail, or a telephone message from the beloved provides an instant shot of energy. Should

they break up, they get depressed—the opposite of the manic high. These “addictive - symptoms”—the highs, crashes, cravings, withdrawal, and fixes—are subjective signs of plastic changes occurring in the structure of our brains, as they adapt to the presence or absence of the beloved.

A tolerance, akin to tolerance for a drug, can develop in happy lovers as they get used to each other. Dopamine likes novelty. When monogamous mates develop a tolerance for each other and lose the romantic high they once had, the change may be a sign, not that either of them is inadequate or boring, but that their plastic brains have so well adapted to each other that it’s harder for them to get the same buzz they once got from each other.

Fortunately, lovers can stimulate their dopamine, keeping the high alive, by injecting novelty into their relationship. When a couple go on a romantic vacation or try new activities together, or wear new kinds of clothing, or surprise each other, they are using novelty to turn on the pleasure centers, so that everything they experience, including each other, excites and pleases them. Once the pleasure centers are turned on and globalization begins, the new image of the beloved again becomes associated with unexpected pleasures and is plastically wired into the brain, which has evolved to respond to novelty. We must be learning if we are to feel fully alive, and when life, or love, becomes too predictable and it seems like there is little left to learn, we become - restless—a protest, perhaps, of the plastic brain when it can no longer perform its essential task.

Love creates a generous state of mind. Because love allows us to experience as pleasurable situations or physical features that we otherwise might not, it also allows us to unlearn negative associations, another plastic phenomenon.

The science of unlearning is a very new one. Because plasticity is competitive, when a person develops a neural network, it becomes efficient and self-sustaining and, like a habit, hard to unlearn. Recall that Merzenich was looking for “an eraser” to help him speed up change and unlearn bad habits.

Different chemistries are involved in learning than in unlearning. When we learn something new, neurons fire together and wire together, and a chemical process occurs at the neuronal level called “long-term potentiation,” or LTP, which strengthens the connections between the neurons. When the brain unlearns associations and disconnects neurons, another chemical process occurs, called “long-term depression,” or LTD (which has nothing to do with a depressed mood state). Unlearning and weakening connections between neurons is just as plastic a process, and just as important, as learning and strengthening them. If we only strengthened connections, our neuronal networks would get saturated. Evidence suggests that unlearning existing memories is necessary to make room for new memories in our networks.

Unlearning is essential when we are moving from one developmental stage to the next. When at the end of adolescence a girl leaves home to go to college in another state, for example, both she and her parents undergo grief and massive plastic change, as they alter old emotional habits, routines, and self-images.

Falling in love for the first time also means entering a new developmental stage and demands a massive amount of unlearning. When people commit to each other, they must radically alter their existing and often selfish intentions and modify all other attachments, in order to integrate the new person in their lives. Life now involves ongoing cooperation that requires a plastic reorganization of the brain centers that deal with emotions, sexuality, and the self. Millions of neural networks have to be obliterated and replaced with new ones—one reason that falling in love feels, for so many people,

like a loss of identity. Falling in love may also mean falling out of love with a past love; this too requires unlearning at a neural level.

A man's heart is broken by his first love when his engagement breaks off. He looks at many women, but each pales in comparison to the fiancée he came to believe was his one true love and whose image haunts him. He cannot unlearn the pattern of attraction to his first love. Or a woman married for twenty years becomes a young widow and refuses to date. She cannot imagine she will ever fall in love again, and the idea of "replacing" her husband offends her. Years pass, and her friends tell her it is time to move on, to no avail.

Often such people cannot move on because they cannot yet grieve; the thought of living without the one they love is too painful to bear. In neuroplastic terms, if the romantic or the widow is to begin a new relationship without baggage, each must first rewire billions of connections in their brains. The work of mourning is piecemeal, Freud noted; though reality tells us our loved one is gone, "its orders cannot be obeyed at once." We grieve by calling up one memory at a time, reliving it, and then letting it go. At a brain level we are turning on each of the neural networks that were wired together to form our perception of the person, experiencing the memory with exceptional vividness, then saying good-bye one network at a time. In grief, we learn to live without the one we love, but the reason this lesson is so hard is that we first must unlearn the idea that the person exists and can still be relied on.

Walter J. Freeman, a professor of neuroscience at Berkeley, was the first to make the connection between love and massive unlearning. He has assembled a number of compelling biological facts that point toward the conclusion that massive neuronal reorganization occurs at two life stages: when we fall in love and when we begin parenting. Freeman argues that massive plastic brain reorganization—far more massive

than in normal learning or unlearning—becomes possible because of a brain neuromodulator.

Neuromodulators are different from neurotransmitters. While neurotransmitters are released in the synapses to excite or inhibit neurons, neuromodulators enhance or diminish the overall effectiveness of the synaptic connections and bring about enduring change. Freeman believes that when we commit in love, the brain neuromodulator oxytocin is released, allowing existing neuronal connections to melt away so that changes on a large scale can follow.

Oxytocin is sometimes called the commitment neuromodulator because it reinforces bonding in mammals. It is released when lovers connect and make love—in humans oxytocin is released in both sexes during orgasm—and when couples parent and nurture their children. In women oxytocin is released during labor and breast-feeding. An fMRI study shows that when mothers look at photos of their children, brain regions rich in oxytocin are activated. In male mammals a closely related neuromodulator called vasopressin is released when they become fathers. Many young people who doubt they will be able to handle the responsibilities of parenting are not aware of the extent to which oxytocin may change their brains, allowing them to rise to the occasion.

Studies of a monogamous animal called the prairie vole have shown that oxytocin, which is normally released in their brains during mating, makes them pair off for life. If a female vole has oxytocin injected into her brain, she will pair-bond for life with a nearby male. If a male vole is injected with vasopressin, it will cuddle with a nearby female. Oxytocin appears also to attach children to parents, and the neurons that control its secretion may have a critical period of their own. Children reared in orphanages without close loving contact often have bonding problems when older. Their oxytocin levels remain low for several years after they have been adopted by loving families.

Whereas dopamine induces excitement, puts us into high gear, and triggers sexual arousal, oxytocin induces a calm, warm mood that increases tender feelings and attachment and may lead us to lower our guard. A recent study shows that oxytocin also triggers trust. When people sniff oxytocin and then participate in a financial game, they are more prone to trust others with their money. Though there is still more work to be done on oxytocin in humans, evidence suggests that its effect is similar to that in prairie voles: it makes us commit to our partners and devotes us to our children.

But oxytocin works in a unique way, related to unlearning. In sheep, oxytocin is released in the olfactory bulb, a part of the brain involved in odor perception, with each new litter. Sheep and many other animals bond with, or "imprint" on, their offspring by scent. They mother their own lambs and reject the unfamiliar. But if oxytocin is injected into a mother ewe when exposed to an unfamiliar lamb, she will mother the strange lamb too.

Oxytocin is not, however, released with the first litter—only with those litters that follow—suggesting that the oxytocin plays the role of wiping out the neural circuits that bonded the mother with her first litter, so she can bond with her second. (Freeman suspects that the mother bonds with her first litter using other neurochemicals.) Oxytocin's ability to wipe out learned behavior has led scientists to call it an amnestic hormone. Freeman proposes that oxytocin melts down existing neuronal connections that underlie existing attachments, so new attachments can be formed. Oxytocin, in this theory, does not teach parents to parent. Nor does it make lovers cooperative and kind; rather, it makes it possible for them to learn new patterns.

Freeman's theory helps to explain how love and plasticity affect each other. Plasticity allows us to develop brains so unique—in response to our individual life experiences—that it is often hard to see the world as others do, to want what they want, or to

cooperate. But the successful reproduction of our species requires cooperation. What nature provides, in a neuromodulator like oxytocin, is the ability for two brains in love to go through a period of heightened plasticity, allowing them to mold to each other and shape each other's intentions and perceptions. The brain for Freeman is fundamentally an organ of socialization, and so there must be a mechanism that, from time to time, undoes our tendency to become overly individualized, overly self-involved, and too self--centered.

As Freeman says, "The deepest meaning of sexual experience lies not in pleasure, or even in reproduction, but in the opportunity it affords to surmount the solipsistic gulf, opening the door, so to speak, whether or not one undertakes the work to go through. It is the afterplay, not the foreplay, that counts in building trust."

Freeman's concept reminds us of many variations on love: the insecure man who leaves a woman quickly after making love during the night, because he fears being overly influenced by her should he stay through the morning; the woman who tends to fall in love with whomever she has sex with. Or the sudden transformation of the man who barely noticed children into a devoted father; we say "he's matured" and "the kids come first," but he may have had some help from oxytocin, which allowed him to go beyond his deep-seated patterns of selfish concern. Contrast him with the inveterate bachelor who never falls in love and becomes more eccentric and rigid with each passing year, plastically reinforcing his routines through repetition.

Unlearning in love allows us to change our image of ourselves—for the better, if we have an adoring partner. But it also helps account for our vulnerability when we fall in love and explains why so many self-possessed young men and women, who fall in love with a manipulative, undermining, or devaluing person, often lose all sense of self and become plagued with self-doubt, from which it may take years to recover.

Understanding unlearning, and some of the fine points of brain plasticity, turned out to be crucial in the treatment of my patient A. By the time A. went to college, he found himself replaying his critical-period experience and being attracted to emotionally disturbed, already attached women very much like his mother, feeling it was his job to love and rescue them.

A. was caught in two plastic traps.

The first was that a relationship with a thoughtful, stable woman who might have helped him unlearn his love for problem women, and teach him a new way to love, simply didn't turn him on, though he wished it would. So he was stuck with a destructive attraction, formed in his critical period.

His second, related trap can also be understood plastically. One of his most tormenting symptoms was the almost perfect fusion in his mind of sex with aggression. He felt that to love someone was to consume her, to eat her alive, and that to be loved was to be eaten alive. And his feeling that sexual intercourse was a violent act upset him greatly, yet excited him. Thoughts of sexual intercourse immediately led to thoughts of violence, and thoughts of violence, to sex. When he was effective sexually, he felt he was dangerous. It was as though he lacked separate brain maps for sexual and violent feelings.

Merzenich has described a number of "brain traps" that occur when two brain maps, meant to be separate, merge. As we have seen, he found that if a monkey's fingers were sewn together and so forced to move at the same time, the maps for them would fuse, because their neurons fired together and hence wired together. But he also discovered that maps fuse in everyday life. When a musician uses two fingers together frequently enough while playing an instrument, the maps for the two fingers sometimes fuse, and when the musician tries to move only one finger, the other moves too. The maps for the two different fingers are now "dedifferentiated." The more intensely the musician tries to

produce a single movement, the more he will move both fingers, strengthening the merged map. The harder the person tries to get out of the brain trap, the deeper he gets into it, developing a condition called “focal dystonia.” A similar brain trap occurs in Japanese people who, when speaking English, can’t hear the difference between r and l because the two sounds are not differentiated in their brain maps. Each time they try to say the sounds properly, they say them incorrectly, reinforcing the problem.

This is what I believe A. experienced. Each time he thought of sex, he thought of violence. Each time he thought of violence, he thought of sex, reinforcing the connection in the merged map.

Merzenich’s colleague Nancy Byl, who works in physical medicine, teaches people who can’t control their fingers to redifferentiate their finger maps. The trick is not to try to move the fingers separately, but to relearn how to use their hands the way they did as babies. When treating guitarists with focal dystonias who have lost control of their fingers, for example, she first instructs them to stop playing guitar for a while, to weaken the merged map. Then they just hold an unstrung guitar for a few days. Then a single string with a different feel from a normal guitar string is put on the guitar, and they feel it carefully, but with only one finger. Finally they use a second finger, on a separate string. Eventually the fused brain maps for their fingers separate into two distinct maps, and they can play again.

A. came into psychoanalysis. Early on we sorted out why love and aggression had fused, tracing the roots of his brain trap to his experience with his drunken mother who often gave free rein to sexual and violent feelings simultaneously. But when he still - couldn’t change what attracted him, I did something similar to what Merzenich and Byl do to redifferentiate maps. For a long period in the therapy, whenever A. expressed any kind of physical tenderness outside the sexual arena untainted by aggression, I pointed

it out and asked him to observe it closely, reminding him that he was capable of a positive feeling and capable of intimacy.

When violent thoughts came up, I got him to search his experience to find even a single instance in which aggression or violence was untainted with sex or was even praiseworthy, as in justified self-defense. Whenever these areas came up—a pure physical tenderness, or aggression that wasn't destructive—I drew his attention to them. As time passed, he was able to form two different brain maps, one for physical tenderness, which had nothing to do with the seductiveness he experienced with his mother, and another for aggression—including healthy assertiveness—which was quite different from the senseless violence he'd experienced when his mother was drunk.

Separating sex and violence in his brain maps allowed him to feel better about relationships and sex, and improvement followed in stages. While he wasn't immediately able to fall in love with or become excited by a healthy woman, he did fall in love with a woman who was a bit healthier than his previous girlfriend, and he benefited from the learning and unlearning that that love provided. This experience allowed him to enter progressively healthier relationships, unlearning more each time. By the end of therapy he was in a healthy, satisfying, happy marriage; his character, and his sexual type, had been radically transformed.

The rewiring of our pleasure systems, and the extent to which our sexual tastes can be acquired, is seen most dramatically in such perversions as sexual masochism, which turns physical pain into sexual pleasure. To do this the brain must make pleasant that which is inherently unpleasant, and the impulses that normally trigger our pain system are plastically rewired into our pleasure system.

People with perversions often organize their lives around activities that mix aggression and sexuality, and they often celebrate and idealize humiliation, hostility, defiance, the forbidden, the furtive, the lusciously sinful, and the breaking of taboos; they feel special for not being merely “normal.” These “transgressive” or defiant attitudes are essential to the enjoyment of perversion. The idealization of the perverse, and the devaluation of “normalcy,” is brilliantly captured in Vladimir Nabokov’s novel Lolita, in which a middle-aged man idolizes and has sex with a prepubescent, twelve-year-old girl, while showing contempt for all older females.

Sexual sadism illustrates plasticity in that it fuses two familiar tendencies, the sexual and the aggressive, each of which can give pleasure separately, and brings them together so when they are discharged, the pleasure is doubled. But masochism goes much further because it takes something inherently unpleasant, pain, and turns it into a pleasure, altering the sexual drive more fundamentally and more vividly demonstrating the plasticity of our pleasure and pain systems.

For years the police, through raids on S&M establishments, knew more about serious perversions than most clinicians. While patients with milder perversions often come for treatment of such problems as anxiety or depression, those with serious perversions seldom seek therapy because, generally, they enjoy them.

Robert Stoller, M.D., a California psychoanalyst, did make important discoveries through visits to S&M and B&D (bondage and discipline) establishments in Los Angeles. He interviewed people who practiced hardcore sadomasochism, which inflicts real pain on the flesh, and discovered that masochistic participants had all had serious physical illnesses as children and had undergone regular, terrifying, painful medical treatment. “As a result,” writes Stoller, “they had to be confined severely and for long periods [in hospitals] without the chance to unload their frustration, despair and rage openly and

appropriately. Hence the perversions." As children, they consciously took their pain, their inexpressible rage, and reworked it in daydreams, in altered mental states, or in masturbation fantasies, so they could replay the story of the trauma with a happy ending and say to themselves, This time, I win. And the way they won was by erotizing their agony.

The idea that an "inherently" painful feeling can become pleasurable may at first strike us as hard to believe, because we tend to assume that each of our sensations and emotions is inherently either pleasurable (joy, triumph, and sexual pleasure) or painful (sadness, fear, and grief). But in fact this assumption does not hold up. We can cry tears of happiness and have bittersweet triumphs; and in neuroses people may feel guilty about sexual pleasure, or no pleasure at all, where others would feel delight. An emotion that we think inherently unpleasurable, such as sadness, can, if beautifully and subtly articulated in music, literature, or art, feel not only poignant but sublime. Fear can be exciting in frightening movies or on roller coasters. The human brain seems able to attach many of our feelings and sensations either to the pleasure system or to the pain system, and each of these links or mental associations requires a novel plastic connection in the brain.

The hardcore masochists whom Stoller interviewed must have formed a pathway that linked the painful sensations they had endured to their sexual pleasure systems, resulting in a new composite experience, voluptuous pain. That they all suffered in early childhood strongly suggests that this rewiring occurred during the critical periods of sexual plasticity.

In 1997 a documentary appeared that sheds light on plasticity and masochism: Sick: The Life and Death of Bob Flanagan, Supermasochist. Bob Flanagan performed his

masochistic acts in public as a performance artist and exhibitionist and was articulate, poetic, and at times very funny.

In Flanagan's opening scenes we see him naked, humiliated, pies being thrown in his face, fed with a funnel. But images flash of his being physically hurt and choked, hinting at far more disturbing forms of pain.

Bob was born in 1952 with cystic fibrosis, a genetic disorder of the lungs and pancreas in which the body produces an excessive amount of abnormally thick mucus that clogs the air passages, making it impossible to breathe normally, and leads to chronic digestive problems. He had to fight for every breath and often turned blue from lack of oxygen. Most patients born with this disease die as children or in their early twenties.

Bob's parents noticed he was in pain from the moment he came home from the hospital. When he was eighteen months old, doctors discovered pus between his lungs and began treating him by inserting needles deep into his chest. He began to dread these procedures and screamed desperately. Throughout childhood he was hospitalized regularly and confined nearly naked inside a bubblelike tent so doctors could monitor his sweat—one of the ways cystic fibrosis is diagnosed—while he felt mortified that his body was visible to strangers. To help him breathe and fight infections, doctors inserted all sorts of tubes into him. He was also aware of the severity of his problem: two of his younger sisters had also had cystic fibrosis; one died at six months, the other at twenty--one years.

Despite the fact that he had become a poster boy for the Orange County Cystic Fibrosis Society, he began to live a secret life. As a young child, when his stomach hurt relentlessly, he would stimulate his penis to distract himself. By the time he was in high school, he would lie naked at night and secretly cover himself with thick glue, for he

knew not what reason. He hung himself from a door with belts in painful positions. Then he began to insert needles into the belts to pierce his flesh.

When he was thirty-one, he fell in love with Sheree Rose, who came from a very troubled family. In the film we see Sheree's mother openly belittle her husband, Sheree's father, who, Sheree claims, was passive and never showed her affection. Sheree describes herself as being bossy since childhood. She is Bob's sadist.

In the film Sheree uses Bob, with his consent, as her slave. She humiliates him, cuts into the skin near his nipples with an X-Acto knife, puts clamps on his nipples, force--feeds him, chokes him with a cord till he turns blue, forces a large steel ball—as big as a billiard ball—into his anus, and puts needles in his erogenous zones. His mouth and lips are sutured shut with stitches. He writes of drinking Sheree's urine from a baby bottle. We see him with feces on his penis. His every orifice is invaded or defiled. These activities give Bob erections and lead to great orgasms in the sex that often follows.

Bob survives both his twenties and his thirties and in his early forties has become the oldest living survivor of cystic fibrosis. He takes his masochism on the road, to S&M clubs and art museums, where he enacts his masochistic rituals in public, always wearing his oxygen mask to breathe.

In one of the final scenes a naked Bob Flanagan takes a hammer and nails his penis, right through its center, to a board. He then matter-of-factly removes the nail so that blood spurts all over the camera lens, like a fountain, from the deep hole through his penis.

It is important to describe precisely what Flanagan's nervous system could endure, in order to understand the extent to which completely novel brain circuits can develop, linking the pain system to the pleasure system.

Flanagan's idea that his pain must be made pleasurable colored his fantasies from early childhood. His remarkable history confirms that his perversion developed out of his unique life experience and is linked to his traumatic memories. As an infant, he was tied into the crib in the hospital so he couldn't escape and hurt himself. By age seven his confinement had turned into a love of constriction. As an adult, he loved bondage and being handcuffed or tied up and hung for long periods in positions that torturers might use to break their victims. As a child, he was required to endure the powerful nurses and doctors who hurt him; as an adult, he voluntarily gave this power to Sheree, becoming her slave, whom she could abuse while practicing pseudomedical procedures on him. Even subtle aspects of his childhood relationship to his doctors were repeated in adulthood. The fact that Bob gave Sheree his consent repeated an aspect of the trauma because, after a certain age, when the doctors took blood, pierced his skin, and hurt him, he gave them permission, knowing his life depended on it.

This mirroring of childhood traumas through the repetition of such subtle details is typical of perversions. Fetishists—who are attracted to objects—have the same trait. A fetish, Robert Stoller said, is an object that tells a story, that captures scenes from childhood trauma and eroticizes them. (One man who developed a fetish for rubber underwear and raincoats was a childhood bedwetter, forced to sleep on rubber sheets, which he found humiliating and uncomfortable. Flanagan had a number of fetishes, for medical paraphernalia and the blunt metals from hardware stores—screws, nails, clamps, and hammers—all of which he used, at various times, for erotic-masochistic stimulation, to penetrate, pinch, or pound his flesh.)

Flanagan's pleasure centers were no doubt rewired in two ways. First, emotions such as anxiety that are normally unpleasant became pleasant. He explains that he is constantly flirting with death because he was promised an early death and is trying to master his fear. In his 1985 poem, "Why," he makes clear that his supermasochism

allows him to feel triumphant, courageous, and invulnerable after a life of vulnerability. But he goes beyond simply mastering fear. Humiliated by doctors who stripped him and put him in a plastic tent to measure his sweat, he now proudly strips in museums. To master his feelings of being exposed and humiliated as a child, he becomes a triumphant exhibitionist. Shame is made into a pleasure, converted into shamelessness.

The second aspect of his rewiring is that physical pain becomes pleasure. Metal in flesh now feels good, gives him erections, and makes him have orgasms. Some people under great physical stress release endorphins, the opiumlike analgesics that our bodies make to dull our pain and that can make us euphoric. But Flanagan explains he is not dulled to pain—he is drawn to it. The more he hurts himself, the more sensitized to pain he becomes, and the more pain he feels. Because his pain and pleasure systems are connected, Flanagan feels real, intense pain, and it feels good.

Children are born helpless and will, in the critical period of sexual plasticity, do anything to avoid abandonment and to stay attached to adults, even if they must learn to love the pain and trauma that adults inflict. The adults in little Bob's world inflicted pain on him "for his own good." Now, by becoming a supermasochist, he ironically treats pain as though it is good for him. He is utterly aware that he is stuck in the past, reliving infancy, and says he hurts himself "because I am a big baby, and I want to stay that way." Perhaps the fantasy of staying the tortured baby is an imaginary way of keeping himself from the death that awaits him should he allow himself to grow up. If he can stay Peter Pan, endlessly "tormented" by Sheree, at least he will never grow up and die prematurely.

At the end of the film we see Flanagan dying. He stops making jokes and begins to look like a cornered animal, overwhelmed with fear. The viewer sees how terrified he must have been as a little boy, before he discovered the masochistic solution to tame his pain and terror. At this point, we learn from Bob that Sheree has been talking of splitting

up—evoking every suffering child's worst fear, abandonment. Sheree says the problem is that Bob is no longer submitting to her. He looks utterly brokenhearted—and in the end, she stays, and nurses him tenderly.

In his final moments, almost in shock, he asks plaintively, "Am I dying? I don't understand it_._._._What is going on?_._._._I'd never believe this." So powerful were his masochistic fantasies, games, and rituals, in which he embraced painful death, that it seems he thought he had actually beaten it.

As for the patients who became involved in porn, most were able to go cold turkey once they understood the problem and how they were plastically reinforcing it. They found eventually that they were attracted once again to their mates. None of these men had addictive personalities or serious childhood traumas, and when they understood what was happening to them, they stopped using their computers for a period to weaken their problematic neuronal networks, and their appetite for porn withered away. Their treatment for sexual tastes acquired later in life was far simpler than that for patients who, in their critical periods, acquired a preference for problematic sexual types. Yet even some of these men were able, like A., to change their sexual type, because the same laws of neuroplasticity that allow us to acquire problematic tastes also allow us, in intensive treatment, to acquire newer, healthier ones and in some cases even to lose our older, troubling ones. It's a use-it-or-lose-it brain, even where sexual desire and love are concerned.