**When Cupid’s arrow strikes**

Many of the feelings — and obsessions — associated with love can be explained by a few key chemicals, research suggests

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Your heart is racing, your palms are sweaty and your appetite gone. You couldn’t sleep if you tried. Focusing on schoolwork is nearly impossible. You realize you must be sick — or, even more serious, in love!

Few feelings are as intense and overwhelming as love. You feel elated and stimulated one minute. The next, you are anxious or pining. Millions of songs have focused on the ups and downs that come with love. Poets and writers have spilled vats of ink trying to capture the experience.

When Arthur Aron found himself in the throes of love, he did something different. He set out to investigate what happens to the brain.

It was the late 1960sand Aron was a student at the University of California, Berkeley. Working to complete a master’s degree in psychology, he looked forward someday to having a career as a college professor. His studies focused on the way people work and relate in small groups. ThenCupid intervened.

Aron fell for Elaine, a fellow student. When he thought of her, he experienced all the symptoms of new love: euphoria, sleeplessness, loss of appetite and an overwhelming desire to be near her. Everything was intense, exciting and sometimes confusing.

To sort through the fog, Aron began searching for published data about what goes on in the minds of people in love. And he turned up almost nothing. At that time, few researchers had begun probing the biology of romantic love.

So Aron dove into the topic himself. He continued his research at the University of Toronto, where he wrote a long report on the subject. (He also married his sweetheart, Elaine.) Today, he teaches psychology at the Stony Brook University in New York. When he’s not teaching, he continues to study what happens when we fall in love.

Recently, he teamed up with other scientists to peer into the noggins of people giddy with love. Their goal was to map love’s impact on the brain. The studies reveal that when shown a sweetie’s picture, a person’s brain will fire up in the same areas that respond when anticipating a favorite food or other pleasure.

“What we’re seeing is the same response, more or less, that people show when they expect to win a lot of money or expect to have something very good happen to them,” Aron says.

His research, along with studies led by other experts, is helping explain the science of love. All that mystery, all those songs and all those complex behaviors can be explained — at least in part — by the surge of just a few chemicals in our brain.

**Love — the drug**

Most people think of love as an emotion. But it’s not, Aron says. Love actually is more of a *drive* — like hunger or addiction.

“Love isn’t a unique emotion, but it leads to all kinds of emotions if you can’t get what you want,” Aron says.

To learn more, Aron teamed up with neuroscientist Lucy Brown, who teaches at the Albert Einstein College of Medicine in New York City, and anthropologist Helen Fisher of Rutgers University in nearby New Brunswick, N.J. Together, they are studying the brains of people newly in love.

For one study, each of their love-struck recruits started by filling out a questionnaire designed to gauge the intensity of his or her feelings. The scientists then rolled each volunteer into the giant cylinder of a big machine to see which brain regions are most affected by love. The machine is called a functional magnetic resonance imaging — or fMRI — scanner. It detects changes in the flow of blood in various parts of the brain. Increased flow generally identifies areas that have become more active.

While in the scanner, subjects viewed a heartthrob’s photo. At the same time, scientists asked them to recall their most romantic memories. Each recruit also looked at photos of friends or other people they knew. While the volunteers viewed all of these snapshots, the researchers asked them to remember something about the subject of each.

After viewing each image of a buddy or beau, the volunteers were asked to count backward from a large number. This helped keep separate the different emotional responses they had after viewing each photograph. Bringing the volunteers down from anyromantic high ensured there wasn’t any spillover when they went on to view pictures of ordinary friends. Throughout all of this, the fMRI machine kept logging activity levels throughout each person’s brain.

“It’s hard to quickly cut off those highly romantic feelings, and go from being swept away by romance to being stone-cold bare,” or objective, Brown says. Still, that was the goal here. And Brown says the brain scans showed that when people look at pictures of their sweeties, several brain areas turn on.

Two in particular light up among people still in the early sizzle of love. One is called the ventral tegmental area. Located deep at the back of the brain, in the brainstem, this group of neurons controls feelings of motivation and reward. A second center of activity is the caudate nucleus. This small area is located near the front of the head, toward the center of the brain, sort of like the area that you find seeds in a pear.

The caudate nucleusis associated with the passion of love: It “can make your hand or voice tremble when you’re near your sweetheart, and make you think of nothing else but them,” Brown explains.

During the brain scanning, both brain areas lit up like a Las Vegas slot machine whenever the recruits saw a heartthrob’s image. But not at other times.

Both the ventral tegmental area and caudate nucleus are involved in very basic functions, such as eating, drinking and swallowing, Brown says. These are things people do without thinking.

Indeed, she notes, “Much of the activity that goes on in those areas is done at the unconscious level. That may be one of the reasons that the feelings associated with early love are so hard to control.”

The ventral tegmental area and the caudate nucleus both serve another important function. They are part of the brain’s *reward system*. Each is packed with cells that produce or receive a brain chemical called dopamine (DOH pa meen). Known as a feel-good chemical, dopamine plays many roles. One of them: contributing to feelings of pleasure and reward. When you spy your favorite food or win a big prize, your brain’s dopamine levels soar.

Dopamine serves as a signaling compound, chatting with other nerve cells. It also helps you to focus intensely on what you really want. And it pushes and energizes you to take action and reach your goals. Those goals can include pursuing a romantic interest. Once smitten, a surge of dopamine helps make you feel exhilarated.

**Is it stress — or love?**

Other chemicals in your body also work overtime when falling in love. Among them are chemicals that can activate a stress response, such asadrenaline. In high-stress situations, this hormone, also known as epinephrine (EP uh NEF rin), increases heart rate and supplies more oxygen to the muscles. That readies the body to take action. It can also make your palms sweat when the object of your affection approaches.

Of course, there’s a downside to all of this stimulation. Any extra dopamine can also increase heart rate, as well as cause sleeplessness and loss of appetite. It also may trigger non-stop thoughts of your sweetie. It may encourage you to spend endless hours talking or texting with your new beau. Your friends may even tell you that you have become obsessed.

Fortunately, this frenzied phase of love doesn’t last. Aron says that while typical at first, this obsessive phase eventually ends. The passion usually lasts for anywhere from a few months to perhaps a year or two. Afterward, your dopamine levels return to normal. You may experience fewer adrenaline rushes, too.

Note, that doesn’t mean the love is gone. Not at all. During the early stages of love, multiple hormones course through the body. As the exciting sizzle fades, another chemical comes onto the scene, Aron says. All those moments of kissing, touching and laughing together can create another, more stable kind of bond, he says. It is fueled by another body chemical with a strange-sounding name: oxytocin (OX ee TOH sin).

**Hugs and hormones**

Paul Zakof Claremont Graduate University in California is also known as Dr. Love. He works in a field of science called neuroeconomics. His research looks at the chemistry of the brain to figure out how people make decisions.

People make thousands of decisions every day, including decisions on whom to trust. As a chemical, oxytocin plays a key role in affecting such decisions. Produced in the brain, oxytocin affects cells in other parts of the brain, as well as elsewhere throughout the body. In the brain, oxytocin also works as a messenger. It delivers information from one nerve cell to its neighbor.

Oxytocin’s most celebrated role comes into play during and immediately after childbirth. It stimulates contractions during labor. It also promotes milk production in nursing mothers. And it helps mothers develop a sense of extraordinary closeness to their babies. It is no wonder oxytocin often iscalled the *love hormone*.

Zak’s studies show oxytocin also plays a role in establishing trust. Working with researchers at the University of Zurich in Switzerland, he designed a nasal spray. It sends a whiff of oxytocin to the brain. When students in his studies inhaled the spray, they became friendlier and more trusting of strangers, Zak says.

“We found that we could turn on these positive social behaviors like opening a garden hose,” he says.

Normally, feelings of trust take time to build. They are created through experience and positive contact with others. These feelings are reinforced by the body’s release of oxytocin. The natural release of oxytocin helps signal who’strustworthy and safe, Zak says. A surge of this hormone also motivates people to behave in positive ways.

“It’s like, if you’re nice to me, I’m nice to you,” he explains.

Of course it would be dangerous and downright creepy to have strangers spraying you with mists of artificial oxytocin. Fortunately, you don’t have to. Your body releases this love hormone naturally when you interact with others in rewarding ways. Zak has followed people through all kinds of interactions to see when this occurs.

After the brain makes oxytocin, it begins coursing through the bloodstream. Zak developed a way to measure oxytocin levels in his student volunteers. By sampling their blood before and after an event, his team could see when oxytocin levels began to rise.

It turns out that almost any positive social interaction helps raise oxytocin levels in the bloodstream. Singing or dancing with someone, for instance, or even just exercising in a group — prompts the brain to produce more of the hormone. So does playing with a pet. Moderately stressful activities, such as watching a scary movie or riding a roller coaster, also boost oxytocin

Even tweeting your friends, sending messages by Facebook or using other social media increase oxytocin levels, Zak’s group found. The researchers had people visit Zak’s laboratory to have their blood drawn. Then the volunteers used social media for 15 minutes. After that, the scientists sampled each person’s blood a second time. “So far, I think 100 percent of the people tested had an increase in oxytocin,” he reports.

**The social hormone**

Oxytocin seems to work by helping to reduce stress, Zak says. Even small increases in oxytocin can do this. Studies show oxytocin also can help slow heart rate and breathing, even reduce blood pressure. Such changes can help damp down the body’s reactions to stress. By doing so, it can make one feel less anxious around others, especially people you are meeting for the first time.

“It’s scary being around people you don’t know,” he points out. “You have to evaluate them very rapidly.”

Positive interactions with others stimulate the release of oxytocin— signaling it’s safe to approach them on subsequent occasions, now that they are known and trusted.

Beyond just mothers and their babies, oxytocin also helps all of us feel connected with others. It may explain the love you feel toward family members and friends. It may even explain your affection for a pet. Studies show that mammals of all types release oxytocin, an indication that Fido may really love you back.

This hormone even encourages bonding between people in love. Studies show that certain forms of touch — such as hand-holding and kissing — can make oxytocin levels soar. One of the best ways to boost oxytocin: Hug someone.

Several years ago, Zak stopped shaking hands with people and started hugging them. He now hugs everyone: his lab assistants, grocer, barber and even strangers who approach him. This tendency to hug others — and boost their oxytocin levels — helped earn him that nickname of Dr. Love.

Zak says the hugs also seem to boost the trust that others have in him. “All of a sudden, I started having much better connections with complete strangers,” he says. “It has a really powerful effect.”