"One word frees us of all the weight and pain of life. That word is love."

It's been more than 2,500 years since the Greek playwright Sophocles wrote those words, but scientists have now proven that being in love can actually reduce pain. And they've also shown why.

Love may tap into some of our oldest brain pathways, making us feel so euphoric that we ignore pain, according to a recent study at Stanford University and the State University of New York at Stony Brook.

The scientists found that students in love felt less pain while staring at a picture of their significant others. In addition, love acted through the same brain pathway as several strong painkillers and addictive drugs such as heroin and cocaine. Studying the effect of love on these pathways might not only tell us more about love itself, but could also help us find ways to treat both pain and addiction.

"It was a nice connecting of the dots between what we understand of the neural systems of love and what we understand of the neural systems of pain," said Dr. Sean Mackey, chief of the pain management division at the Stanford University School of Medicine and one of the study's researchers.

Aron has been a "love researcher" for 30 years, but he never thought to study pain until he attended a big neuroscience conference five years ago in Washington, D.C., and shared a hotel room with Mackey.

"Sean and I really hit it off," Aron said. As he and Mackey discussed what brain pathways each studied, they realized they were talking about the same ones, and decided to study the interaction between love and pain.

In July 2007, the researchers started recruiting Stanford undergraduates for their study.

"It's the easiest study I've ever recruited for," Mackey said. They put up fliers around campus, and "within hours we had a dozen couples knocking on our door."

Sara Parke, a Stanford undergraduate and research assistant in Mackey's lab at the time, said numerous students would approach her to ask about the study.

"Our participants were some of the happiest people that you'd meet," she said, noting how excited they were to see neuroimages of their brains in love.

"They had all these questions: 'Am I in love?' 'Is my partner in love?' 'How much in love?' Are we going to be together forever?"

Having so many volunteers allowed the scientists to screen for those who described themselves as intensely in love and also scored highly on a "passionate love scale," a standardized measure of...
romantic feelings. Additionally, the group only considered students who had been in a relationship for nine months or less, to get those with the strongest romantic feelings.

It was a good thing the eight women and seven men picked for the study were as happy and excited as they were, because the next step was to subject them to "a very intense, acute pain experience," said Jarred Younger, a Stanford assistant professor who conducted the study while a post-doctoral researcher in Mackey's lab.

To inflict pain, the scientists used a heated probe on each student's hand, and slowly increased the temperature until the pain became intolerable. Students rated their pain on a scale of zero to 10, with zero being "no pain at all," and 10 being "the worst pain imaginable."

The researchers then generated pain levels of zero, four and seven while students lay inside a brain scanner looking either at a picture of their significant other or of someone they found equally attractive.

Students felt a lot less pain when they stared at their partner's picture. And the more time students had previously said they spent thinking about their partners, the greater their pain relief. Students who spent more than half of the day thinking of their significant others experienced three times more pain relief than other participants, Younger said.

Parke remembered one participant who was just wildly in love with his partner. "His answers to the love questionnaire were hilarious," she said. "He picked the maximum level on every single answer."

That student experienced the most pain relief, Parke said. He and his partner have now been together for several years, and "they're still really enthusiastic about each other," she said.

But participants also experienced pain relief while performing distracting word association tasks, thinking of responses to questions such as, "What are some sports that don't use a ball." Previous studies had shown that such distractions could reduce pain.

When the scientists compared brain images from the love and distraction tasks, "the results were very exciting," Mackey said. "Love engaged all the regions that we were hoping that it would engage. But even better, it clearly demonstrated that it works in an entirely different way than distraction."

Mackey likened the brain to a stereo receiver, with multiple amplifiers such as love and distraction. How we perceive pain depends on how high the volume is on these amplifiers, and they can work independently of each other, he said.

Unlike distractions, love acted through a reward pathway that's "a really old, reptilian, early-evolutionary part of the brain," Mackey said. And there's a good reason we have it - to override pain. Without a way to do that, we would stop doing things if they caused even the slightest twinge.

Understanding these powerful reward pathways could help develop pain medication with fewer side effects, or find behavioral ways to treat pain.

"I could just prescribe a passionate love affair for all my patients every six months," Mackey said with a laugh. But a more realistic way for them to reduce their pain would be for them to "get out there and do something new and fun," he said.

But the researchers point out that romantic love isn't always a good thing.
"If it's not reciprocated, it's tragic," Aron said.

Whom you fall in love with is very random, and rejection in love is a major cause of suicide and depression, he said. But even when it's reciprocated, "our great archetype is Romeo and Juliet," Aron noted.

And there's a reason the story of two love-struck teenagers who take their own lives rings true. According to Mackey, young people "are often recklessly, passionately, head-over-heels in love." And as a consequence, they may do silly - or even deadly - things.

Love acts through the same reward systems as other addictive substances, and letting these systems run wild is dangerous. That's why we normally rely on other parts of our brain to keep them in check, Mackey said, regardless of what the addictive substance is. "For me it's dark chocolate," he said. "For some people it's passionate love."

The fact that addictive drugs hijack the same reward pathways as love could help scientists study addictions, Younger said. While researchers can't give participants heroin or cocaine just to see how their brains respond, he said, they could find people in love to study the same pathways.

Studying the brains of people in love could also help understand relationships. And the researchers plan to study other kinds of love, such as maternal love or the love of people in long-term relationships.

But, Mackey said, he didn't want to make the experience of love too clinical.

"Our hope," he said, "is not to diminish the experience of love, or the wonderful attributes of love, but instead to provide a little better understanding of the how and why."