BBC WORLD SERVICE

BBC on air

the BBC's international magazine and programme guide for radio and tv | £2 | €3.10 | US$3.70 | july 2004

WHAT IS LOVE?

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'Love expert', author and presenter of BBC World Service **Love** series **Dr Helen Fisher** has studied the nature of love extensively. In her recent research, she has focused on the drive for romantic love and presents some conclusions here

What 'tis to love?" Shakespeare asked. The great bard was not the first to wonder. I suspect our ancestors pondered this question a million years ago as they lay and watched the stars.

There are many kinds of love. But I have come to believe that during our long evolutionary past, human beings evolved three basic brain networks for loving as they courted, mated, reproduced and reared their young: lust, romantic attraction and attachment. And as days turned into centuries and nature weeded out those who failed to reproduce, natural selection hardwired these three distinct systems into the human brain.

Each brain system is associated with a different set of primary neurochemicals and brain networks. Lust – the craving for sexual gratification – is associated primarily with testosterone in both men and women. Romantic attraction – the elation, heightened energy, obsessive thinking, focused attention and yearning of new, fresh love – is associated with elevated brain activities of dopamine and norepinephrine, natural stimulants, and low activity of a related brain chemical, serotonin. And attachment – the calm and emotional union one often feels with a long term partner – is associated with oxytocin and vasopressin.

Moreover, each of these brain networks evolved to direct a different aspect of human reproduction. Lust drives us to copulate with almost any remotely appropriate partner. Romantic attraction (romantic love, obsessive love or being in love) evolved to motivate us to prefer and pursue specific mating partners, thereby conserving precious courtship time and energy. And feelings of attachment evolved to enable new parents to remain together at least long enough to rear a child though infancy.

When nature makes a good design, she uses it over and over. And it is possible that almost all types of human love – from love of God to maternal love to brotherly love to all the other subtle varieties of human love – are variations of these three basic brain systems, mixing in myriad ways with one another and with other brain networks.

The brain system I am studying is romantic love. I began by culling from the scientific literature those mental and physical traits that people regularly express when they are madly in love. Next, I established that people everywhere, from the ancient Sumerians and Chinese to contemporary Tanzanians, Eskimos and Arabs, express these traits. From these preliminary investigations, I concluded that romantic love is a universal experience – deeply embedded in the human brain. Moreover, I developed my hypotheses about the brain chemistry of this passion. Last, with collaborators Dr Lucy L Brown, Dr Arthur Aron and several others, I used functional Magnetic Resonance Imaging (fMRI) to scan the brains of more than 40 men and women who were wildly in love. Half were loved in return; the rest had recently been rejected by someone they adored.

The results were remarkable. When lovers gaze at a photo of a beloved, they experience increased activity in a tiny 'factory' near the base of the brain that produces and distributes dopamine to many brain regions. Dopamine is associated with excessive energy, elation, focussed attention and the motivation to win rewards – basic traits of romantic love. We also found activity in several other brain regions rich in dopamine receptors and basic to the brain's reward system.

These results changed my thinking about romantic love: this passion is a fundamental human mating drive. Like the craving for food, romantic love is a powerful physiological need, an urge, a motivation, an instinct that evolved specifically to enable men and women to court and win a preferred mating partner. Indeed, the drive to love is stronger than the sex drive. Few people kill themselves when someone denies them sex; many have committed suicide after being rejected by a beloved.

> 'Romantic love is a universal experience – deeply embedded in the human brain'

Our scanning team also found gender differences. Male subjects showed more activity in a brain region associated with the integration of visual stimuli. This makes evolutionary sense. For millions of years ancestral males needed to visually appraise a female's ability to bear healthy young. Women showed more activity in brain regions associated with memory recall. This, too, has evolutionary logic. Ancestral females needed to choose mates who could provide and protect. So females needed to remember what a lover


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promised yesterday and what he did (and didn't do) last week. Women still remember more details of a love affair than men.

These data also led me to hypothesise that animals feel primitive forms of romantic love. All mammals (and birds) have mating preferences. And as they court, they focus their attention on specific individuals, follow them obsessively, express intense energy and pat, lick, stroke and caress in tender ways. All are characteristics of romantic love. And this 'animal attraction' has been associated with dopamine in the brain – just like human romantic love. Attraction lasts only seconds in rats, about three days among elephants, and months in dogs; but animals do love. In fact, they often express this attraction instantaneously – the forerunner of love-at-first-sight.

So I suspect that as our hominid forebears descended from the fast-disappearing trees of Africa some five million years ago and began to pair up to rear their helpless babies, courtship intensified. Then at some point in human evolution, probably some two million years ago, the primitive brain system for animal attraction evolved into human romantic love.

Love has its sorrows, of course. Being rejected is among the most painful experiences a human being can endure. As the poet Emily Dickinson wrote, "Parting is all we need to know of hell." Our scanning team has not yet finished analysing the brain scans of our rejected subjects. But I suspect many of the same brain regions will be involved. Alas, one doesn't stop loving when one is spurned. But rejected lovers most likely struggle with a host of other brain responses, too.

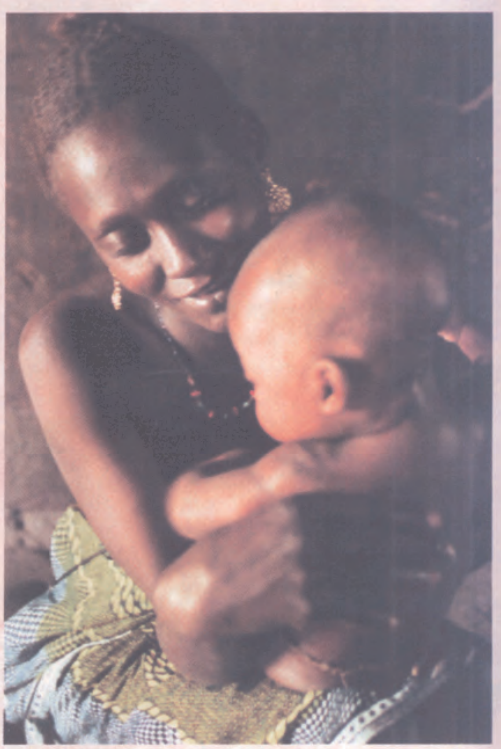
Romantic rejection has two general phases: 'protest' and 'resignation/despair'. During the protest phase, deserted lovers obsessively try to win the beloved back. Incessantly they phone or email or make dramatic entrances and exits. And as the adversity intensifies, so does their passion. This phenomenon is so common that I coined the term 'frustration attraction'.

Disappointed lovers can also hate. Known as 'abandonment rage', this fury has a biological explanation. The rage network in the brain is closely linked to centres behind your brow that anticipate rewards. And when these centres begin to register that a reward will never come, they can trigger a brain region that generates rage. This common response to unfulfilled expectations is known as 'frustration aggression'.

Eventually, however, the disappointed lover gives up; many also slip into despair. A forsaken Chinese woman confided to an anthropologist, "I can't bear life. All my interests in life have disappeared." An Aztec Indian man left these words in the 16th century, "Now I know why my father would go out and cry in the rain." And in New Guinea rejected men compose tragic love songs about marriages that might have been. Stalking, spouse abuse, homicide, suicide and clinical depression: many worldwide social maladies stem from thwarted love.

Why do we suffer so? Because long ago romantic love

↑ **Love flourishes despite Iran's strict social and religious codes which restrict the behaviour of men and women in public**



→ **The helplessness of a newborn child inspires a protective instinct in a mother**

MAGNUM/ALAMY/REUTERS

'Attraction lasts only seconds in rats, about three days among elephants, and months in dogs'

↑ **Young and old, the desire for companionship and love remains**

← **Marriage can symbolise more than loving commitment, often conferring legal and social privileges**

evolved to motivate our forebears to win life's most important prize – a special mating partner. And rejected lovers have (temporarily, in most cases) failed at this crucial mating game. How is romantic love changing in our modern world? How are working women affecting ancient patterns of sex, romance and family life? Some demographers theorise that middle-age now extends to age 85; how are older people expressing their romantic passion and feelings of attachment? What do homosexuals say about romantic love? Why do young children fall madly in love long before they reach reproductive age? How do people living in polygynous societies handle the possessiveness of infatuation? Do men and women in arranged marriages fall in love? Why does romantic attraction trigger sexual desire? How is it that casual sex rarely remains casual? And how can we trick the brain into keeping romance alive in long-term partnerships?

This BBC World Service series explores these and many other aspects of this primal force – the human drive to love.

For times see **Love**, page 31.
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