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## The Molecular Basis Of Love

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### **Abstract:**

*Love is the cherished emotion and nurtures the relationship. It is a chemical process. The neurochemicals and hormones are biochemical players of love making. Dopamine, norepinephrine, phenylethylamine, serotonin, estrogen, testosterone, oxytocin, vasopressin, endorphins and nerve growth factor are biomolecules of love. They define molecular basis of love. The chemistry of love in our brains is guided by DNA under the environmental influence. The chemical addiction of love has great demerit in modern arena. It keeps us reproducing, correctionpopulating, pooring and global warming. The martial and non-martial loves have their own achievements. The problems of love are addiction, boredom, polygamy adultery, incompatibility, loss of creativity, negative emotions, martial mishap, and biological precursor of poverty, population and pollution. Possibly the molecular basis of love can educate to keep the love-bonding free from the psychosocial and psychobiological adversities and tragedies.*

### **1.Introduction**

Love<sup>1</sup> exhilarates and motivates all of us. It is the core psychosocial intercourse for the continuation of species. The chemicals of brain have many purposes but primary aim is to have families and children. The birth of children encourages to stay together to raise them. Recently love has found to be chemical addiction that keeps us reproducing for poverty, population and global warming. The various behavioural facets of love are interrelated.

<b>Behaviors</b>	<b>Facets</b>
1. Biological	Male and female intercourse
2. Physical	Expression of sexual urge or desire for pleasure
3. Emotional	Alloy of male and female emotional affinities.
4. Social	Procreative dispersal or harmony
5. Genetical	Fusion of X and Y chromosomes
6. Sipuritual	Sublimation of two souls
7. Cultural	Anesthetic gift of human endocrines

Table 1

The love is a chemical process<sup>2,3</sup>. The neurochemicals, responsible for that “Loving feelings are biogenic amines. They are pleasure chemicals present in the brain and act as the neurotransmitters. The formation of love-bond and attachment involves neurotransmitters and hormones. The neurochemicals and hormones are the biochemical players of love making. The biomolecules participate in the chemistry of love are- dopamine, nor epinephrine, serotonin, endorphins, oxytocin, vasopressin, estrogen, testosterone and nerve growth factor. They are modulators and coordinators of love, pleasure and sex. The human brain<sup>4,6</sup> and love are interconnected aspect

of biological love which is the product of biological drives-mutual attraction and attachment. All the drives travel through different pathways in the brain involving different neurochemicals are given in the following which act as the love and pleasure chemicals.

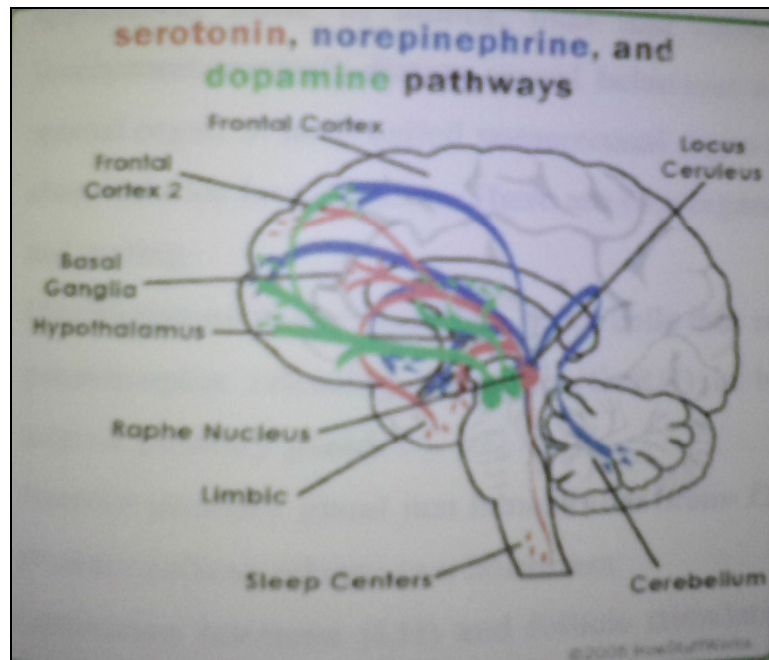


Figure 1

Hypothalamus in the brain<sup>7-9</sup> has nerve cells that secrete a hormone called gonadotrophin releasing hormone (GnRH) in blood vessels leading to anterior pituitary gland. GnRH causes the anterior pituitary cells to release two hormones. Luteinizing hormone (LH) and follicle stimulating hormone (FSH) into the general blood circulation. LH and FSH act on the testes/ovaries to stimulate the making and maturation of the sex cells and production of sex hormones (testosterone, estrogen, progesterone). The chemical interplay between the hypothalamus, anterior pituitary gland, and the testes/ovaries is essential for maintaining sexual function and reproduction<sup>10</sup>.

## 2.Theoretical Methodology

The biochemical players of love-making are:

- Phenylethylamine (PEA): occurs in the brain and acts as the stimulant for the release of norepinephrine and dopamine. This triggers falling in love and elates the feelings of love.
- Norepinephrine (NE): excitement, tachycardia, flushed skin, sweaty palms is physiological signs of falling in love.
- Dopamine (DA)<sup>11</sup>: involved in mate selection, stimulates the copulatory desire. It is a pleasure chemical, so the feeling of bliss is experienced.
- The DA and NE = elation, euphoria, intense energy, sleeplessness and couples focus on relationships.
- Oxytocin<sup>12-14</sup>: DA initiates the release of this in both genders which is catalysed by touching. It fosters trust, happiness and bonding in females for the long-term attachment. Oxytocin creates feelings for hug and touch. It acts as glue chemical produced in the ventral tegmental area of brain for binding persons, so, represents togetherness. It cements strong bond between mother and children.
- Testosterone<sup>15-18</sup>: ignites raw lust in males and females. The physical attraction and sexual arousal in the females depend on testosterone levels.
- Endorphins<sup>19</sup>: are opiates like neurochemicals. Their release is indicator of honeymooning is over. They promote feelings of calmness, comfort and attachment. They also relieve pain, anxiety and reduce stress.
- Serotonin (5-HT) is counter intuitive neurohormone, promotes feelings of contentness relaxation togetherness, and warm feelings. It typifies longer attachment, end of honeymoon phase and solidify relationship by opening door to trust.
- Vasopressin: It is released after sex and assures long-term commitment and helps loved ones to stay together. It is credited for making human being monogamous and ties the feelings to memories. Vasopressin and oxytocin are flooded after sex for attaching life time relationships. These neurological ingredients promote faithfulness. Vasopressin saturates brain structure in sensing satisfaction for life long coupling.
- Nerve growth factor<sup>20,21</sup> (NGF)- released in high levels when first fall in love, especially in young people, but return to initial level after one year. The elevated levels of NGF in circulation plays role in the social chemistry of the human beings. It induces the release of vasopressin which has pivotal role in the formation of social bondings.

The love making<sup>22,23</sup> has three steps:

- Lust : Craving for the sexual gratification. It is linked with testosterone in both men and women. It is also known libido and relative of sex-drive. The love molecule PEA released in brain with eyes contact and touching hands. This is transition of lust to love.
- Romantic Love<sup>24-26</sup>: is a constellation of emotions, motivations and behaviors. Romantic love and attraction are different. The right side of brain is activated with intense romantic love but left brain is only activated by facial attractiveness. Romantic love is an intrusive thinking and may be passionate, obsessive or being in love. It is endorsed by DA (pleasure, dictates the choice), NE (euphoria) and 5-HT (happiness). This is an opiate/cocaine like state, where partners focus on each other. Romantic love is not an emotion but motivation (DA to sustain intimate relationship) with preferred mate in goal oriented manner. Neurochemically romantic love is a chemical state of elevated DA/NE and suppressed 5-HT. Romantic love is universal which may be individual preference pleasure choice or attraction ( Love at first sight). The addiction of romantic love causes physical and emotional dependences (declined 5-HT, enhanced NE activity, excessive DA ).
- Attachment<sup>22,27-30</sup>: It is hormonal. The levels of oxytocin and vasopressin suppress neuronal circuits for lust and romantic love for establishing long-term partnership. The love-bond made socially recognized pair bond monogamous. Oxytocin is potent hormone released during male and female orgasm with deep feelings of security and calmness. Oxytocin and DA are complimentary in bonding and love. They are acting on reward circuitry at ideal levels to stay in love. DA gives kick and oxytocin makes particular mate appealing. The emotional union provides social comfort with long-term mate, derived by physical and emotional cues. The fidelity of love bond is sustained by child rearing/parenting. It may be long and expensive. Here love is legalized. The consensual sex releases oxytocin. Oxytocin creates strong friendships. The change of sexual relationship shows neurochemical shift. The blocking of oxytocin and DA receptors result in loss of motherly instinct. The blocking of vasopressin receptors promote adultery. The consanguineous love bonds are biological precursors of genetic disorders and pregnancy mishaps Therefore nature discourages intra-breeding. The ageing declines the biosynthesis of lust and romantic love chemicals.

Researchers, using functional magnetic resonance imaging (fMRI)<sup>25</sup> to look people's brain when they are in love. The scans showed that at the attraction stage (biological drive), enhanced blood flow in areas of brain with high concentrations of receptors for dopamine associated with euphoria, craving etc. High levels of dopamine (DA) also associated with norepinephrine (NE) which heightens attention and goal-oriented behavior. This stage of love focus on the relationship. Dopamine is thought to be the pleasure chemical, producing a feeling of bliss. The release of dopamine and norepinephrine during love have racing heart, flushed skin and sweaty palms. Another explanation for intense focus and idealizing view at attraction stage have lower level of serotonin. Besides, pleasurable biogenic amines, estrogen and testosterone harmonize the sex drive. The love attachment or relationship involves oxytocin, vasopressin and endorphins which are also released when having sex. Oxytocin produces feelings of satisfaction and attachment, vasopressin is associated with long-term monogamous relationships. They interfere with DA and NE pathways which explains why passionate love fades as attachment grows.

Endorphins are the body's natural pain killer and substantiates the long term relationships. They produce sense of well being, soothed feeling, peaceful and secure acumen. Endorphins are released during sex and physical contacts. In other words love-bonding is chemically oriented because it has hormonal and neurotransmitter releases. There are two aspects of human sexuality<sup>26</sup>. They are sexual desire and performance which are complex, processes involving an intricate interplay of emotional, neurological and vascular events. They release pleasurable neurochemicals DA, NE, which triggers love making.

The chemistry of sexual desire, interest and libido is ascribed to testosterone molecule (C<sub>19</sub>H<sub>28</sub>O<sub>2</sub>) which controls sexual excitement in both men and women. The hormonal level governs the sex drive. The low levels of testosterone dwindles the interest in sex. The stress, fatigue and depression adversely effect sexual interest.

### 3. Discussion And Result

The areas of brain involved in love making<sup>7</sup> are media insula, anterior cingulate frontal lobe, septal areas and amygdale. They are rich in receptors of neurochemicals which participate in love making. (fMRI) studied psychobiological-oriented chemical behavior in love making and revealed

- Foci in the media insula is the place of love instinct
- Anterior cingulate related to euphoria

The template of love buried in the subconscious which directs conscious for love and mating<sup>31-33</sup>. The limbic system ( set of emotional governs social development, physical contact and affection, therefore, it plays a role in love , attachment and social bonding. This empathy is called limbic resonance. fMRI found that estrogen like chemical triggers blood flow to male's hypothalamus but not females whereas testosterone like compound stimulates blood flow in hypothalamus of females. This possibly creates mutual attraction. Human sweats<sup>34</sup> of both genders and scents<sup>35,36</sup> catalyse love making. Kissing is a chemical touch at lips, as saliva has testosterone and estrogen. All the processes of love making is chemical play in the limbic system of the brain<sup>37,38</sup>.

The dominance of love chemicals and receptors impart loving traits<sup>39-41</sup> related to pleasure and sex. They are genetically<sup>42</sup> linked to social and cultural developments, therefore, past experiences environmental, biological happiness, psychological pleasure and spiritual faith influence the preferential love life. There is a relationship between loving traits and love chemicals which characterize five types of lovers.

- Dopamine – dominant- type of lovers- novelty-seeker curious, creative, liberal, optimistic, spontaneous, mentally adaptable. The up regulation and activation of dopamine receptors may endorse this love.
- Serotonin- dominant- type of lovers- calm, conscientious, conventional protective, community-oriented, precautionary attitude.
- Testosterone – dominant –type of lovers- logical, decisive, analytical, competitive, ambitious, tough, position and power oriented.
- Estrogen – dominant- type of lovers- Intuitive, imaginative, introspective, very interested other people business, talkative, verbally skillful, emotionally expressive.
- Oxytocin- vasopressin – Endorphins- dominant type of lovers, strong love-bond, friendly, stable, family- oriented, monogamous, parental, contented, trustful, satisfied.

Testosterone dominant preferably select their opposites estrogen dominants<sup>43-45</sup>. Men of testosterone potential are mostly attracted to youth and beauty, whereas women are more attracted to money, education and position.

PEA induces feelings of attraction, followed by loving thoughts (DA, NE) for touching or kissing. DA is reward hormone. The normal DA motivates the feelings of well being satisfaction, pleasure and reward of accomplishment and motivation. DA cohorts, processes and manifests love. DA's deficiency cause anhedonia anxiety and even depression whereas excess leads to compulsion and addiction. Oxytocin is cuddle hormone. It is really sustainer of love-bond. The calmness, enhanced curiosity, reducer of addictions and cravings, enhancing positive feelings and sexual receptivity are positive hormonal effects. Fantasy also contributed by oxytocin. It coordinates with vasopressin and endorphins for marital togetherness by intimacy, warmth, sharing, caring and serenity. Endorphins are lowered in separation or divorce<sup>46,47</sup> because they are key chemicals of marital addiction<sup>48</sup>. Testosterone powerfully affect mood, desire and perception of mate. The obsessive-compulsive-disorder has declined 5-HT and DA. The social exclusion or rejection induce emotional pain with intensified emotional regulation by neurochemicals.

The negative love is product<sup>49-52</sup> of contemporary cross-cultural impacts, attributable to biological and neurological independences. The consequences are philandering, sexual jealousy<sup>46</sup>, love homicide and clinical depression. The negative biological drive of 5-HT is enhanced by antidepressants. They suppress dopaminergic pathways with reduced sexual drive and arousal. The attraction for love-bonding between same genders is harmless pleasure, possibly mediated by 5-HT. It lacks biological cause and there is no genetic, neurochemical and neuroanatomical links to such love making, although hygiene and safety have strongly advocated.

At molecular level two interdependent concepts of love chemistry were innovated.

- Neurochemical Concept: Love chemicals act through receptor mechanisms, therefore receptor densities, turnovers and up and down regulations influence the mood, thought and behaviors of love-making.
- Hormonal Concept: Neuroendocrinologically love hormones exert their actions through their release in blood circulation. The desire, libido, attraction, intimacy of mutual love bonds are directed by hormones. The love-making hormones may be positive or negative. Oxytocin, vasopressin, androgen and estrogen are promoters of love bonding but negative hormones (corticosteroids) spoil love bonding by suppression of libido and inducing negative emotions (anger, fear, anxiety etc) and energy depletion. The blood flow to brain cells, rich in love neurochemicals coordinate or modulate psychobiological-neuroendocrine-environmental synergism for eternal nature of love. The love-making is accompanied by generation of sexual energy, having the healing effect with immunological complementarity. Love keeps body tuned, mind alert, and provides lovers with compassion, optimism and comfortable bioenergy. Finally life is an energy of psychobiological emotion for lovable social chemistry.

#### 4. Conclusion

The biomolecules (dopamine, serotonin, nor-epinephrine, endorphins, estrogen, testosterone, oxytocin, phenylethylamine, vasopressin and nerve growth factor) define the molecular basis of love. The love is an eternal emotion of life, therefore, love blossoming and bonding can never be ceased as long as youthful spirit is alive. The neurochemicals and sex hormones are the biological players of love. The puberty embraces the both love and erotic chemistry. The template of love resides in limbic and subconscious areas of the brain. The emotional intelligence measures empathy, intuition, self assurance and self identity. The love-making and sexual pleasure with compatibles are offsprings of emotional intelligences, communications and harmony. The compatible and attractive relationship make love chemistry pleasurable and graceful. The seven neurochemicals characterize the distinctive qualities of lovers and their social chemistry. The social toxicants spoil the love bonding and creativity because they are emotional antagonists with negative emotions (jealousy, rivalry, adultery, divorce, polygamy, extra children etc). The variations in neurochemical receptors and their activations are attributable to all these. The love is a chemical state with genetic roots and environmental influences. The selection of love may have good and bad times, as chemicals do not make choices. Every heart has freedom of choice. The love chemicals allow to make the decisions of the heart for life-long lasting marital relationships.

Romantic love should not be addiction for the physical and emotional dependencies. The psychobiological interaction of lust, romance and attachment based on mutual attraction and sharing interpersonal relationships fosters positive emotions of love bond. The top five love chemicals are dopamine, vasopressin, oxytocin, serotonin, and testosterone, endow love intelligence to happy people, having cheerful faces with positive outlooks. Finally the people sing and dance for love, almost do everything for love, even live and die for love, thus, love is an indispensable human drive and mandatory emotion of the life.

The love industry is booming. The pharmaceutical companies are marketing love products<sup>53</sup> that claim to amplify love, sex and pleasure potentials.

It is worthwhile to dedicate this publication to handsome and beautiful connoisseurs of entertainment profession who express love in the most charming and pleasurable styles with sparkling happiness, as evidenced by the following pictures of love efficacy.

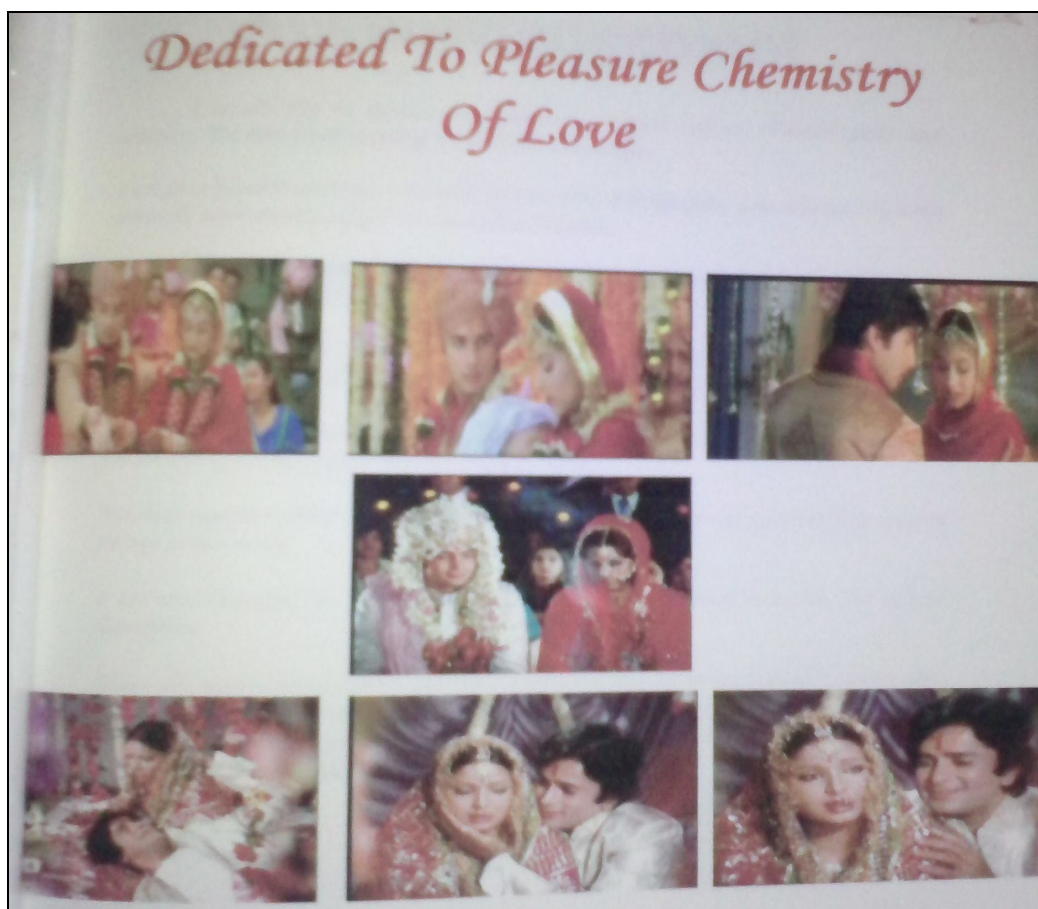


Figure 2

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