THE HEALING POWER OF LOVE: AN OXYTOCIN HYPOTHESIS – OVERVIEW

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Dedicated to a deeper understanding of the neurobiological basis of love, sexuality, and wellness
SOCIAL BEHAVIOR, SOCIAL BONDS AND LOVE EXIST IN THE CONTEXT OF EVOLUTION

The most common unit of analysis in Psychology and Biology and especially in Physiology is the INDIVIDUAL.
However,
Most living organisms cannot
SURVIVE
OR REPRODUCE ALONE.
The mammalian nervous system especially functions best in a social environment.

Social behavior and connection is necessary for physiological and behavioral homeostasis.

What Myron Hofer called “Hidden regulators”
In the ABSENCE of appropriate social interactions & social bonds (i.e. ISOLATION) - Substitutions May occur

Abuse of Drugs, Food, Mental Dysfunction
In the ABSENCE of LOVE or other appropriate social interactions, during forced or self-induced ISOLATION - Substitutions May occur

Depression, Illness
Shut-down even, Death
LOVE and FEAR are most easily understood in the context of EVOLUTION and DEVELOPMENT. BOTH LOVE and FEAR directly or indirectly support:

SURVIVAL

SOCIAL SUPPORT AND PERCEIVED SAFETY
DEFENSE AND AGGRESSION

REPRODUCTION

ACCESS TO MATES
CARE OF OFFSPRING
GENETIC SURVIVAL
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What is love?

LOVE is usually defined by ATTACHMENTS AND SOCIAL BONDS AND A NEED TO PROTECT THOSE THAT WE LOVE.

Here I define LOVE as a complex of neurobiological processes that facilitates health, wellness, reproductive fitness & biological optimality.
There is no fear in love; but perfect love casteth out fear.

1 John 4:18
Physiological states, regulated by ancient hormones and the autonomic nervous system are elements in the dynamic dance between approach and avoidance – between LOVE and FEAR.
Secure attachments & bonds matter especially in EARLY LIFE.

The protective effects of positive early life experiences and attachment depend in part on oxytocin.
An example of the HEALING POWER of LOVE & SOCIAL SUPPORT: Following a heart attack, patients without support (in red) were more likely to die within 6 months.

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REPRODUCTION
- ACCESS TO MATES
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- GENETIC SURVIVAL
Overview: OXYTOCIN PATHWAYS, CRITICAL TO A SENSE OF SAFETY, UNDERLIE CENTRAL FEATURES OF SOCIAL BEHAVIOR ASSOCIATED WITH MAMMALIAN REPRODUCTION AND SURVIVAL
Oxytocin is a NEUROPEPTIDE MOLECULE with functions throughout the BRAIN and BODY.

OXYTOCIN is central to the biology of SAFETY & LOVE.
WHAT IS OXYTOCIN?

Cys-Tyr-Ile-Gln-Asn-Cys-Pro-Leu-Gly-NH$_2$

9 amino acids configured as a ring and a tail.

The ring in oxytocin is held together by sulfur bonds. These bonds allow oxytocin to have a high degree of biological activity and support positive social behaviors, stress buffering and good health.
Oxytocin plus vasopressin both underlie central features of social behavior associated with mammalian reproduction and survival.

- Reproduction & Sexuality
- Resilience & Survival
- Maternity, Paternity & Genetic Survival
- Social Bonds & Love

Oxytocin & Vasopressin
Oxytocin does NOT act alone.

OXYTOCIN (OT) has a sibling hormone –
Arginine VASOPRESSIN (AVP) –
from which it differs by 2 (of 9) amino acids

**OXYTOCIN (OT)**

Cys-Tyr-Ile-Gln-Asn-Cys-Pro-Leu-Gly-NH₂

**Arginine VASOPRESSIN (AVP)**

Cys-Tyr-Phe-Gln-Asn-Cys-Pro-Arg-Gly-NH₂
Oxytocin and Vasopressin evolved from an ancestral molecule, VASOTOCIN, that preceded the evolution of Vertebrates.

Arginine Vasopressin (AVP) evolved about 200 million years ago – from VASOTOCIN (a more ANCIENT peptide).

Oxytocin (OT) is more MODERN... appearing about 100 million years ago, associated with the evolution of mammals (SOCIAL BONDS, BIRTH, LACTATION AND SOCIAL COGNITION).
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What is oxytocin

Oxytocin was classically viewed as a “FEMALE REPRODUCTIVE HORMONE,” acting primarily on the UTERUS and MAMMARY GLAND.

Of course, we now know that this is only part of the story!

OXYTOCIN HAS EFFECTS IN BOTH MALES & FEMALES THROUGHOUT THE BODY & BRAIN
Oxytocin is made primarily in the BRAIN (HYPOTHALAMUS), and released into the blood stream at the Posterior Pituitary, but is also released within the nervous system.

Oxytocin can affect social behavior, the autonomic nervous system, and the immune system, allowing the body to ADAPT, PROTECT and HEAL especially in the face of challenge and STRESS.
The human nervous system is a consequence of evolution. Compared to reptiles humans have a massive increase in the size of the cerebral cortex.

**OXYTOCIN (OT)** allowed the transition from reptile to mammal. OT permits birth (helps expel the large-brained baby from the uterus). OT facilitates post-birth nutrition & supports the baby (lactation/maternal behavior/, alloparenting). OT facilitates oxygenation of the brain (myelinated vagus). OT PERMITS HUMAN COGNITION AND SOCIAL BEHAVIOR. WE ARE HERE TODAY BECAUSE OF OXYTOCIN!
HUMAN BIRTH presents special problems because of our

- BIG CORTEX and SKULL,
- BIPEDAL LOCOMOTION and
- SMALL, RIGID PELVIC GIRDLE

OXYTOCIN FACILITATES BIRTH by STRONG UTERINE CONTRACTIONS
**OXYTOCIN** and **VASOPRESSIN** are similar in structure but have different functions

<table>
<thead>
<tr>
<th>Vasopressin</th>
<th>Oxytocin</th>
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<tbody>
<tr>
<td>Fear/Defense</td>
<td>Prosociality/Approach</td>
</tr>
<tr>
<td>Territoriality</td>
<td>Sharing</td>
</tr>
<tr>
<td>Vigilance, Arousal</td>
<td>Relaxation, Resilience</td>
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<tr>
<td>Mobilization</td>
<td>Immobilization without fear</td>
</tr>
<tr>
<td>Sympathetic nervous system</td>
<td>Parasympathetic nervous system (the vagus nerve)</td>
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<tr>
<td><strong>PROTECTIVE</strong></td>
<td><strong>HEALING &amp; RESTORATION</strong></td>
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<tr>
<td>(active strategies)</td>
<td>(The healing power of “love”)</td>
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<td>More ”primitive”</td>
<td>More modern.</td>
</tr>
<tr>
<td>Dominant during Extreme stress/ Trauma</td>
<td>Dominant when there is a sense of SAFETY.</td>
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**CONTEXT of PERCEIVED -**

**OXYTOCIN**

**VASOPRESSIN**

**LOVE and SAFETY**

**SOCIAL BONDS & LOVE**

**SAFETY OR CALM**

**ANXIETY or FEAR**

**AVOIDANCE & ANXIETY**

**DEFENSIVENESS & FEAR**

**AGGRESSION**
Oxytocin can act through the VASOPRESSIN RECEPTOR with effects that depend on CONTEXT. High levels of OT may act like AVP. It is often the RECEPTOR that determines the effect – NOT the PEPTIDE itself. (Detailed in Carter, 2017 Frontiers in Endocrinology)

**CONTEXT of PERCEIVED** -

\[\uparrow \text{OT} \quad \text{SAFETY or LOVE} \quad \text{OXYTOCIN RECEPTOR (OXTR)} \]

\[\uparrow \text{AVP} \quad \text{ANXIETY} \quad \text{VASOPRESSIN RECEPTOR (V1aR)} \]

\[\text{ANXIETY or FEAR} \]
Prairie voles share with humans the following traits (rare in other rodents):
A socially monogamous mating system with:
   Capacity to form social bonds and selective secure attachments
   Alloparental behavior and biparental behavior
High levels of OXYTOCIN and OXYTOCIN RECEPTORS
High levels of parasympathetic function (vagal activity in the human range)
Unique OXYTOCIN Receptor GENES allowing EARLY EXPERIENCES and OXYTOCIN ITSELF to TUNE EXPRESSION of the OXYTOCIN Receptor especially around the time of birth.

Vasopressin is particularly important to
DEFENSE of SELF AND FAMILY
Including
Increased Arousal and
Protective Aggression,
through actions on VASOPRESSIN RECEPTORS
THE OXYTOCIN PARADOX?

Oxytocin ALSO may be released under conditions that are negative or acutely "stressful," –
Inflammation
Disease

Oxytocin serves as a component of an adaptive, COPING strategy, BUFFERING against stressors.

At high level OXYTOCIN also may act by binding to VASOPRESSIN RECEPTORS.
(reviewed in Carter, 2017 Frontiers in Endocrinology)
Of particular importance to understanding Oxytocin & Vasopressin - as well as the HEALING POWER OF LOVE - is the fact that these hormones act on the AUTONOMIC NERVOUS SYSTEM and regulate the VAGUS NERVE.

The Vagus (10TH CRANIAL NERVE), shown here, links the body to the brain, and is critical to explaining the health benefits of feeling safe and the health risks of fear and anxiety.

Oxytocin & Vasopressin both regulate the adaptive functions of the autonomic nervous system as well as regulating inflammation and healing.
DISORDERS LINKED TO OXYTOCIN DEFICIENCY OR DYSFUNCTION (or ATYPICAL/EXCESS VASOPRESSIN) (Based on both human conditions and animal models)

MENTAL HEALTH
Social & Emotional Dysfunction
Autism Spectrum Disorders
Schizophrenia
Anxiety
Depression (general)
Postpartum depression
Trauma
Prader-Willi Syndrome
Fragile X
Substance Abuse
Williams Syndrome (hi PEPTIDES)

PHYSICAL HEALTH
Stress management
Cardiovascular Devel. & Disease
Obesity & Metabolism
Wound Healing
Bone Health (Osteoporosis)
Muscle Strength (Myopenia)
Chronic Pain
Fibromyalgia
Immune dysfunction (HIV?)
Longevity

INFLAMMATION
OXYTOCIN IS ANTI-INFLAMMATORY
VASOPRESSIN PREDOMINANTLY PRO-INFLAMMATORY

LINKED BY VAGUS/AUTONOMICS and OXYTOCIN – VASOPRESSIN AN INTEGRATED SYSTEM
What is the power of love?
How does it overcome fear?

UNDERSTANDING THE BIOLOGY OF LOVE AND SAFETY OFFERS NEW INSIGHTS INTO THE PHYSIOLOGY OF GOOD HEALTH.

LOVE originated from the same processes that underlie MOTHERHOOD. The biological mechanisms that allow us to give BIRTH, NURTURE our young and form SECURE ATTACHMENTS, also PROTECT OUR BODIES in the FACE OF THE CHALLENGES OF LIFE ACROSS THE LIFE-SPAN.

LOVE AND CONNECTION ARE STRONG MEDICINE
This is the power of love

It originates in the biology of birth, and allows us to bond to and support others throughout life.

The soul is healed by being with children.”
F. Dostoyevsky

It is critical that we support and love the next generation – our children and each other – promoting health and healing.