

# THE HEALING POWER OF CONNECTION AND LOVE: AN OXYTOCIN HYPOTHESIS

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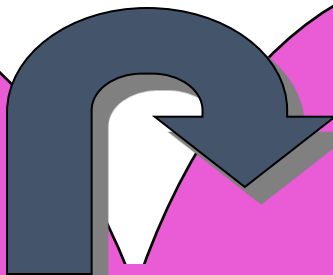
Dedicated to a deeper understanding of the neurobiological basis  
of love, sexuality, and wellness



# **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.**





**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**



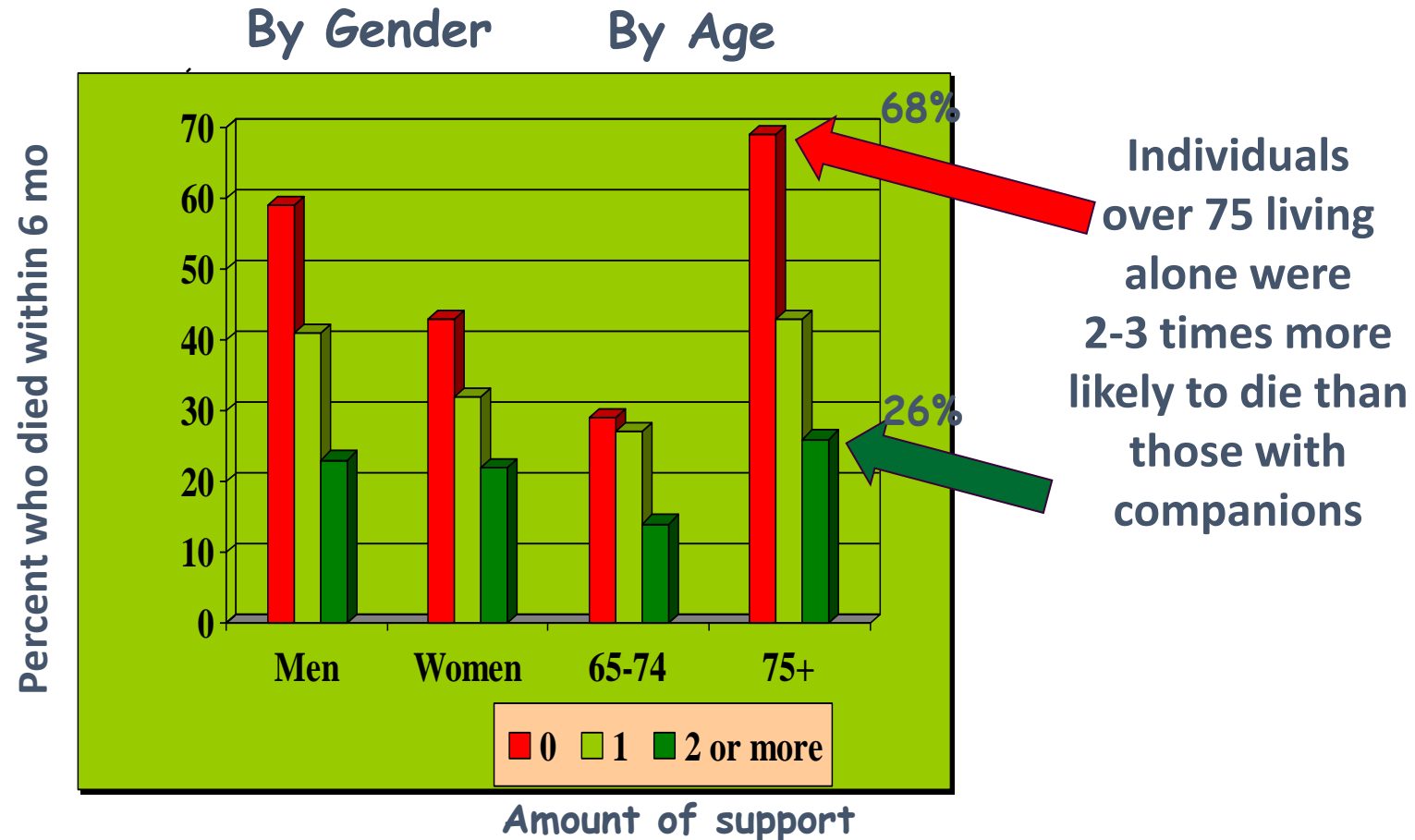
**In the ABSENCE  
of LOVE or other  
appropriate  
social interactions,  
during forced or self-  
induced ISOLATION -  
Substitutions  
May occur**

**Depression,  
Illness  
Shut-down  
even, Death**



# 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.



Berkman, et al., Emotional support and survival after myocardial infarction: A prospective, population-based study of the elderly. Ann Int Med 1992



**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**

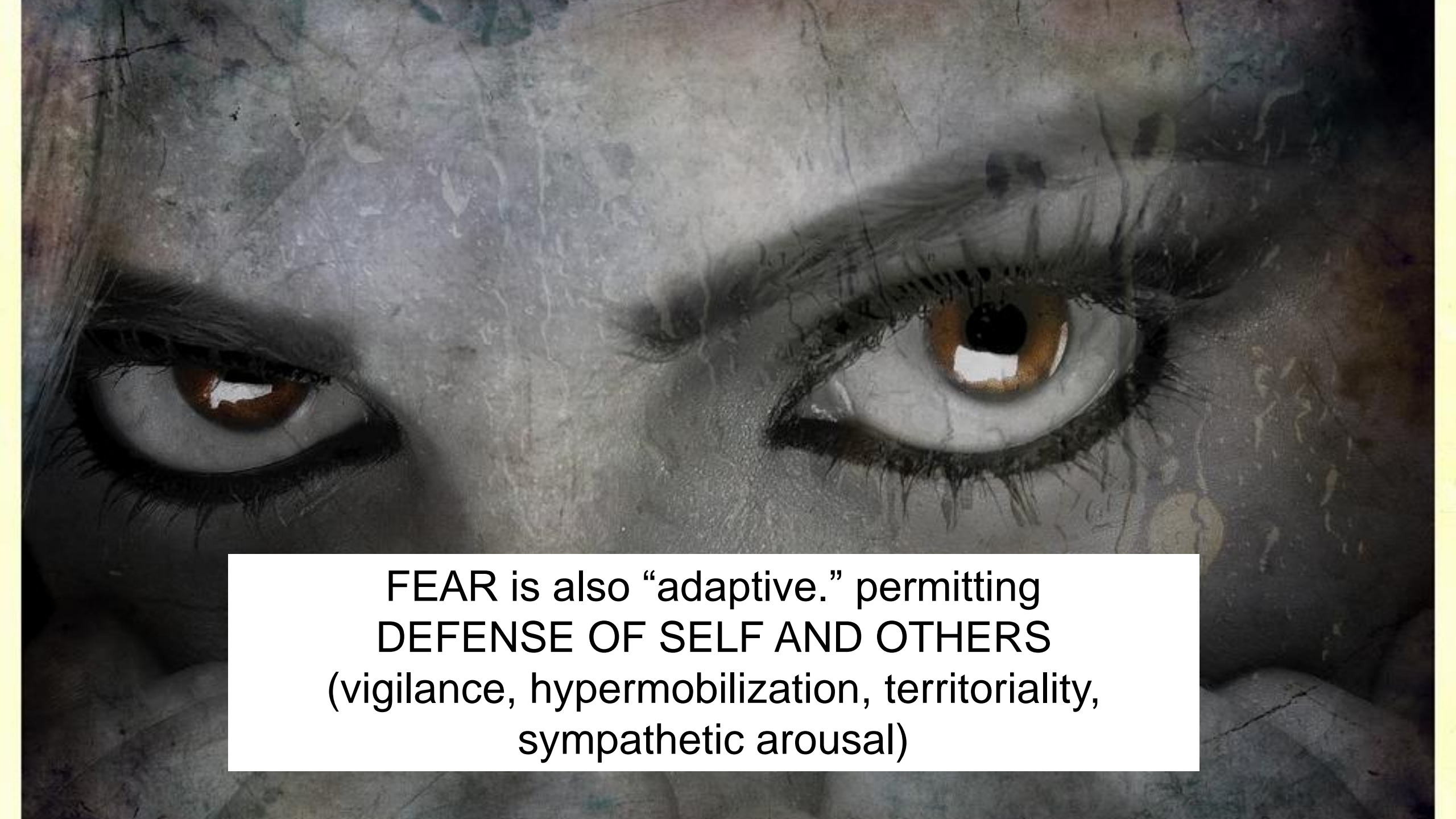
## **REPRODUCTION**

**ACCESS TO MATES**

**CARE OF OFFSPRING**

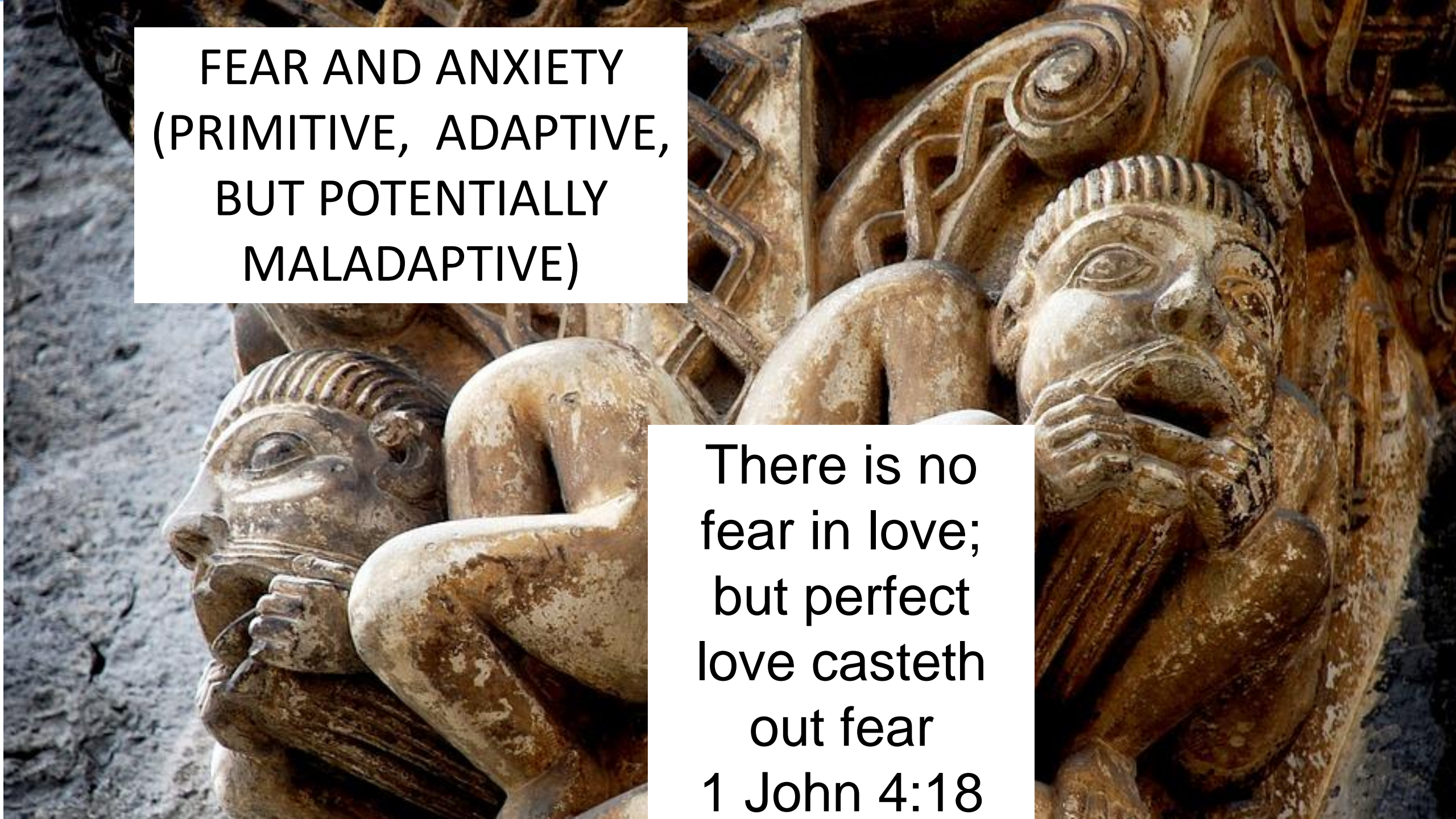
**GENETIC SURVIVAL**



A close-up photograph of a person's eyes, which are brown and looking slightly to the right. The skin around the eyes is light-colored and has a textured, slightly wrinkled appearance. A white rectangular text box is overlaid on the lower portion of the image, containing black text.

FEAR is also “adaptive.” permitting  
DEFENSE OF SELF AND OTHERS  
(vigilance, hypermobilization, territoriality,  
sympathetic arousal)



The background of the image features ancient Egyptian stone carvings. On the left, a sphinx is depicted in profile, with its hands clasped near its mouth. To the right, a seated human figure is shown, also with hands near the mouth, possibly in a gesture of prayer or contemplation. The carvings are weathered and set against a dark, textured background.

FEAR AND ANXIETY  
(PRIMITIVE, ADAPTIVE,  
BUT POTENTIALLY  
MALADAPTIVE)

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**





**The EVOLUTIONARY & BIOCHEMICAL prototype for  
LOVE and social bonds in mammals is the  
mother-child interaction including BIRTH & LACTATION**





**HORMONES INCLUDING OXYTOCIN  
FACILITATE BIRTH, LACTATION &  
BUFFER NEW PARENTS  
(FATHERS AND MOTHERS) FROM  
THE STRESS OF CHILD REARING.**



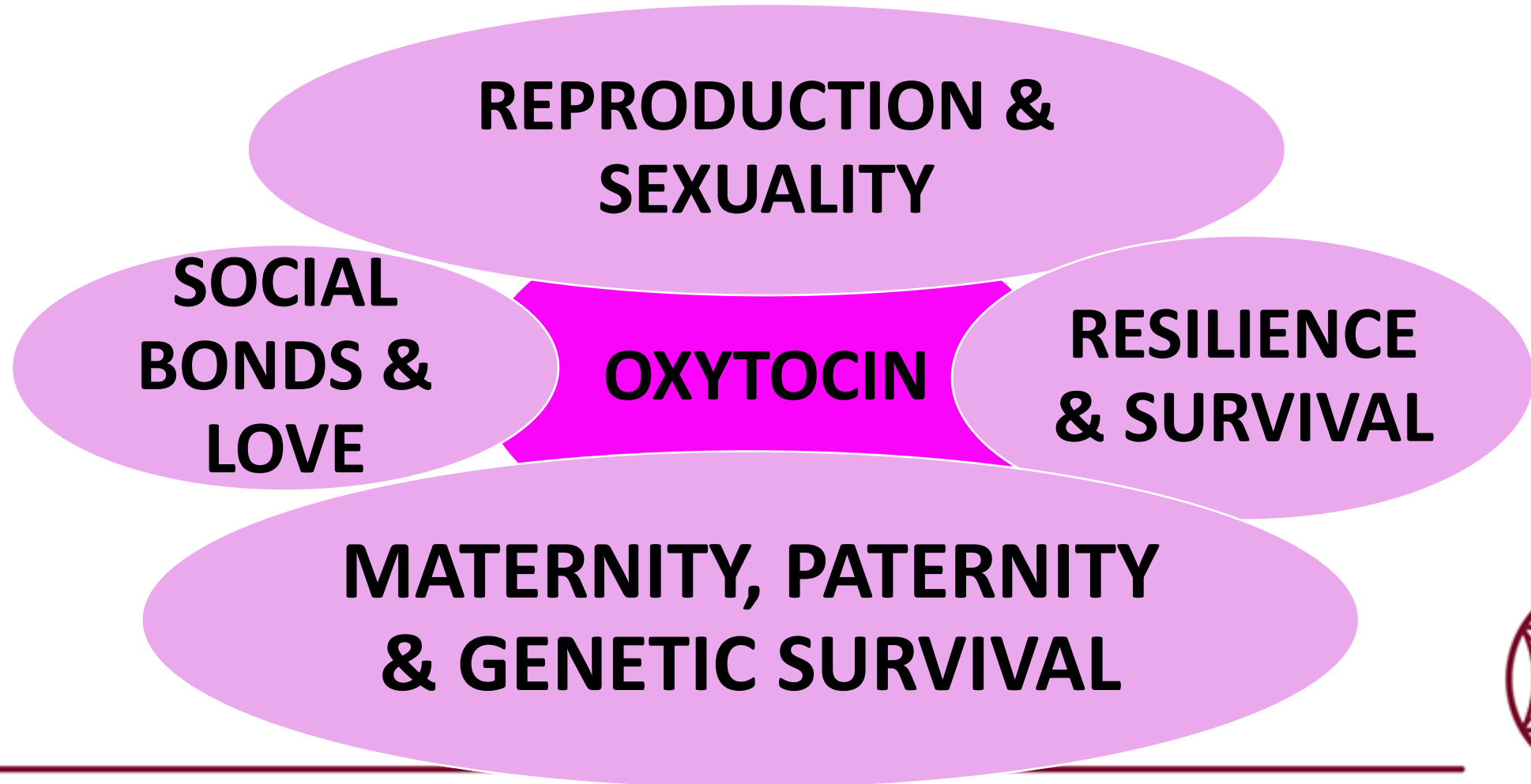
**Secure attachments & bonds matter especially in EARLY LIFE.**



**The protective effects of positive early life experiences and attachment depend in part on oxytocin.**



**Overview: OXYTOCIN PATHWAYS, CRITICAL TO A SENSE OF SAFETY,  
UNDERLIE CENTRAL FEATURES OF SOCIAL BEHAVIOR ASSOCIATED  
WITH MAMMALIAN REPRODUCTION AND SURVIVAL**



# WHAT IS OXYTOCIN?



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.

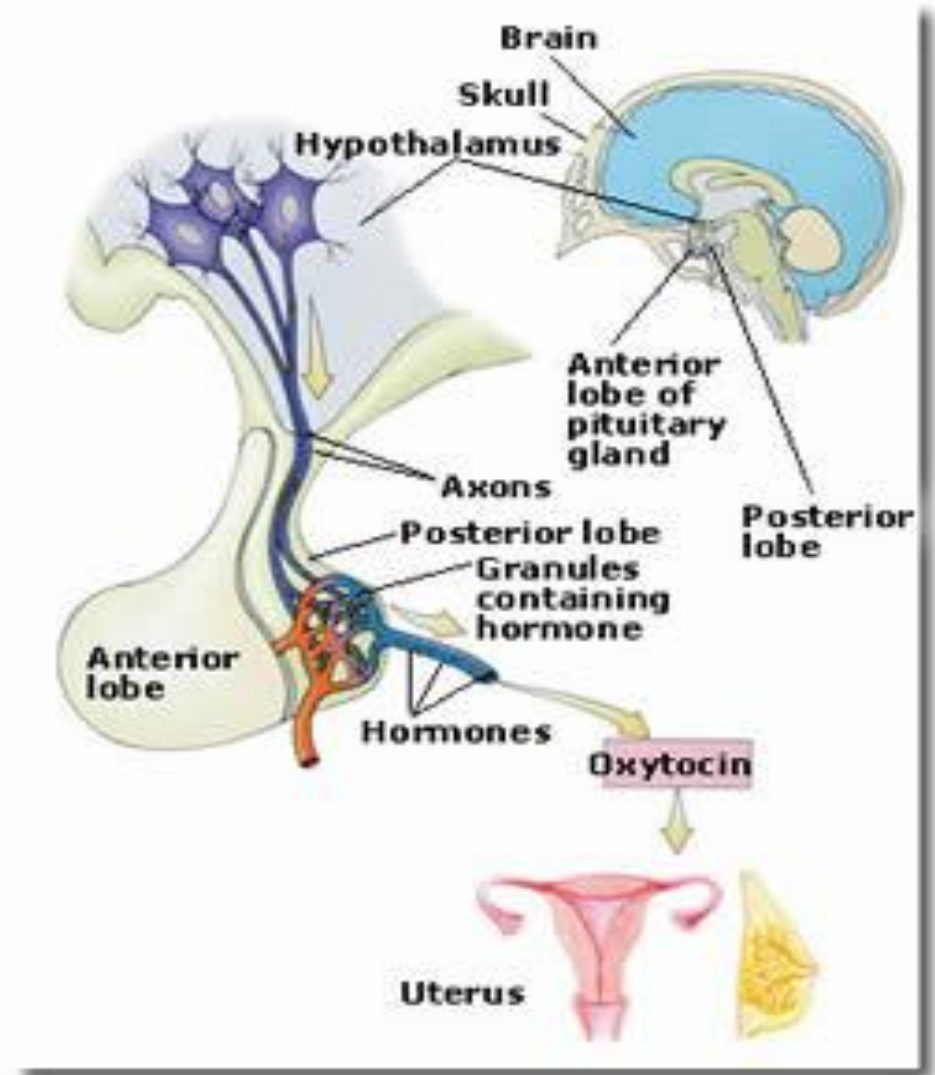


## What is oxytocin

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

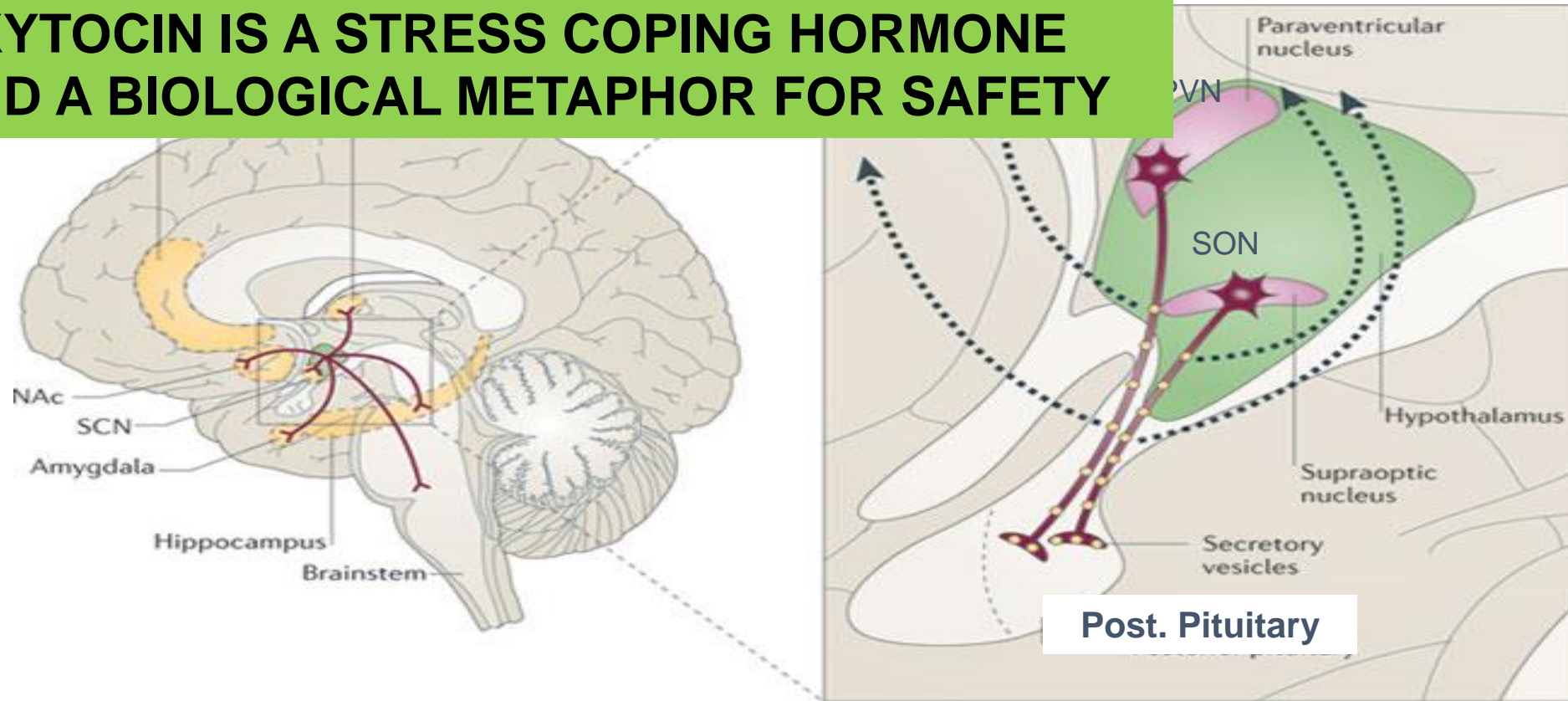
Of course, we now know that this is only part of the story!

OXYTOCIN HAS EFFECTS IN BOTH MALES & FEMALES THROUGHOUT THE BODY & BRAIN





# OXYTOCIN IS A STRESS COPING HORMONE AND A BIOLOGICAL METAPHOR FOR SAFETY

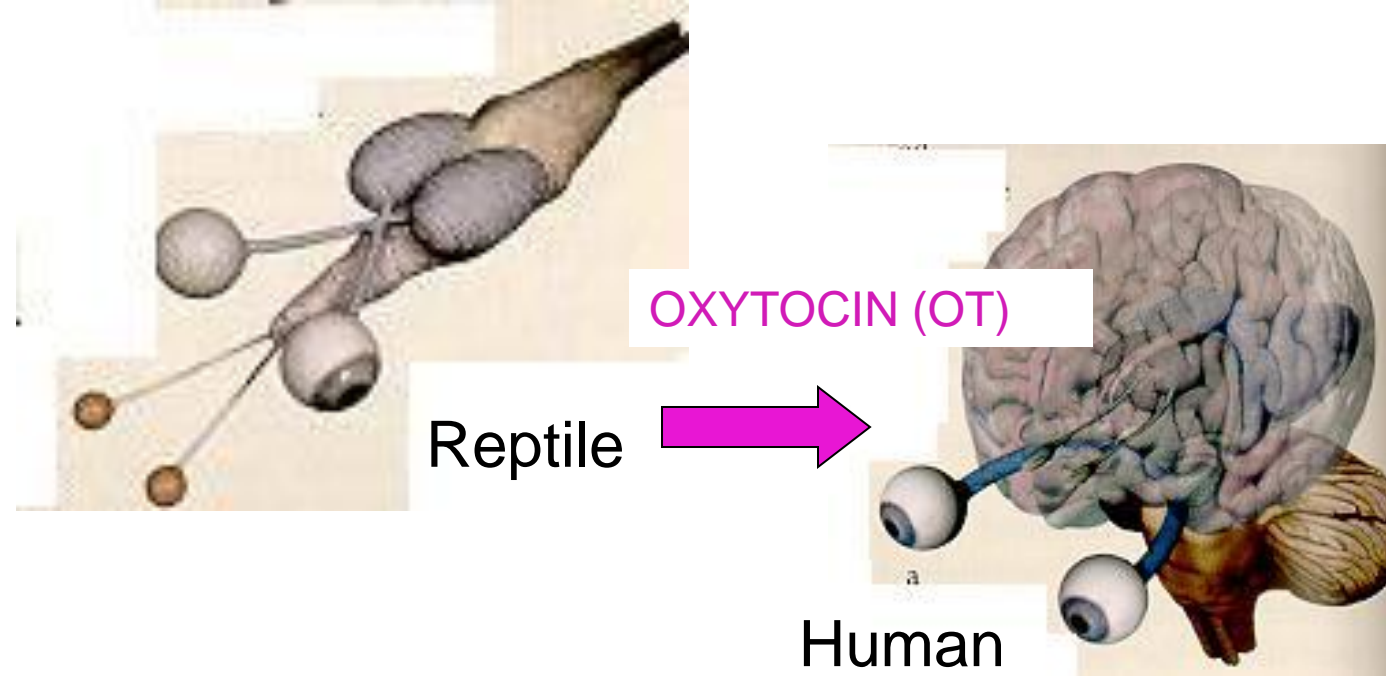


Oxytocin is made primarily in the **BRAIN (HYPOTHALAMUS)**, and released into the blood stream at the Posterior Pituitary, but is also released within the nervous system.

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)**

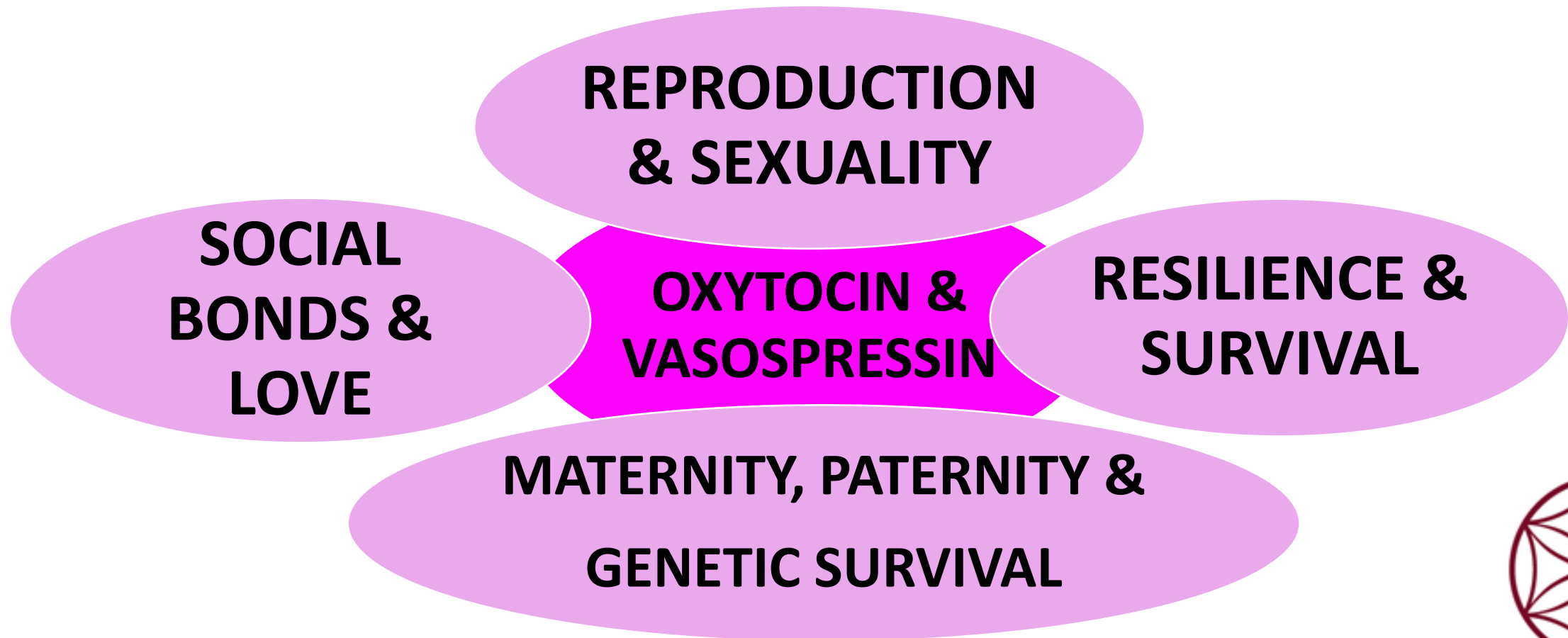
**OT facilitates oxygenation of the brain (myelinated vagus).**

**OT PERMITS HUMAN COGNITION AND SOCIAL BEHAVIOR.**

**WE ARE HERE TODAY BECAUSE OF OXYTOCIN!**



# **OXYTOCIN PLUS VASOPRESSIN BOTH UNDERLIE CENTRAL FEATURES OF SOCIAL BEHAVIOR ASSOCIATED WITH MAMMALIAN REPRODUCTION AND SURVIVAL**



**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)**

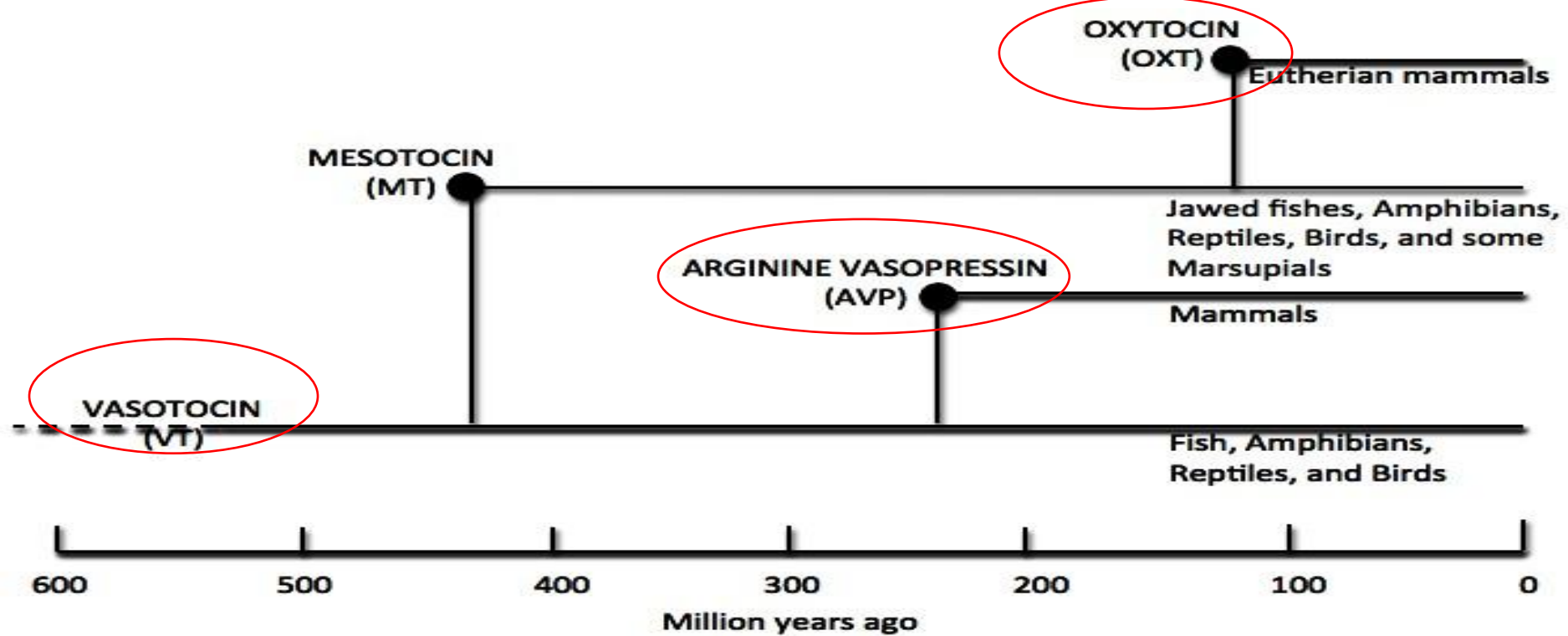
Cys-Tyr-Ile-Gln-Asn-Cys-Pro-Leu-Gly-NH<sub>2</sub>

## **Arginine VASOPRESSIN (AVP)**

Cys-Tyr-Phe-Gln-Asn-Cys-Pro-Arg-Gly-NH<sub>2</sub>



# 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).



**OXYTOCIN and VASOPRESSIN are similar in structure  
but have different functions**

**Vasopressin**

**Fear/Defense  
Territoriality**

**Vigilance, Arousal  
Mobilization**

**Sympathetic nervous system**

**PROTECTIVE  
(active strategies)  
More "primitive"  
Dominant during  
Extreme stress/ Trauma**

**Oxytocin**

**Prosociality/Approach  
Sharing**

**Relaxation, Resilience  
Immobilization without fear**

**Parasympathetic nervous  
system (the vagus nerve)**

**HEALING & RESTORATION  
(The healing power  
of "love") More modern.  
Dominant when there  
Is a sense of SAFETY.**



# ***CONTEXT of PERCEIVED -***

**↑ OXYTOCIN**

***LOVE and SAFETY***



**SOCIAL BONDS & LOVE  
SAFETY OR CALM**

**↑ VASOPRESSIN**

***ANXIETY or FEAR***



**AVOIDANCE & ANXIETY  
DEFENSIVENESS & FEAR  
AGGRESSION**



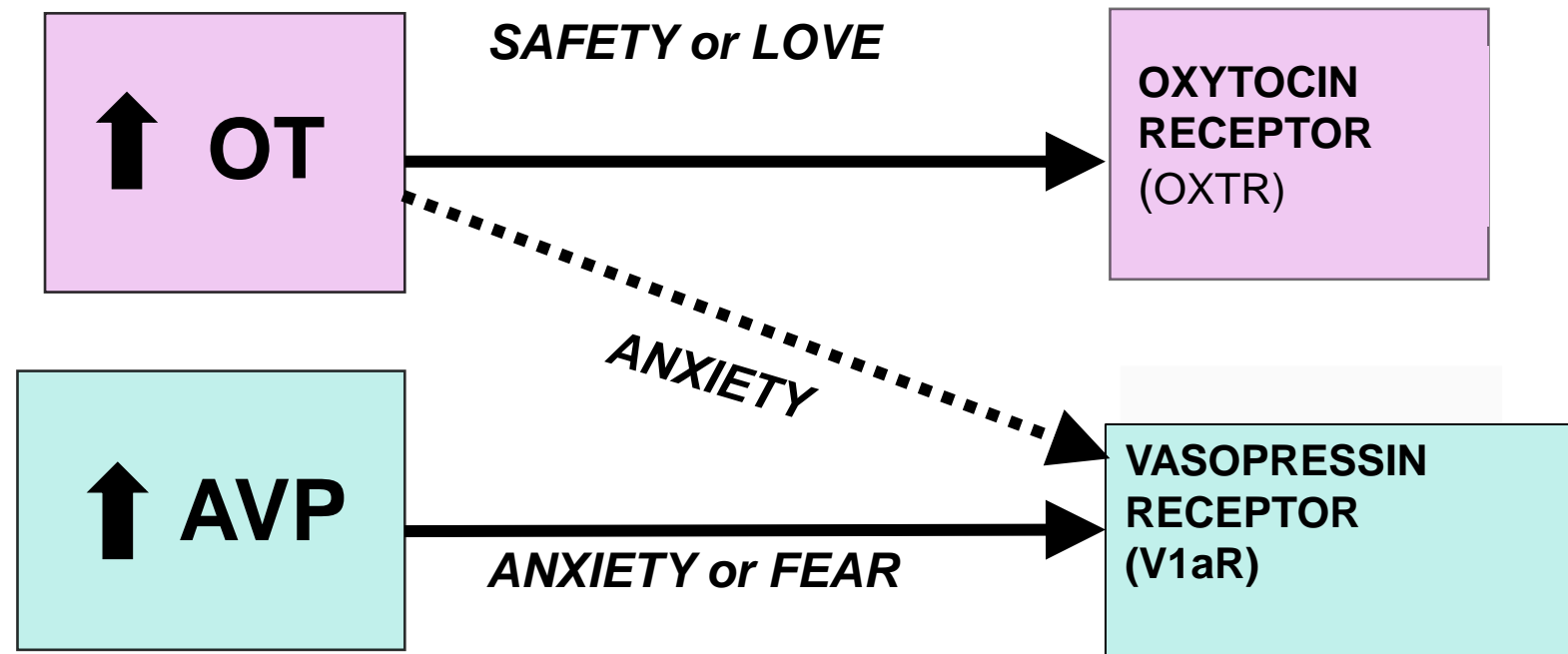
Oxytocin can act through the  
**VASOPRESSIN RECEPTOR** with effects that depend on **CONTEXT**.

High levels of OT may act like AVP.

It is often the **RECEPTOR** that determines the effect –**NOT** the **PEPTIDE** itself.

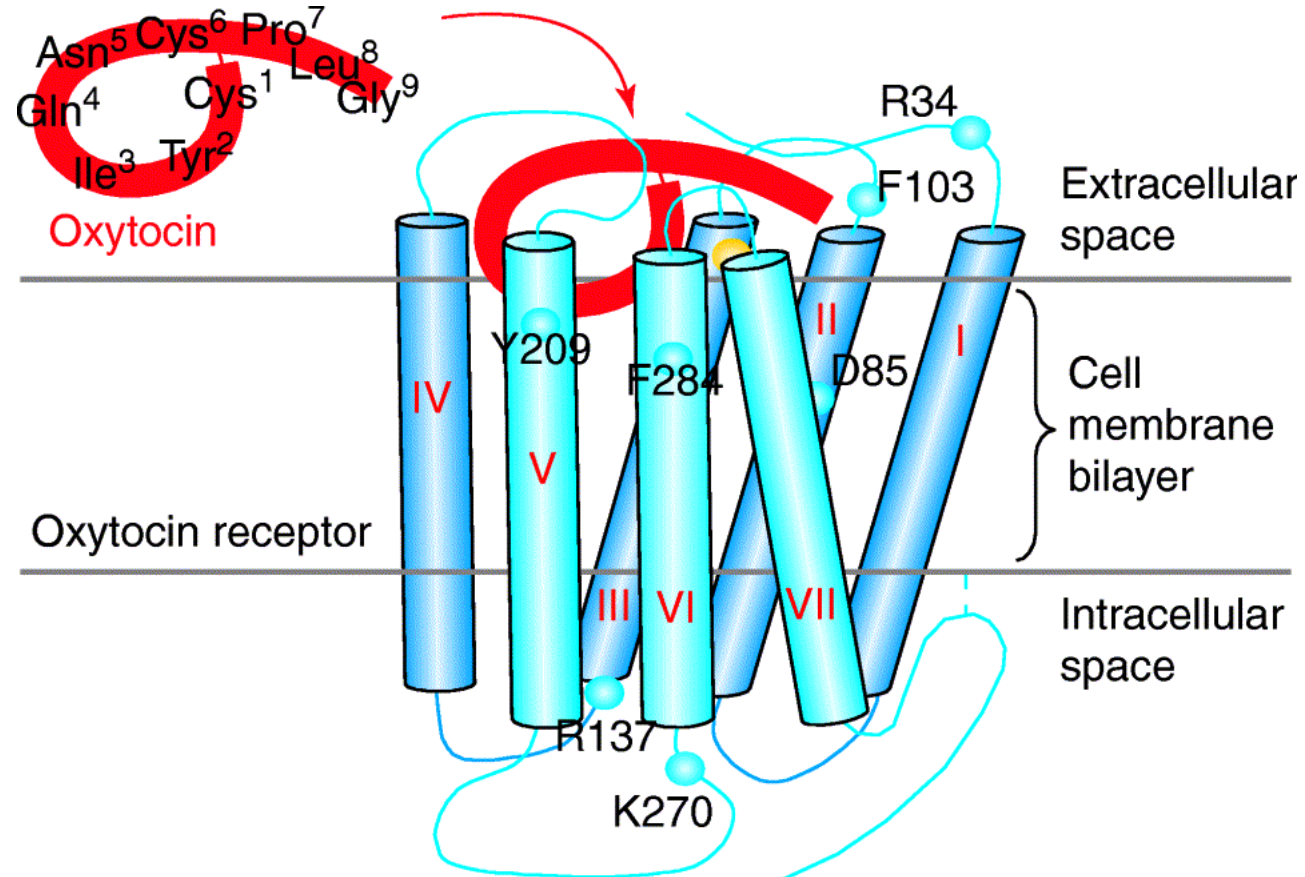
(Detailed in Carter, 2017 *Frontiers in Endocrinology*)

***CONTEXT of PERCEIVED -***





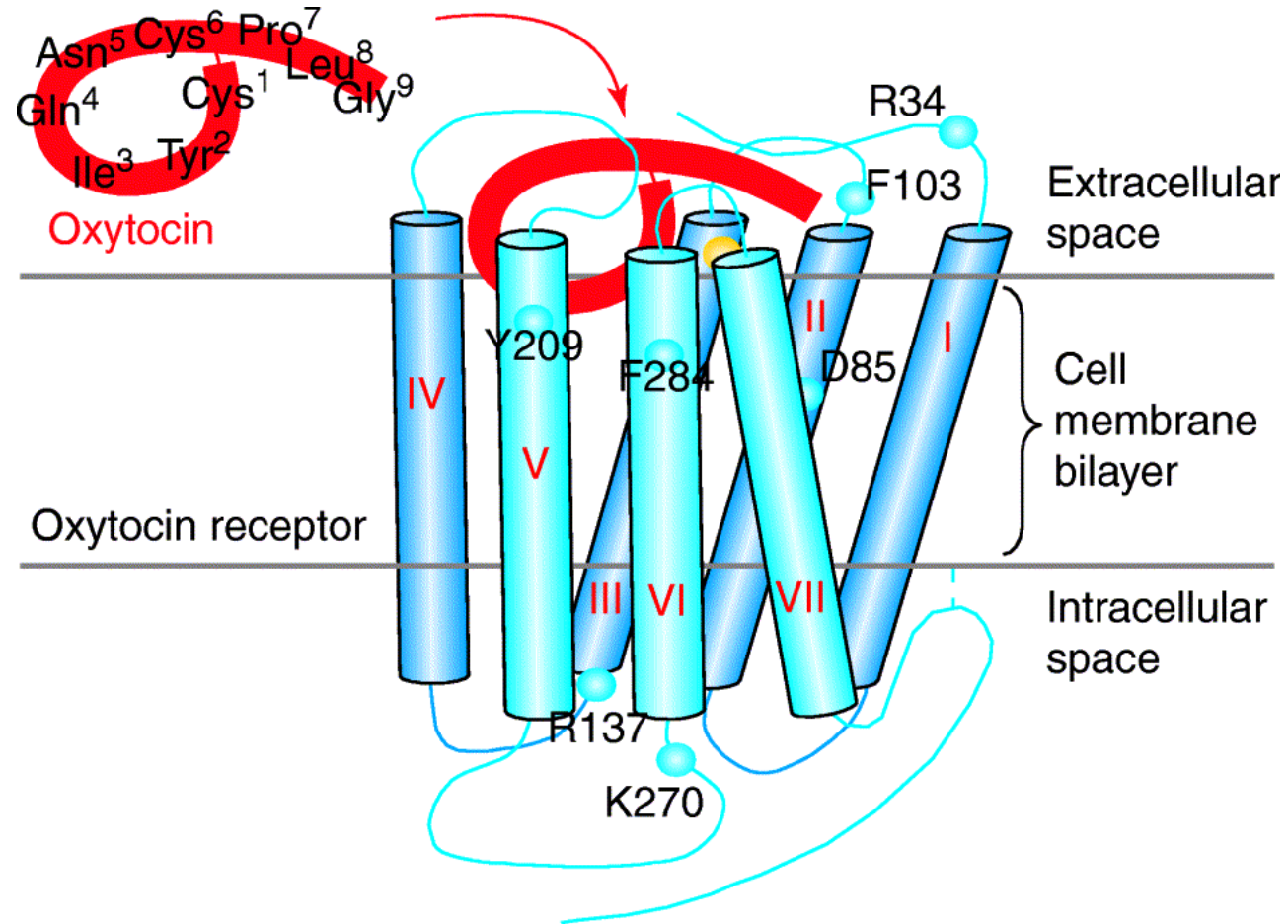
# Oxytocin Receptor Signaling is at the center of LOVE, a sense of SAFETY and GOOD HEALTH



The actions of peptides are mediated by receptors, illustrated here by the **OXYTOCIN RECEPTOR**



# Oxytocin Receptor Signaling



**The OXYTOCIN RECEPTOR is “EPIGENETICALLY TUNED”  
Especially by EARLY LIFE EXPERIENCES, and is generally  
UPREGULATED by POSITIVE EXPERIENCES.**



**SOCIAL BONDS and SECURE ATTACHMENTS are essential to all definitions of LOVE.**

**The capacity for SELECTIVE & SECURE social relationships, as well as the emotions and chemistry associated with SOCIAL BONDS, are not unique to humans or other primates. This has allowed a deeper understanding of the biological basis of psychological concepts like LOVE, SAFETY and FEAR.**



Photo by Jessie Williams



**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.**



**PRAIRIE VOLES,  
Microtus ochrogaster**



**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*)

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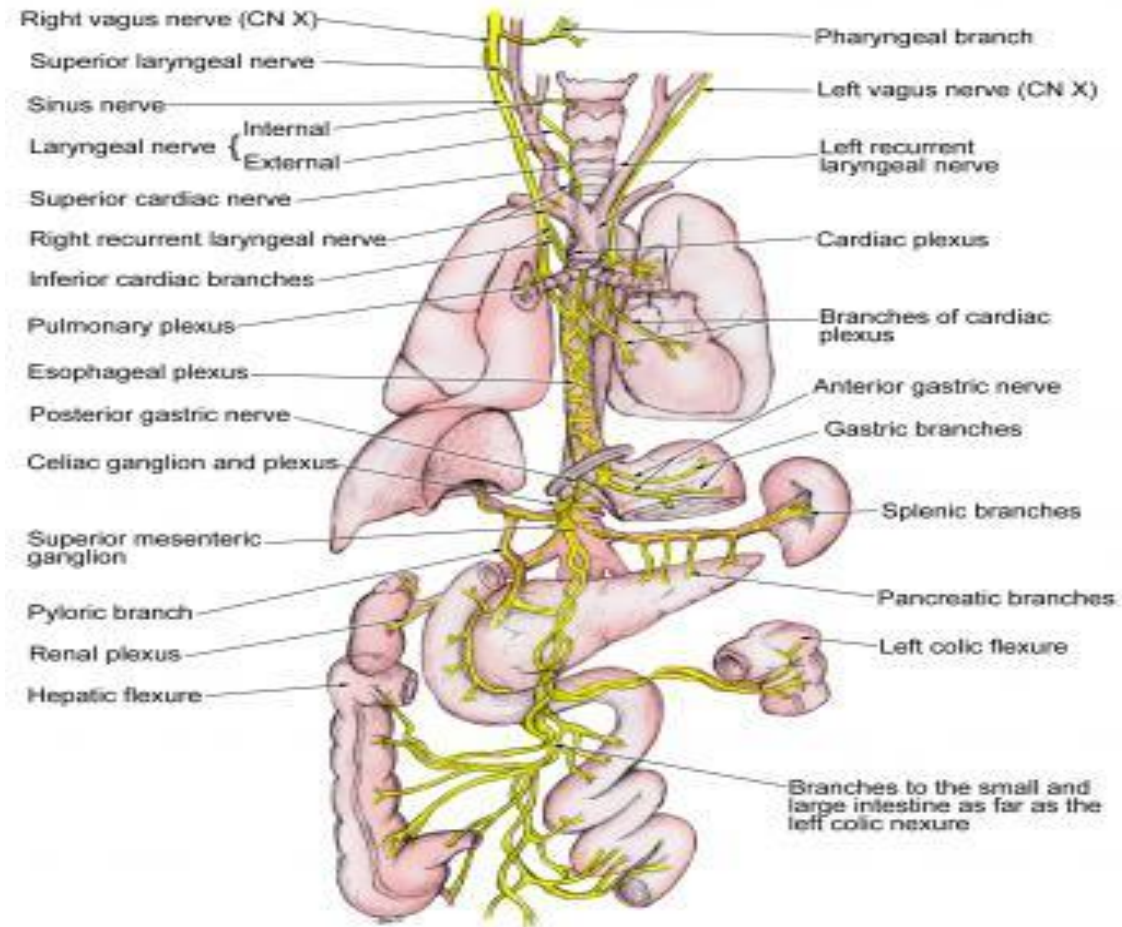
**OXYTOCIN IS A STRESS-COPING  
HORMONE**



# 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 (10<sup>TH</sup> 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.



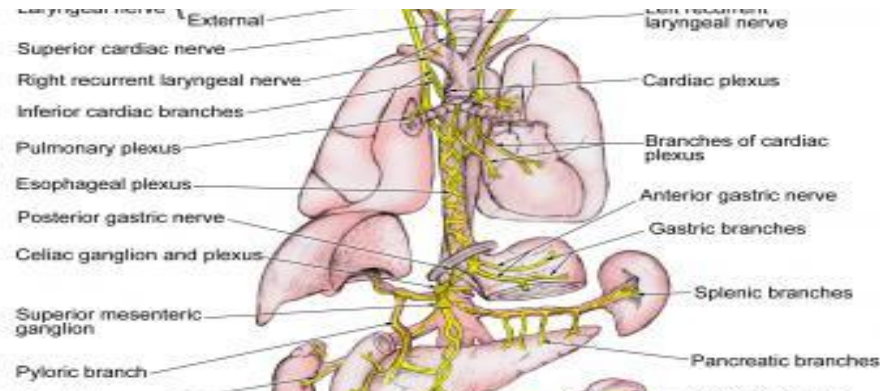
# DISORDERS LINKED TO OXYTOCIN DEFICIENCY OR DYSFUNCTION (or ATYPICAL/EXCESS VASOPRESSIN) (Based on both human conditions and animal models)

## 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)

## LINKED BY

**VAGUS/AUTONOMICS and  
OXYTOCIN – VASOPRESSIN  
AN INTEGRATED SYSTEM**



## 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**

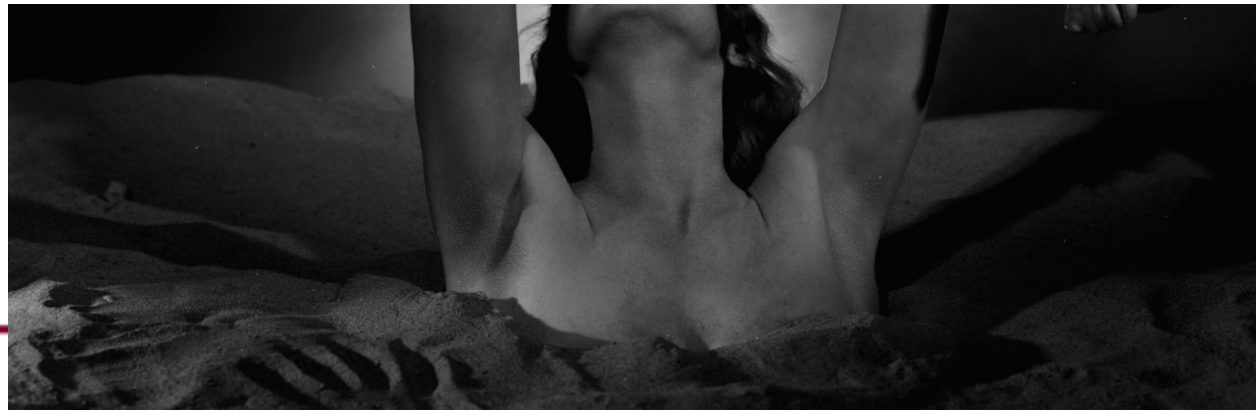




“The soul is healed by being with children.”  
F. Dostoyevsky



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





**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**

**“Nothing is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less.”**

***Marie Curie***



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