

DSHS Grand Rounds

October 12

Obesity and Distress: The "Second Brain" Connection

Presenter:
Karen Williams, MSSW, Williams Group



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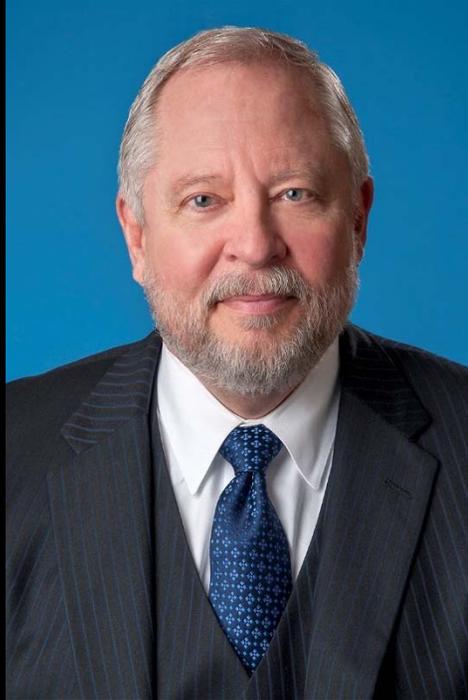
Accredited status does not imply endorsement by Department of State Health Services - Continuing Education Services, Texas Medical Association, or American Nurses Credentialing Center of any commercial products displayed in conjunction with an activity.

Additional Readings

Gershon M. *The Second Brain: A Groundbreaking New Understanding of Nervous Disorders of the Stomach and Intestine*. New York: Harper Perennial, 1999.

Knight R, Buhler B. *Follow Your Gut: the Enormous Impact of Tiny Microbes*. New York: Simon & Schuster, 2015.

Perlmutter D, Loberg K. *Brain Maker: The Power of Gut Microbes to Heal and Protect Your Brain-for Life*. New York: Little, Brown and Co., 2015.



John Hellerstedt, MD
DSHS Commissioner

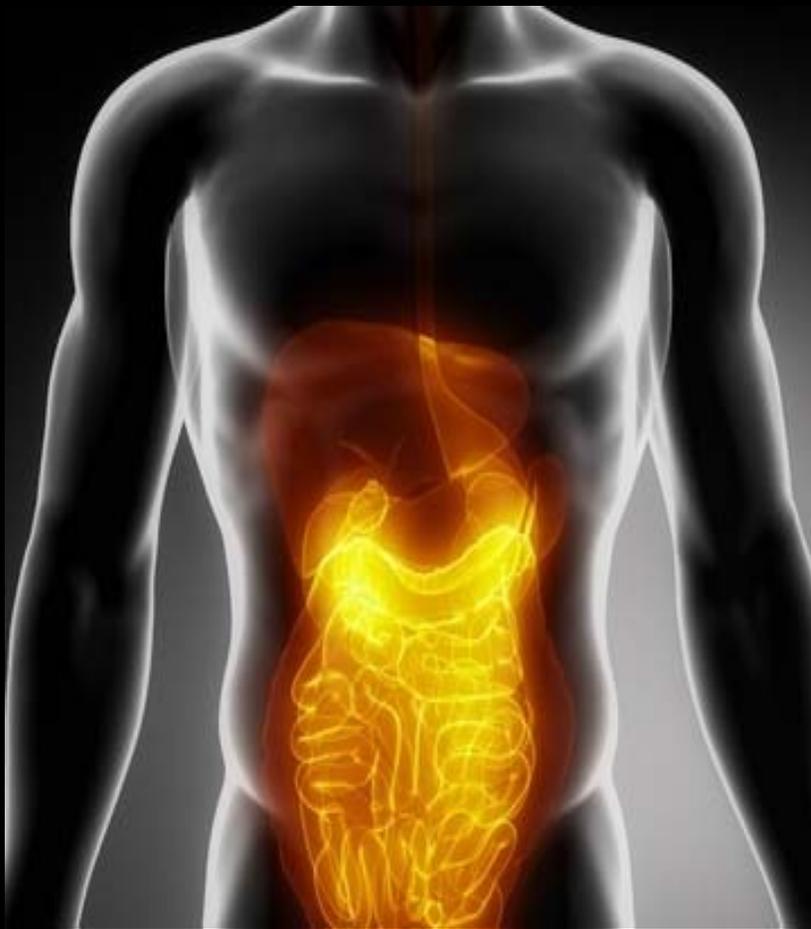
Introductions

John Hellerstedt, MD
DSHS Commissioner is pleased to
introduce our DSHS Grand Rounds speakers

Obesity and Distress: The "Second Brain" Connection



Karen Williams, MSSW
Williams Group



Obesity & Distress:

*The “Second Brain”
Connection®*

Karen Williams
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Program Objectives

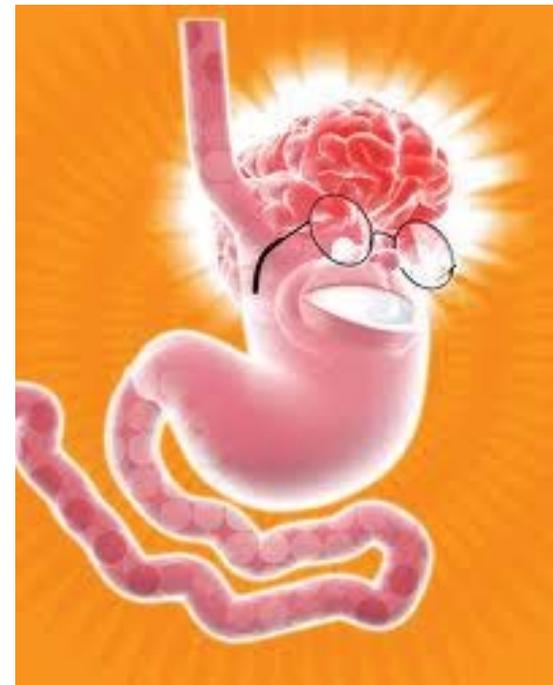
1. Discuss the role of the vagus nerve.
2. Describe at least one reason the gut is called our “second brain”.
3. Identify the links between childhood adversity, distress, and health risks.

SPOILER ALERT!

The latest neuroscience has recognized the many links between our brain, emotions, gut, and our eating behavior.



Scientists now call our gut
our **SECOND BRAIN!**



Before We Begin.....

**The information in this workshop
applies to ALL Ages,
however,
our focus is on
CHILDREN & ADOLESCENTS**



Our Goal....

To examine what the latest neuroscience has added to our knowledge about obesity.





Background...

Facts About Obesity



“Overweight”

Means a child is ABOVE a WEIGHT THAT IS CONSIDERED NORMAL and HEALTHY. Being overweight as a child can lead to obesity as an adult.

Means a person is ABOVE a WEIGHT THAT IS CONSIDERED NORMAL and HEALTHY. Being overweight as a child can lead to obesity as an adult.



“Obese”

Means a child is SEVERLY OVERWEIGHT with a body Mass index (BMI) that is equal to or greater than the 95th percentile.

Means a person is SEVERELY OVERWEIGHT with a body Mass Index (BMI) that is equal to or greater than the 95th percentile.

Obesity is attributed to:



- **GENETICS:** Our DNA... how our individual genes respond to changes in our environment
- **DIET:** Our calorie consumption...foods high in fat, sugar and “empty calories” – especially sweet foods (donuts, cookies, etc.) and “sodas”
- **FOOD DESERTS:** Lack of access to healthy food
- **PORTION SIZE:** Burgers, sodas, and other less healthy foods have increased in size **THREE-FOLD** since the middle of the last century.
- **LACK of PHYSICAL ACTIVITY:** Not enough play; too much sedentary technology - - not burning calories...

Obese teens' brains appear to be unusually susceptible to food commercials

TV food commercials disproportionately stimulate the brains of overweight teenagers, including the regions that control pleasure, taste and -- most surprisingly -- the mouth, suggesting they mentally simulate unhealthy eating habits that make it difficult to lose weight later in life.

Dartmouth College
May 21, 2015





Obesity Is Linked to Increased Risks for:

- **Type 2 Diabetes**
- **High Cholesterol & Heart Disease**
- **High Blood Pressure & Stroke**
- **Joint/Bone Problems**
- **Breathing Problems**
- **Sleep Disorders**
- **Cancers**

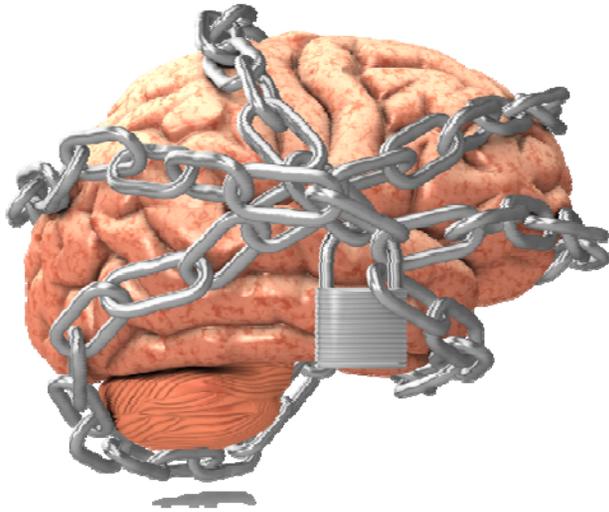


- Childhood obesity has more than tripled in the past 30 years.
- 1/3 of ALL U. S. children and adolescents are obese (severely overweight).
- Overweight adolescents have a 70% chance of becoming overweight adults.



Because Obesity Is a Form of Malnutrition,

childhood obesity can have a
profound effect on:



- **Brain Development**
- **Cognition and Memory, *i.e., thinking and learning***
- **Attention, Focus, and Concentration**
- **Behavioral Health**



The other half of the story...

Two Epidemics...

At the same time there has been an epidemic of

Obesity

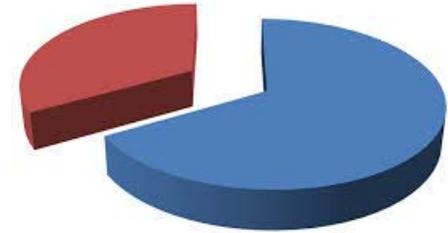
among our children and youth,

*there has been an epidemic of
Childhood Adversity.*



National Survey of Children's Health, 2012

“There are 76 million children under the age of 17 in the U.S.



60%, or 46 million, will have their lives touched by violence, crime, abuse, and psychological trauma in a given year.”

**Does
include
Bullying**

**Report on the Attorney General’s Task Force on
Children Exposed to Violence, December, 2012**

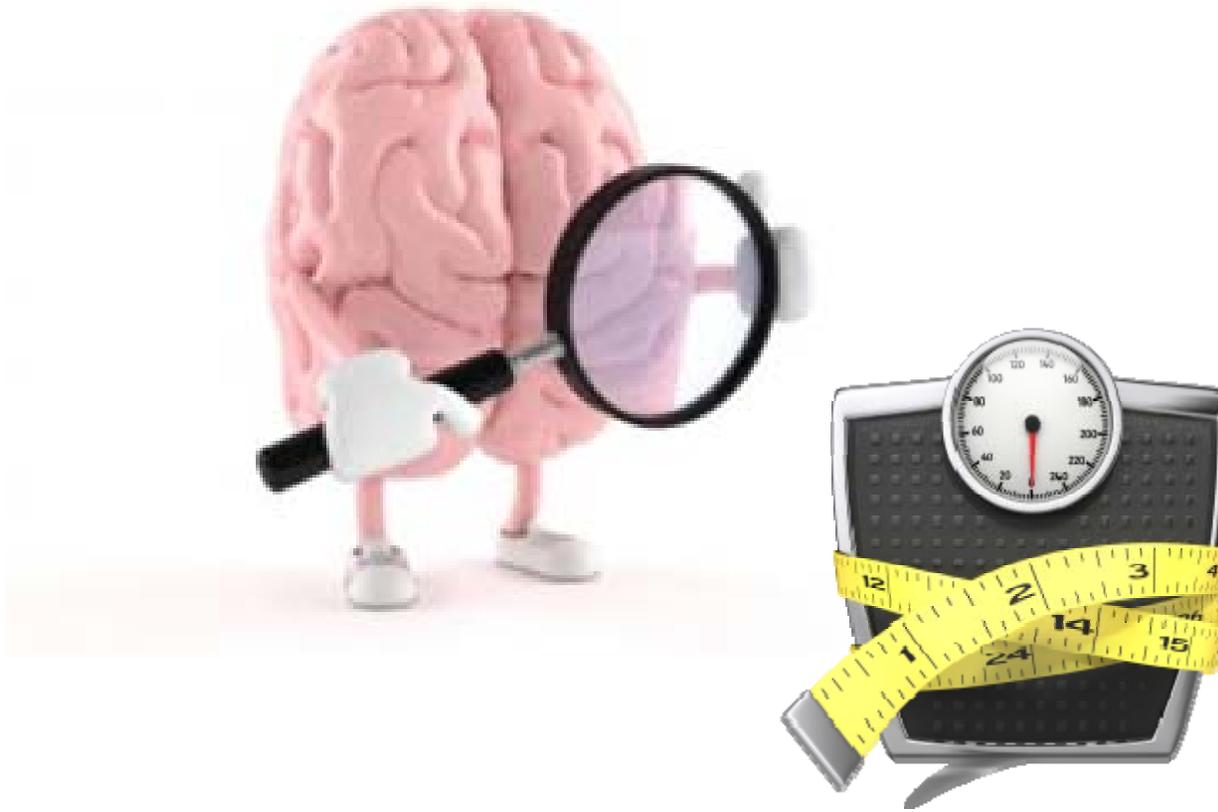
**Does not
include
MEDIA**

Poverty
Hunger/Food Insecurity
Homelessness Sofa-Surfing
Foster Care Family Separations
Blended Families Custody Sharing
Bullying Family/Community Violence
Child Neglect/Abuse Sexual Abuse
Substance Abusing Parent/Sibling
Parent w/Mental/Disabling Illness
Parent/Sibling in Prison/Jail
Military Deployments
Deportations

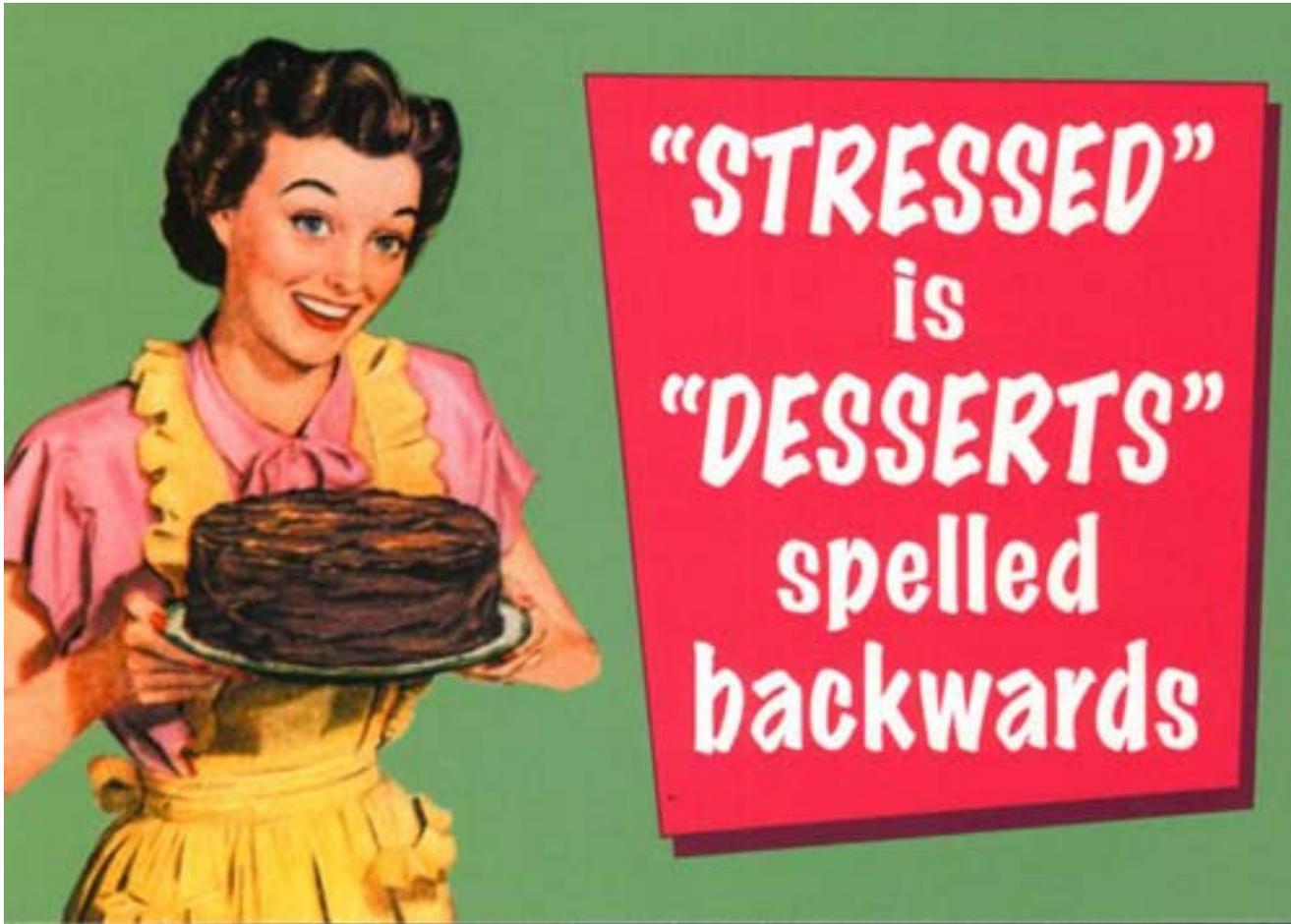
**An Epidemic of
Adversity =
Unmet Needs
= an Epidemic of
Distress,
Anxiety &
Trauma**



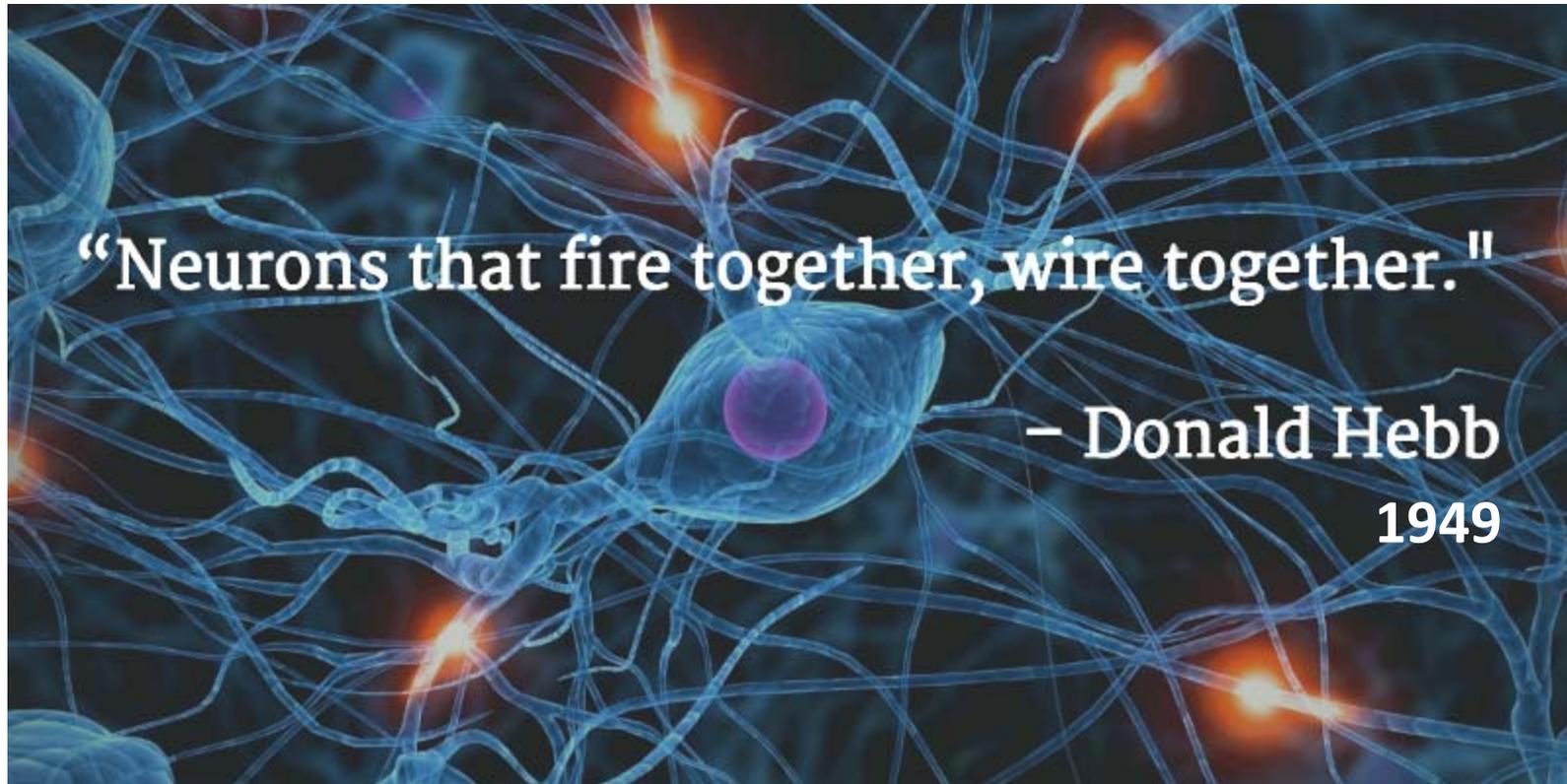
**Neuroscience has revealed
that these two epidemics
are related.**



Stress vs. Distress



**“Stress” is NOT bad...*Stress is Stimulation.*
Stimulation is LIFE!**



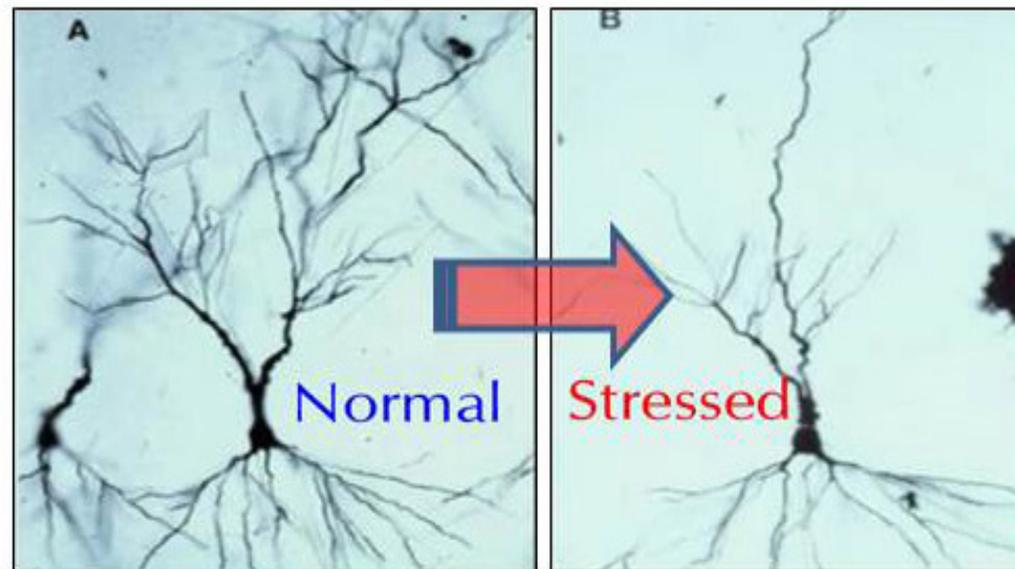
“Neurons that fire together, wire together.”

**– Donald Hebb
1949**

**Experience Stimulates.
Stimulation Changes Our Neural Structure**

But, DISTRESS triggers
AUTOMATIC, CHEMICAL CHANGES
in our brain/body that – if unmitigated –
can be harmful....

DISTRESS Can SHRINK Neural Networks.



Trauma = Toxic Stress

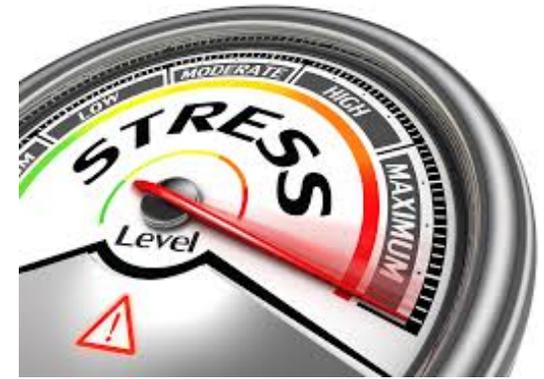


When an emotional or social burden is unmitigated and overwhelms one's ability to cope, the level of stress is said to be **“toxic”**.

The burden can be caused by an adverse environment, condition, situation, relationship or event.

The impact/effect of the burden is personal. The same burden will affect/impact different people differently.

“Toxic...”



means that the level of

**UNMITIGATED/UNBUFFERED
STRESS**

is interfering with or “disrupting”
emotional, social, cognitive & behavioral
development.

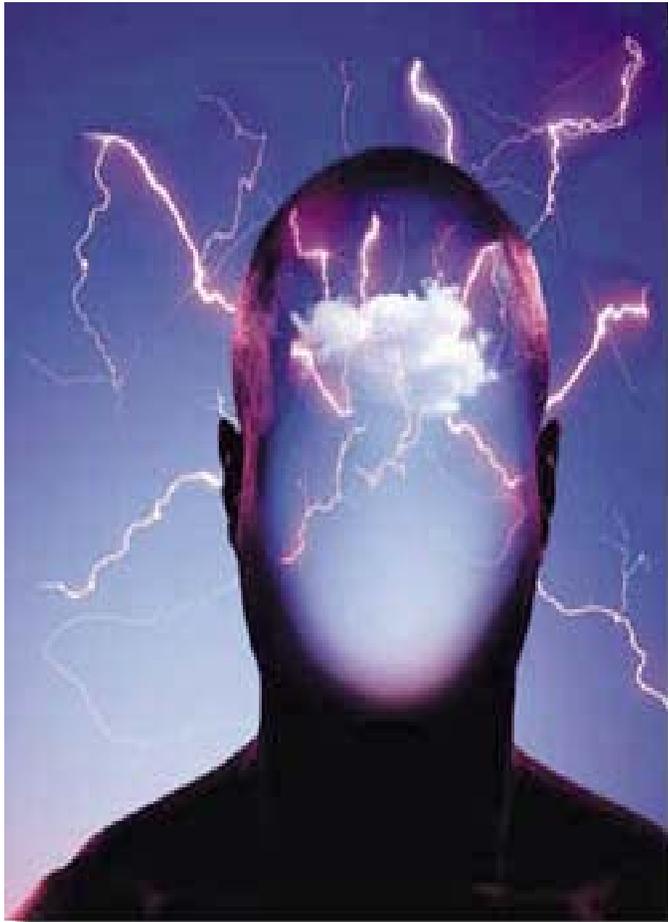


Because youth are all about building their brains, you can multiply what you know about how stress affects the adult brain by ten-fold when you think about a 10-20 year old's brain...



Dr. Robert Sapolsky,
Stanford University

New research shows that...



**both chronic stress &
frequent periods of normal
to moderate stress *appear to*
be particularly damaging to
YOUNG BRAINS ...
and YOUNG BODIES.**

National Science Foundation, 2010.

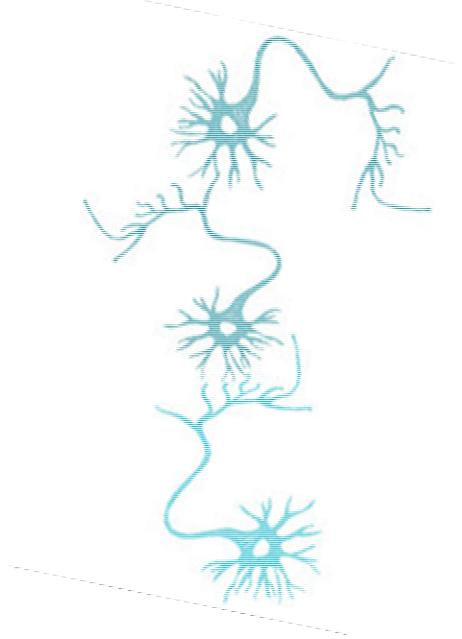
How Our “First Brain” Works



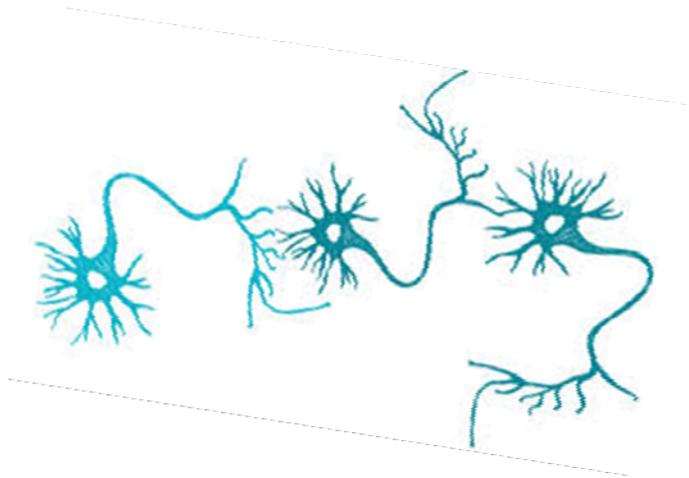


When we are born, we start out with about 100 billion neurons in our brain...

..and trillions in the rest of our body.

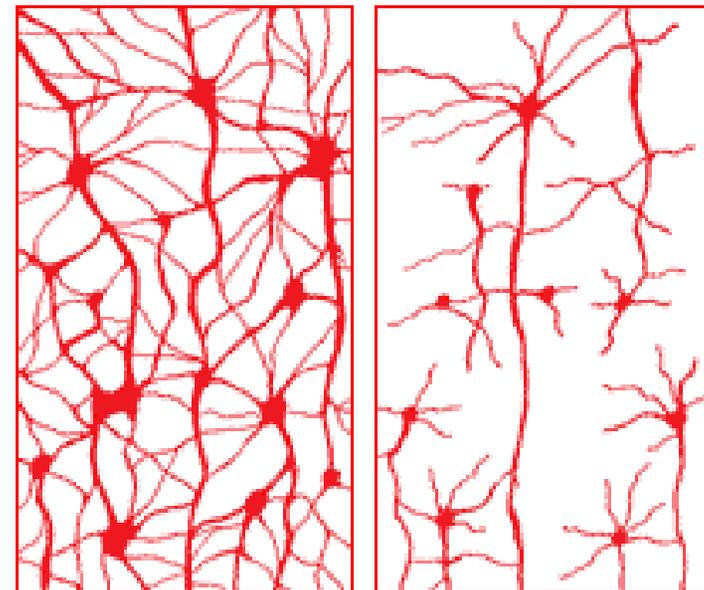


**25% of our neurons are
pre-wired**
(already programmed and
wired/connected/
networked, i.e., developed)
in the womb.



The other 75% are **waiting**
for stimulation from the outside.
POSITIVE EXPERIENCES
(Positive Interactions)
to wire/connect/network them.

Brain cell connections



section of a
stimulated brain

section of an
unstimulated brain



**What can
newborns do?
(Only the 25%)**



**Everything they
cannot do
(75%)
has to be
BUILT/developed!**

Because only **POSITIVE** experiences build/develop,
we seek **COMFORT** and **CONTROL (C&C)**.



We are driven to get comfort at any cost!

Development of our 75% “yet-to-be-developed”

neurons only takes place when

Comfort & Control are Present.

Major Problem:

The #1 Job

of our FIRST BRAIN is to
use our pre-wired (25%)

AUTOMATIC

Feelings, Drives & Instincts

(FDIs)

to protect us & help us

SURVIVE!

1 Job:



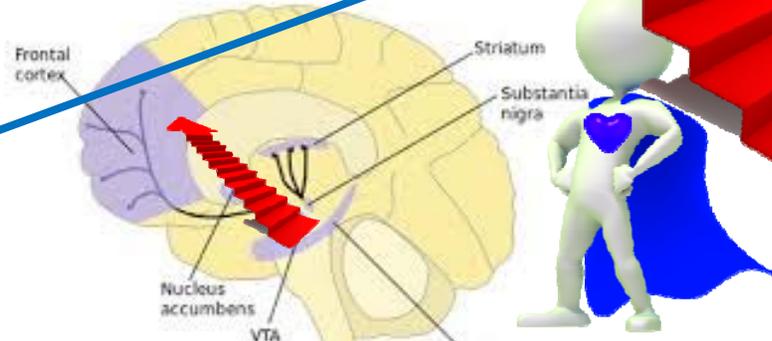
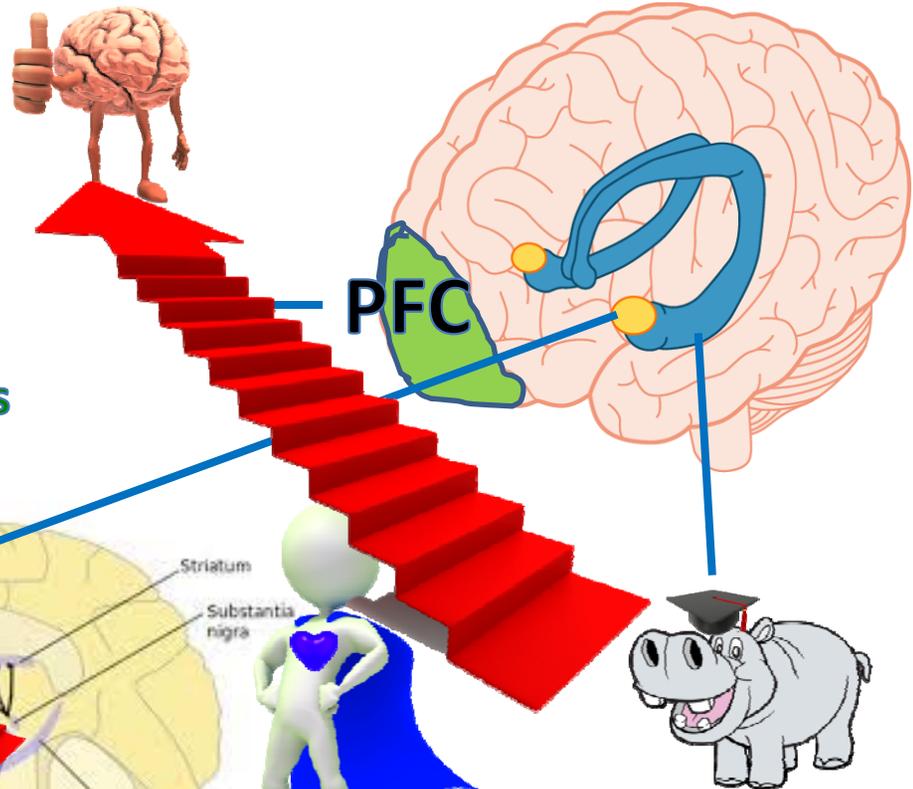
OJ

**Overreact & Jump to
Conclusions!**

Pre-Frontal Cortex (PFC)

SELF-REGULATION of:

- EMOTIONS & BEHAVIOR
- Active ATTENTION & LISTENING
- Short-term/Working MEMORY
- Mindfulness & Executive Functions



Reward Circuit

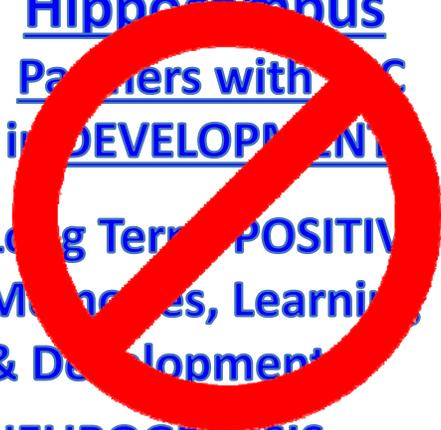
The Only Part of our Brain
More Powerful than Amy is
our REWARD/PLEASURE/
RESILIENCY CIRCUIT.
It restores balance.

Hippocampus

Partners with PFC in DEVELOPMENT

Long Term POSITIVE Memories, Learning & Development

NEUROGENESIS & Recovery



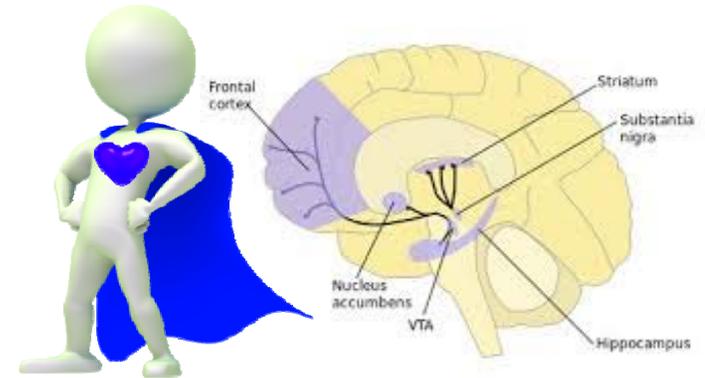
When PFC is in charge

PFC & HIPPOCAMPUS
are DISRUPTED;
THE "PAUSE" until
AMYGDALA HANDS
DOWN.



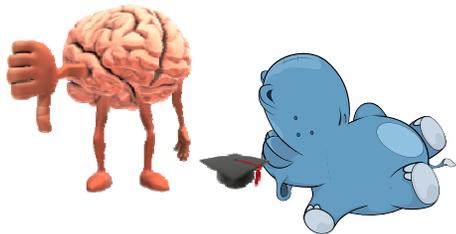


FEELINGS ARE FIRST!
It's Amy G.
VS.
Reward Center

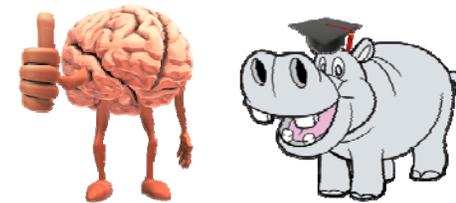


Dopamine Pathways in the Brain

The one in control determines the outcome:



OR



DISCOMFORT & LACK of CONTROL

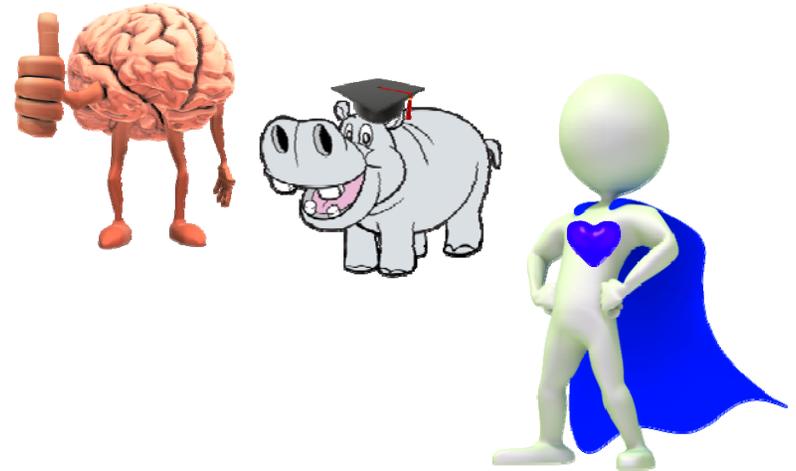
COMFORT/SENSE of CONTROL

Are fueled by adrenaline
and cortisol.
They trigger a shift of blood
& energy from learning to
Fight-Flight-Freeze Behaviors

Are fueled by Oxytocin,
Dopamine, Anandamide,
Endorphins, & Serotonin,
which trigger
Calm, Alert Behaviors

What we stimulate, WIRES, i.e. GETS STRONGER!

Reward Circuit,
Pre-Frontal Cortex (PFC), & Hippo
FEELING SAFE & CALM, Aware,
Focused Attention & Listening,
Short Term & Working Memory,
Long-Term Memory and Development,
Mindfulness, Motivation,
Emotional & Behavioral Control,



Amygdala = AMY G. & the OJs
FEAR, Discomfort, Distress, Worry,
Anxiety, Helplessness, Hopelessness
Automatic Drives & Instincts (FDIs),
Fight, Flight, Freeze, Appease



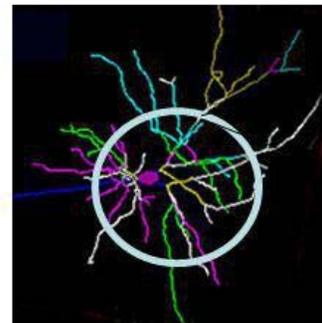


When distress is not relieved, it becomes “toxic”, i.e., it starves the developing neural networks of energy and they shrink.

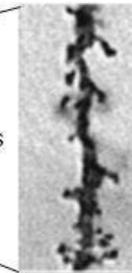
“Toxic” means that the discomfort or distress has remained long enough to interrupt the neural development of the PFC & Hippocampus

Toxic Stress Changes Brain Architecture

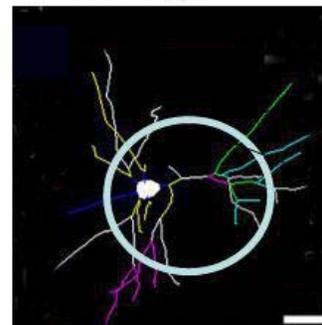
Normal



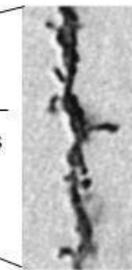
Typical neuron—
many connections



Toxic stress



Damaged neuron—
fewer connections



Prefrontal Cortex and
Hippocampus

Amy gets stronger

Our neurons operate on:



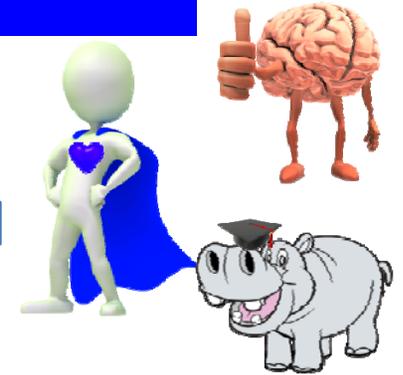
Electricity

Neurotransmitters
CODE

h1bnc
medical animation

Development & Emotional/Behavioral Health

- **Oxytocin – Safety, Trust, Relationships, Bonds**
- **Serotonin – Rest, Digest, Learn, Develop, Build**
- **Dopamine – Reward, Pleasure, Motivation**
- **Endorphins – Pain Relief & Euphoria**  **Body's Morphine**
- **Anandamide – “Bliss”/Wellbeing – Body's THC**



Protection & Survival



Norepinephrine – Noradrenaline (Alarm System)

Adrenaline and Cortisol = ACTION! & A-C-T-I-O-N

Maintaining Comfort & Control
(the ability to think, learn, and manage behavior)
requires a chemical balance...

**Maintaining Balance =
Comfort & Control.**



**Comfort & Control
= “Homeostasis”,
i.e., Chemical Balance.**

To maintain/keep our balance requires **“Resilience”**.

To maintain/keep our balance on our own is **“Self-Regulation”**.



Oxytocin: TRUST; Essential to Relationships;
Influences Digestion, Immune System, Healing.



Sara

REST, DIGEST, BUILD

Community!

Culture

Society

SEROTONIN

PFC & HIPPO

- Calm, Alert & Mindful
- Judgment & Empathy
- Explicit Learning
- Focus & Memory
- Behavioral Control
- Prevents Depression

Dr. Dopa 
COMFORT/CONTROL.
Pleasure & Pain Relief



Warning:
Addictive!

"Doctor
Feel Good!"

DOPAMINE:

REWARD CIRCUIT

- Cements Learning
- Creates Motivation
- Seek It at ALL Times
- First Aid Kit: Our Body's
Endorphins = "Morphine"
Anandamide = "THC"

Nora!

Alarmed/Armed
AGAINST THREATS



Auto!
Warrior!
Defender!

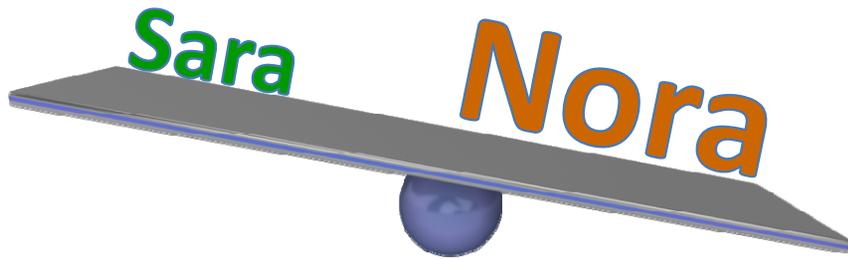
NOREPINEPHRINE:

AMYGDALA (OJ)

(Adrenaline/Cortisol)

SURVIVAL! FEAR!

- Short-Bursts ONLY!!!
- Too Much Creates
Distress, Anxiety, &
Trauma Resulting in
Fight-Flight-Freeze!



Distress



Anxiety



TRAUMA



**The more Nora; the less Sara!
When this happens....**

**..we crave Dopa to restore comfort and balance.
A sense of balance is a sense of CONTROL.**



**To ask for help, we need Oxy-T.
Oxytocin produces trust, which keeps Nora in
check, so we can build and maintain positive
relationships.**

Child & Adolescent Behavior...



Nora!

**ALARMED &
ARMED AGAINST
THREATS!**

Sara
REST, DIGEST, BUILD

Dr. Dopa
**COMFORT, CONTROL
& REWARD**
Pleasure & Pain Relief

Leptin
Sense of Fullness
and Satisfaction

"Hangries"*

Coping Skills & Support:
To Maintain Balance

Oxy-T

**TRUST Keeps NORA
in Check**

*Appetite Hormone Ghrelin:
Distress = "Hunger & Angries" =
"Hangries"

Seeking Balance = "Homeostasis" = Comfort & Control

Warning: In the same situation...



Adolescents' dose of
Cortisol is 2 to 5 times
MORE than that of adults
& it stays
2 to 5 times **LONGER!**

This helps explain why distress can be so damaging to young brains.....why they have trouble “calming down” after a distressful episode...and why they are at high risk for emotional, social and behavioral health problems.

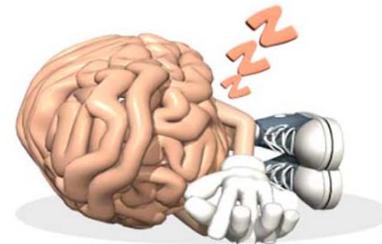
Dr. Russell Romeo, Rockefeller University

Lack of Sleep Increases Risk for Teen Obesity

Teens typically need about **9 hours of sleep** per night.

Fewer than 6 hours of shut-eye a night at age 16 increases the risk of obesity by age 21 by 20%, compared with 16-year-olds who slept more than 8 hrs.

A lack of sleep is associated with **increased distress and increased levels of cortisol**, which affect our cardio-metabolic risk, which includes things like high blood pressure, blood sugar, and body mass index.

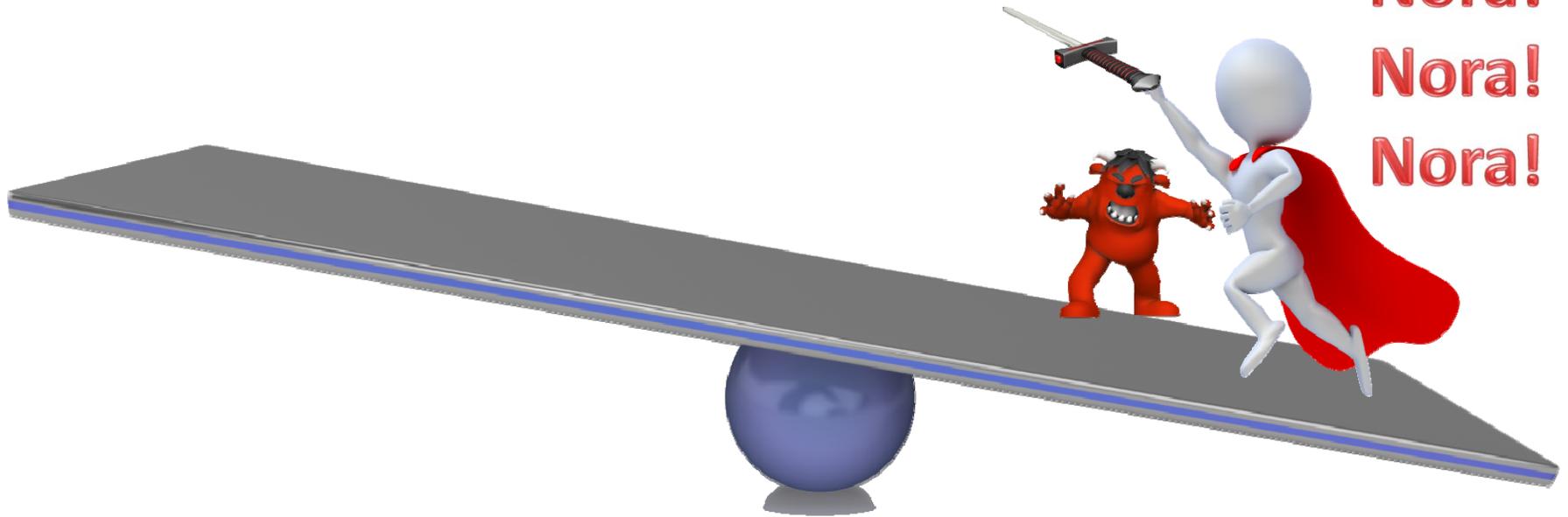


Sleep Study: Columbia University and the University of North Carolina, 2014

Amount of Sleep: National Sleep Foundation

Because the developing nervous system is so sensitive to distress, *it takes very little to change the “tipping point.”*

Nora!
Nora!
Nora!



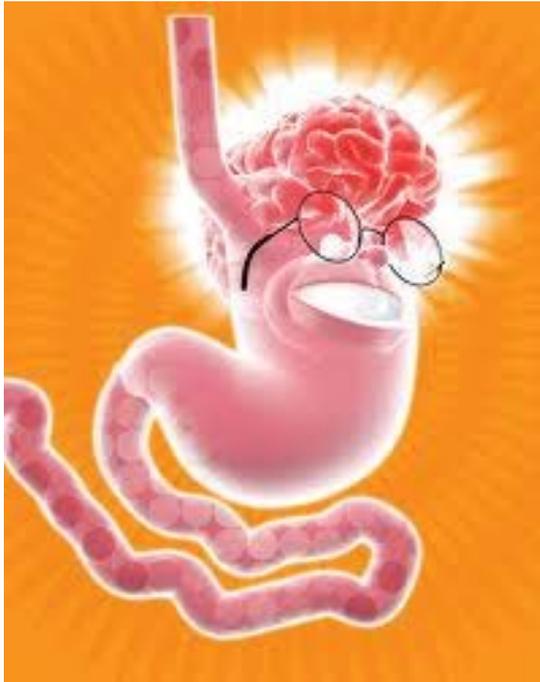


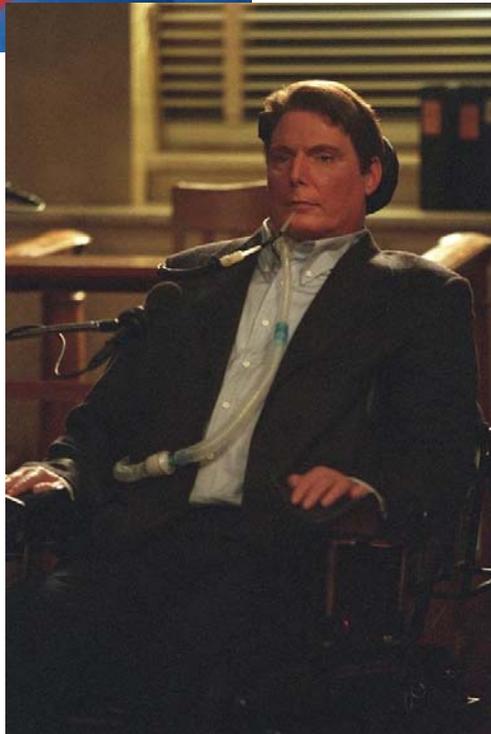
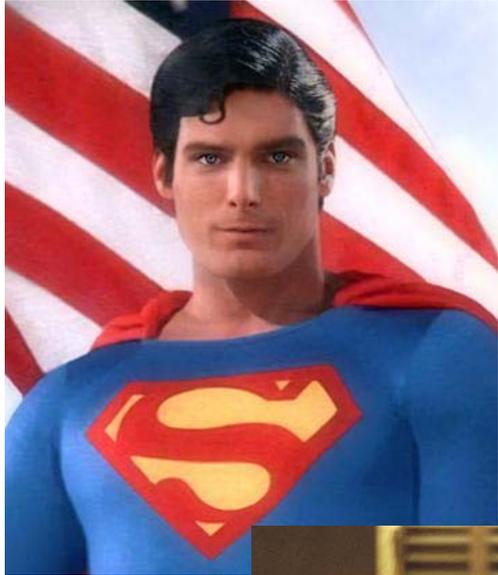
Because youth are all about building their brains, you can multiply what you know about how stress affects the adult brain by ten-fold when you think about a 10-20 year old's brain...



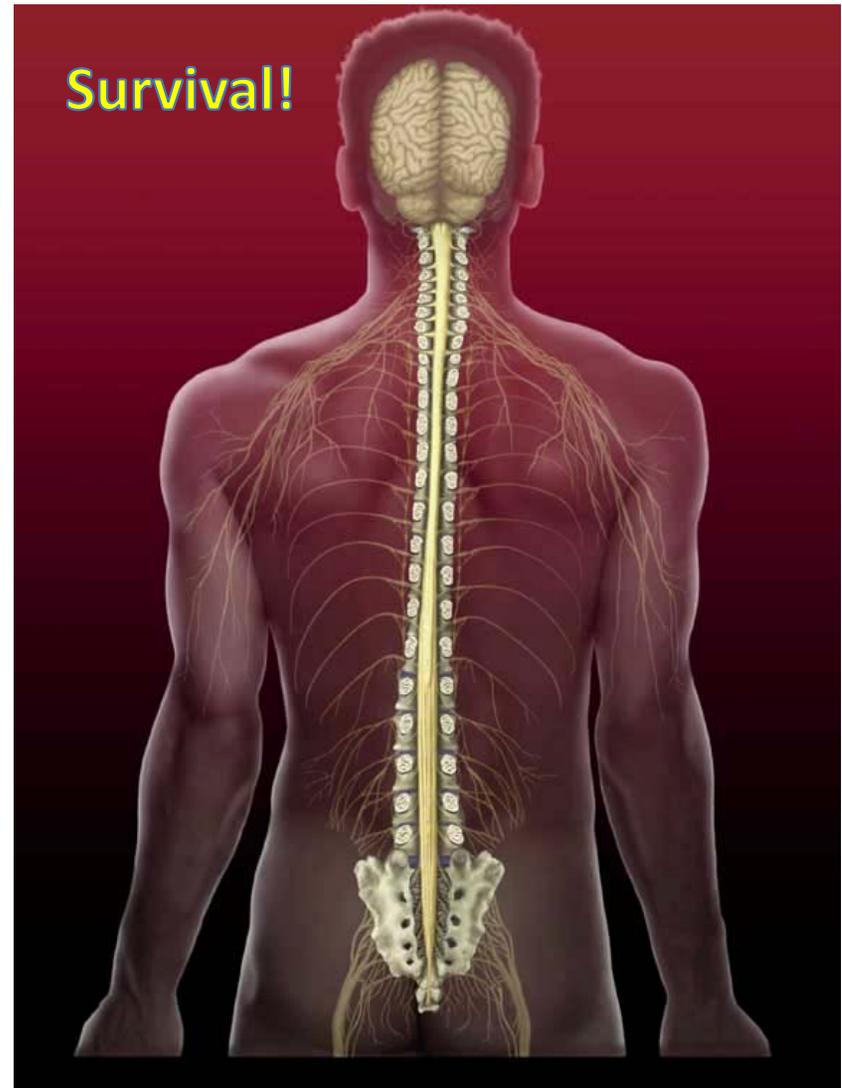
Dr. Robert Sapolsky,
Stanford University

Getting to Know Our “Second Brain”



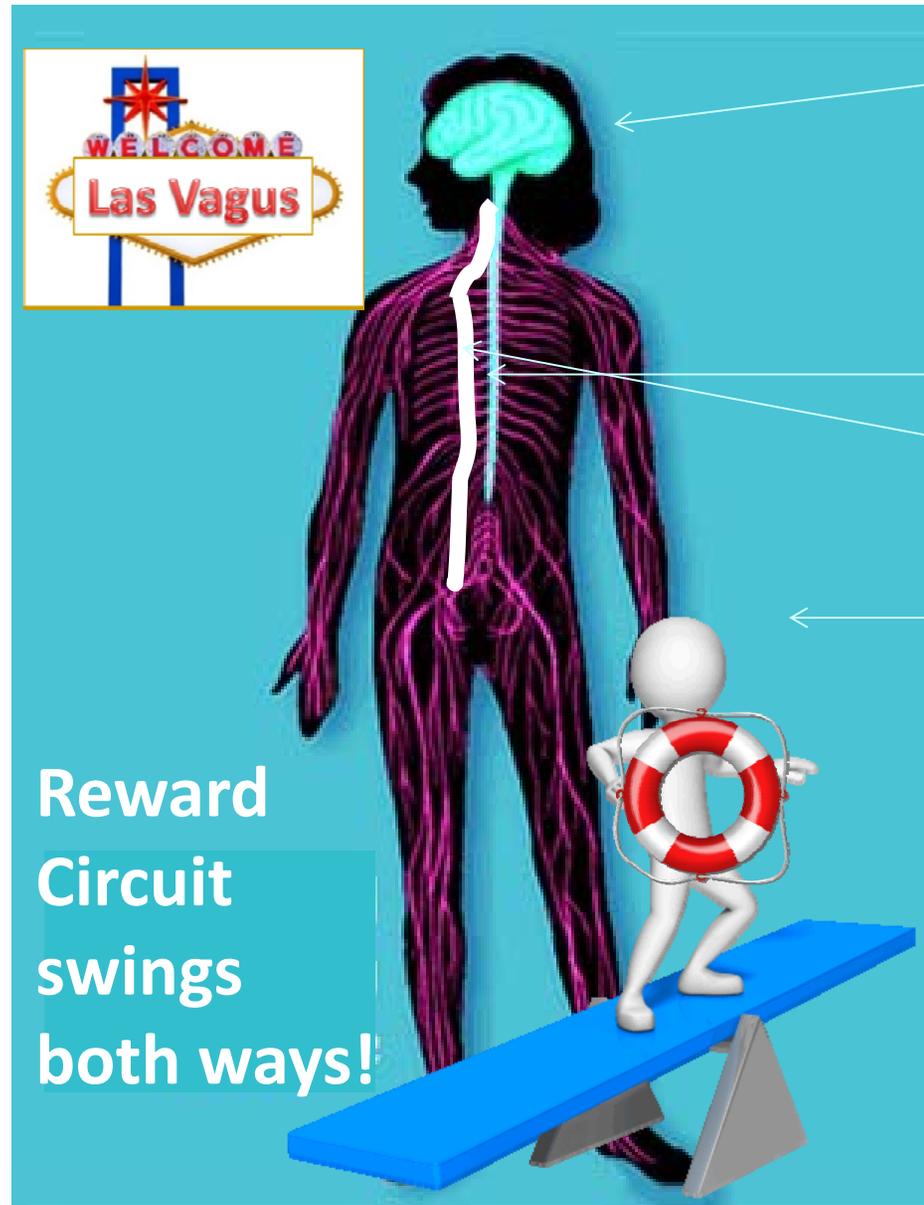


Our Spinal Nerves are in charge of
movement & response to threats.



Our Nervous System Has 2 Major Divisions.

One we hear a lot about and one we don't!

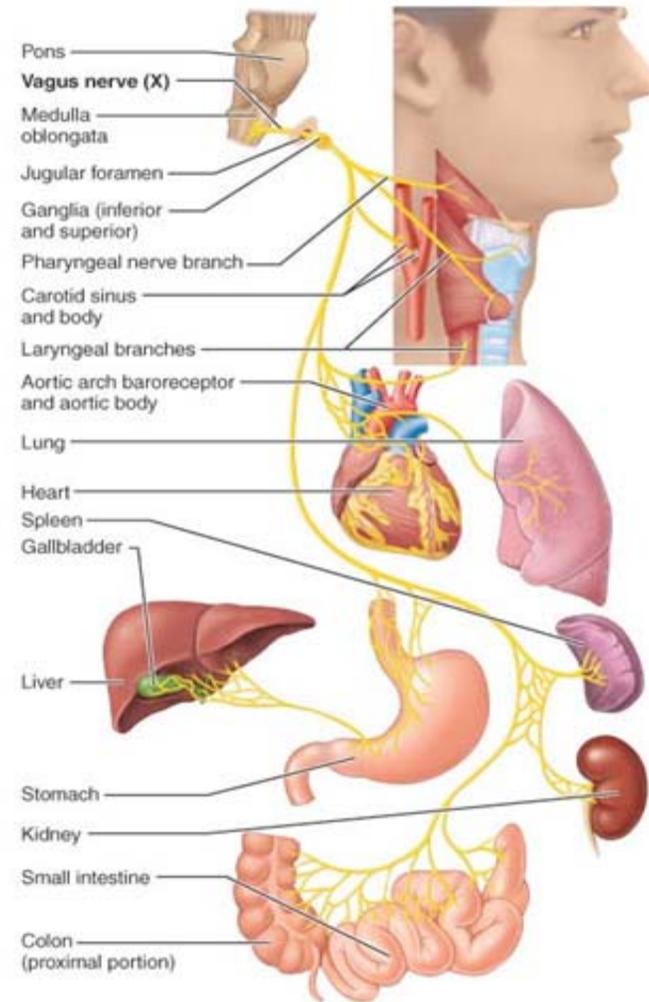
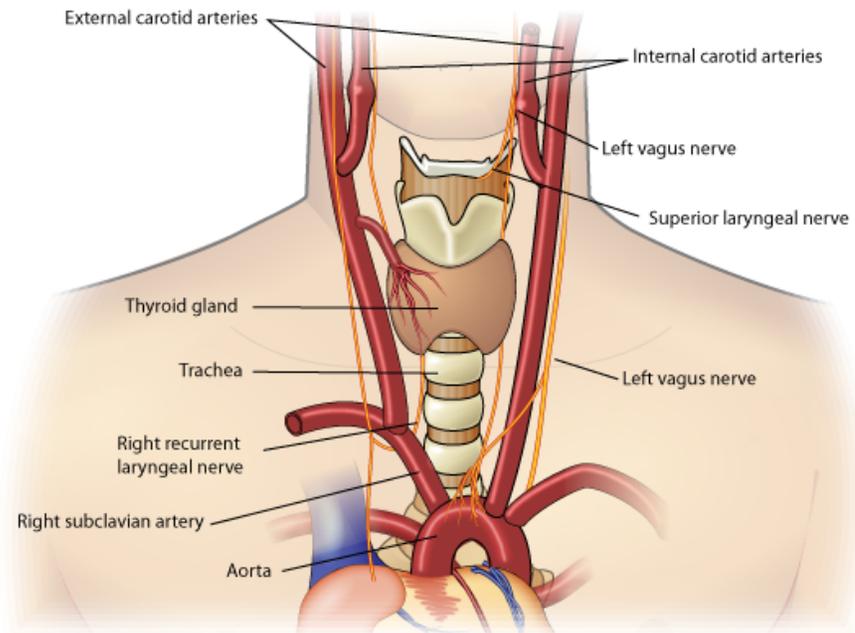


We have 2 "Two-Way Communication Pathways"

1. Amy G. & NORA. work with the SPINAL NERVES
2. PFC & HIPPO work with the VAGUS NERVES

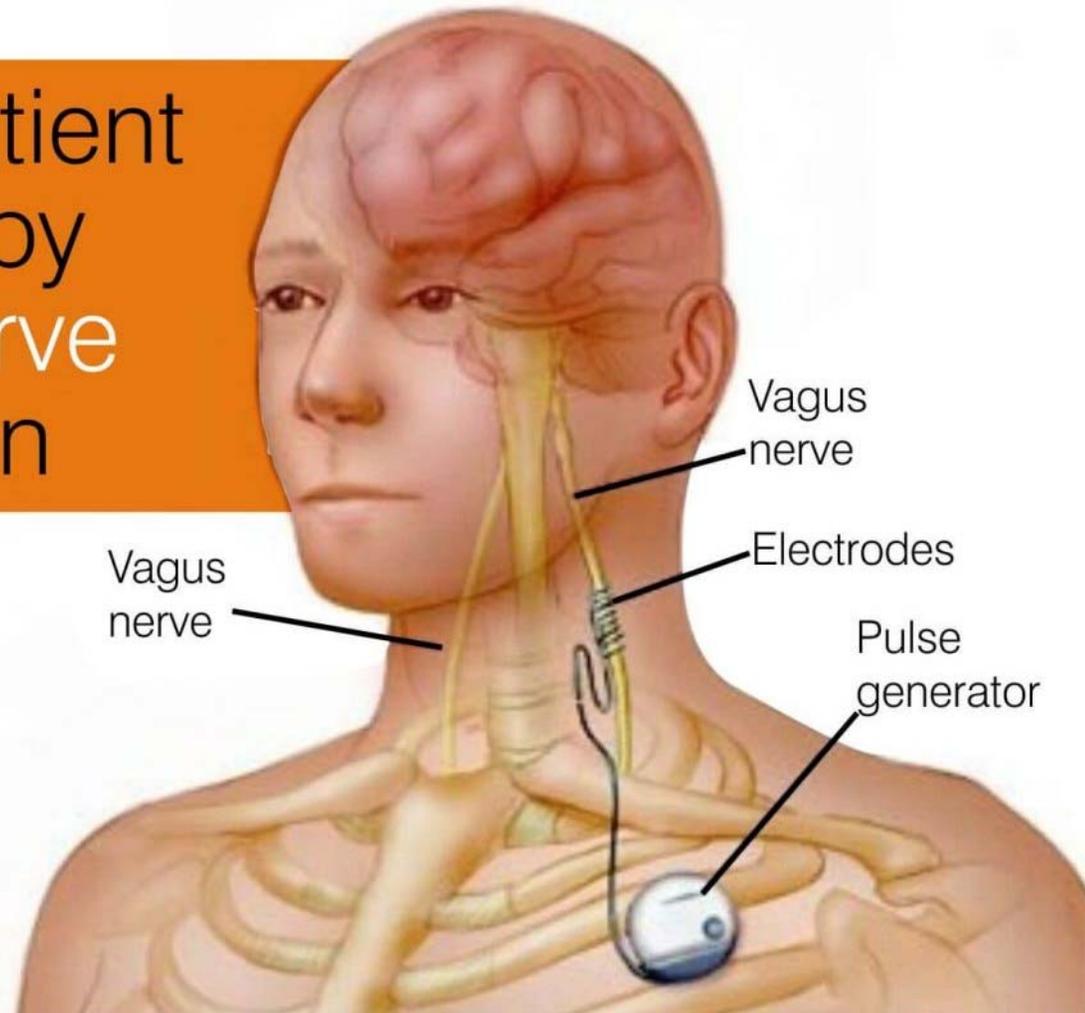
The Vagus Nerves - X

- A mixed sensory and motor nerve
 - “Wanders” into thorax and abdomen
 - Parasympathetic innervation of organs



Vagal Nervous System: Our Development & Mental Health Nerves

Stroke patient recovery by Vagus nerve stimulation



Vagal nerve stimulation (VNS) is an approved treatment for epilepsy and is currently under investigation as a therapy for other disorders, including depression, anxiety and Alzheimer's disease.

“The Twins” Share the Operation of Our Organs

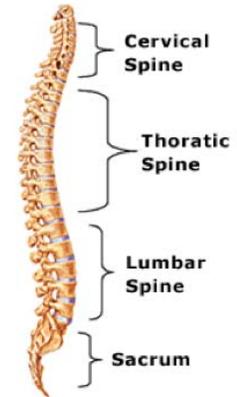
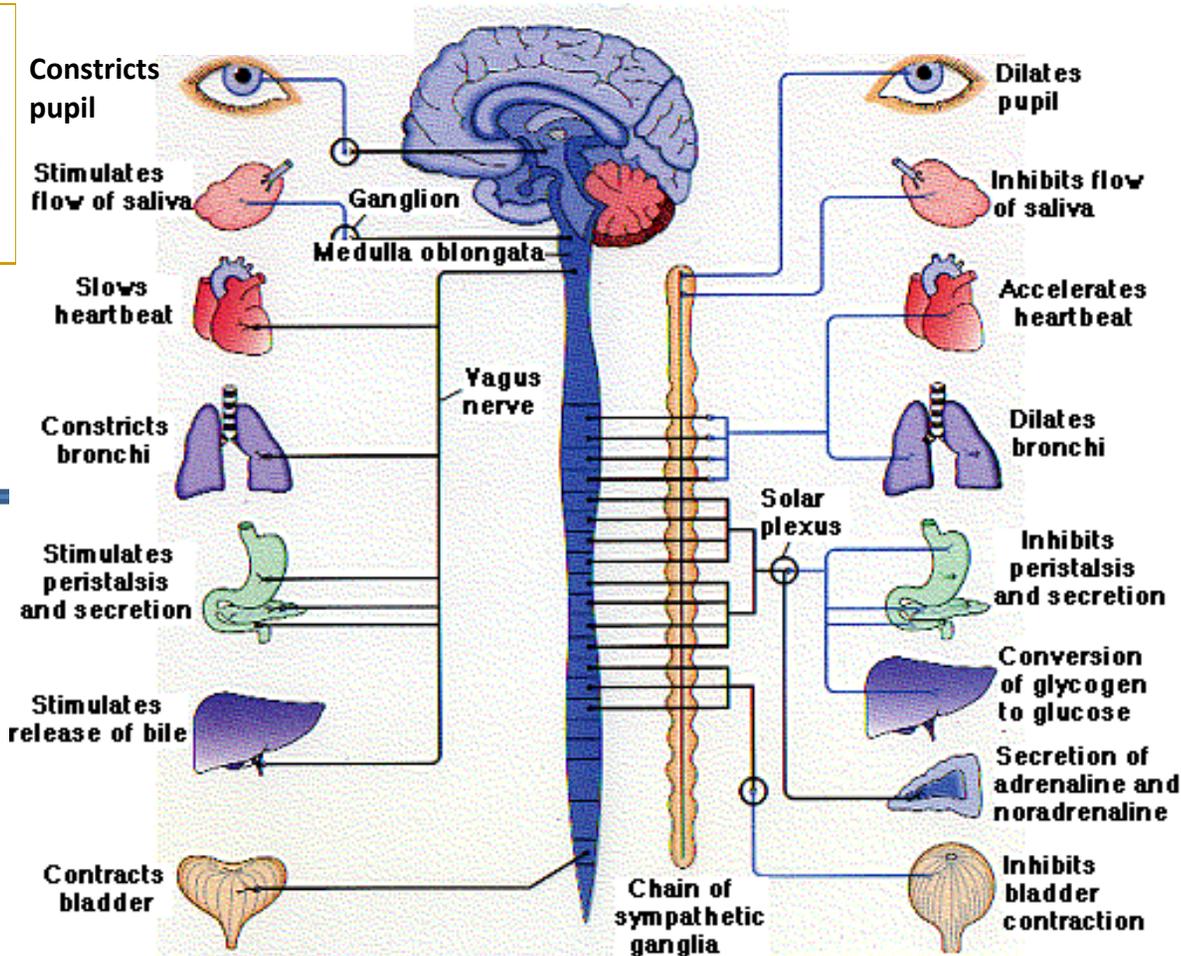
Parasympathetic – Handles “Peacetime”
 Comfort, Control & Support

Sympathetic – Handles “Threats”
 Threats = Unmet Needs/Burdens



**Vagus
Nerve:**

**PFC &
HIPPO**



Spine:

**AMY &
NORA**

DEVELOPMENT:

**Rest & Digest/Restful Alertness
 Feed, Breed & Build**

SURVIVAL:

**Alarmed & Armed/
 Fight, Flight, & Freeze**

Follow the blood & energy...



**“PEACETIME” –
REWARD, HIPPO & PFC**

- Oxytocin = Trust
- Dopamine = Comfort/Control
- Anandamide = Wellbeing/Bliss
- Endorphin = Pain Mgt./Euphoria
- Serotonin = Rest, Digest, Learn

- CALM ALERTNESS=
- RATIONAL THINKING
- REGULAR Heartbeat
- REGULAR Blood Pressure
- OPEN Esophagus:
“Whew” – Blow Out &
Deep, Regular Breathing
- REGULAR Digestion/Elim.

**In Response to a
Perceived Threat:**

NORA & AMY RULE



***Blood and energy are
shifted away from
thinking, learning,
developing, healing and
digesting to tensing the
muscles and preparing
for fight or flight.***

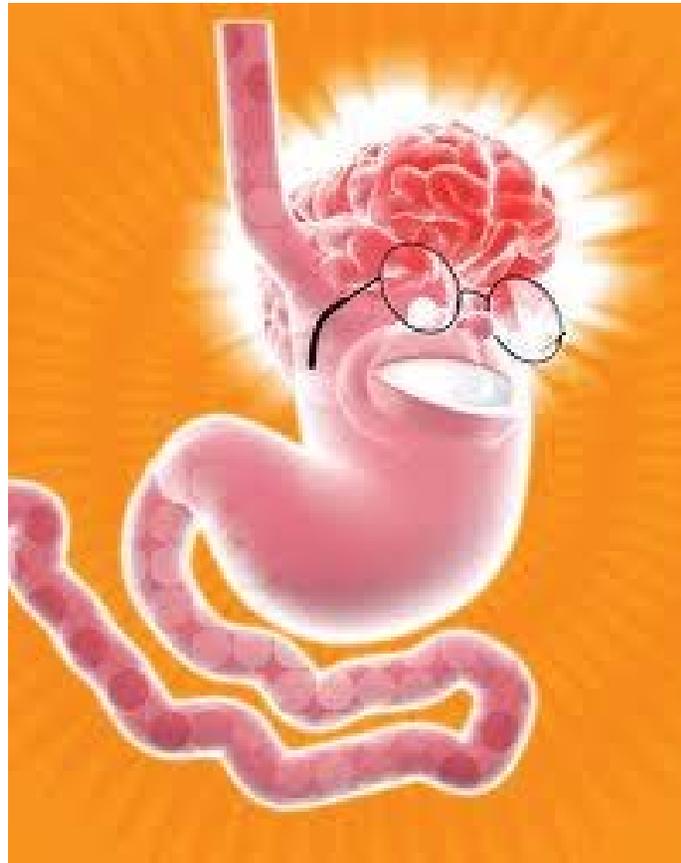
“WARTIME” – AMY G.

- Norepinephrine = Alarm
- Noradrenaline = Armed
- Adrenaline = ACTION
- Cortisol = A-C-T-I-O-N

- TENSE Muscles
- RAPID Heartbeat
- RAISED BP
- GASP - Rapid,
Shallow Breathing
or Holding Breath
- SLOWS/DISRUPTS
Digestion/Elim.
- Fear/Fight/Flight/
Freeze/Appease

***The shift is intended to be
TEMPORARY & SHORT-TERM for EMERGENCIES ONLY!***

“Toxic Stress” also disrupts our “SECOND BRAIN”



So...where are Sara, Dopa & Oxy-T made?

Serotonin

“SARA”

THINKING, LEARNING
& CONTROL (TLC)



DEVELOPMENT,
RECOVERY & HEALING

Dr. Dopa

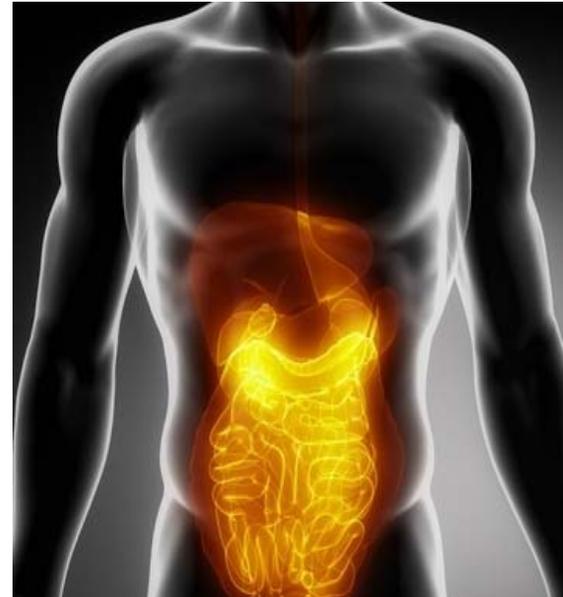
COMFORT, REWARD
Pleasure & Pain Relief



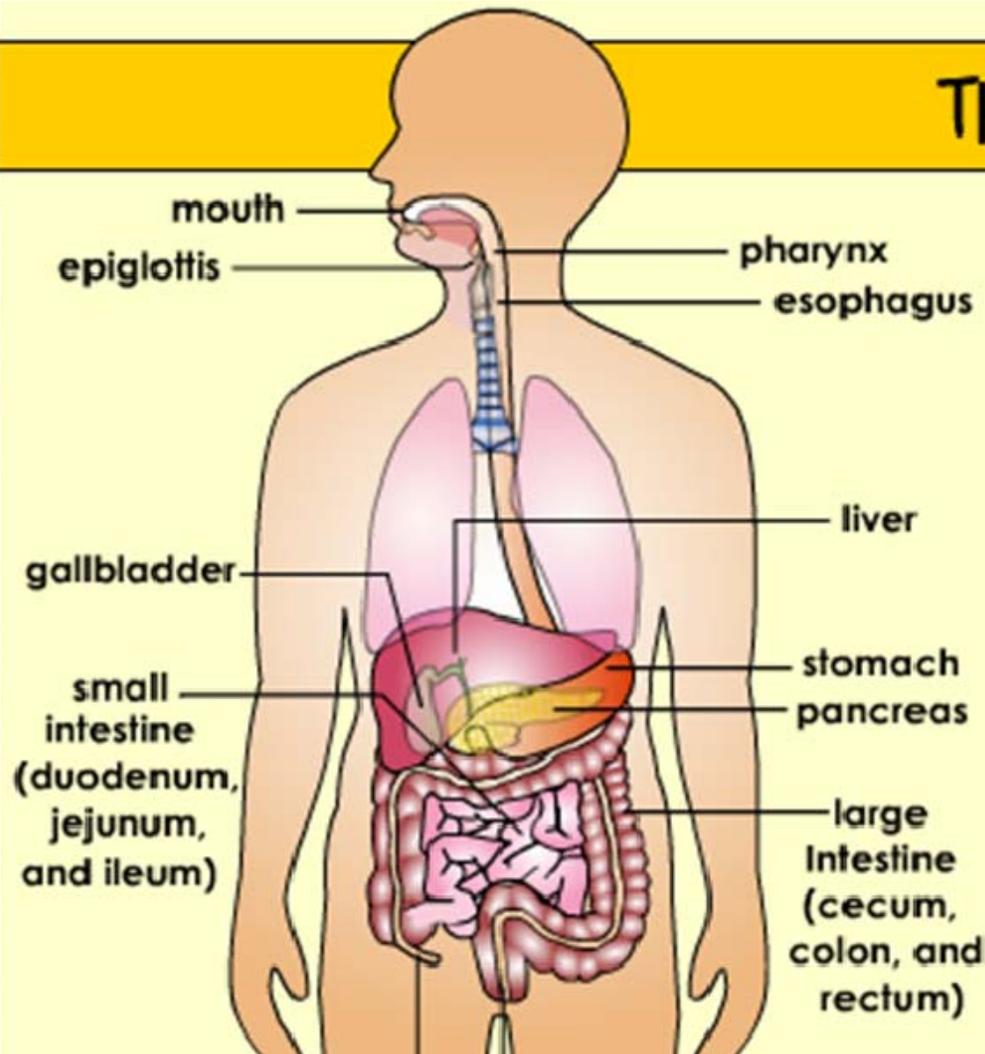
Oxy-T

TRUST Keeps NORA
in Check

In our two brains!



THE DIGESTIVE SYSTEM

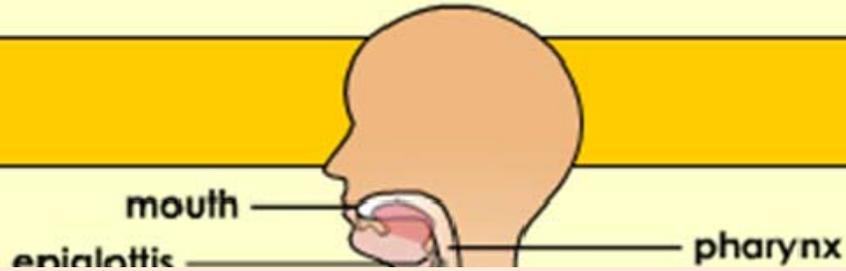


DIGESTIVE BREAKDOWN

The digestive system consists of the parts of the body, working together, that help turn food and liquids into the building blocks and fuel the body needs.

Our Digestive system uses the food we give it to make the chemicals we need to function, even the brain chemicals we use to think and learn, and the chemicals that protect us from disorders and diseases.

THE DIGESTIVE SYSTEM



Our gut “composts” - breaks down - our food into bacteria, which produce the chemicals for **life, survival, feelings, & thoughts.**

Nutrients and micronutrients are extracted and absorbed into our blood stream.

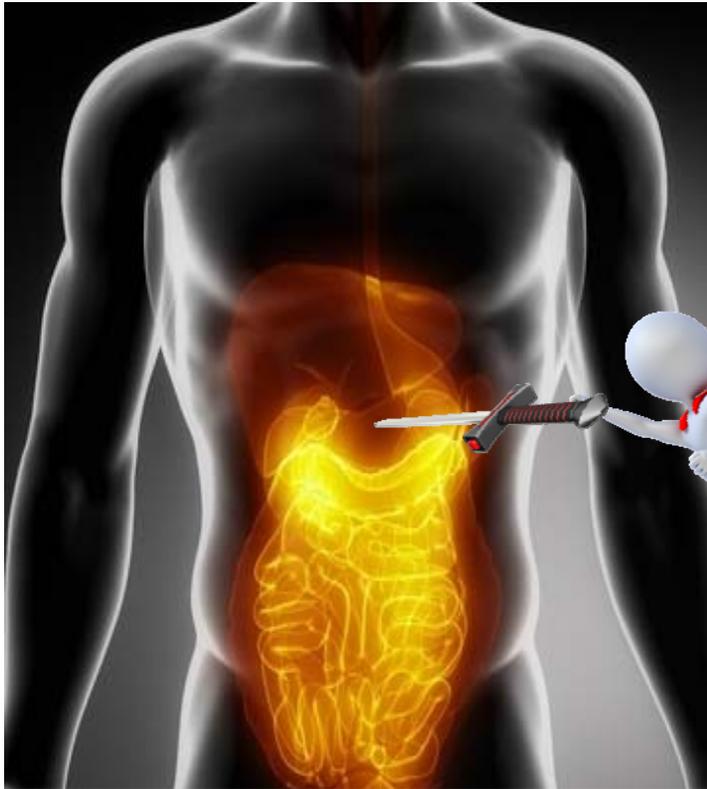
Neurotransmitters are sent up the Vagus Nerve to our brain.

DIGESTIVE BREAKDOWN

The digestive system consists of the parts of the body, working together, that help turn food and liquids into the building blocks and fuel the body needs.

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Our Gut is Our “SECOND BRAIN”

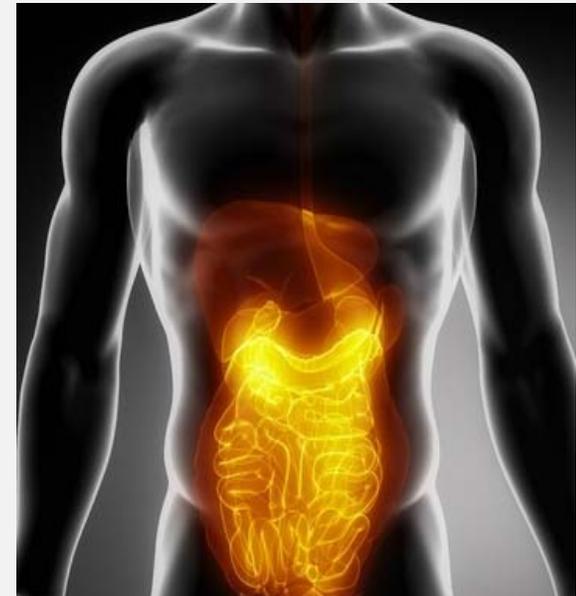


**DISTRESS SLOWS/
SHUTS IT DOWN!**

- Has 500 Million Neurons that are in constant contact with the neurons in our “*First/Big Brain*”.
- Job: To produce hundreds of chemicals our brain and the rest of our body use to function.
- Produces:
 - **85-95% of Serotonin**
 - 40-50% of Dopamine
 - 40-50% of Oxytocin
 - Houses and programs 70% of our Immune System, that protects us from illness & disease.

When stress SLOWS/SHUTS DOWN our gut, it leads to:

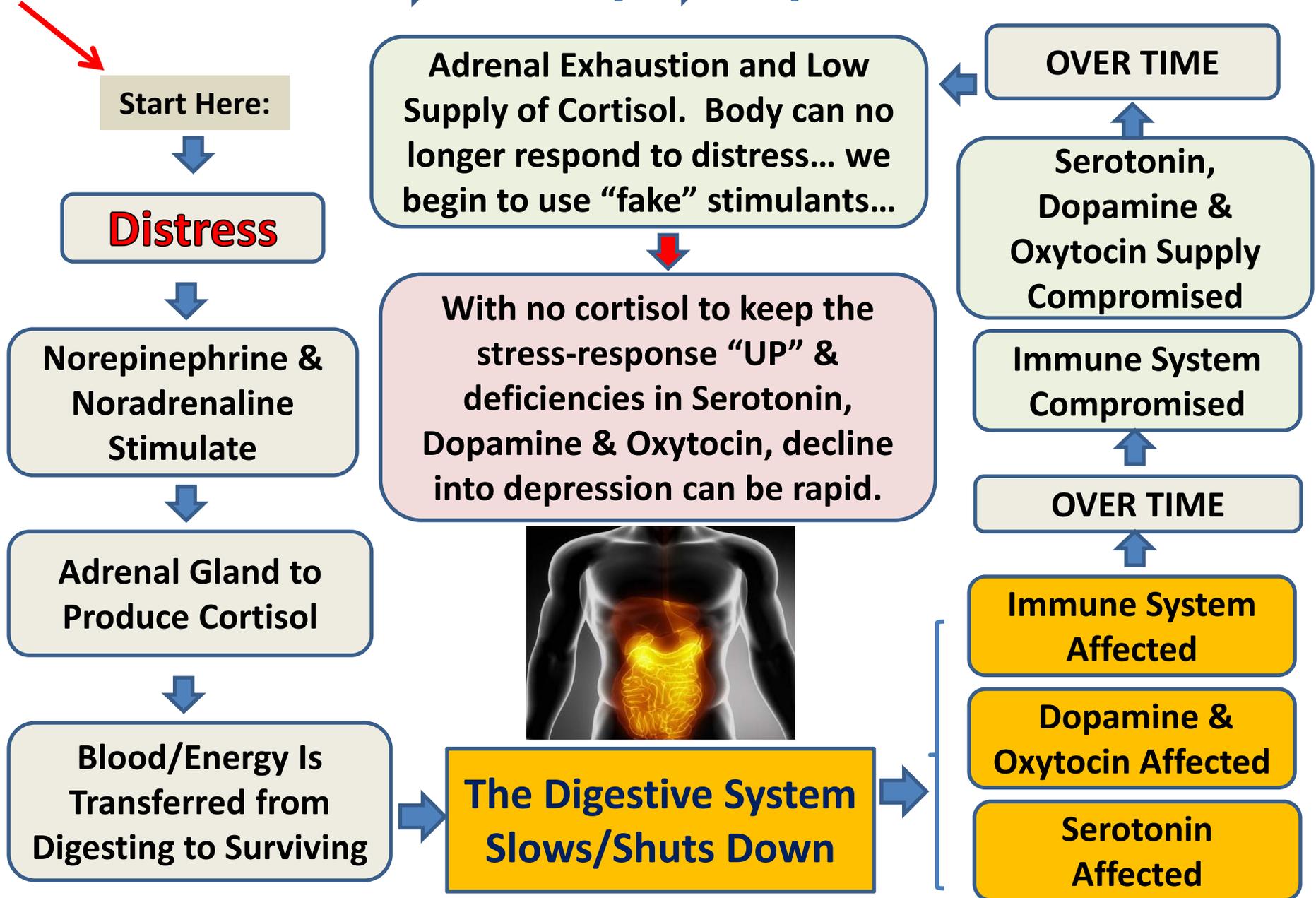
- **Digestive & Elimination Problems - Acid Reflux, Indigestion, IBS, Constipation, Colitis, Crohn's**
- **Metabolism Problems, Gall Bladder, etc.**
- **Weight Gain, Obesity**
- **Diabetes (Type 2)**
- **High Cholesterol, Blood Pressure**
- **Heart Disease**
- **Slower Healing**
- **Inflammations and Allergies**
- **Infections**
- **Anxiety & Depression**



**Digestion, Elimination,
Metabolism,
Immune System,
Mfg. of Sara, Dopa, & Oxy-T**

**Why does it matter
that our “gut is shut”?**

The Distress → Anxiety → Depression “Cascade”



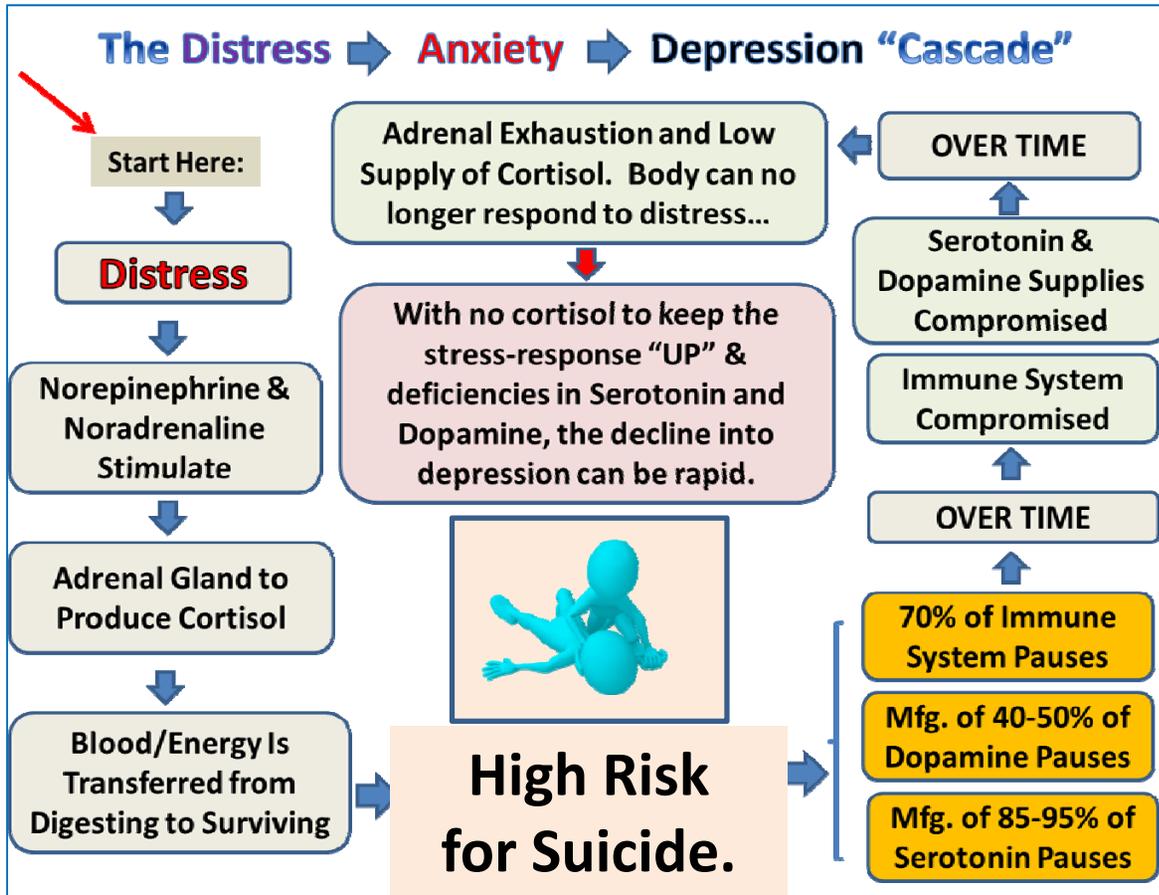
Know the symptoms:



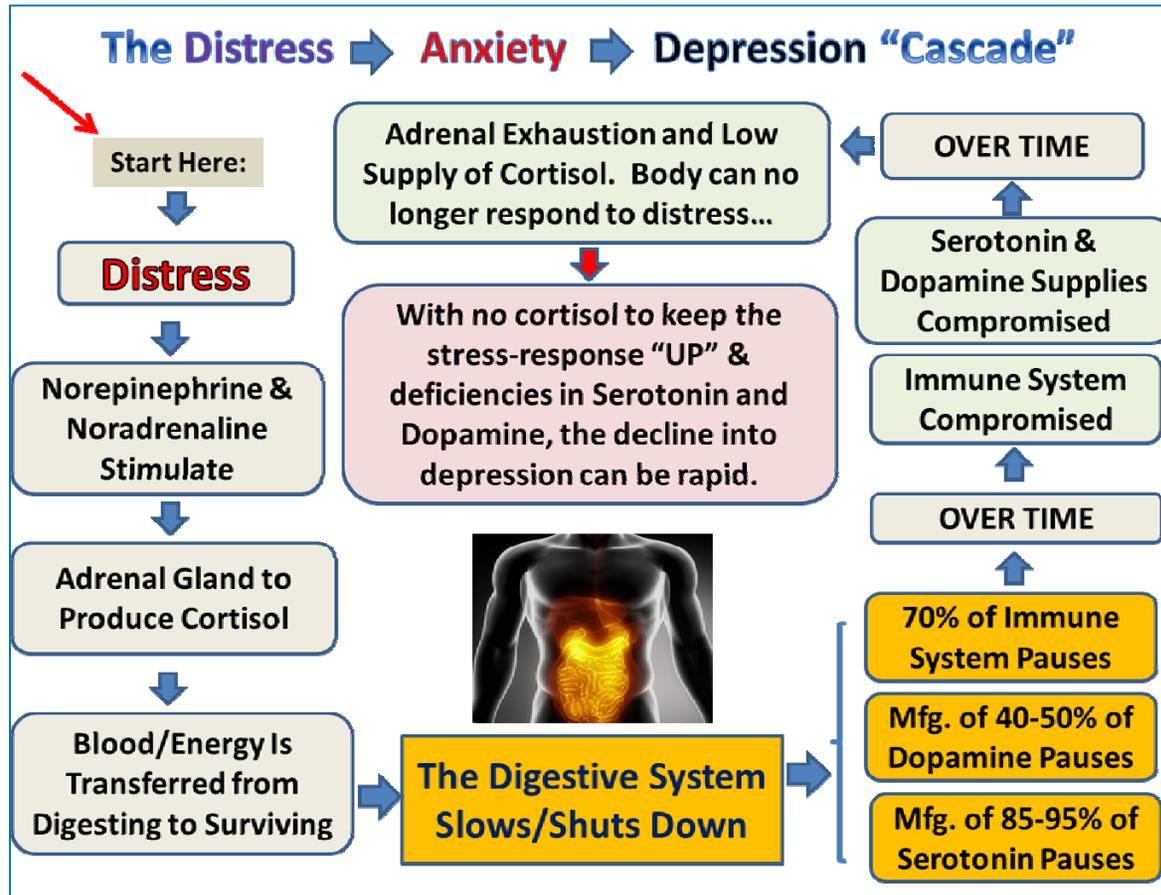
Behavioral Health Problems/Disorders (Acting Out; Using)



Somatic Complaints: Hunger, Fatigue, Headaches, Pain and Digestive & Elimination Complaints



When the gut shuts, malnutrition follows....



When the immune system is compromised, the body can't protect itself from diseases.

As digestive problems increase, they become diseases as well.



*Appetite Hormone Ghrelin:
Distress = “Hunger & Angries” = “Hangries”



Serotonin regulates the distribution of energy.

Serotonin works in partnership with Leptin, the chemical in charge of feeling satisfied, and full.

Without the partnership, we feel hungry all the time.

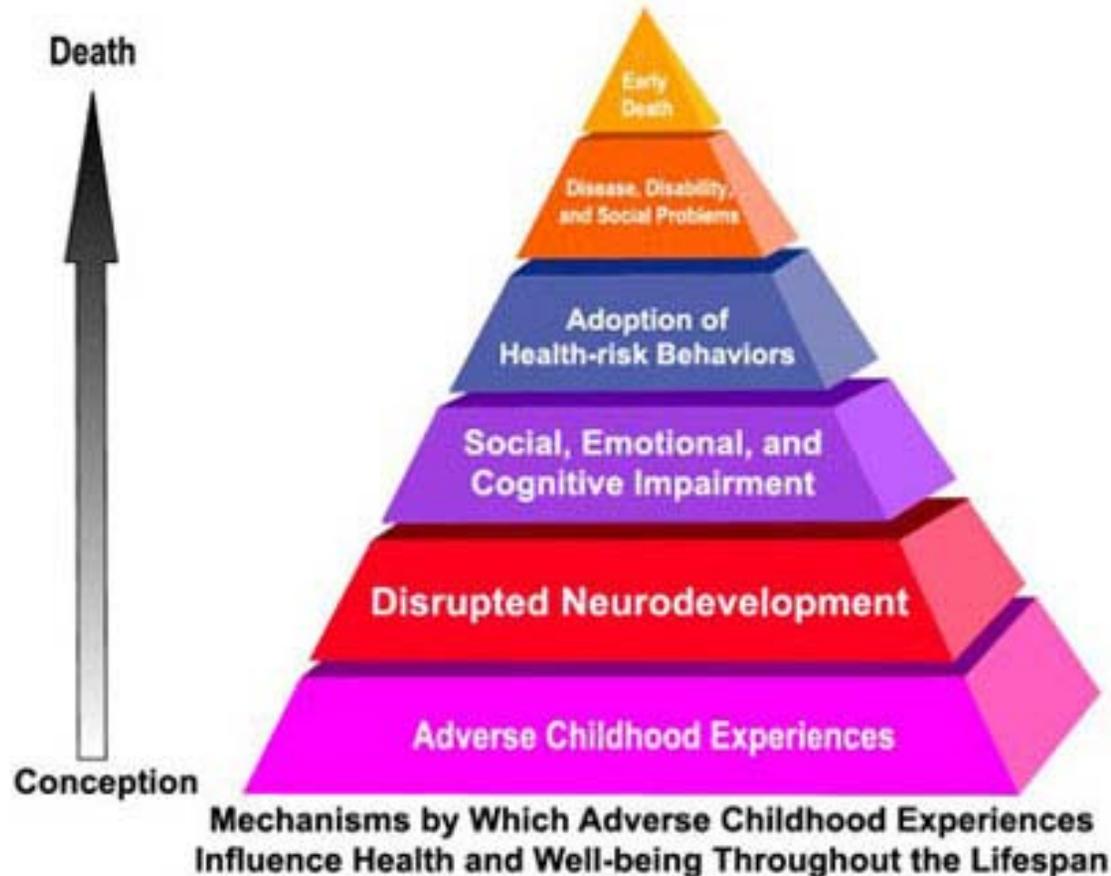
**Ask “gut” questions;
the answers can be early warning signs.**



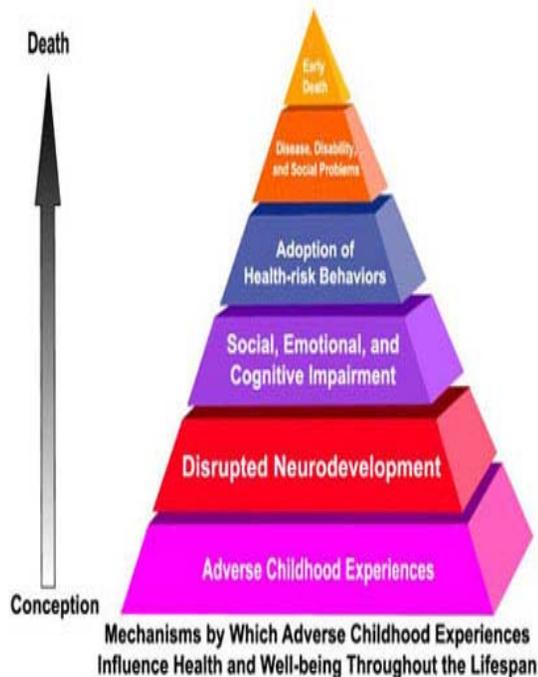
**Implications for both
medical and psychological
interventions are spurring
new research at a rate we
have not seen in decades.**

Obesity:

The Impetus for the CDC's Adverse Childhood Experiences (ACE) Study



Adverse Childhood Experiences (ACE Study)



- Public/Private Partnership – KP* and CDC**
- Largest study of its kind, and unusual participants
- 17,000 middle, upper-middle class, college-educated San Diegans with good jobs and KP Insurance
- The ACE Study linked childhood adversity with a wide-range of emotional, social, behavioral and physical health problems in adulthood
- Was the impetus for “Child Traumatic Stress” Field

Co-Principal Investigators:



Vincent J. Felitti, MD
Internist
Kaiser Permanente*
Founded the Dept. of
Preventive Medicine for
Kaiser Permanente



Dr. Robert F. Anda MD
Internist and
Epidemiologist
Centers for Disease
Control (CDC) &
Prevention**

It all began In 1985, when Dr. Felitti, couldn't understand why 55% of the 1,500 patients enrolled in his weight-loss clinic dropped out BEFORE completing, and the more successful they were the more likely they were to drop out.



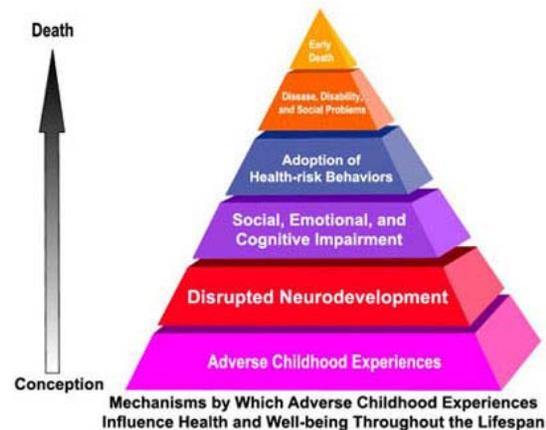
Follow-up interviews accidentally uncovered that at least half of the cohort dropping out reported **childhood sexual abuse that they had not previously revealed – and further reported having unexplained panic attacks when they begin losing and receiving compliments on their weight loss.**

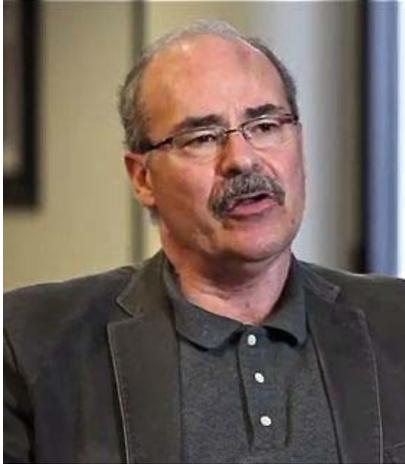


They were literally hiding behind their weight for protection. When their shield was threatened, they felt vulnerable. They could not even drive by or think about the weight loss clinic without feeling a sense of panic.

Dr. Felitti published his findings, which were read by Dr. Robert Anda at CDC.

Dr. Anda wondered if other forms of childhood adversity could also lead to health risks in adulthood, and proposed the ACE Study to find out.





Dr. David Williamson, CDC Researcher states that while there is a link between abuse – physical, verbal and sexual - - and obesity, it is estimated to be present in only 8% of the overweight population.

That means that today, among the 78 million obese Americans, more than six million overweight people are likely to have suffered physical, verbal and/or sexual abuse during their childhoods.

**What if we could mitigate the harm
for 6 million?**



**How about using the
10-Item ACE Questionnaire
as a routine part of
every child's health risk assessment?**

**And...let's teach ALL youth
coping and stress management
skills, which includes how and when
to ask for help.**



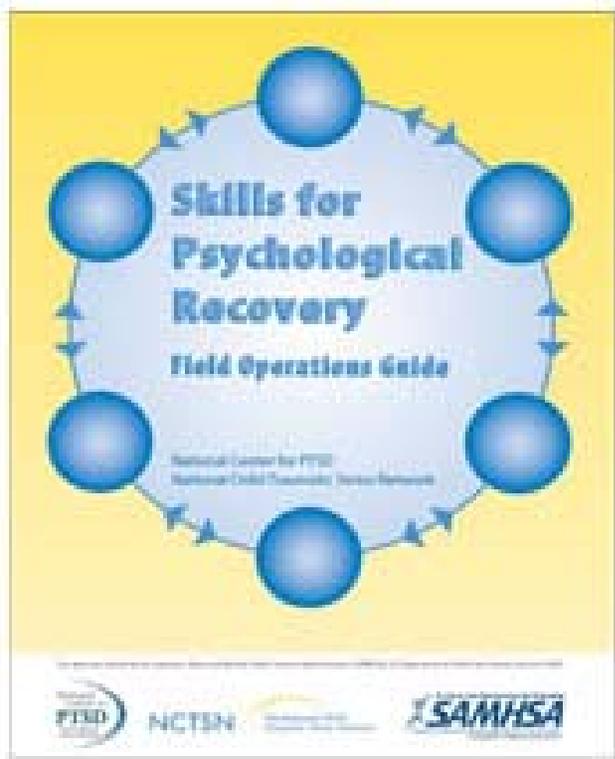
**...just think of the
return on the investment!**

We are ALL 1st Responders!

Tell Someone!

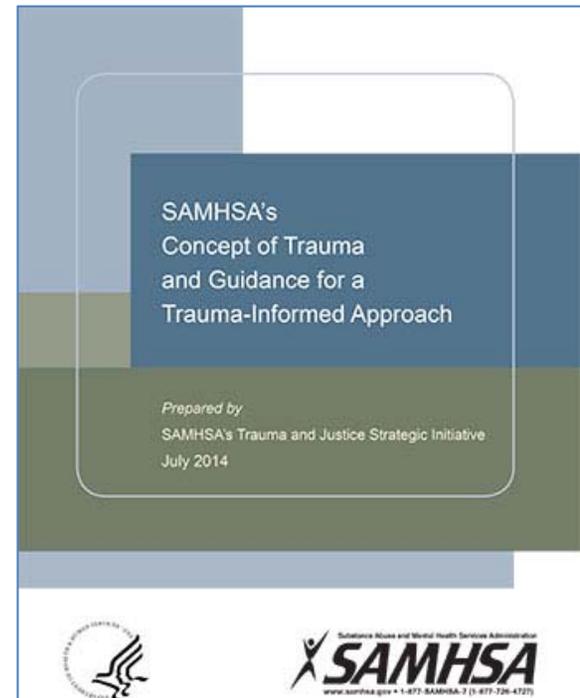
National Child Traumatic Stress Network (NCTSN)

<http://www.nctsn.org/>



SAMHSA's "Concept of Trauma and Guidance for a Trauma-Informed Approach"

Free Download



<http://store.samhsa.gov/product/SAMHSA-s-Concept-of-Trauma-and-Guidance-for-a-Trauma-Informed-Approach/SMA14-4884>

Where to go for:

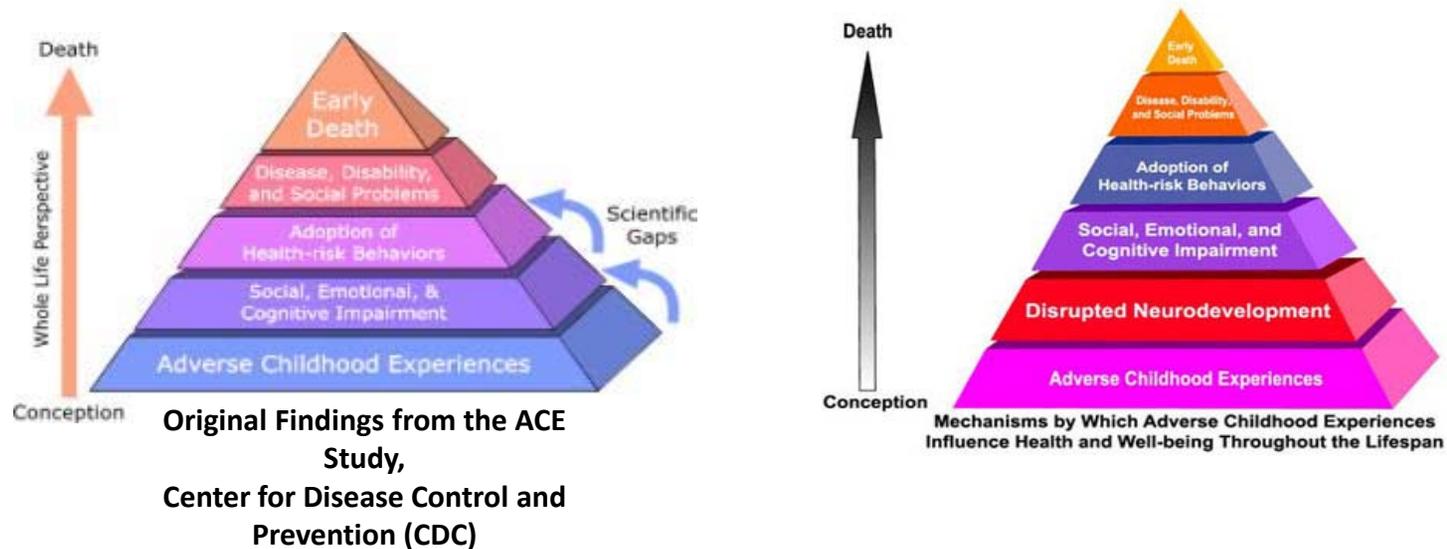
Original ACE Study, Findings, Articles, etc.:

www.cdc.gov/violenceprevention/acestudy

Information about
ACE-Informed and Trauma-Informed Schools:

www.cestoohigh.com

www.acesconnection.com





Q & A Moderator

Evelyn Delgado
Associate Commissioner for
Family and Community Health

Questions and Answers

Remote sites can send in questions by typing in the *GoToWebinar* chat box or email GrandRounds@dshs.state.tx.us.

For those in the auditorium, please come to the microphone to ask your question.

October 19

Obesity: A Public Health Approach

Presenter:

Jay Maddock, PhD, Dean and Professor,
School of Public Health,
Texas A&M University

