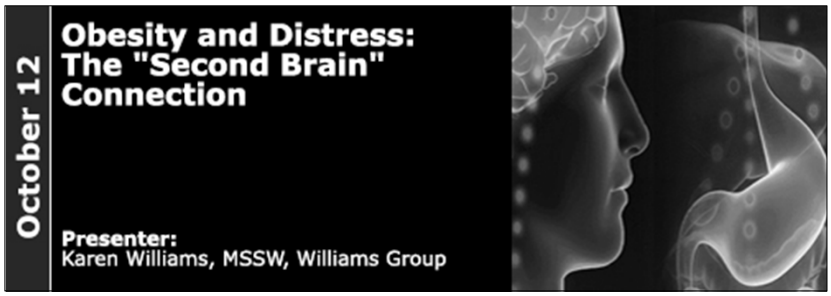
DSHS Grand Rounds



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3

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4

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.

5

John Hellerstedt, MD
DSHS Commissioner

Introductions

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

6

Obesity and Distress:
The "Second Brain" Connection

Karen Williams, MSSW
Williams Group

7

Obesity & Distress:

The "Second Brain" Connection©

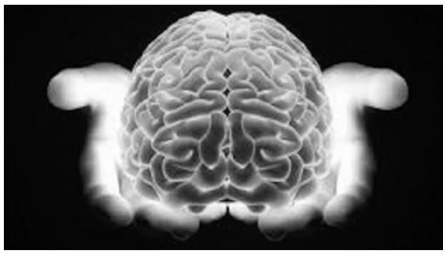
Karen Williams
williamsgroup@cableone.net
903-814-1171

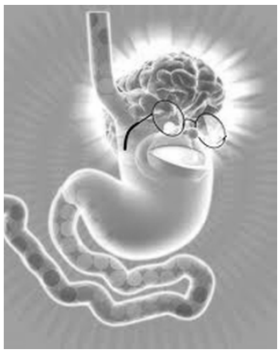
Program Objectives

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

17

- Childhood obesity has more than <u>tripled</u> 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

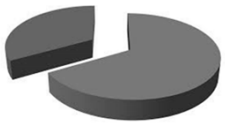
among our children and youth,

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.

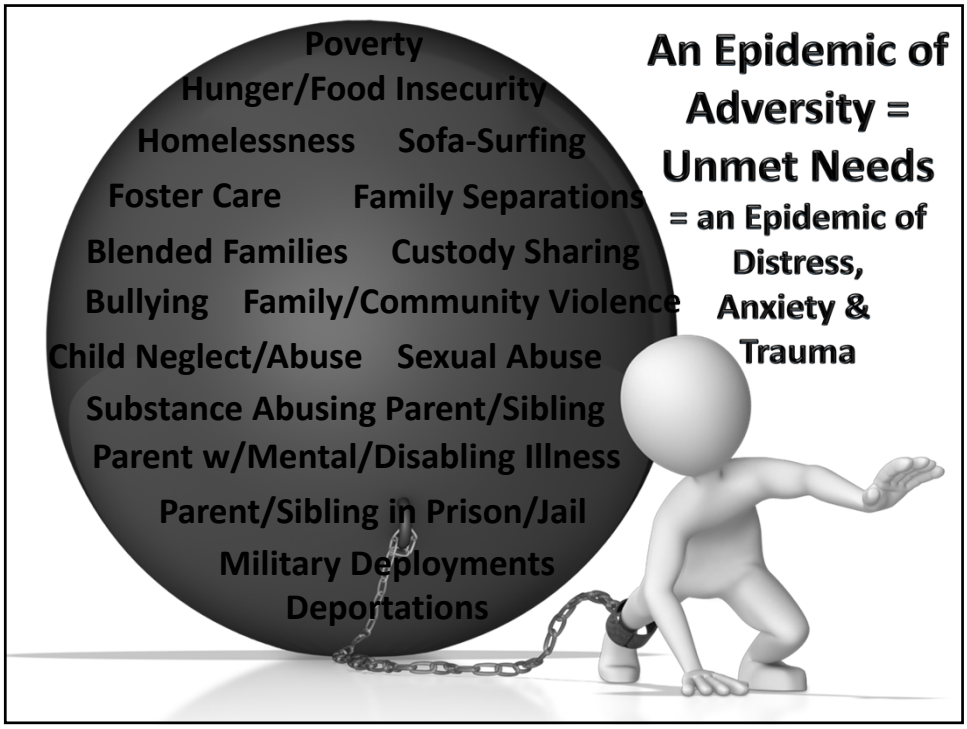


60%, or 46 million, will have their lives touched by violence, crime, abuse, and psychological trauma in a given year."

Does include Bullying

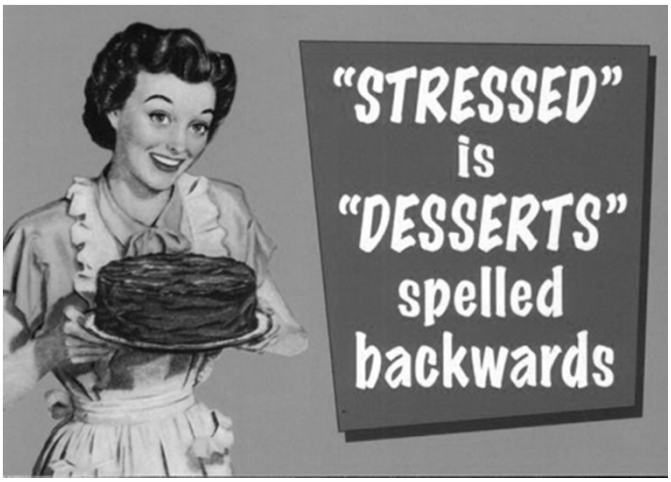
Report on the Attorney General's Task Force on Children Exposed to Violence, December, 2012

Does not include MEDIA



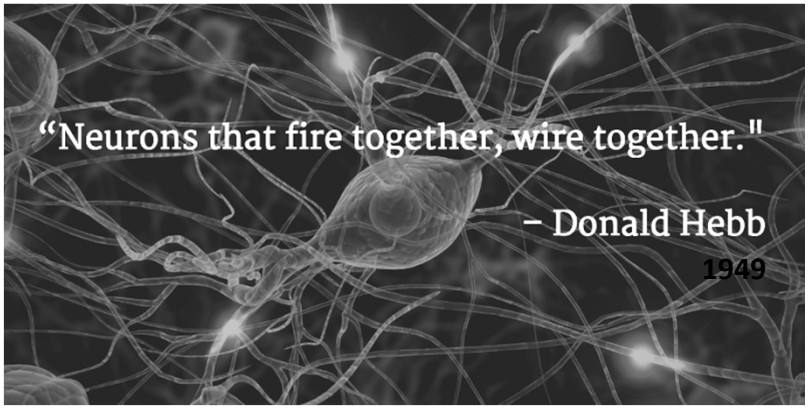
Neuroscience has revealed that these two epidemics are related.

Stress vs. Distress



"Stress" is NOT bad…*Stress* is *Stimulation*.

<u>Stimulation is LIFE</u>!

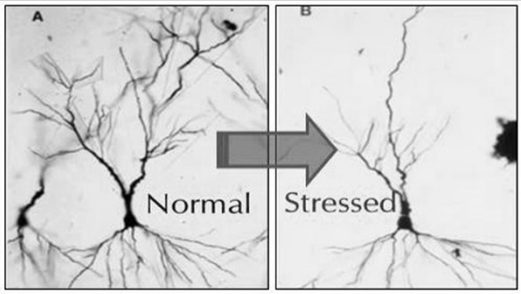


Experience Stimulates.

Stimulation Changes Our Neural Structure

But, <u>DISTRESS</u> 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 <u>overwhelms one's ability to cope</u>, the level of stress is said to be "toxic".

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

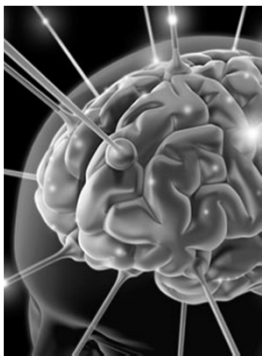
The impact/effect of the burden is personal. The same burden will affect/impact different people differently.

"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*…

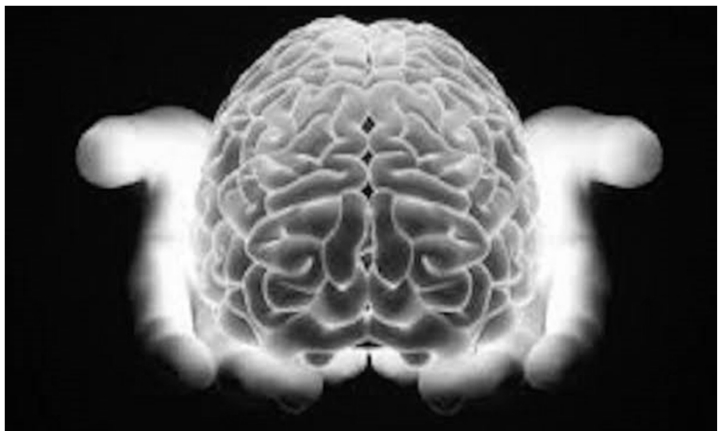
Dr. Robert Sapolsky, Stanford University

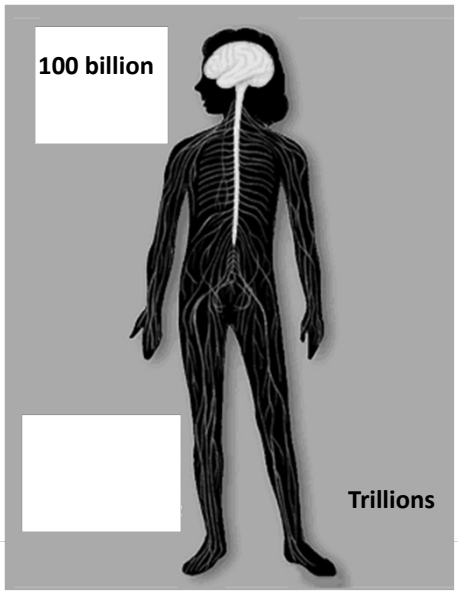
New research shows that…

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

National Science Foundation, 2010.

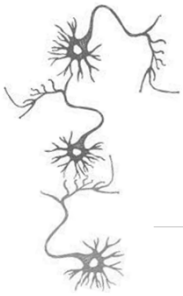
How Our "First Brain" Works





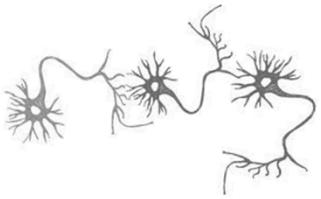
When we are born, we start out with about 100 billion neurons in our brain…

..and trillions in the rest of our body.



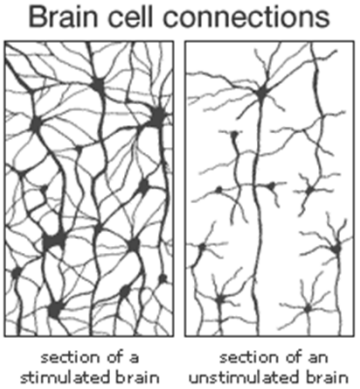
25% of our neurons are pre-wired

(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.



What can newborns do? (Only the 25%)

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

Rainbow Days, Inc. 2014

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

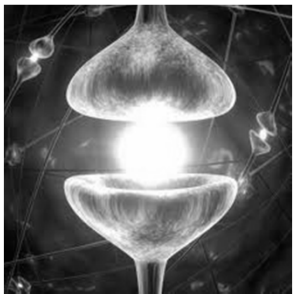
Feelings, Drives & Instincts

(FDIs)

to protect us & help us

SURVIVE!

1 Job:



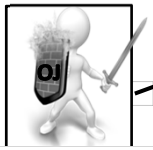
OJ

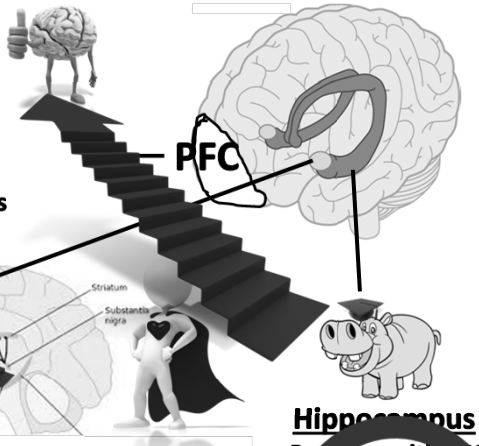
Overreact & Jump to Conclusions!

Pre-Frontal Cortex (PFC)

SELF-REG ATION of:

- **EMO ONS & B AV R**
- **Acti ATTEN ION & STENING**
- **Shor / Working EMORY**
- **Mindfu ss & Ex utive Functions**





Whe G is in charg

PFC & PPO re D RUPTE THE PAUSE" ntil AMY ANDS DOWN.

Reward Circuit

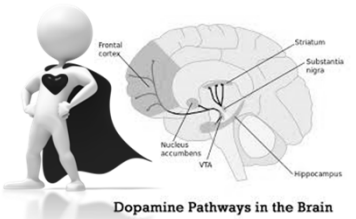
The Only Part of our Brain More Powerful than Amy is our REWARD/PLEASURE/ RESILIENCY CIRCUIT. It restores balance.

Hippocampus

Pa ners with C in DEVELOPM NT

L g Ter POSITIV M es, Learni & De lopment NEUROGENESIS & Recovery

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



Dopamine Pathways in the Brain

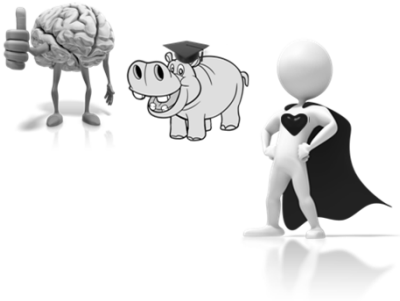
The one in control determines the outcome:

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	Are fueled by Oxytocin, Dopamine, Anandamide, Endorphins, & Serotonin, which trigger
Fight-Flight-Freeze Behaviors	**Calm, Alert Behaviors**

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

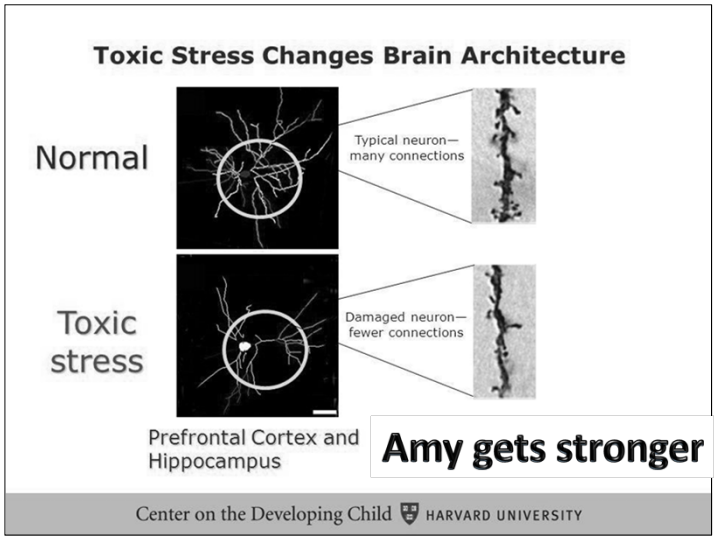
Reward Circuit,
Pre-Frontal Cortex (PFC), & Hippo
FEELING SAFE & CALM, Aware,
Focused Attention & Listening,
Short Term & Working Memory,
Long-Term Memory and Development,
Mindfulness, Motivation,
Emotional & Behavioral Control,

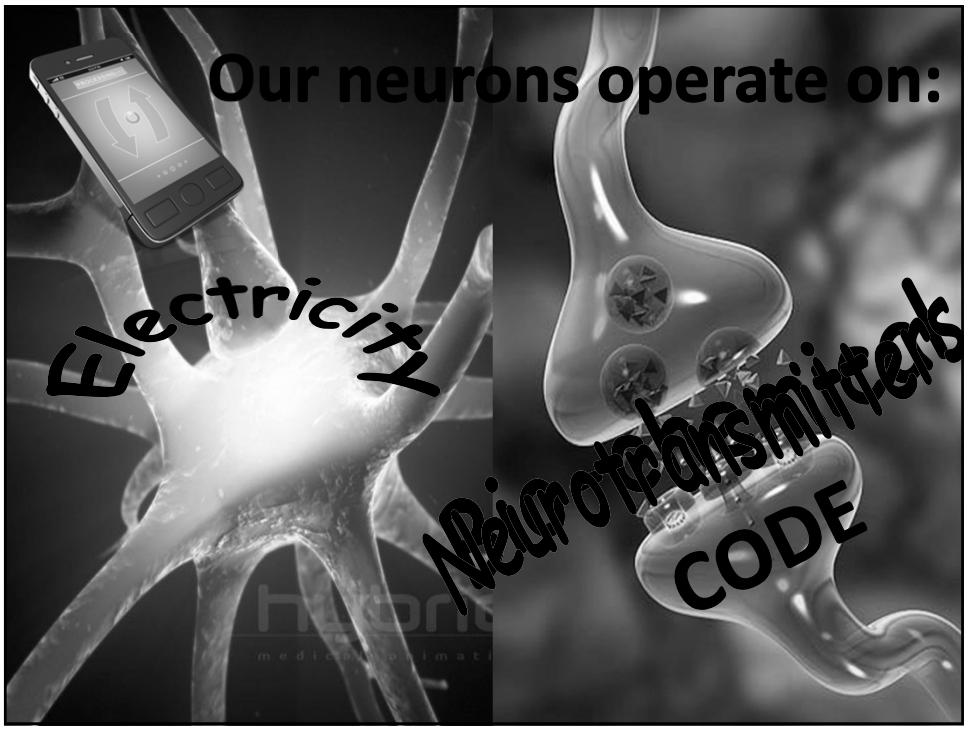


Amygdala = AMY G. & the OJs
FEAR, Discomfort, Distress, Worry,
Anxiety, Helplessness, Hopelessness
Automatic Drives & Instincts (FDIs),
Fight, Flight, Freeze, Appease

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





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".

Oxy-T

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

Sara

Community!
Culture
Society

Dr. Dopa

COMFORT/CONTROL.
Pleasure & Pain Relief

Warning: Addictive!

"Doctor Feel Good!"

Nora!

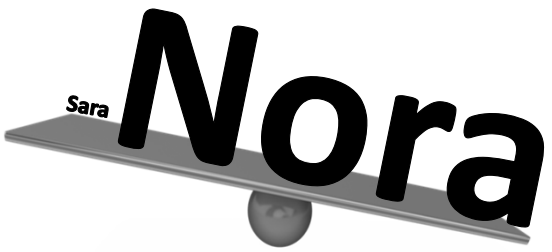
Alarmed/Armed AGAINST THREATS

Auto!
Warrior!
Defender!

SEROTONIN	DOPAMINE:	NOREPINEPHRINE:
PFC & HIPPO	REWARD CIRCUIT	AMYGDALA (OJ)
		(Adrenaline/Cortisol)
		SURVIVAL! FEAR!
• Calm, Alert & Mindful	• Cements Learning	• Short-Bursts ONLY!!!
• Judgment & Empathy	• Creates Motivation	• *Too Much Creates Distress, Anxiety, & Trauma Resulting in Fight-Flight-Freeze!*
• Explicit Learning	• Seek It at ALL Times	
• Focus & Memory	First Aid Kit: Our Body's	
• Behavioral Control	Endorphins = "Morphine"	
• *Prevents Depression*	Anandamide = "THC"	

Distress

Anxiety



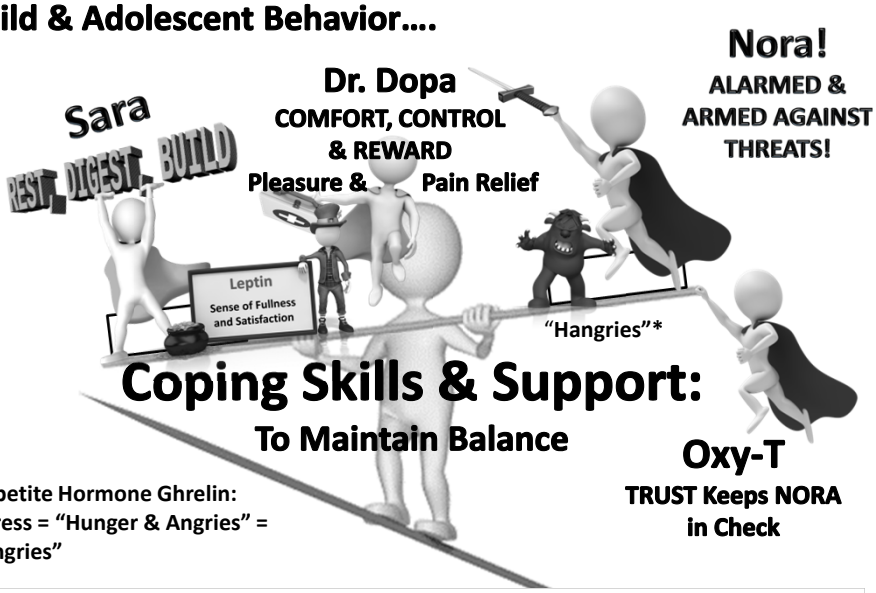
TRAUMA

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….



*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.

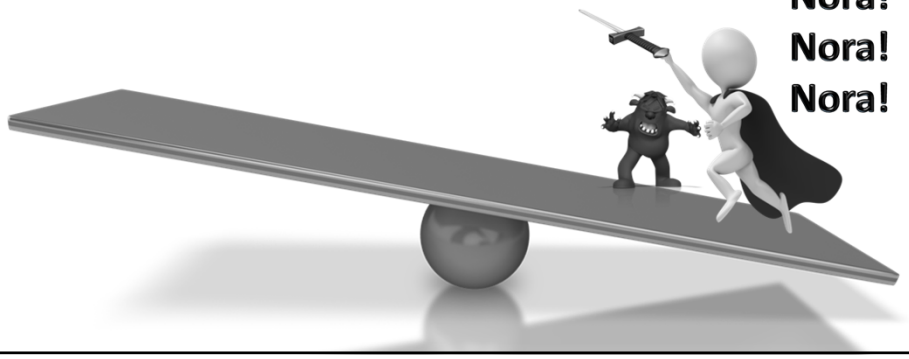
Fewer than 6 hours of shut-eye a night at age 16 increases the risk of obesity by age 21 by 20%, compared with 16-year-olds who slept more than 8 hrs.

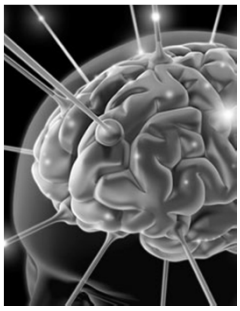
A lack of sleep is associated with **increased distress and increased levels of cortisol**, which affect our cardio-metabolic risk, which includes things like high blood pressure, blood sugar, and body mass index.

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."*

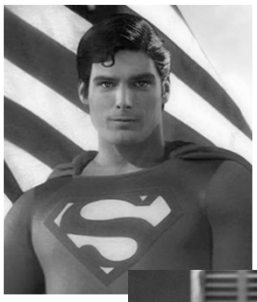


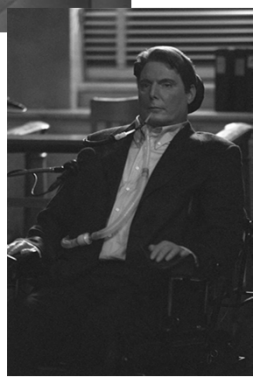


Because youth are all about building their brains, you can multiply what you know about how stress affects the adult brain *by ten-fold when you think about a 10-20 year old's brain*…

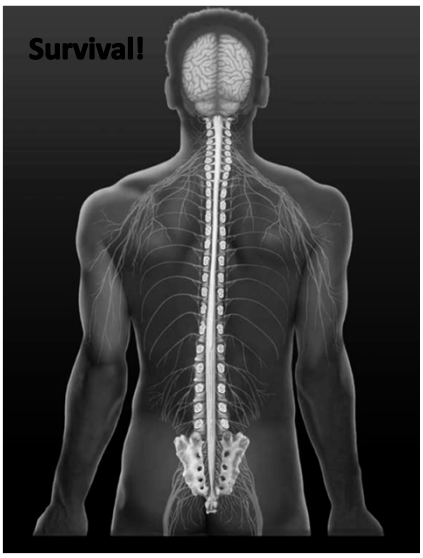
Dr. Robert Sapolsky, Stanford University

Getting to Know Our "Second Brain"



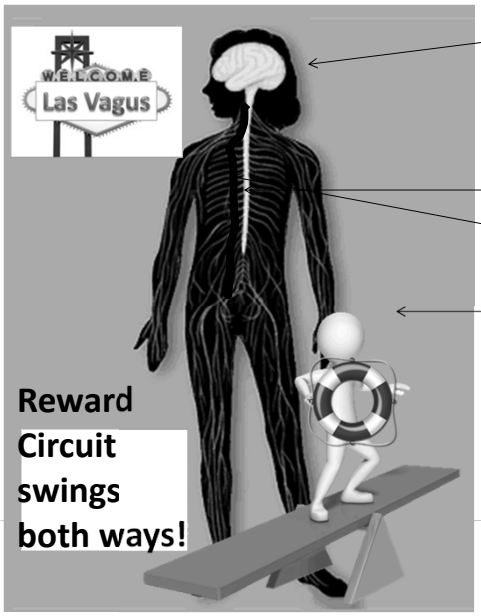


Our Spinal Nerves are in charge of *movement & response to threats*.



Our Nervous System Has 2 Major Divisions.

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

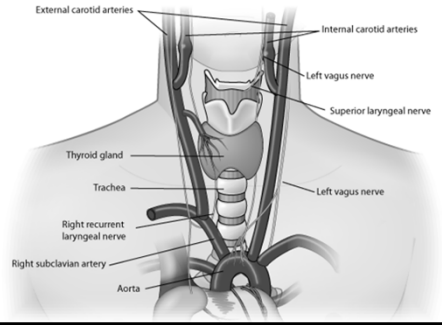


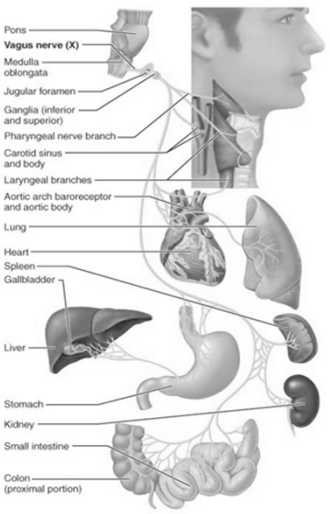
We have 2 "Two-Way Communication Pathways"

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

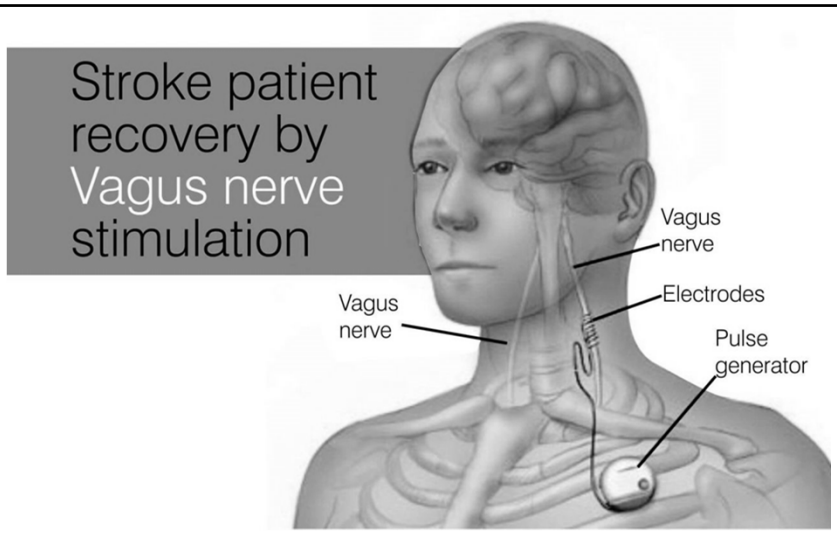
The Vagus Nerves - X

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





Vagal Nervous System: Our Development & Mental Health Nerves



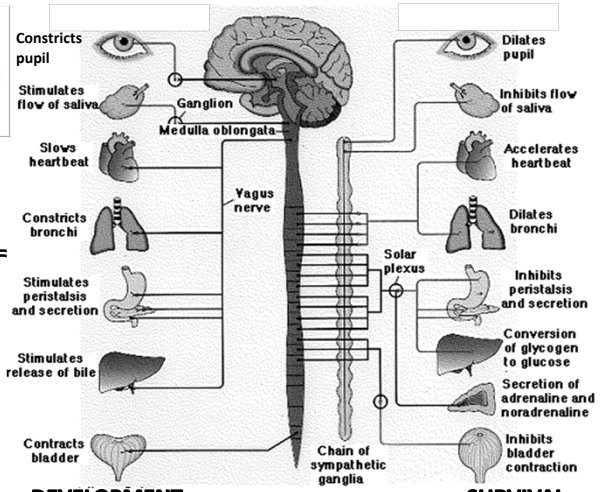
Vagal nerve stimulation (VNS) is an approved treatment for epilepsy and is currently under investigation as a therapy for other disorders, including depression, anxiety and Alzheimer's disease.

"The Twins" Share the Operation of Our Organs

Parasympathetic – Handles "Peacetime"	Sympathetic – Handles "Threats"
Comfort, Control & Support	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 & Energy Transferred

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

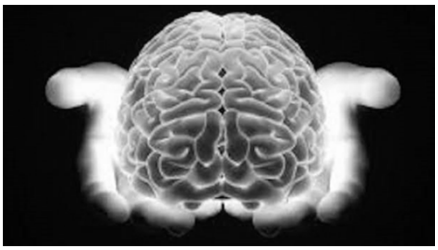
Dr. Dopa

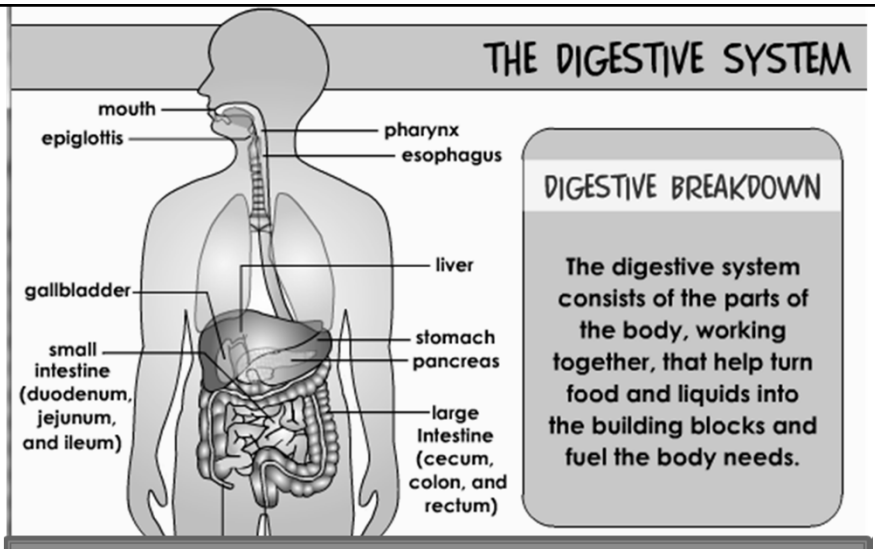
COMFORT, REWARD Pleasure & Pain Relief

Oxy-T

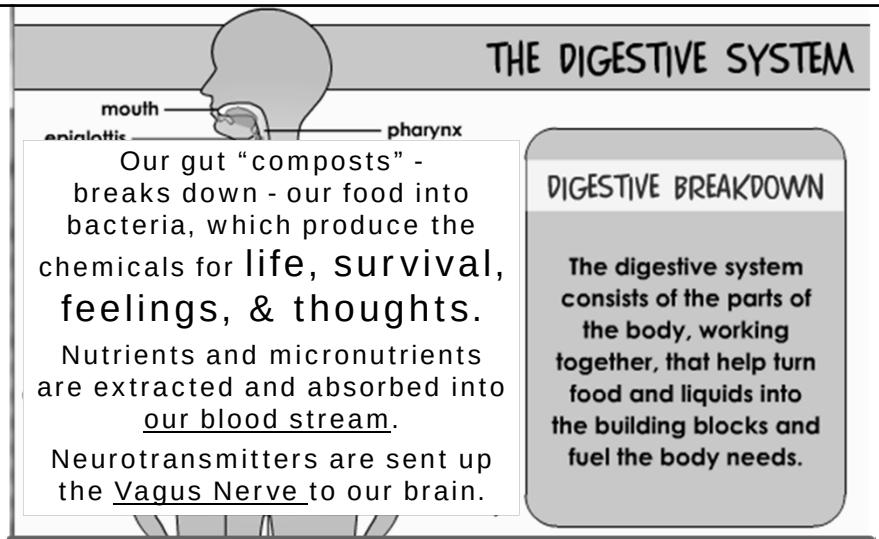
TRUST Keeps NORA in Check

In our two brains!

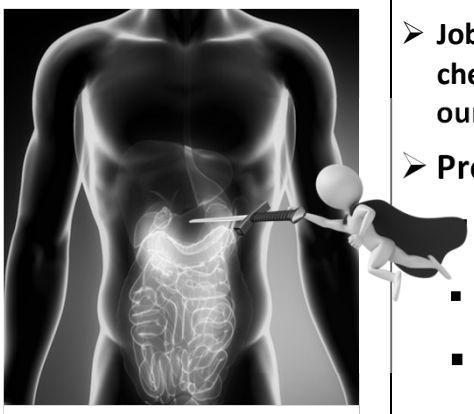




Our Digestive system uses the food we give it to make the chemicals we need to function, even the brain chemicals we use to think and learn, and the chemicals that protect us from disorders and diseases.



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"

Start Here:

Distress

Norepinephrine & Noradrenaline Stimulate

Adrenal Gland to Produce Cortisol

Blood/Energy Is Transferred from Digesting to Surviving

The Digestive System Slows/Shuts Down

With no cortisol to keep the stress-response "UP" & deficiencies in Serotonin, Dopamine & Oxytocin, decline into depression can be rapid.

Adrenal Exhaustion and Low Supply of Cortisol. Body can no longer respond to distress… we begin to use "fake" stimulants…

OVER TIME

Immune System Affected

Dopamine & Oxytocin Affected

Serotonin Affected

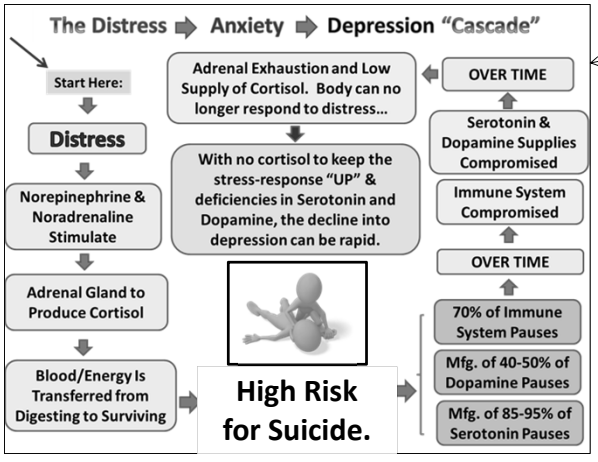
OVER TIME

Immune System Compromised

Serotonin, Dopamine & Oxytocin Supply Compromised

OVER TIME

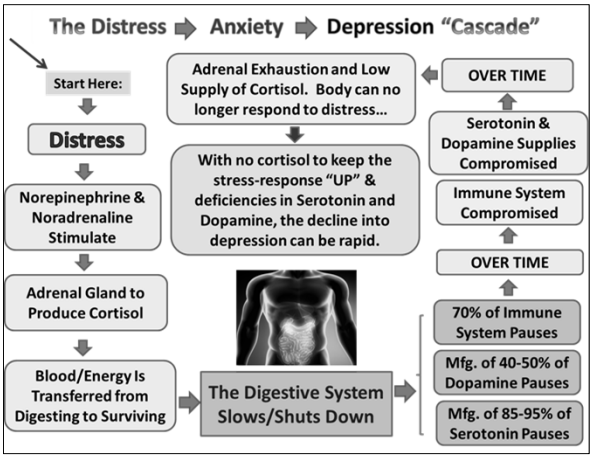
Know the symptoms:



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.

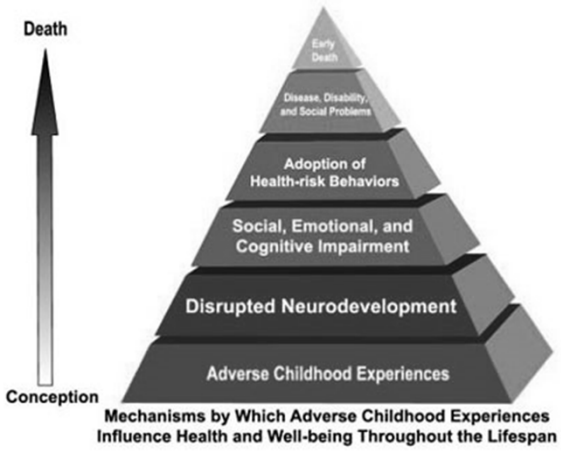
Without the partnership, we feel hungry all the time.

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



Mechanisms by Which Adverse Childhood Experiences Influence Health and Well-being Throughout the Lifespan

CDC

Adverse Childhood Experiences (ACE Study)

Mechanisms by Which Adverse Childhood Experiences Influence Health and Well-being Throughout the Lifespan

- 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**

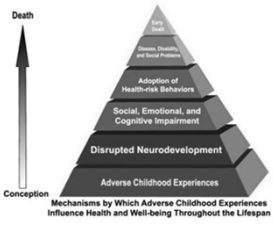
It all began In 1985, when Dr. Felitti, couldn't understand why 55% of the 1,500 patients enrolled in his weight-loss clinic dropped out BEFORE completing, and the more successful they were the more likely they were to drop out.

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 <u>six million overweight people are likely to have suffered physical, verbal and/or sexual abuse during their childhoods.</u>

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.

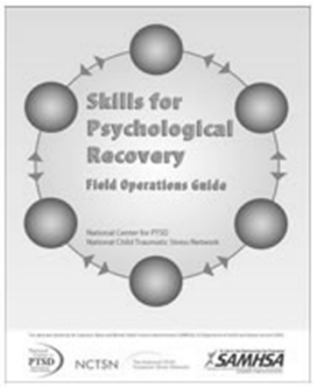
…just think of the return on the investment!

We are ALL 1st Responders!

Tell Someone!

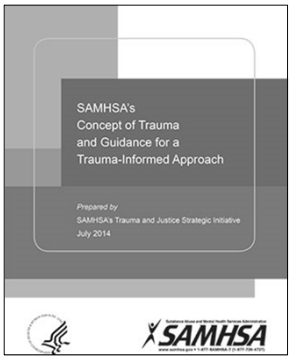
National Child Traumatic Stress Network (NCTSN)

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.acestoohigh.com

www.acesconnection.com

Original Findings from the ACE Study, Center for Disease Control and Prevention (CDC)

Mechanisms by Which Adverse Childhood Experiences Influence Health and Well-being Throughout the Lifespan

Q & A Moderator

Evelyn Delgado
Associate Commissioner for
Family and Community Health

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