

## The Mature Mind

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Brain Health = social eng, ex, new learning  
Power learning = learn + ex + NAP

### POTENTIAL OF OLDER BRAINS

Neural density

Learning causes physical changes in the brain: Learned in the 1960s by Dr. Marion Diamond at UCB

Synapses (connections)

Dendrites (extensions)

Chemicals (increased acetylcholine)

Learning links neurons in new patterns

Repetition cements memory

London cab drivers have larger hippocampuses: three dimensional space

Musicians have larger areas of brain that discriminate pitch and tone and hearing

Older brains have complex neural architecture, built over years of experience, practice and daily living.

More complex, more resistant to degradation by injury and disease

Able to maintain, build and remodel

Avoid activities that weaken the structure: stress, excessive alcohol, drug use, inactivity, smoke, obesity, malnourishment, isolation

Brain uses larger portion of the human genome than any other organ

### NEW BRAIN CELLS, NEW POTENTIAL

New neurons CAN form discovered by Joseph Altman at MIT in 1960s: new neurons in rats in

Hippocampus critical for new memory formation.

1998: Showed new neuron formation in humans: Neurogenesis

Glia provide nutritional support for neurons.

Certain areas of brain have primitive cells that under certain conditions can mature into glia or neurons. Especially CORTEX

What triggers new neural growth? Challenge, vigorous physical exercise, (stimulates production of chemicals called brain growth factors which trigger glia to form neurons. Prolonged stress (physical and psychological), depression and PTSD suppresses neural production. Fred Gage at Salk Institute

Memories stored in patterns of connection between existing neurons, new neurons will not mean the recovery of memories lost to disease or injury.

### EMOTIONS in BALANCE

Many factors play into the high moral and positive outlook of so many older persons

Acceptance of life's realities

Greater sense of self

Long term perspective that makes it easier to accept the inevitable slings and arrows of daily life

AND changes in older brain itself play an important role in the emotional aplomb and equanimity of many older adults

Human emotional responses are produced and regulated by a set of structures deep in brain called Limbic system: carrot and stick guide to behavior that favor survival and reproduction.: affection, bonding, love, pleasure, happiness to external cues such as proximity to potential mates, success in attaining food, status, security, satisfaction of higher drives such as curiosity and artistic and musical expression.

Negative emotions such as fear, anger, envy, disgust, and depression arrive in response to events or situations that threaten our survival, well being or sense of fair play. Some emotions (anger, fear) are genetic, some are learned.

How are these emotions connected to the neocortex where higher attributes of consciousness are performed? Morals, beliefs, intentions, goals and aspirations.

More fibers run from limbic to cortex than reverse: we respond quickly: causes imbalance between reason and emotions, what we know is right and what we want to do, trouble controlling emotions and modulate behavior.

With age, able to ride out emotional storms more flexibly and resiliently due to learning, experience and practice which stimulates growth of dendrites and sometimes new neurons, back down to limbic.

Also Limbic system grows calmer with age.

Amygdalae stimulates intense emotions, intercepts info from ears, eyes, notes. Sends message to heart to race before we even realize we have the emotions, before interpreted by neocortex.

Brains are as unique as faces. Some very reactive and sensitive.

PET positron emission tomography scanning find amygdalae activity decreases with age.

Experience less intense neg. emotions (but not positive)

Pay less attention to neg than pos. emotional stim (positive plays larger role)

Less likely to remember neg than pos materials

So older people calmer

## EXTREME MAKEOVER OF AGING BRAIN

Older adults tend to use both hemispheres for all tasks, more than younger people  
We reorganize our neural networks

## BRAN FITNESS

Older brain more resilient, adaptable and capable

Four attributes: brain resculpting as result of new experience and learning

New brain cells formation

Maturing of the emotional circuitry

Bilateral activity in aging brain

Five categories of activity that if practiced regularly can significantly boost the power, clarity and subtlety of both brain and mind

### **Exercise mentally:**

Experience modifies brain structure at every stage of life, from before birth to death.

Improves information processing, memory storage, especially in hippocampus.

Choose something appealing and challenging, something you will have to work at.

### **Exercise physically**

Especially aerobic: large muscle groups continuously and rhythmically

Increased blood flow to brain, production of endorphins, better filtration of waste products from brain, increased brain oxygen levels

### **Pick challenging leisure activities**

By order of impact

Dancing, playing board games, play musical instrument, doing crosswords, reading

**Achieve Mastery**

Boosts the immune system: T cells, white blood cells that orchestrate immune defenses, and natural killer cells, which are large white blood cells that attach tumor cells and infected body cells

**Establish strong social networks**

Loneliness associated with a range of adverse health effects

Hardware reserve: neurons

Software reserve: capacity, experience