INTRODUCTION

Section One


Section Three: A mighty river

Amazon River Quote


Section Four: It’s a good time to grow old

Life expectancy, past and future and why are we getting older

Life expectancy figures


Evolutionary history of life expectation (after age 30 it’s all over)


122nd birthday


Section Five: How the brain is wired

Basic Brain Anatomy/cellular physiology


Various theories of aging

CHAPTER ONE – Your Friendships

Section One

*Karl and Elizabeth, 75th wedding anniversary*


Section Two: Socializing: vitamins for the brain

*New York socialites*


70% decline in global cognition and social interactivity


Memory decline and social interactivity


Cognitive boost in as little as ten minutes


Video-chat based interventions

Section Three: More parties, less flu

**Allostatic load defined**


**Socialization reduces allostatic load**


**Aging and immune system competency**


**Marriage, stress and wound-healing**


**Gary Skole quote**


Section Four: A workout for your brain

**When Harry Met Sally Scene**


**Social interactions extremely complex**

**Synaptic plasticity (interactivity produces structural/volumetric changes, general considerations)**


**Chelsea Wald quote**


**Definition and neural substrates of mentalizing (Theory of Mind)**


**Mentalizing deficits**

Moran, J.M., et al. "Social-Cognitive Deficits in Normal Aging." *J Neurosci* 32, no. 16 (2012): 5553-61. (Fig. 4)


Statistics from Figure 4

**Social interactions and grey matter volume (PFC)**


**Social interactions and amygdalar volume**


**Social interactions and grey matter volume (temporal lobe)**

Section Five: The boss from hell

Story of a bad boss


Quality of interactions, not just quantity, important (quote)


Section Six: Drop the ego

Type of interactions matter


Quotes from Rebecca Adams


Intergenerational activities are important


Improvement in elderly brains

Improvements in pediatric brains


Section Seven: All the lonely people

20 – 40 percent increase in loneliness in older populations


The U-shaped curve


Loneliness as a risk factor for depression in older populations


Definition of loneliness


UCLA Loneliness Scale

Section Eight: Where social isolation leads

Poorer grooming habits


Depression in healthy seniors no different, physical disability is key


Loneliness, viral infections, and cancer


Lonely seniors have poorer immune function


Loneliness and declines in cognition


Loneliness, stress levels and changes cardiovascular health


Loneliness and increases in mortality rates


Kim, L. “Loneliness Linked to Serious Health Problems and Death Among Elderly.” University of California San Francisco. (2012).

Section Nine: Inflammation of the brain

*Molly Holderness quote*


*The work of Laura Fratiglioni*


*Types of inflammation*


*Inflammation and the brain*


*Loneliness damages white matter*


*Verstynen hypothesis*


Section Ten: A cultural shift

*Friendship number peaks at age 25*

Seventy-five years to eighty year changes, loneliness, gender and nationality

Luhmann, M., and L. Hawkley. "Age Differences in Loneliness from Late Adolescence to Oldest Old Age." Dev Psychol 52, no. 6: 943-59.

Overall health and loneliness


Section Eleven: Face time

Prosopagnosia biology


Oliver Sacks and face blindness


Changes in fusiform connectivity


Heritability of prosopagnosia


Face identification declines with age

Emotional display identification selectively declines with age


Loss of social interactivity in aging humans and monkeys


Section Twelve: Dance the night away

*Mikhail Baryshnikov* quote

http://www.brainyquote.com/quotes/quotes/m/mikhailbar131525.html

Dancing improves cognition


Prevention of falls

Cameron, I.D., and et al. \"Interventions for Preventing Falls in Older People in Care Facilities and Hospitals.\" *Cochrane Database Syst Rev* 12, no. 12 (2012): 10.1002/14651858.CD005465.pub3.

Cost of falls


Section Thirteen: The human touch

The importance of physical contact in human populations

*Fifteen minutes a day*

CHAPTER TWO – Your Happiness

Section One

*Grumpy old man to do list greeting card*


*Ed Diener and happiness*


*Marty Seligman and optimism*


Section Two: Onward, mostly upward

*Older people really are happier*


*Marriage stability*


*Emotional stability and agreeableness figures*

“Happiness Increases With Age, Across Generations.”

Quote from Sutin study


1,546 people study


The boost doesn’t last forever


Section Three: What Satchmo says

*What a Wonderful World*


*Louis Armstrong quote*


Positivity Effect defined


Results of attention and memory

Positivity effects on various memory subsystems and attention


**Section Four: Lessons from London**

**Socioemotional Selectivity Theory**


“FADE” changes


**Section Five: Roller-coaster grandpa**

Roller-coaster grandpa


Roller-coaster grandpa quote

Mentor to Six Figuires.
https://www.youtube.com/watch?v=o3G3oKv1HTY.

Risk-taking and the Certainty Effect


Risk-taking and changing motivations


Motivations for happiness of younger and older adults

**Section Six: Smell a rat?**

**Physician scam story**


**MetLife Study about cost**


**Older people are more gullible – insula involvment**


**Prediction error and the 20% figure**


**Highway to Hell and risk-taking**


**Section Seven: A darker shade of gray**

**Death of Keith Emerson**


Herman, A. “Why We Need To Talk About Keith Emerson’s Carpal Tunnel Syndrome,” http://www.laweekly.com/music/why-we-need-to-talk-about-keith-emersons-carpal-tunnel-syndrome-6723079
Definition of depression in elderly


First quote about depression


Second quote about depression


Disease states and depression


Living situation vs nursing homes, rates of depression percentage


Projections into 2020


Section Eight: Dopamine’s decline

General review dopaminergic system

Role in addictive behaviors


Section Nine: The mouse that didn’t roar

Dopamine-deficient mice starve to death


Dopamine-synthesis loss


Receptor loss


Cell loss


Dopamine-deficient depression


Dopamine and reward-predictions

Dopamine and interior motivations


Dopamine and risk-taking


Dopamine and attentional networks


Section Ten: Awakenings

Awakenings


Restoration of reward-prediction


Side effects of L-Dopa


Increasing optimism


Optimism quote

Scicurious. "Dopamine Goggles Make the Glass Half Full." *Scientific
Attitude towards aging and 7.5 year boost


Oprah Quote


Oprah Winfrey gratitude journal


Research results of “gratitude visit” and “three good things”


Dirk Kummerle quote


Marty Seligman’s PERMA


p. 16 -20
CHAPTER THREE – Your Stress

Section One

Older people are less stressed than younger people


Section Two: Running from the grizzly

General review of fight-or-flight response


Section Three: Cranking it up

Diurnal cortisol levels

“Normal Values of Cortisol and ACTH.” Cushing’s Support and Research Foundation. https://csrf.net/doctors-answers/diagnosis-qa/normal-values-of-cortisol-and-acth/


Inverted-U of cortisol regulation


Cortisol regulation changes with age


Section Four: A dysfunctional damper

A Christmas Story

Jean Shepherd, A Christmas Story, 35mm, directed by Bob Clark (1983; USA: MGM.), Film

Prolonged stress affects on the hippocampus and amygdala


Prolonged stress damages the PFC


Amygdalar reactions to stressful pictures


Magic number is “12”


Marquez quote


Hippocampal neurogenesis

**Hippocampal neurogenesis and human memory**


**Section Five: Wait, females are a different story**

**Sweat, lab animals and sex-based differences in stress responses**


**Hippocampal volume shrinkage greater for men**


**Four-fold hippocampal volume association**


**Older women are more susceptible to cortisol’s negative effects on cognition and emotional regulation**


This effect on women three times greater


Prevalence rates of Alzheimer’s


Possible reasons for female prevalence – estrogen and genetics


Section Six: Being mindful of mindfulness

Jon Kabat-Zinn biography


Time magazine


Mindfulness training – Jon Kabat-Zinn quote


Two components to mindfulness

8-week manualized training


The calming effects of mindfulness


Mindfulness, sleep and cortisol


Mindfulness and mental health

Kumar, S., et al. "Impact of Mindfulness-Based Stress Reduction (MBSR) on Depression among Elderly Residing in Residential Homes.". Nurs J India 105, no. 6 (2014): 248-51


Mindful practice, loneliness and general mood


Immune effects of mindfulness


Mindfulness and cardiovascular issues

Mindfulness quote summarizing changes in affect


Mindfulness and attentional issues


Attentional blink and mindfulness


Mindfulness and visuospatial processing, working memory and general executive function


Mindfulness training on verbal fluency and cognitive flexibility


Section Seven: Full-court press

Phil Jackson bio


Phil Jackson quotes

Phil Jackson salary


General review article neural substrates mindfulness


Cortisol levels, mixed results data


Amygdala activation/deactivation studies


Section Eight: Attention on attention

Role of the ACC in mindfulness practice


Section Nine: Of mice and men

Flowers for Algernon

CHAPTER FOUR – Your Memory

Section One
George Burns bio and quotes


Section Two: Many types of memory

Many types of memory


Components of declarative memory


Section Three: Oh, God! It's George Burns

Core language components are preserved into old age


Procedural memory preservation


Age-related wisdom (including quote about wisdom)

Section Four: Now for the bad news

Finding Nemo


Baddeley’s original definition of working memory


Working memory naturally declines with old age


Working memory is highly heritable


Executive function is highly heritable


Section Five: Down for the count

Mohammad Ali’s interview

ibhof2. "Muhammed Ali - "This Is Your Life"." https://www.youtube.com/watch?v=ZWZO8X1vE7A.

Definition of episodic memory

Woman with eidetic autobiographical episodic memory


33% drop in episodic performance


Source memory may be the problem


Default mode network defined


Episodic memory involvement in the default network


Age-related episodic memory structural changes and default network


Section Six: It’s on the tip of my tongue

Tip of the Tongue explained


Erosion of Tip of the Tongue abilities

TOT failure – neurological substrates


Timeline issues


Section Seven: By hook or by crook

*Star-Trek episode*

http://www.startrek.com/database_article/arena

*Mythbusters Gorn Cannon*

https://vimeo.com/20117750

*How normal syntactic processing works*


*Lexical representations (vocabulary changes)*


*Pierre-Paul Broca*


*What we see when we open up the hood are changes*

a) The right hemisphere is “recruited”

b) *The prefrontal cortex is “recruited”*


c) *Changes occur in the connectivity of the “normal system”*


Section Eight: The power of the new

Mikey commercial (facts and figures and YouTube)


https://www.youtube.com/watch?v=vYEXzx-TINc

*Sustained education good for cognition*


*Productive engagement boosts episodic memory*


https://agingmind.utdallas.edu/learn-about-our-work/the-synapse-project-major-findings-publications-press/

*Teaching boosts cognition*


Section Nine: Saints be praised

Pope John Paul various facts
Effects of learning another language


Effects of music


Association of reading with living longer


Section Ten: A private reserve

John Hetlinger


Definition and neurological characterization of cognitive reserve, quantitative boost


Cognitive reserve quote


Quote about “any age”

CHAPTER FIVE – Your Mind

Section One

*I Love Lucy* clip, and episode rank

https://www.youtube.com/watch?v=4AZK2-Tfc84


Section Two: Noisy cocktail parties

*Processing speed declines*


Wahl, H.W., *et al.* "Is the Emergence of Functional Ability Decline in Early Old Age Related to Change in Speed of Cognitive Processing and Also to Change in Personality?". *J Aging Health* 22, no. 6 (2010): 691-712.

*The stages of processing speed and U-shaped development*


Kerchner, G.A. "What Causes the Brain to Have Slow Processing Speed, and How Can the Rate Be Improved?". *Scientific Amer Mind* 26, no. 2 (2014): 70.


*10 milliseconds and 100 milliseconds data*


Section Three: Nature, nurture, and speed

Frontal issues, cerebellar issues, white matter and processing speed


Oligodendrocyte erosion


Cerebellum and slowing process speed


Section Four: Intellectual hiccups

Ignoring distractions erodes with age – general comments


Ignoring distractions erodes with age (task monitoring data, fig. 2, female)


Event boundary (door way effect)

GA, Radvansky, et al. "Walking through Doorways Causes Forgetting:

**Radvansky quote (door way effect)**


**Divided attention research**


**Driving and task-switching abilities**


**Driving and processing speed**


**Recommendations from the National Institute on Aging**


**Section Five: Not-so-fluid intelligence**

*Wilhelm Wundt*


**Decision-making, arousal and approach avoidance**

Definition of fluid intelligence (quote)


Working memory and fluid intelligence


Age-related losses of fluid intelligence (quant)


The Affect-Integration-Motivation framework proposal


Age-related neural changes in fluid intelligence, effects on AIM framework.


Choice bias (loss anticipation)


Positive and negative arousal neural substrates


Role of fluid intelligence in new learning


Section Six: Brain games

FTC, Lumosity, and brain training programs


Petition signed by skeptical scientists


Contradicting scientific consensus


Positive quote that brain training works


Section Seven: Speed demons

Far and near transfer effects

Dementia and videogames


Auditory speed of processing result


Distractibility study (quant) Beeper Seeker game and quote


Section Eight: From arcade to prefrontal cortex

NeuroRacer results and paper quote


Gazzeley quote and skepticism

CHAPTER SIX – Your Pathology

Section One

Alois Alzheimer’s first patient (references therein)


Menigoz, A. “Pathologies of the CNS: The Sadly Famous Case of Alzheimer Disease.”
https://www.coursehero.com/file/19960028/Alzheimers-lecture-DrMenigozpdf/

Section Two: Mild cognitive impairment

Symptoms of MCI


Causes and clinical evaluation of MCI


Section Three: Robin Williams

Death and symptoms of Robin Williams


Dementia with Lewy Bodies

Zupancic, M., *et al.* "Dementia with Lewy Bodies: Diagnosis and Management for Primary Care Providers." *Prim Care Companion CNS Disord* 13, no. 5 (2011): PCC.11r01190.
**Parkinson’s disease**


**Frontotemporal dementia**


**Section Four: Alzheimer’s disease: an overview**

**Confirmation that Alzheimer really studied Alzheimer**


**Various costs (facts and figures)**


**Controversies about what AD actually is**


**No single test can diagnose AD**

University of Iowa Hospitals Healthcare and Clinics. University of Iowa Healthcare [https://www.uihealthcare.org/ADAM/Neurology%20Center/33/000005.htm](https://www.uihealthcare.org/ADAM/Neurology%20Center/33/000005.htm).

Section Five: Alzheimer's disease: warning signs

Alzheimer's Association 10 signs


Supporting peer review for the 10 signs approach


Section Six: Lessons from a president

Ronald Reagan’s farewell letter


Various facts and figures of AD


Disease progression


AD is cumulative


AD Stages

Inevitability quote


Section Seven: The amyloid hypothesis

Castellano’s death


The amyloid hypothesis and the molecular biology of amyloid and tau


Bloom, G.S. "Amyloid-β and Tau: The Trigger and Bullet in Alzheimer Disease Pathogenesis.". JAMA Neurol 7, no. 4: 505-08.


Section Eight: The Nun Study

Sister Mary and AD pathology


The Nun Study


Ambiguity of Amyloid and Alzheimer’s (30% figures)


Failure of solanezumab (and quotes therein)


Alternate explanations for AD origins


Section Nine: Predicting Alzheimer's in your twenties

Linguistic ability, AD and quote (quote from second paper)


Pittsburgh Compound-B.


Colombian study, early onset and predictability


Alzheimer’s Prevention Initiative

Neurolinguistic changes in Colombian cohort

CHAPTER SEVEN – Your Food and Exercise

Section One

Henry Heimlich story


Section Two: Calm, cool, collected

President Obama and Executive Function


Development of EF throughout childhood


Section Three: Cracks, leaks, and potholes

Seattle City Census


Executive function naturally declines with old age

Connectivity degeneration and the 82% figure


Prefrontal cortex and hippocampal shrinkage


Section Four: Get your brain off the couch

Norman Lear


Exercise changes the areas involved in executive function


Exercise changes executive function in elderly populations


Associative findings (effect size data on fig. 1)

Causal findings (fig. 1 and Table 3)


Benefit 25 years later


Frank Hu quote


Focusing behavior unaffected by exercise


Working memory results more ambiguous


Section Five: Bulking up your neural tissue

Exercise alters volume in the PFC


Exercise alters volume in PFC: particularly in the dlPFC

Exercise alters volume in the hippocampus (2% figure)


Exercise alters connectivity


Exercise increases gray matter volume by 8%


Effects of exercise on gray matter last a long time (9 years); reduced risk for dementia


Effects of exercise on BDNF


Effects of exercise on cerebral blood volume


Molecular basis of angiogenesis

Section Six: A little exercise goes a long way

Minimum amount to achieve cognitive benefit


The benefits are dose dependent


Longitudinal 72 blocks (and starting younger)


Resistance training data


Adding 104 minutes of mobility


Fidgeting (Incidental Physical Activity)

Minimal environmental movement, largest life spaces and Alzheimer’s risk


Different types of exercise may produce different cognitive effects


Section Seven: Cheese lovers, beware the bedsheets!

Association does not mean causation


Skepticism about nutrition research


Section Eight: Free radicals in a hungry brain

2% of the body weight, 20% of the calories

Brain metabolizes glucose, not fat


Molecular repair processes begin to fail during aging (slide quotes fig. 2)


Interactive roles of oxidative stress and anti-oxidants


Section Nine: Less is more—maybe

50% extension of life in lab animals


Life extension in other animals (including fruit flies)


Human research (bio and behavioral marker work)


Section Ten: Are you nuts?

Original Mediterranean research diet

Mediterranean research diet – living longer (reduction in mortality)


Effects of Mediterranean diet on cognition (Graph, fig. 2)


David Bennet quote


Mediterranean, MIND and DASH diets


Michael Pollan Quote


Section Eleven: No pain, no gain

Hormesis review

Calorie restriction works through hormesis


Phytochemicals work through hormesis


Mediterranean effects on connectivity


Anti-oxidants taken as individual supplements don’t work.

CHAPTER EIGHT – Your Sleep

Section One

Susannah Mushatt Jones


Section Two: Night owls and early birds

Basic sleep biology


Estimates about much sleep we need (lifespan, including British septuagenarian )


Section Three: Catching the wave

Opponent Process Theory


Section Four: We sleep to learn (breakthrough one)

Bioenergetics and the incongruities of sleep


Why we sleep – memory consolidation


Section Five: Slow-acting acid

Videotape degradation over time


Specific changes in REM, SWS

Section Six: The grip of a tiny clock

Atomic clocks


Role of the suprachiasmatic nucleus


Section Seven: Losing our rhythm

How sleep changes with age


Sleep Cognition Hypothesis


Old age, Memory and Executive Function


Section Eight: An early start

Joseph and Pharaoh

Gen. 41:1-40 NIV

Quote about starting healthy sleep hygiene early

Scullin, M.K., and D.L. Bliwise. "Sleep, Cognition, and Normal Aging:

**Section Nine: We sleep to sweep (breakthrough two)**

*Why we sleep – toxic waste removal*


*Glymphatics, toxic waste removal and sleep*


**Section Ten: When toxic waste builds up**

*Garbage strike*

"The Garbage Strike of 1911."  

*Alzheimer’s disease*


*Role of clearance systems in neurodegeneration*


**Section Eleven: The bedtime story that’s just right**

*Goldilocks story*

Goldilocks and the Three Bears "Fractured Fairy Tales."  

*The optimum amount of sleep you need*


**Sleep difficulties: links to mental health**


**Section Twelve: How to bet better sleep**

*Dr. Peter Hauri*


"Conversations with Our Founders: Peter Hauri, PhD."
Sleep Research Society,

**Suggestions for sleep hygiene from the Mayo Clinic**


**Protocol for elderly insomniacs**


**Sleep sedative effects**

CHAPTER NINE – Your Longevity

Section One


Various British Longitudinal Studies


Super Agers


Scottish study


Genetic studies


Section Two: The Holy Grail of Indy genes

Indy Gene


Fruit flies and Michael Rose data


Mice and longevity


**Roundworms and longevity**


**Section Three: The cells of Henrietta Lacks**

*Henrietta’s bio*


*HeLa Cell controversy*


*Cancer and the process of immortalization*


**Section Four: Counting tips**

*The Hayflick Limit*


**Section Five: Help is on the way, sort of**

*Basic biology of telomeres*


Section Six: The rise and fall of longevity genes

Gibbon bio and works


Sirtuin story


IGF-I story


mTOR story and rapamycin


Section Seven: A pill for aging?

History of anti-aging pharmacological reagents


Metformin story


Montelukast story


Basis and NAD

Section Eight: Blood brothers

History of parabiosis


The mechanics of parabiosis


The Wyss-Coray findings


The clinical trial


Controversies about the clinical trial

CHAPTER TEN – Your Retirement

Section One


Section Two: The worst thing you can do to yourself?

Charles Eugster


Eugster, C. "Charles Eugster
Expert in Successful Ageing & Multiple Record Holder." www.charleseugster.net/home.

Retirement 10th on the list of most stressful events


Early retirement associated with early death


Section Three: Retirement by the numbers

40% risk increase heart attack or stroke


Retirement significantly increase the risk of being diagnosed with a chronic condition. 21% of retirees have any chronic condition. 11% of non-retirees do

Behncke, S. "Does Retirement Trigger Ill Health?". Health Econ 21, no. 3 (2012): 282-300.

Retirement associated with a decline of fluid intelligence and memory scores

Wroblewska, A. "Your Brain on Retirement." JSTOR,
Retirees 40% increase in depression


Retirement associated with an increased risk for dementia


Section Four: The good old days

Colonel Sanders bio


25% social network improvement


Oxford English Dictionary


The behavioral benefits of nostalgia


Section Five: The power of “our song”

“Reminiscing” by Little River Band
The practical benefits of nostalgia


Section Six: The brains behind nostalgia

Brain imaging and nostalgia


Section Seven: The golden age: our twenties

Toy Story 3

Toy Story 3. Directed by Lee Unkrich (2010; USA: Walt Disney Pictures), Film.

The double-humped camel reminiscence bump


Biases in various life events and artistic exposures


Section Eight: Thawing out in our sixties

Permastore


Caveats to reminiscence bump


Section Eight: The newly young ones

Langer’s website, The Young Ones description, and quotes from the participants


Ellen Langer’s research results


Ellen Langer’s quote

Ibid., p. 135

Section Nine: A day in the life (past)

A Day in the Life


Section Eleven: Building a mighty river

Section Twelve: Hot spots of healthy old age

The Blue Zones

D. Buettner. "Here are the Secrets to a Long and Healthy Life." National Geographic, April 12, 2015.

Greek Island


Costa Rica


20% of variance figure


6% of variance figure


Lessons from the Blue Zones

Section Thirteen: Now, Voyager

Voyager mission


“Voyager, The Interstellar Mission.”

Cost of various items:

Food

“1977 Economy/Prices.”

“1989 Economy/Prices.”

Stark, C. “By the Numbers are You Better Off?” CNN. (2012).
http://www.cnn.com/2012/09/13/politics/btn-are-you-better-off/

Honda


Life expectancy changes

https://www.indexmundi.com/facts/united-states/life-expectancy-at-birth