



THIS IS YOUR BRAIN ON SPACE

Architecture & Neuroscience

LITTLE

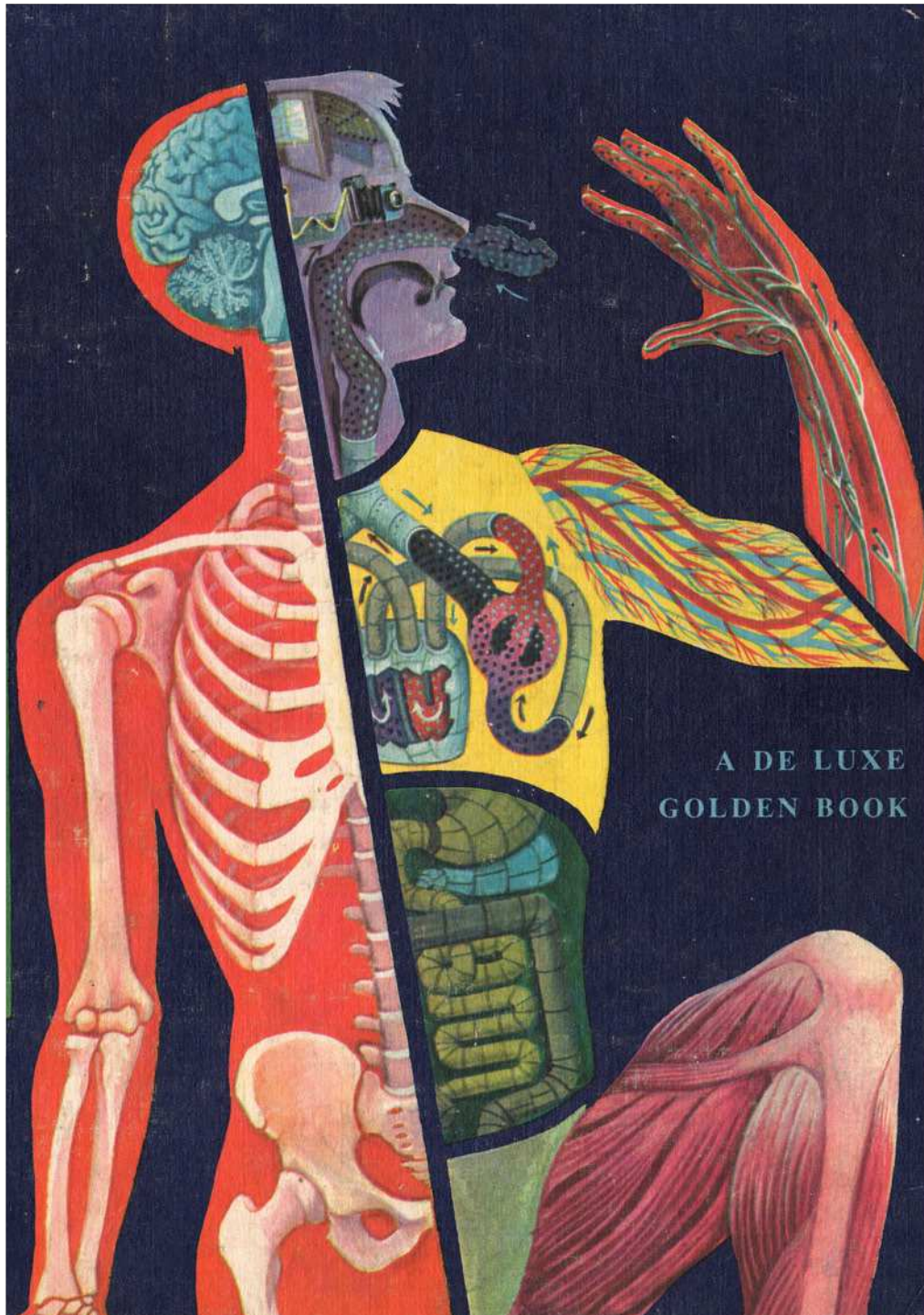
THINK ABOUT

how you feel

IN THE FOLLOWING

SETTINGS...






HOW WELL DO YOU
really
UNDERSTAND THE
HUMAN BODY?

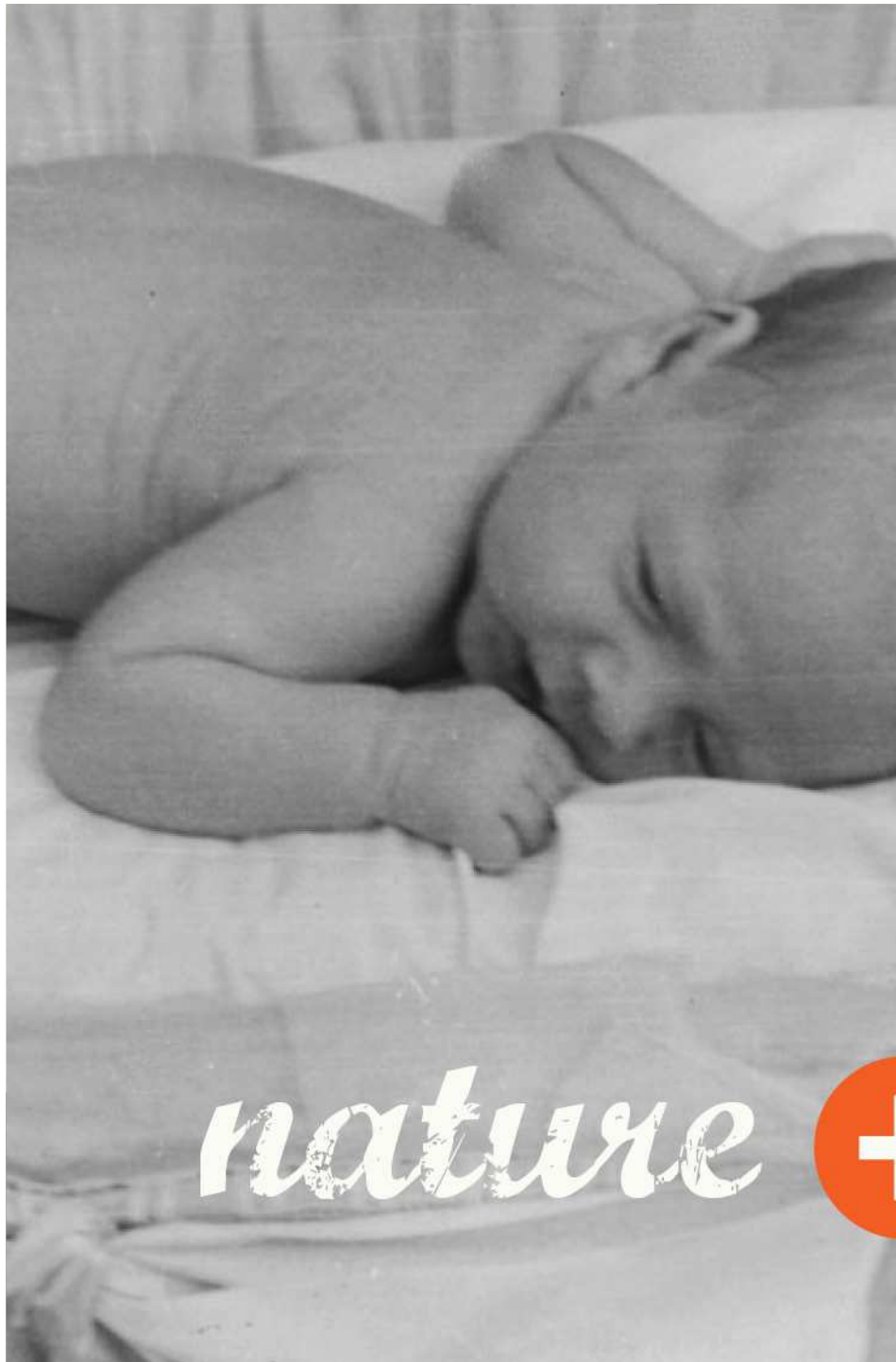
DO WE KNOW
enough

ABOUT WHO WE ARE
DESIGNING FOR?

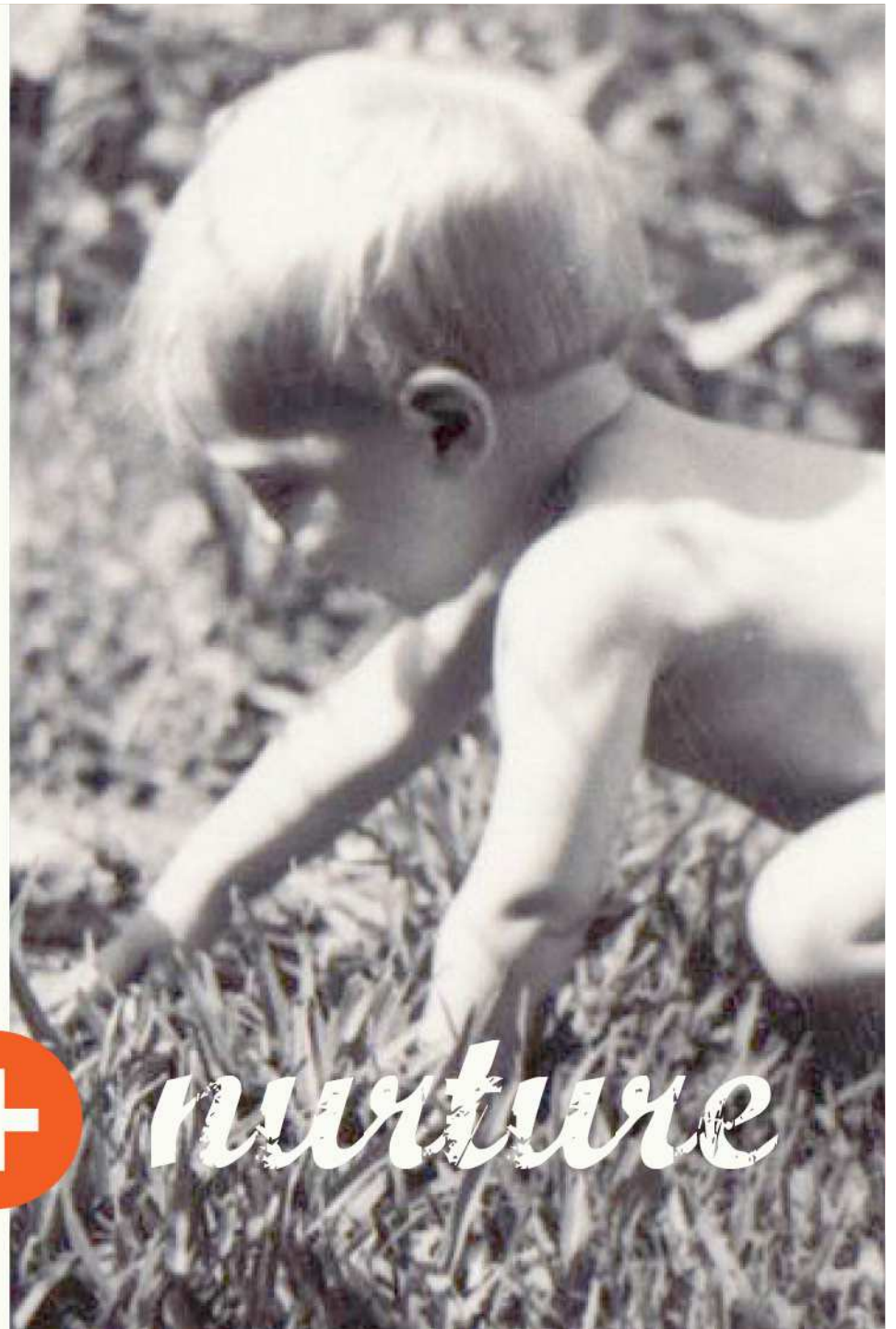




THE
HUMAN BRAIN IS A
jaw-droppingly
STUNNING THING



nature



nurture

CAN DESIGNED
ENVIRONMENTS
change
OUR BRAINS AND
BEHAVIOR?





our goal

DESIGN FOR A MORE

POSITIVE IMPACT

the senses



SIGHT

BALANCE AND
ACCELERATION

SOUND

TEMPERATURE

SMELL

KINESTHETIC SENSE

TASTE

PROPRIOCEPTION

TOUCH

PAIN

TIME

PULMONARY STRETCH
RECEPTORS

PERIPHERAL
CHEMORECEPTORS

CHEMORECEPTOR
TRIGGER ZONE

CUTANEOUS RECEPTORS

GAS DISTENTION

SENSORY RECEPTORS
IN THE ESOPHAGUS

SENSORY RECEPTORS
IN THE PHARYNX

SENSORY RECEPTORS IN
THE URINARY BLADDER

STRETCH SENSORS AND
BLOOD VESSELS



proprioception

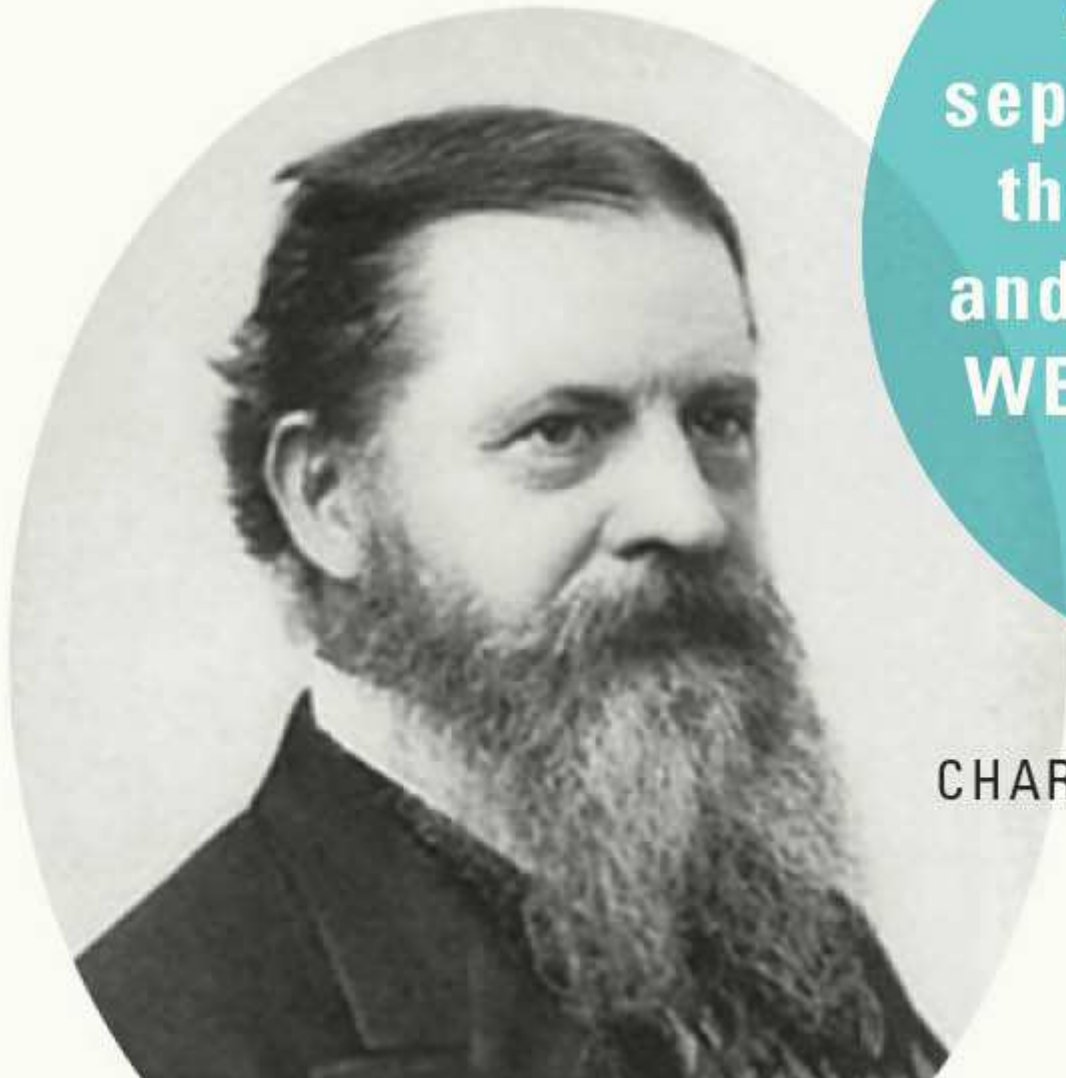
ONE'S OWN INDIVIDUAL PERCEPTION

"THE SENSE OF THE RELATIVE POSITION OF
NEIGHBOURING PARTS OF THE BODY AND STRENGTH OF
EFFORT BEING EMPLOYED IN MOVEMENT."

MOSBY'S MEDICAL, NURSING AND ALLIED HEALTH DICTIONARY

egocentric predicament

A theoretical
separation between
the REAL WORLD
and THE WORLD AS
WE PERCEIVE AND
KNOW IT



CHARLES SANDERS PEIRCE



A Venn diagram with two overlapping circles on a light yellow background. The left circle is orange and contains the text 'MY RED'. The right circle is magenta and contains the text 'CAROL'S RED'. The overlapping area is a darker red. Below the orange circle is the label 'REALITY' and below the magenta circle is the label 'CAROL'S REALITY'.

**MY
RED**

REALITY

**CAROL'S
RED**

CAROL'S REALITY

the senses



SIGHT

SOUND

SMELL

TASTE

TOUCH





VISION

TOUCH

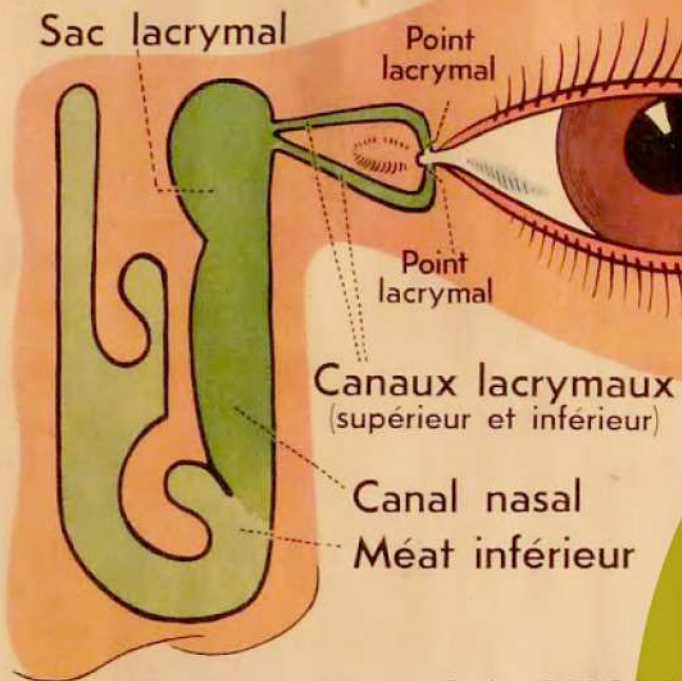
HEARING

SMELL

TASTE

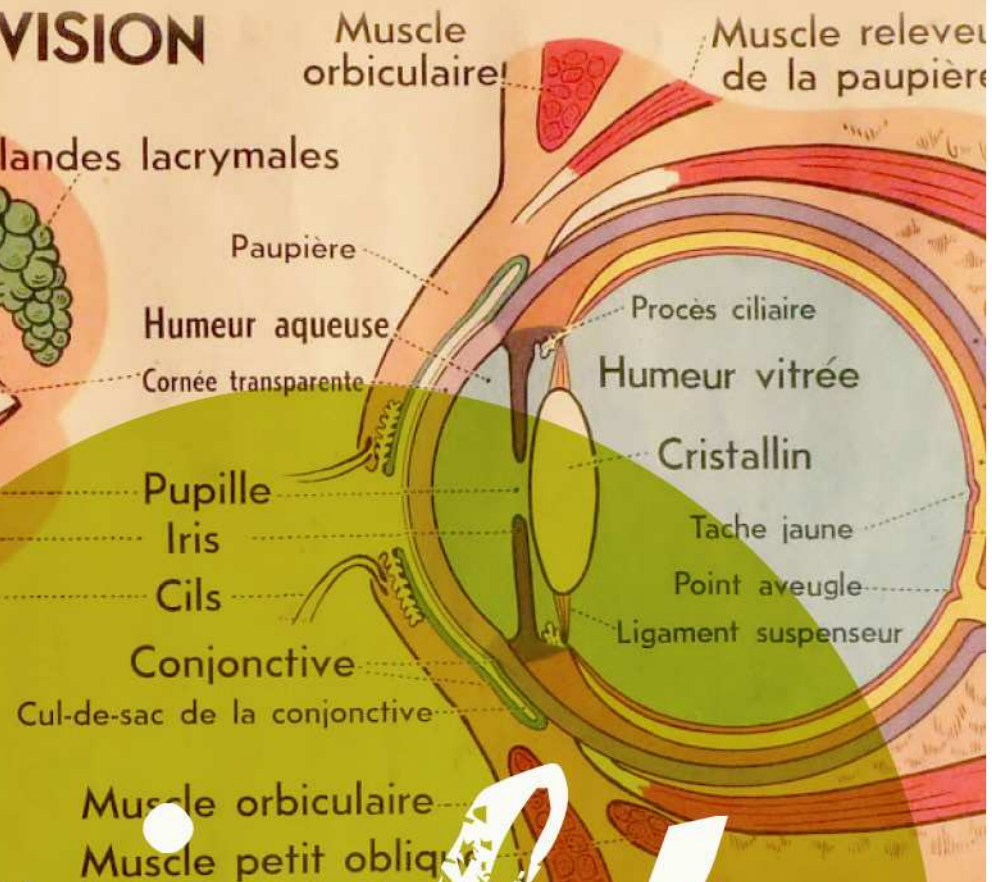
L'APPAREIL LACRYMAL

(Œil gauche)

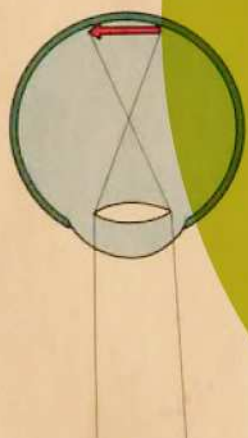
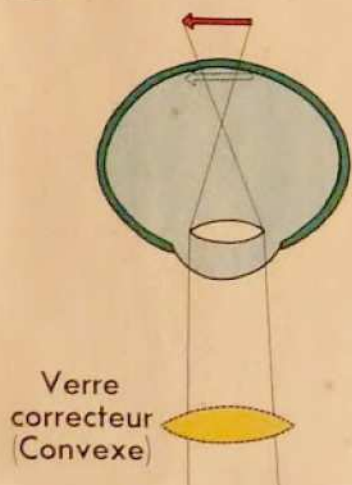


L'ŒIL ET LA VISION

Glandes lacrymales



LA VISION



Œil myope

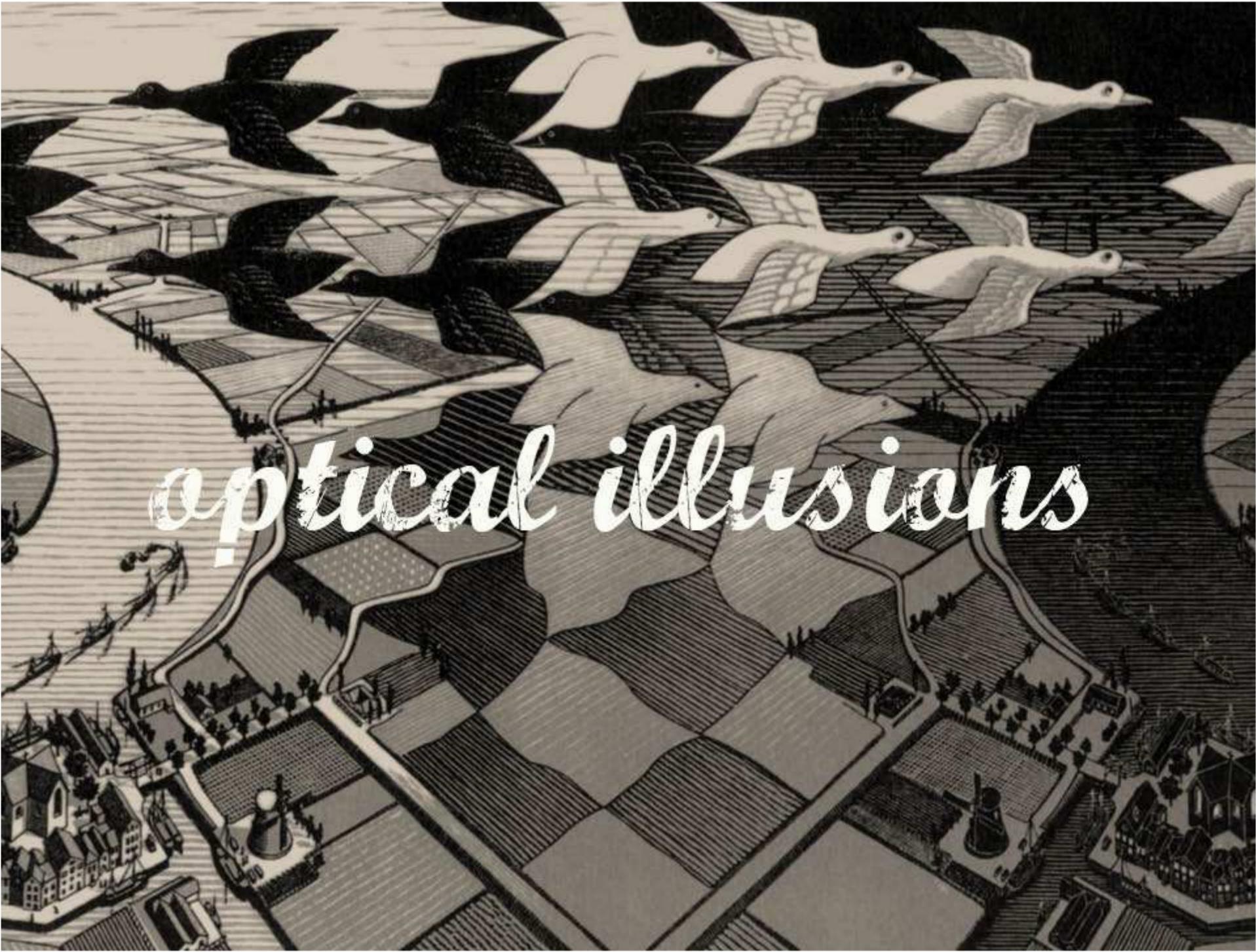
COEUR DE L'ŒIL

LES MUSCLES DE L'ŒIL

sigfot



sensory illusions

A black and white woodcut-style illustration of a Dutch landscape. The foreground and middle ground are filled with a complex checkerboard pattern of squares, creating a strong sense of perspective and depth. A winding river flows through the landscape, with several windmills visible along its banks. In the upper half of the image, a large flock of birds, possibly swans or geese, is shown in flight, their wings spread wide. The overall composition is a classic example of an optical illusion, where the checkerboard pattern creates a 3D effect that contradicts the 2D nature of the image. The text "optical illusions" is written in a stylized, cursive font across the center of the image.

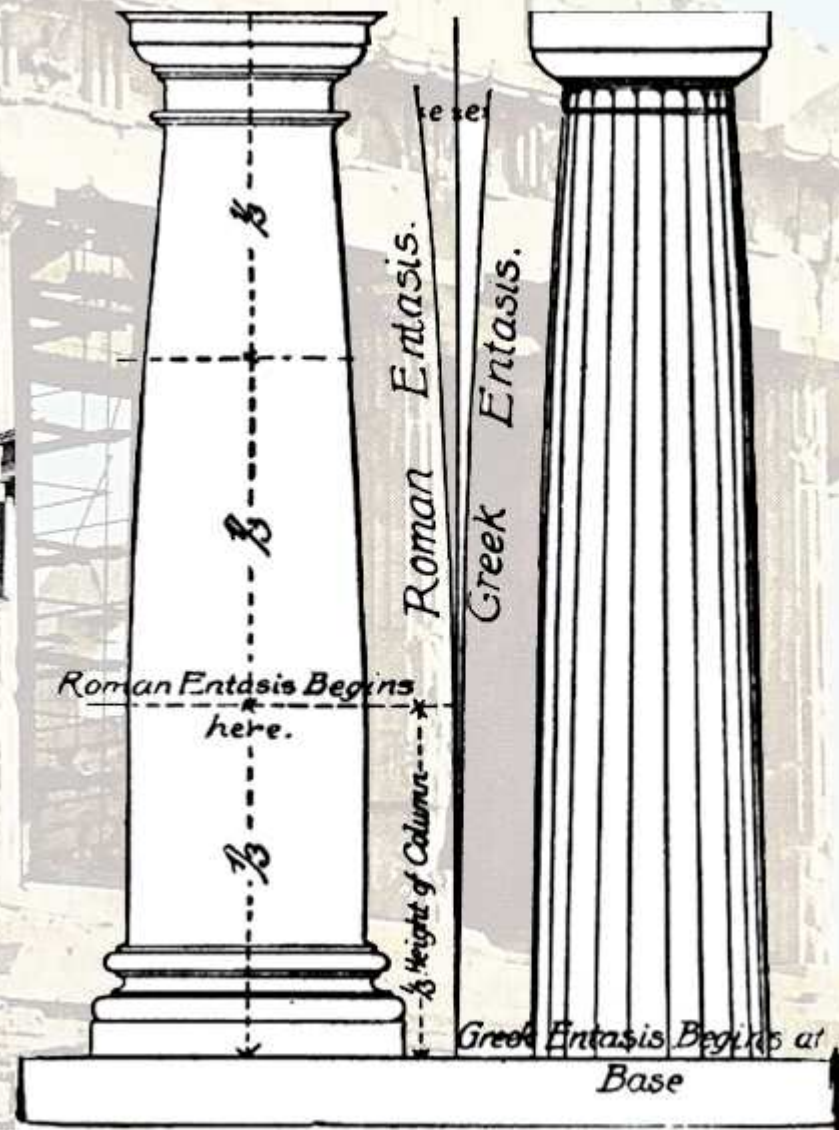
optical illusions



ENTASIS

The intentional slight convex curving of the vertical profile of a tapered column; used to overcome the optical illusion of concavity that characterizes straight-sided columns.

McGraw-Hill Dictionary of Architecture and Construction

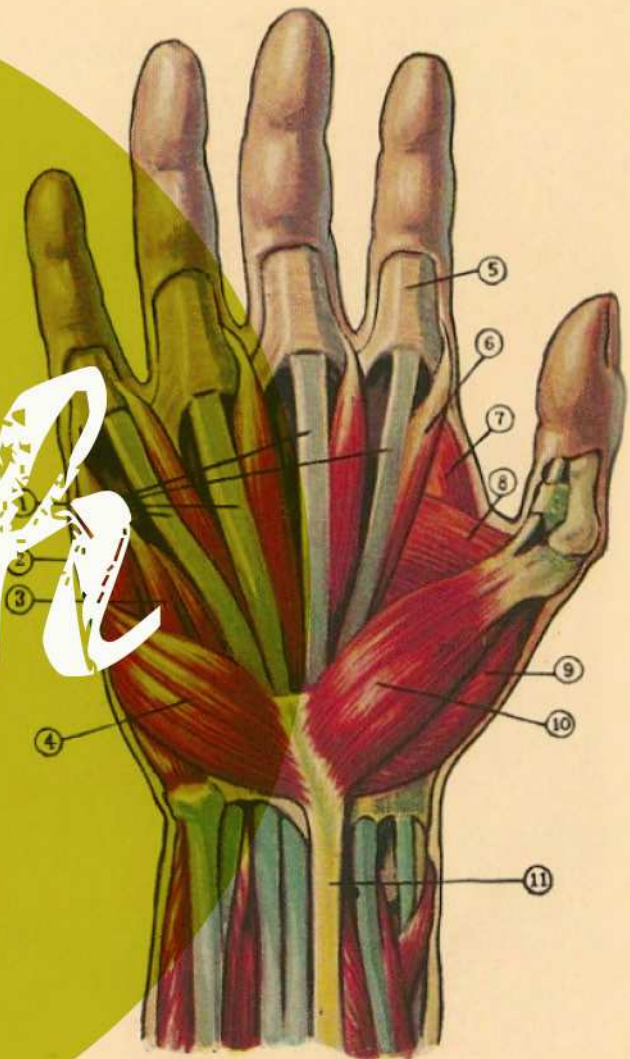
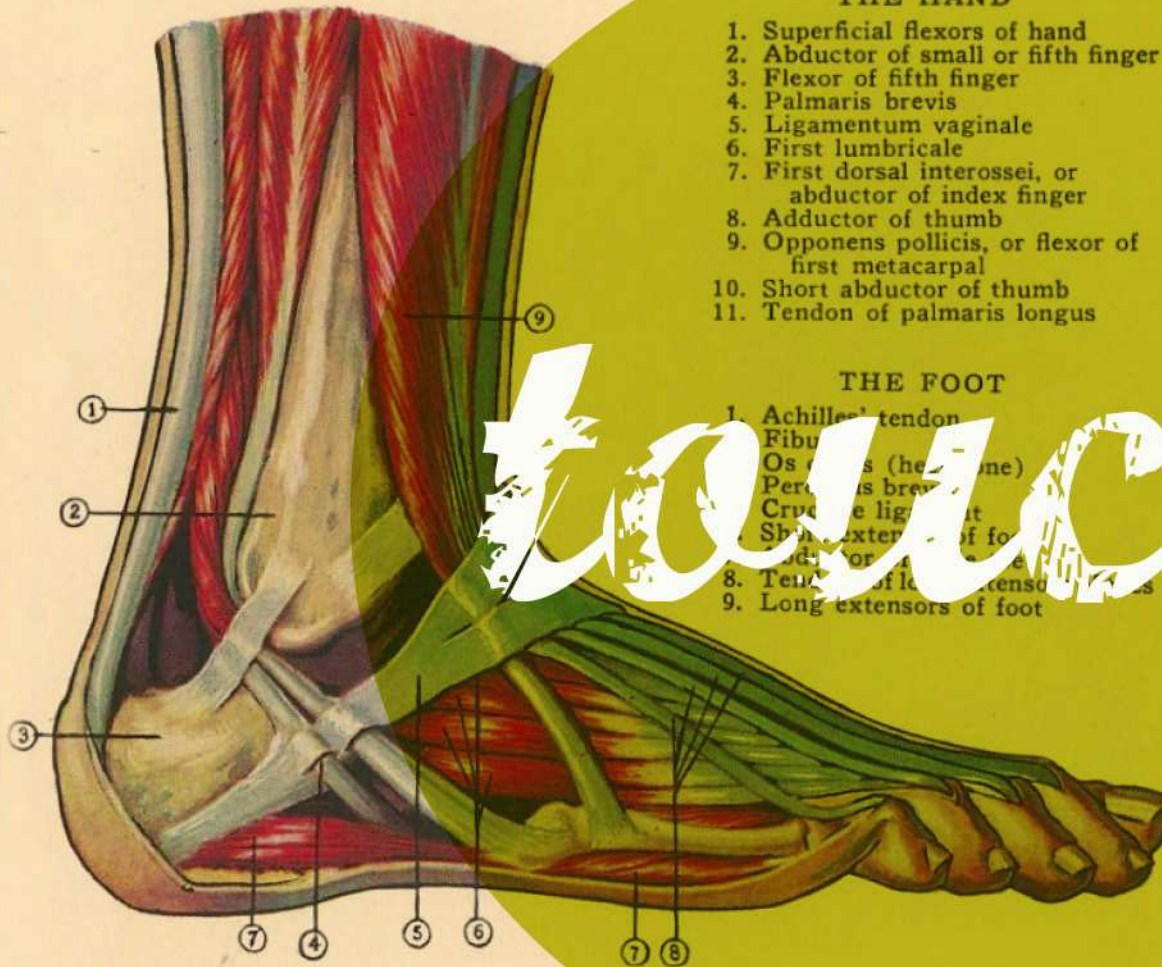


THE HAND

1. Superficial flexors of hand
2. Abductor of small or fifth finger
3. Flexor of fifth finger
4. Palmaris brevis
5. Ligamentum vaginale
6. First lumbricale
7. First dorsal interossei, or abductor of index finger
8. Adductor of thumb
9. Opponens pollicis, or flexor of first metacarpal
10. Short abductor of thumb
11. Tendon of palmaris longus

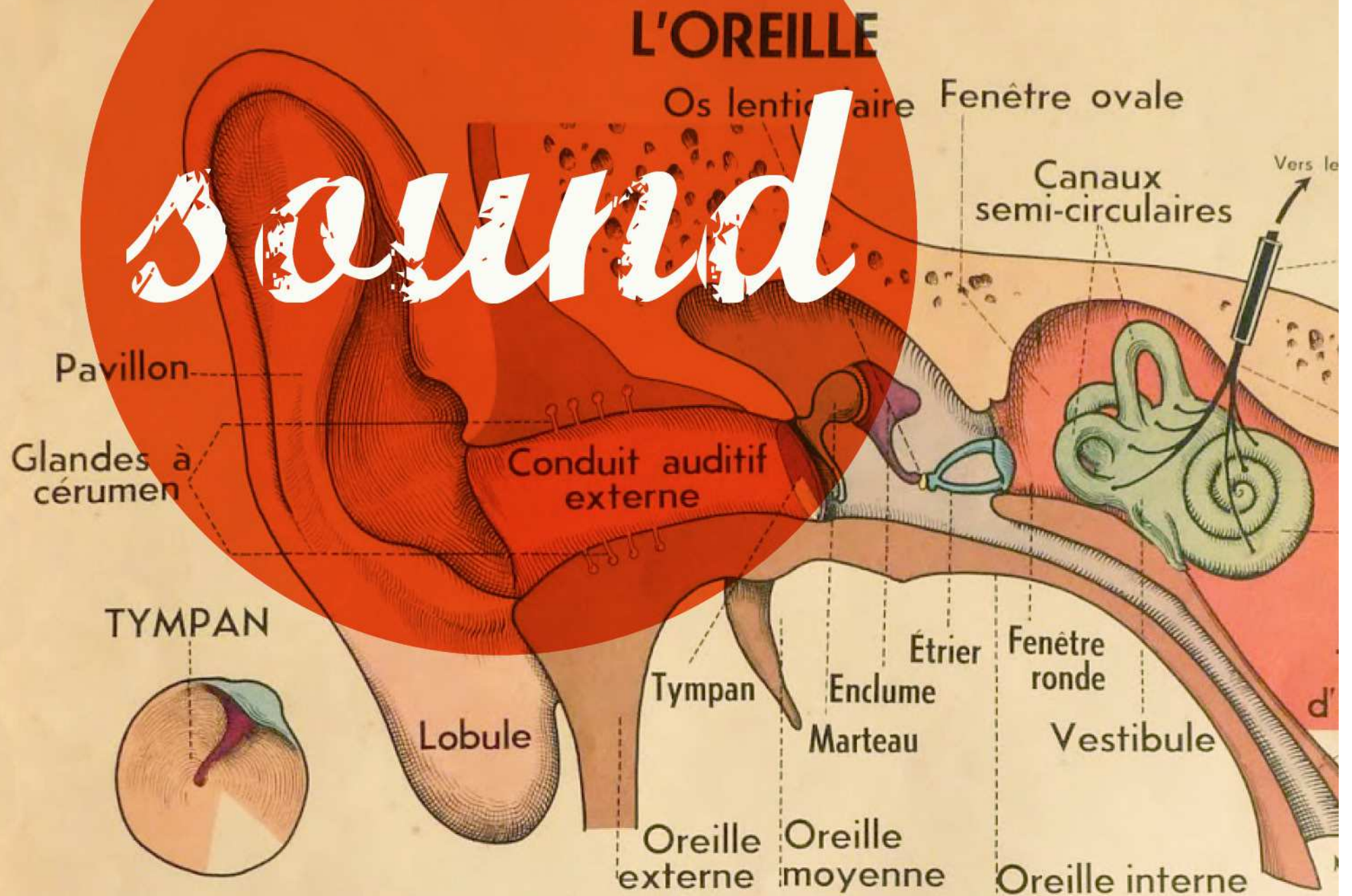
THE FOOT

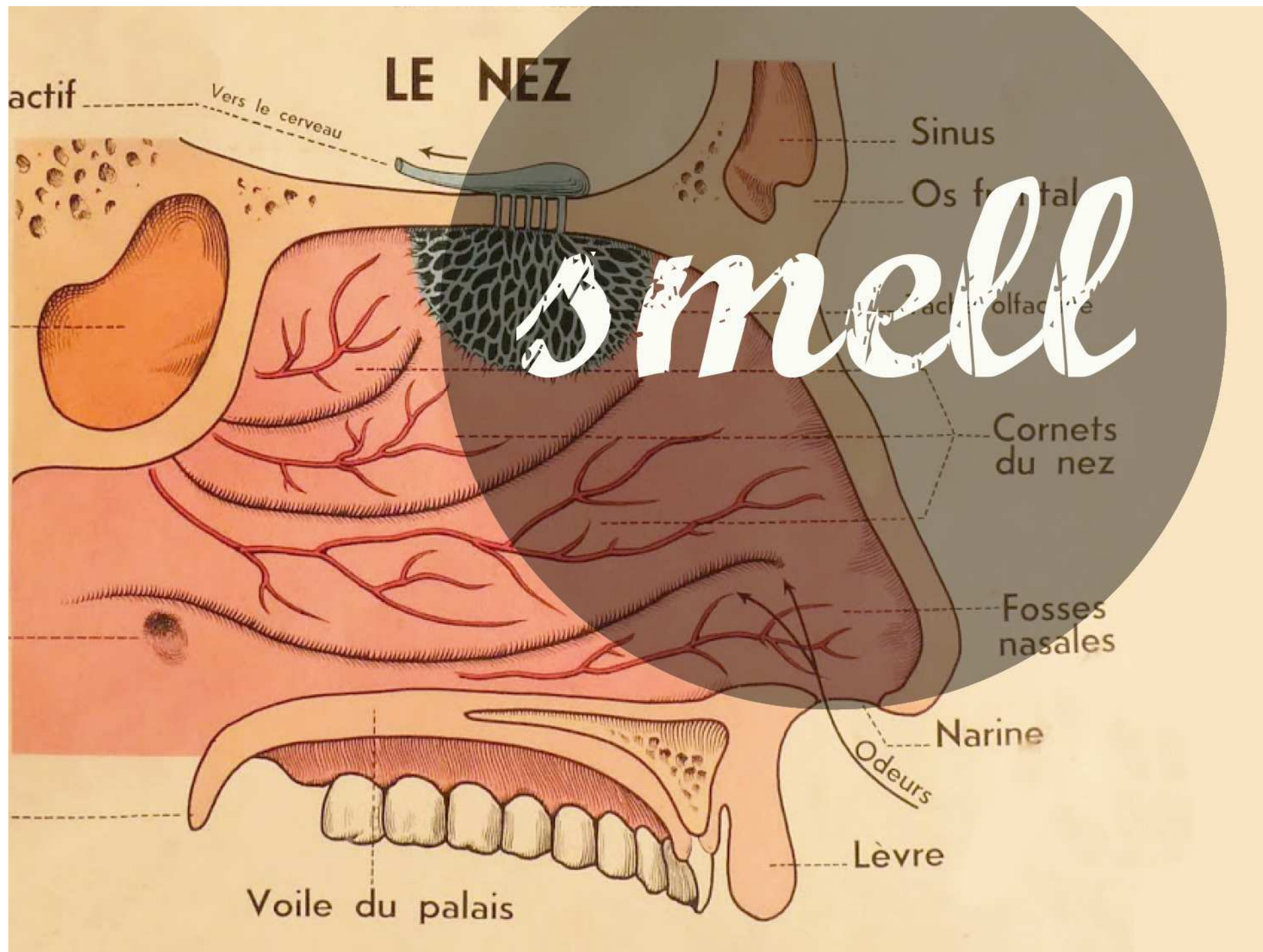
1. Achilles' tendon
2. Fibula
3. Os calcis (heel bone)
4. Peroneus brevis
5. Cruciate ligament
6. Short extensor of foot
7. Adductor of foot
8. Tendon of long extensor
9. Long extensors of foot





sound

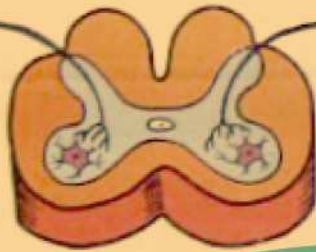




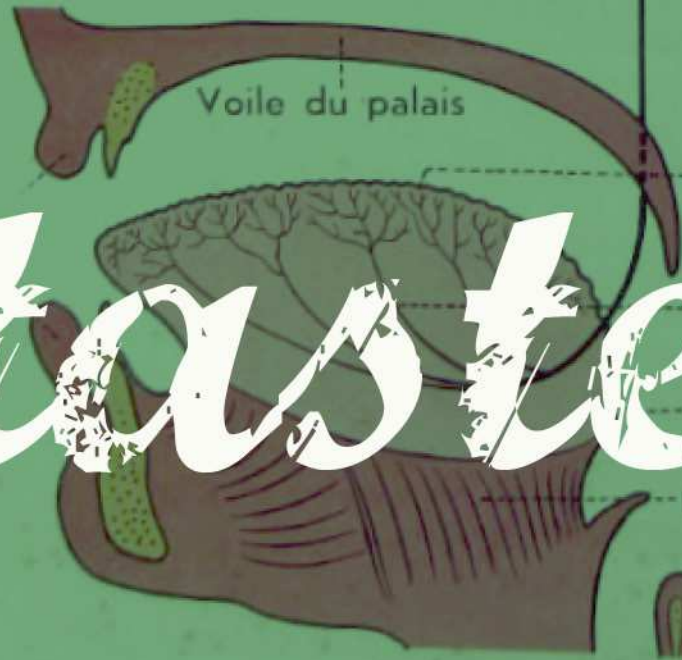
olfactory illusions



LE GOÛT



goutte



Amygdale

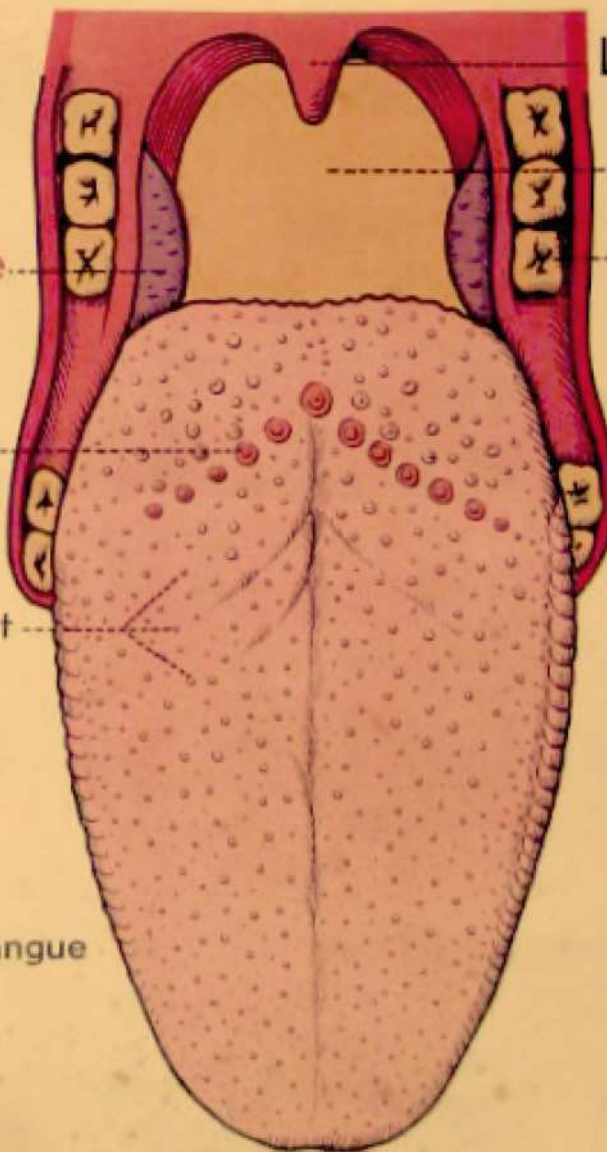
V. Lingual

Papilles du goût

Nerfs du goût

Pharynx

Muscles de la langue



Luiette

Pharynx

Molaires

MUCH OF EVOLUTION IS
incremental



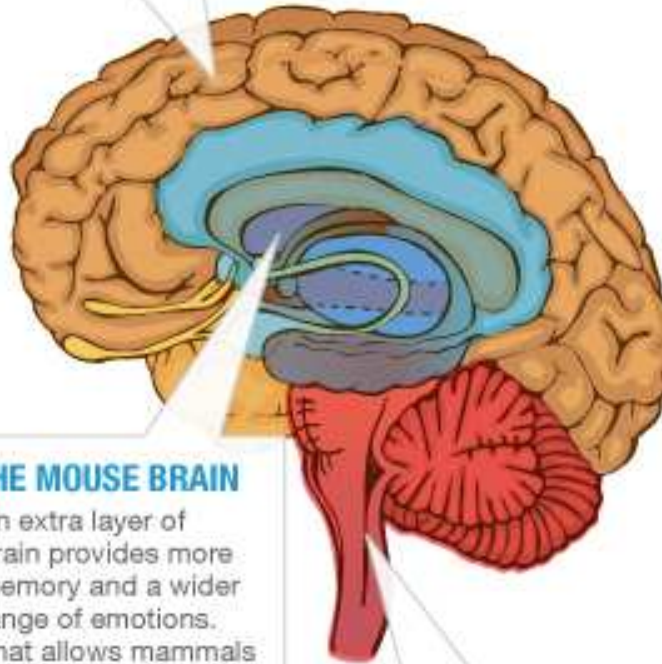


A VERY UGLY ICE CREAM CONE

a brief introduction to your brain

THE HUMAN BRAIN

With 100 billion cells and 500 trillion connections, this part of the brain allows us to solve difficult problems and navigate a very complex social world. It's also responsible for imagination, culture and the ability to figure out what other people are thinking based on social cues.



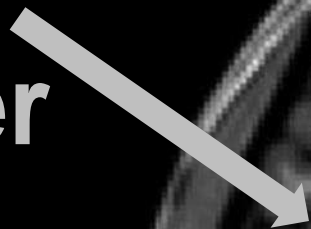
THE MOUSE BRAIN

An extra layer of brain provides more memory and a wider range of emotions. That allows mammals to do things like learn from their experiences and anticipate danger, rather than merely reacting to it.

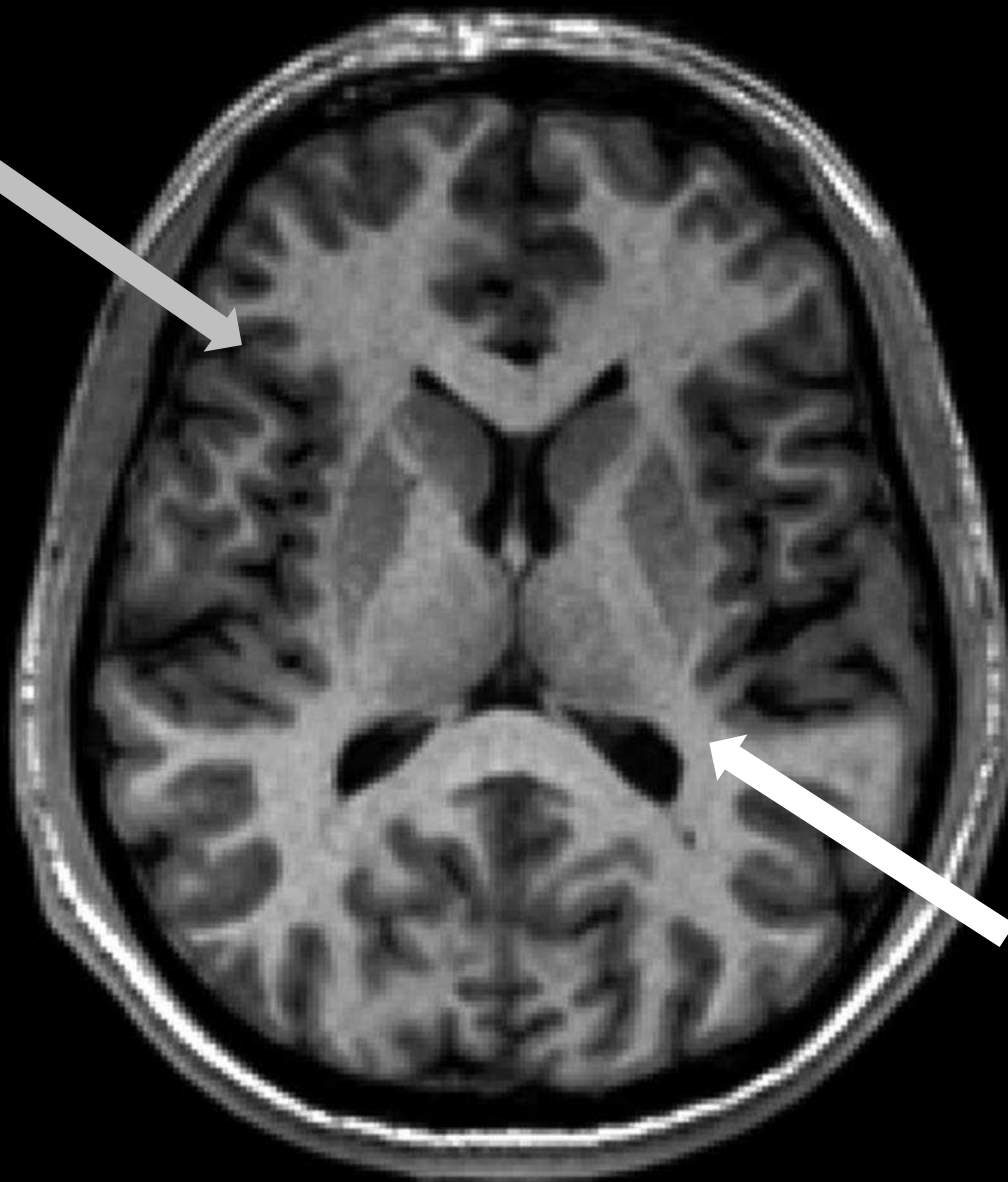
THE LIZARD BRAIN

This ancient brain is all about survival. When danger appears, it decides whether to fight or flee.

**grey
matter**



**white
matter**



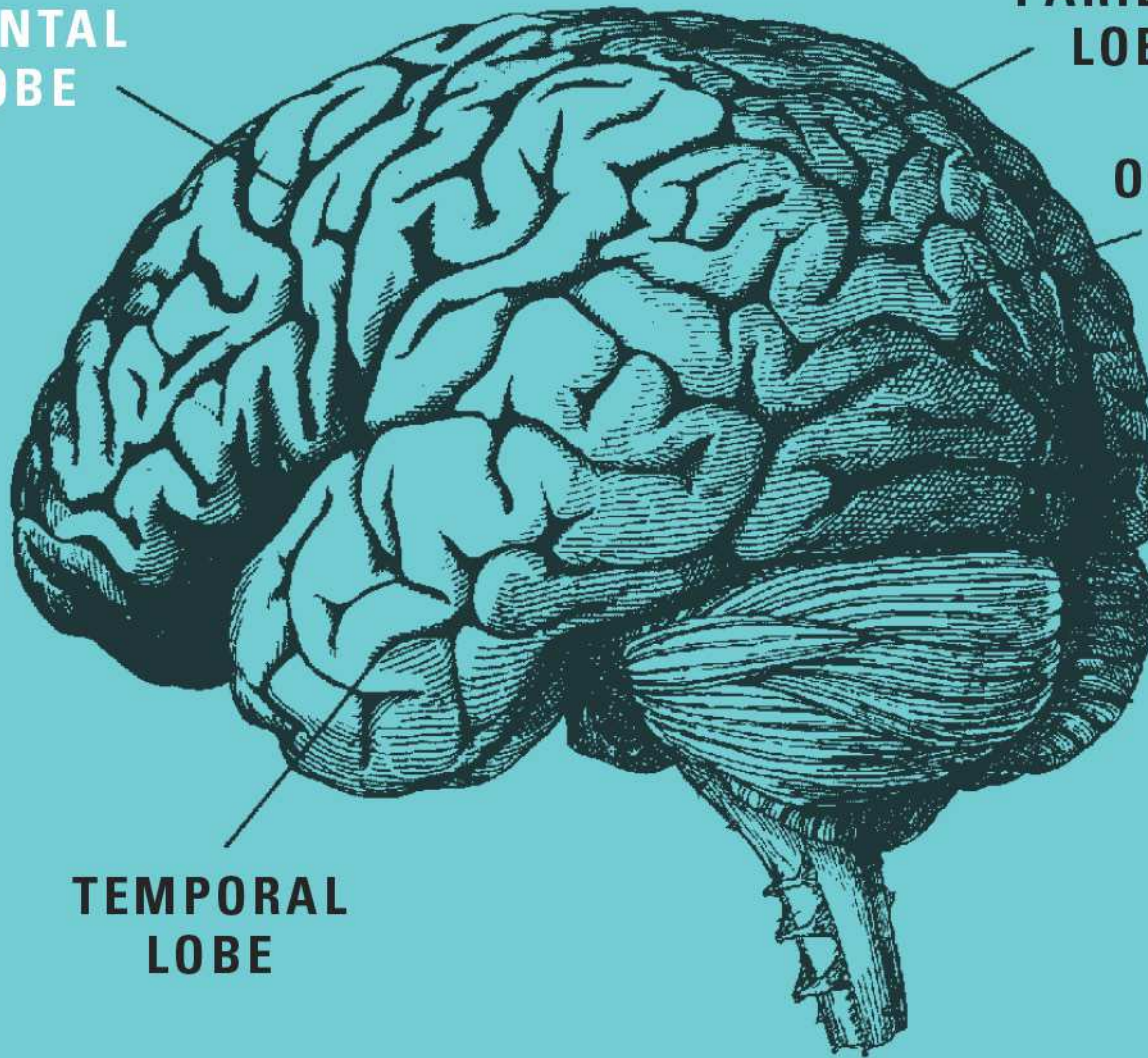
four lobes

FRONTAL
LOBE

PARIETAL
LOBE

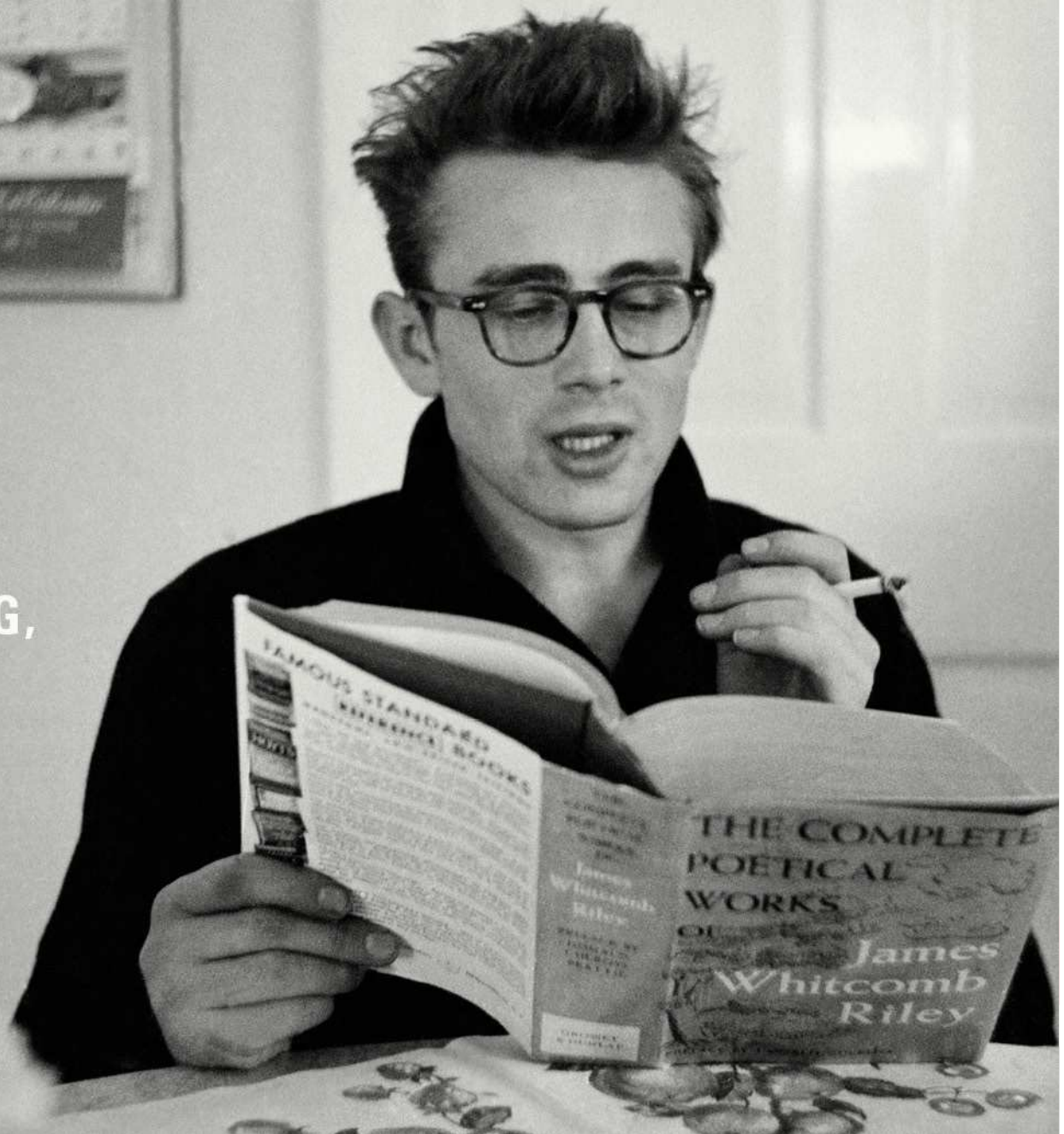
OCCIPITAL
LOBE

TEMPORAL
LOBE

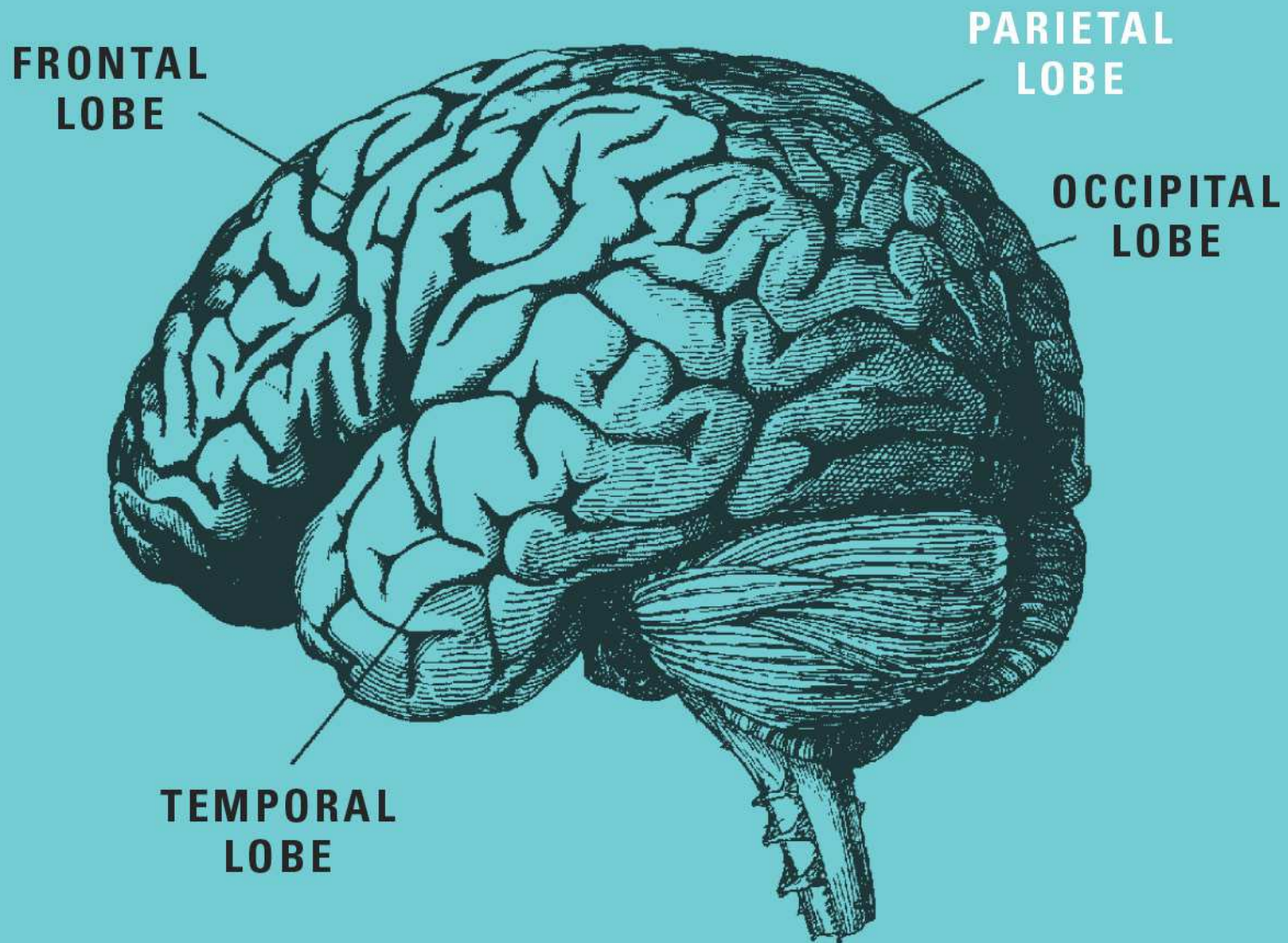


Frontal Lobe

COMPLEX
REASONING, SELF
CONTROL, PLANNING,
AND ABSTRACT
THOUGHT.

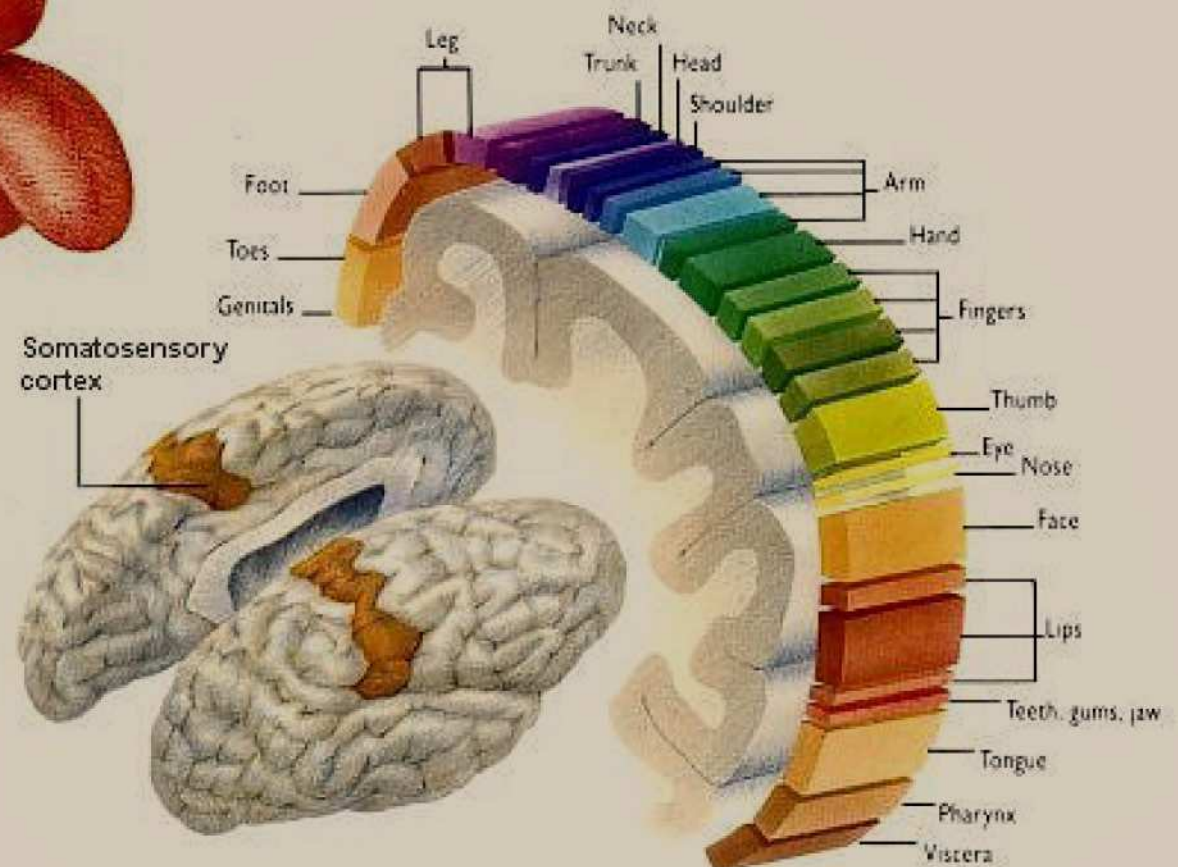
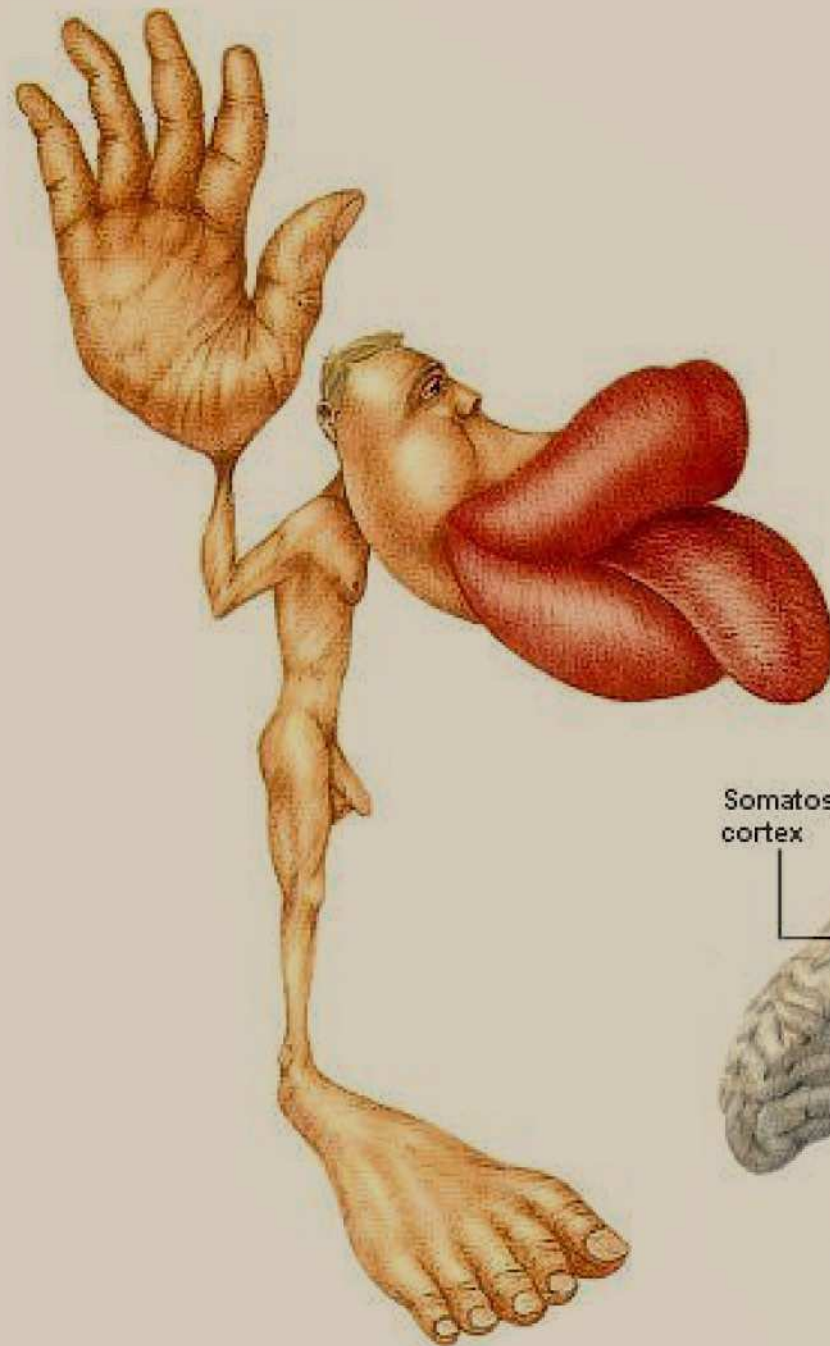


four lobes

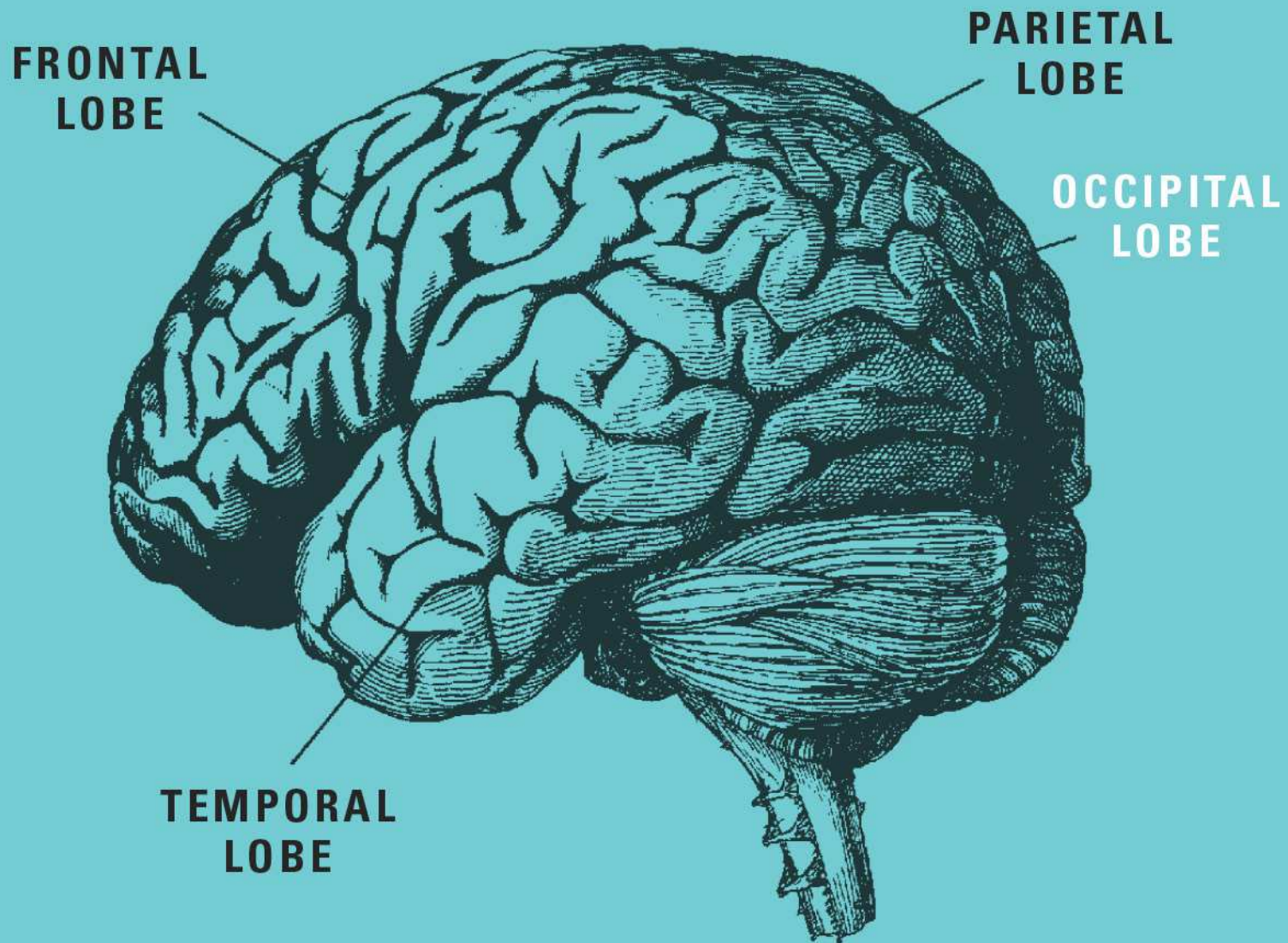


Parietal Lobe

SENSORY INPUT, SPECIAL
SENSE, NAVIGATION AND BODY
ORIENTATION

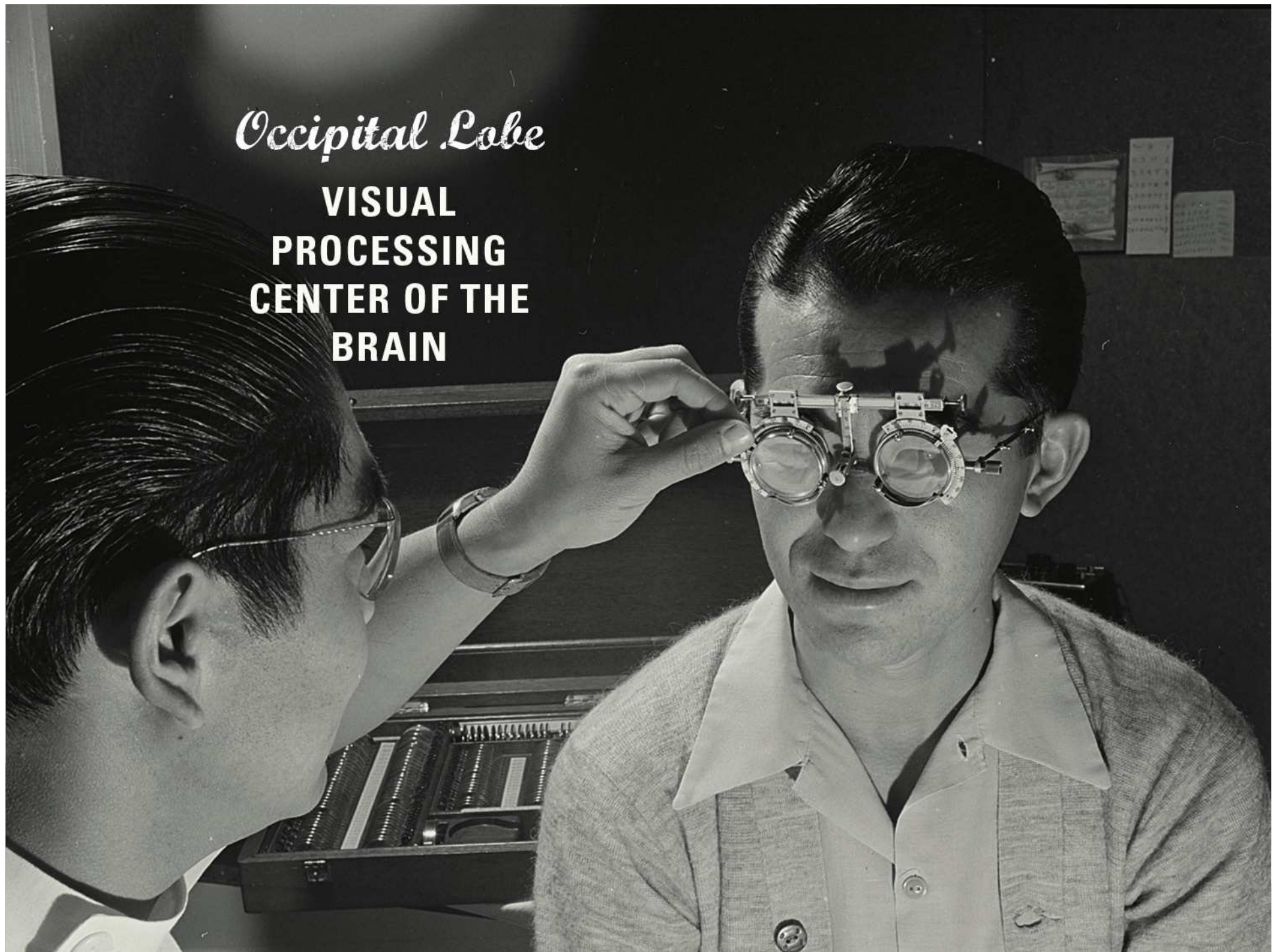


four lobes

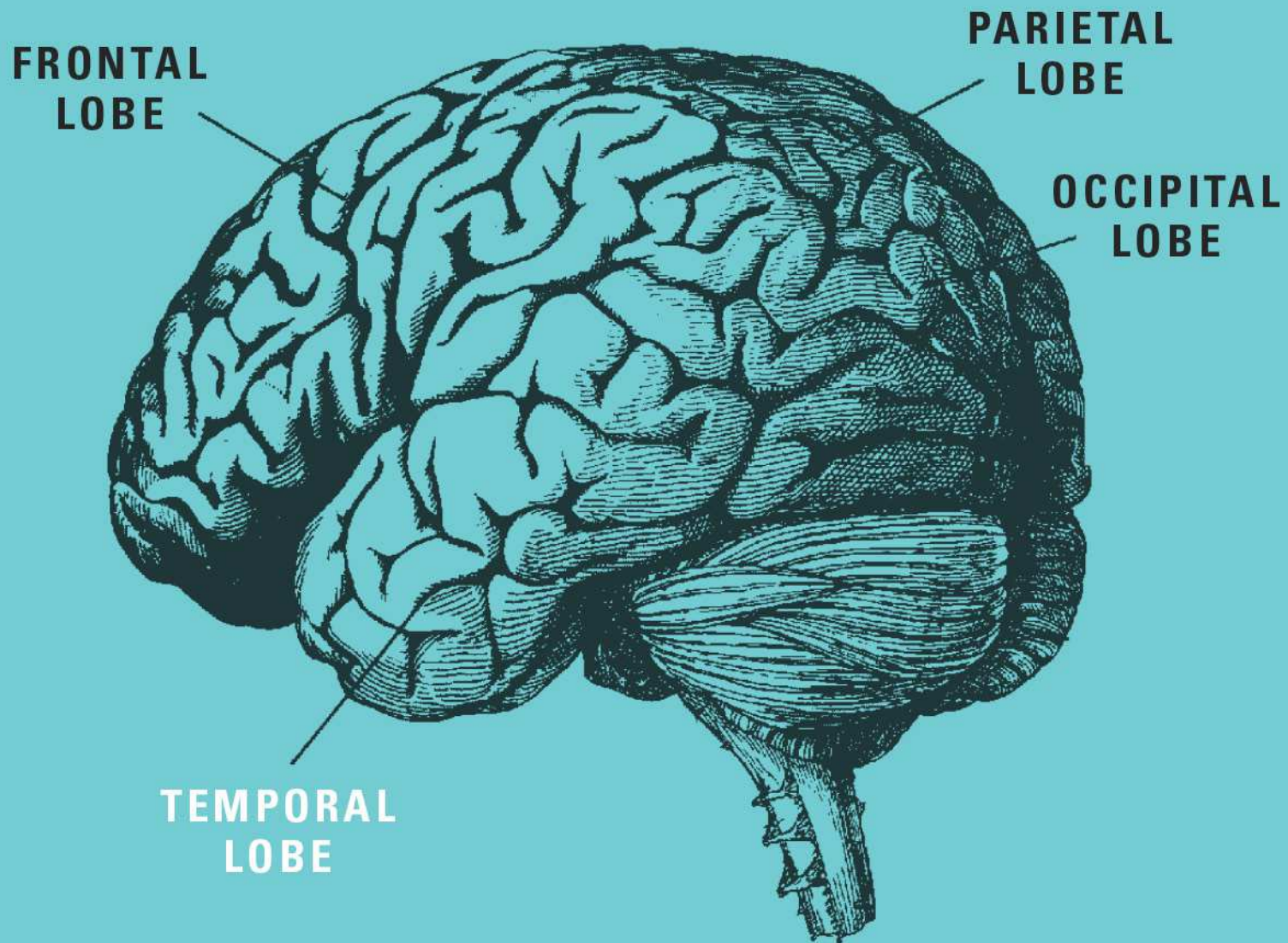


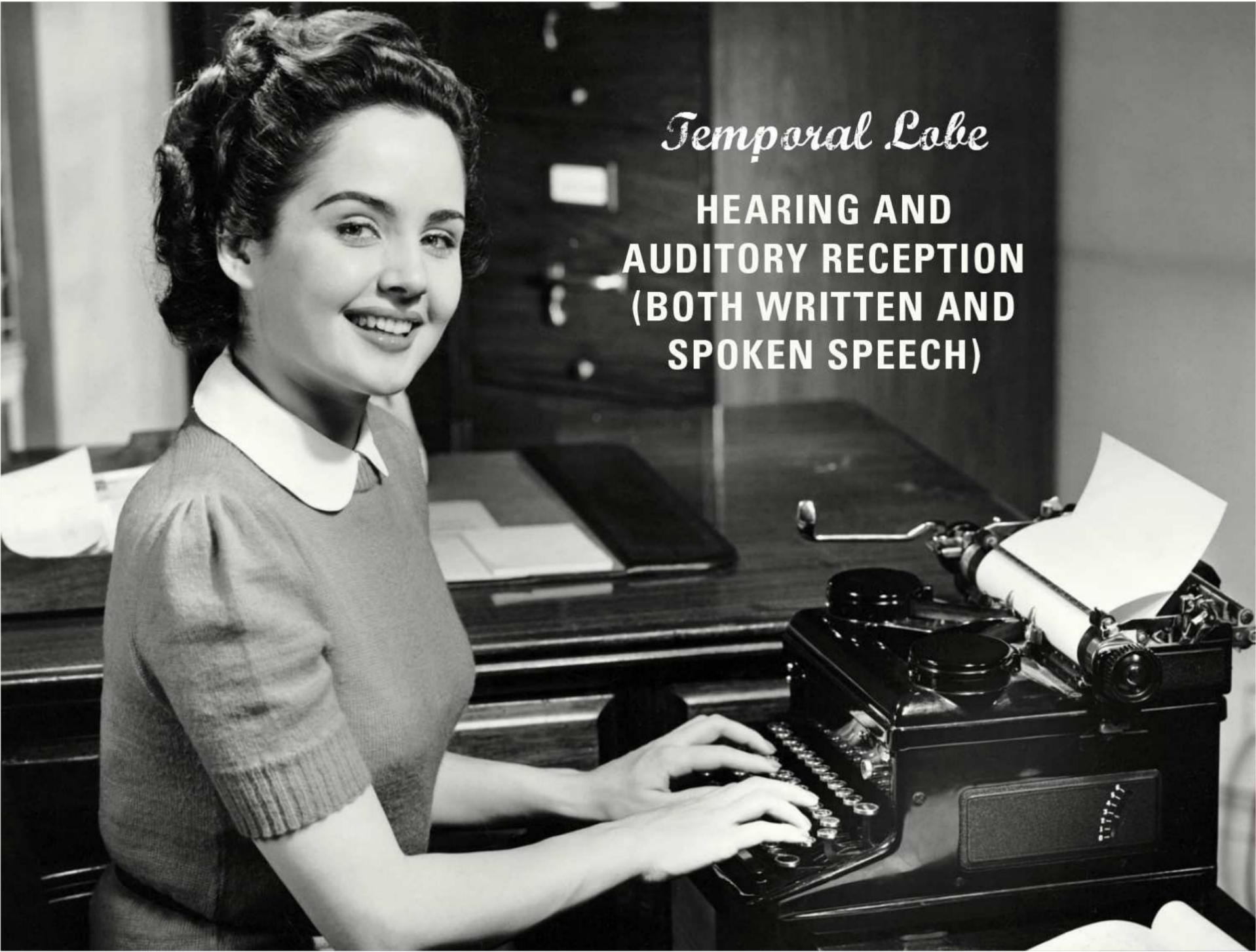
Occipital Lobe

**VISUAL
PROCESSING
CENTER OF THE
BRAIN**



four lobes





Temporal Lobe

**HEARING AND
AUDITORY RECEPTION
(BOTH WRITTEN AND
SPOKEN SPEECH)**



HYPOTHALAMUS

AMYGDALA

HIPPOCAMPUS

*more important
brain parts*



CASE STUDIES

Architecture & Neuroscience



ENRICHED ENVIRONMENTS / SALUTOGENIC DESIGN



*you can't teach an
old dog new tricks*

OR CAN YOU?



Rusty Gage



neuroplasticity

**STRENGTHENING OF NEURONS
THROUGH ESTABLISHING NEW
CONNECTIONS**

A black and white photograph of a mouse in a wire cage. The mouse is positioned in the lower-left corner, looking towards the right. The cage is made of wire mesh. A large, semi-transparent red circle is overlaid on the right side of the image, containing white text. The background shows the interior of the cage with some mechanical parts and a dark floor.

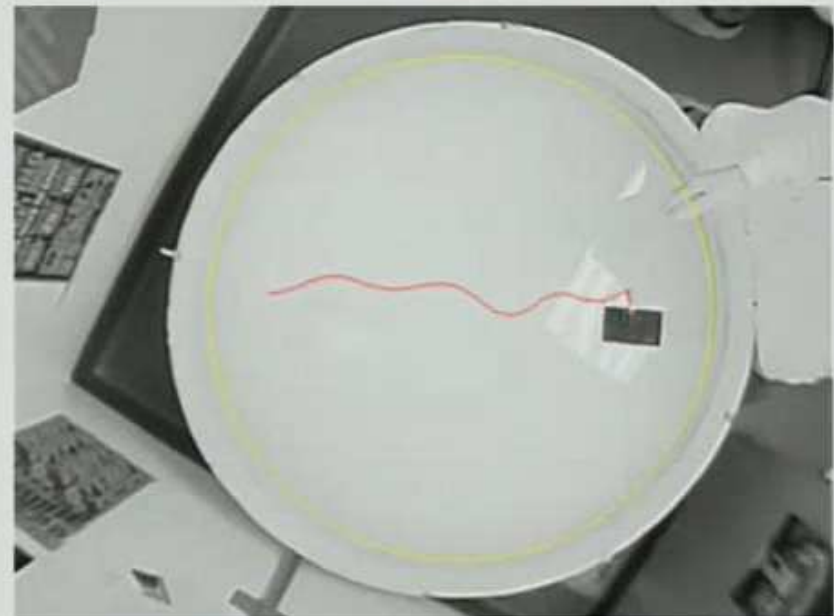
15%

*increase in
hippocampal
neurons*

Learning is improved in aged running mice



Old Sedentary



Old Runner

SERIES 2
EXERCISE 3
4 counts

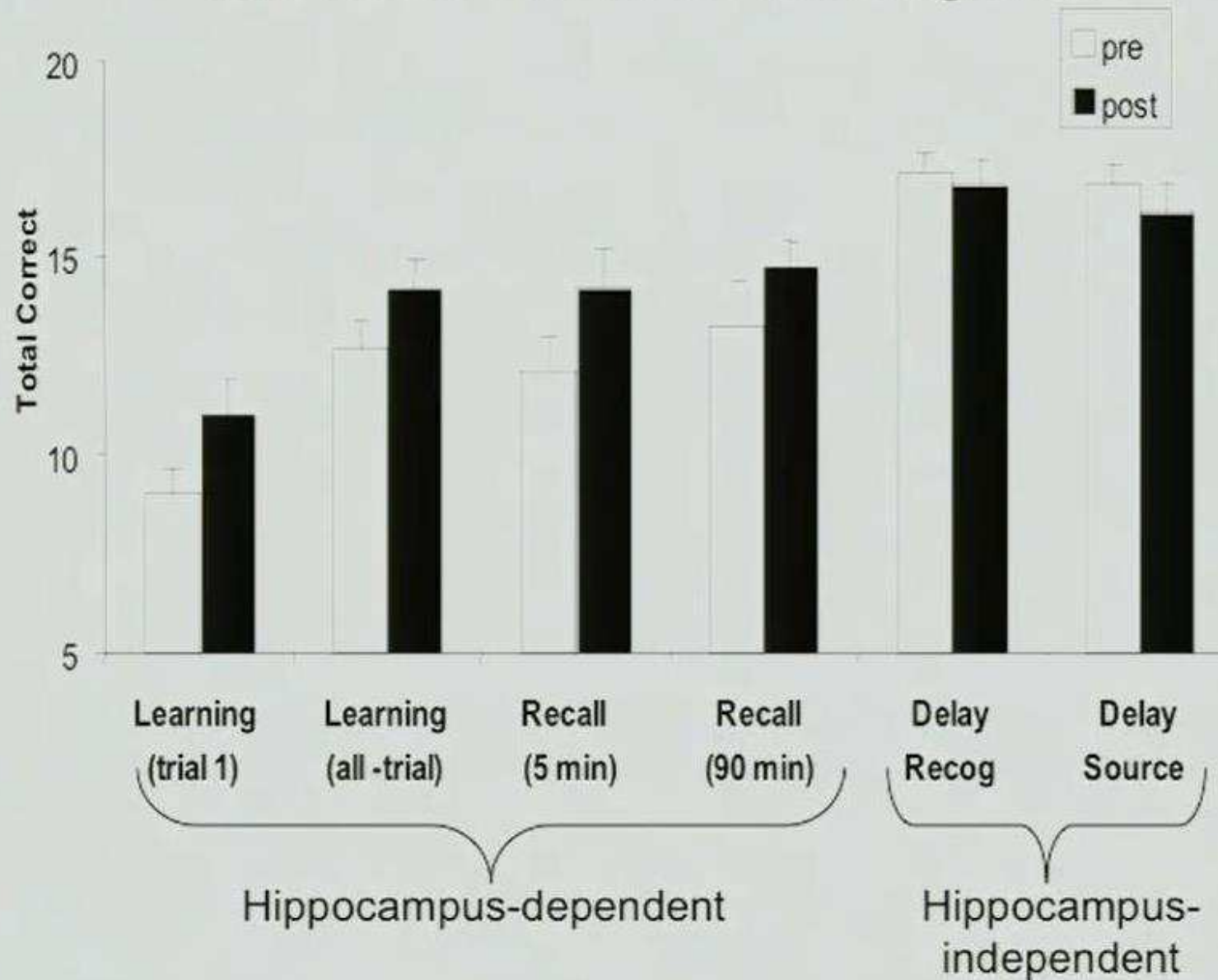
SERIES 3
EXERCISE 2
4 counts

6

*week exercise
regimen*

SERIES 4

Movement in our environment, can effect our brain and cognition



Burn Calories,
Not Electricity



Take the Stairs!

Walking up the stairs just 2 minutes a day helps prevent weight gain. It also helps the environment.

Learn more at www.nyc.gov or call 311.

CENTER

FOR ACTIVE

DESIGN







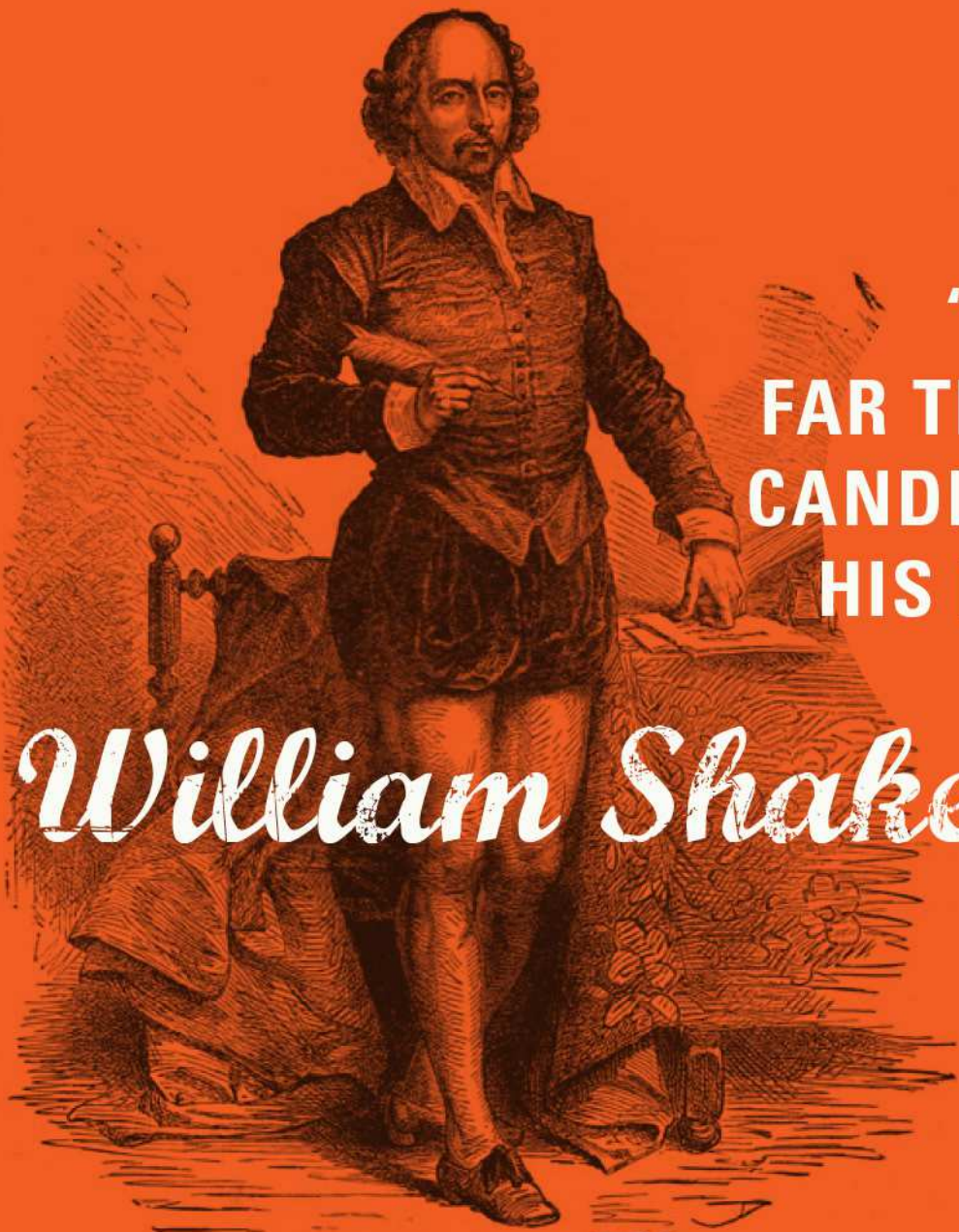






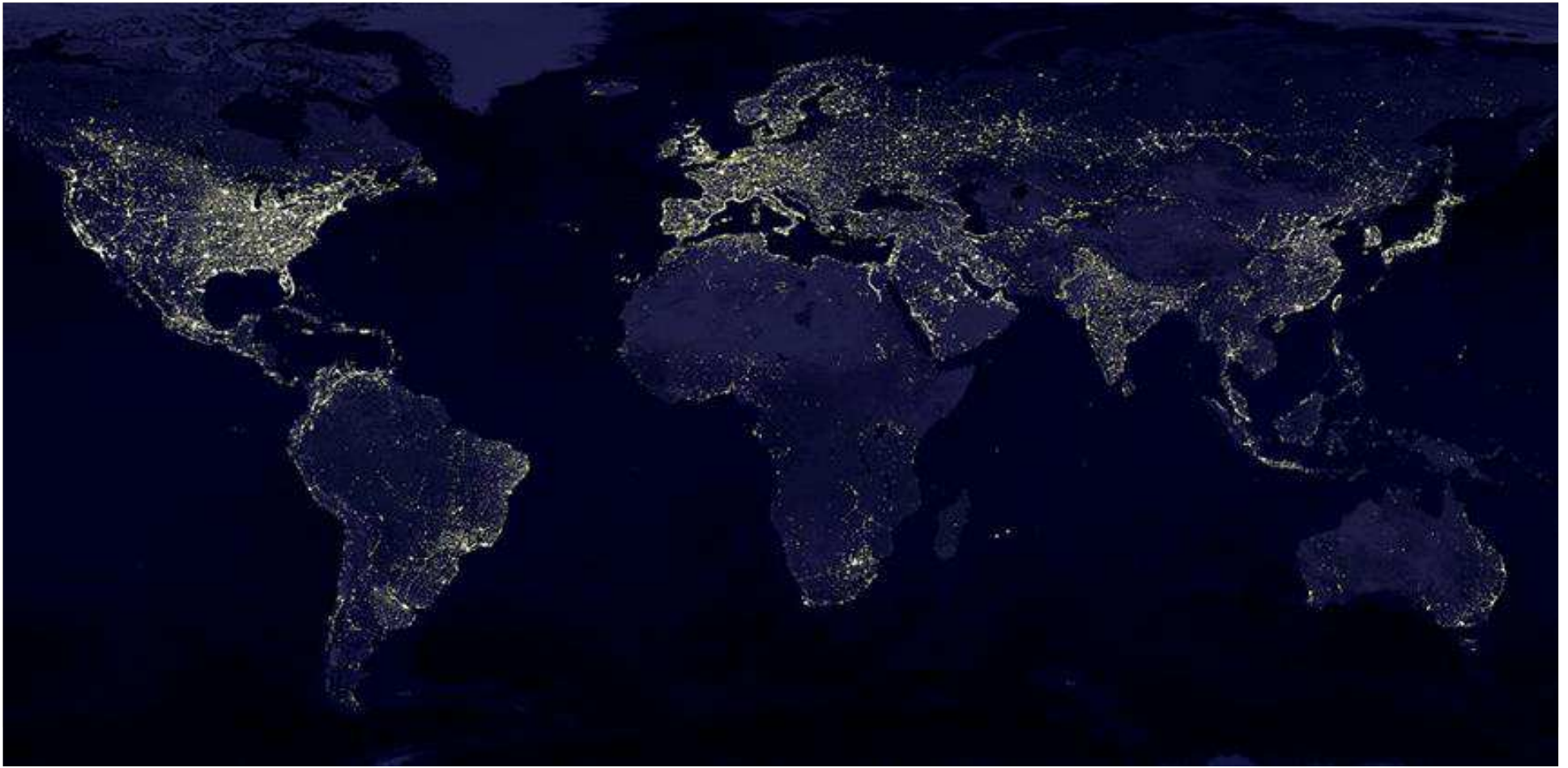


CHRONOBIOLOGY & CIRCADIAN RHYTHM

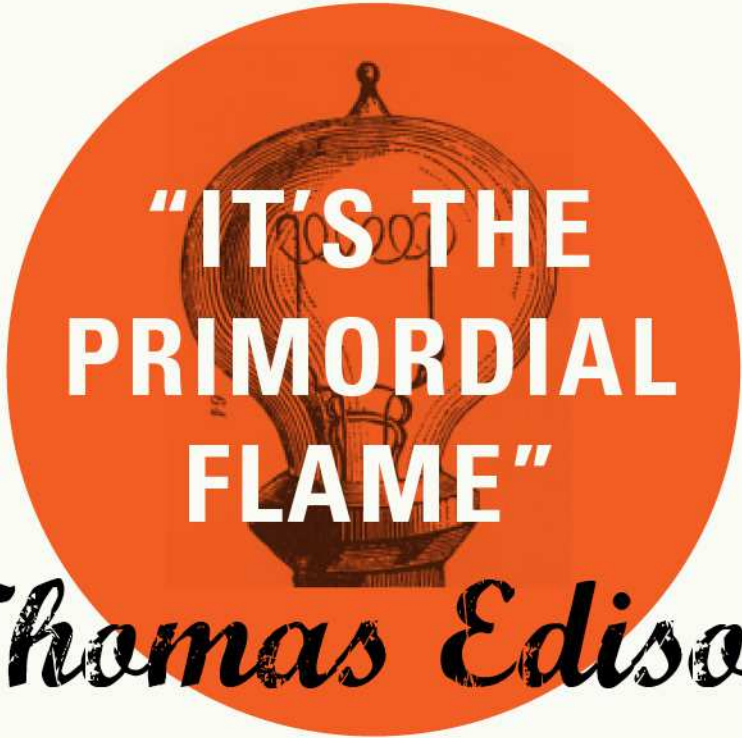
A woodcut-style illustration of William Shakespeare. He is standing, facing slightly to the right, with his left hand resting on a desk. He is wearing a dark, buttoned doublet over a white ruffled shirt, and dark breeches. On the desk in front of him is a lit candle in a holder, and several books or papers are scattered on its surface. The background is a simple, textured wash.

**"HOW
FAR THAT LITTLE
CANDLE THROWS
HIS BEAMS!"**

William Shakespeare

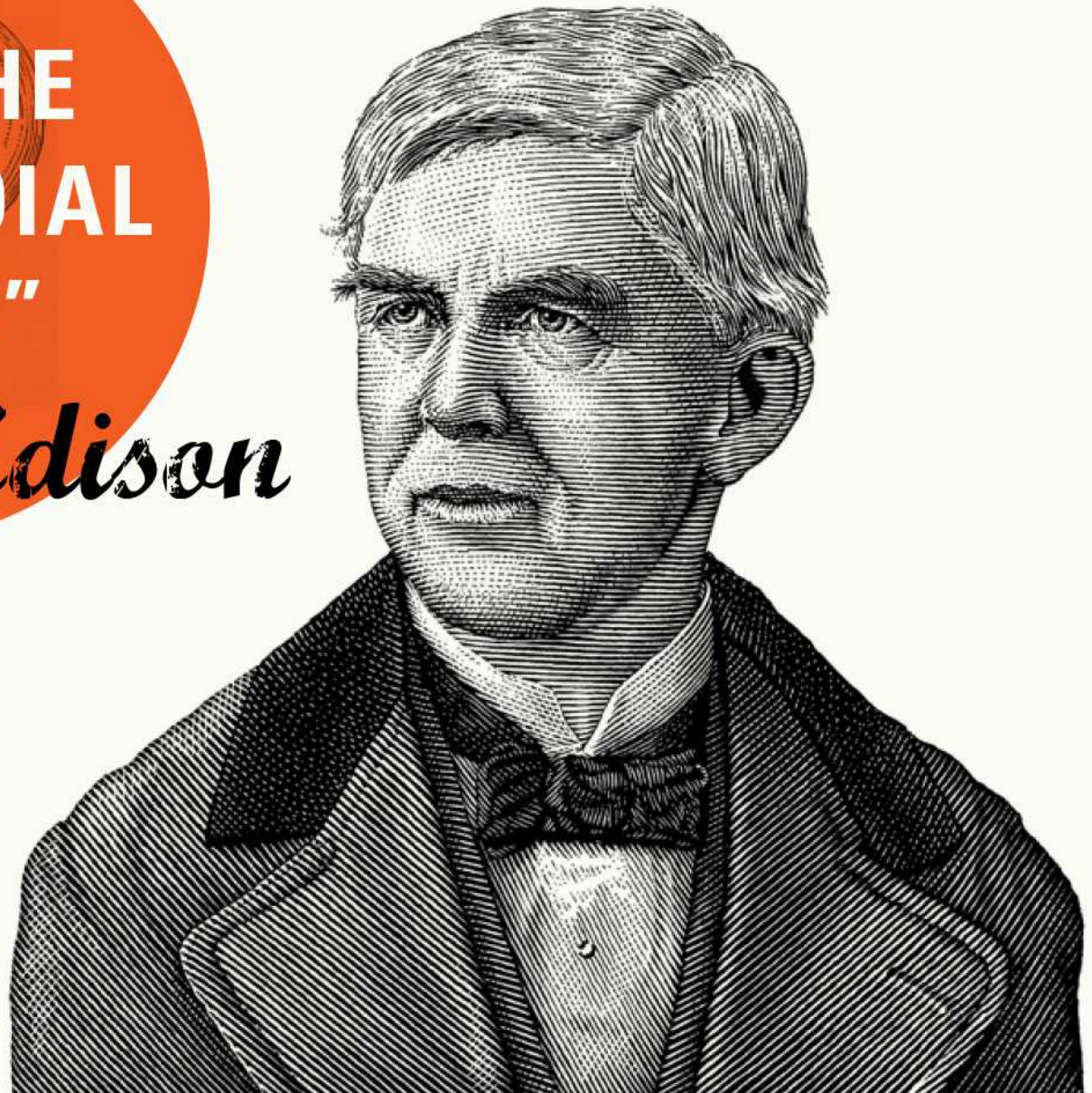


artificial light = depression?



**"IT'S THE
PRIMORDIAL
FLAME"**

Thomas Edison

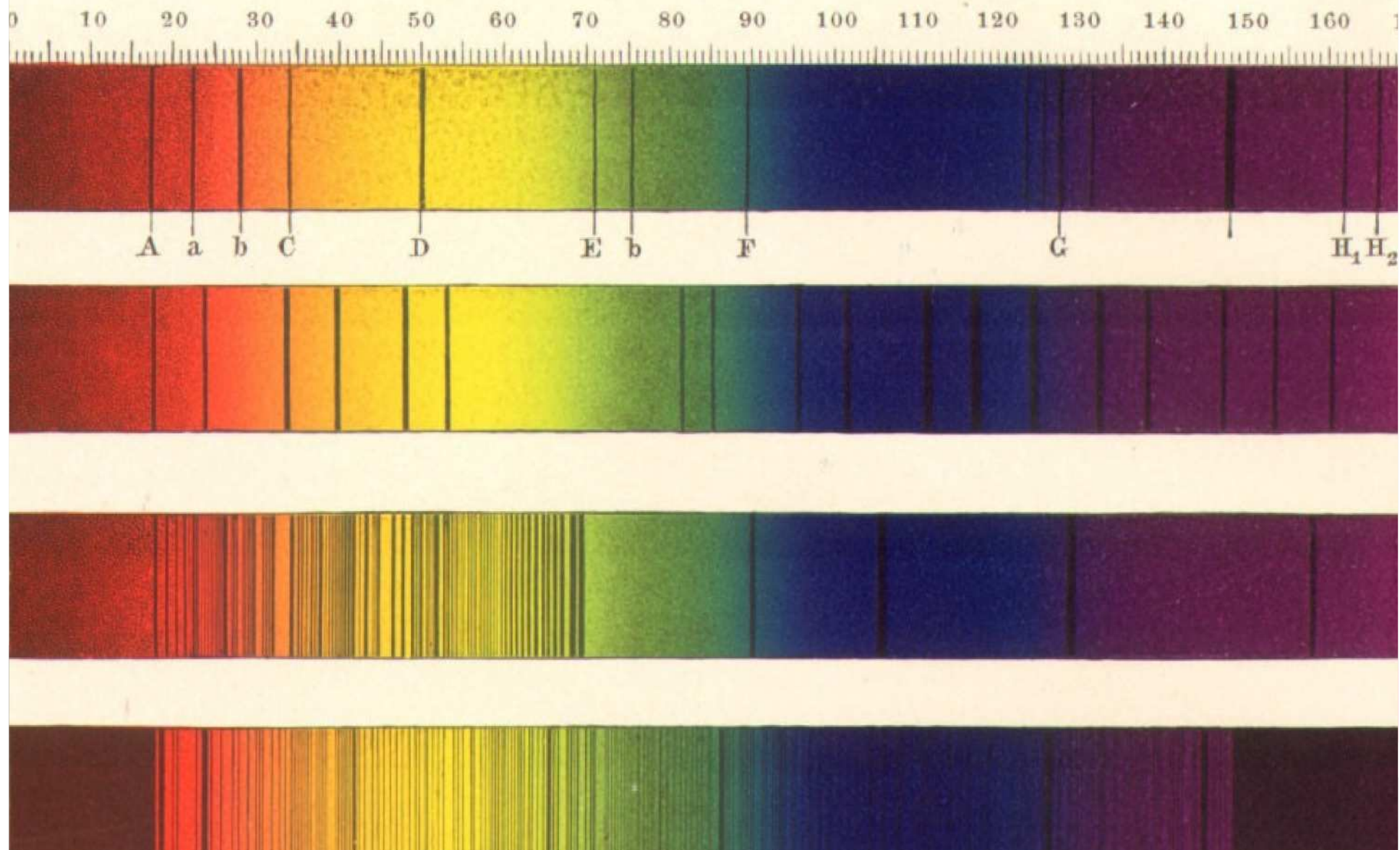


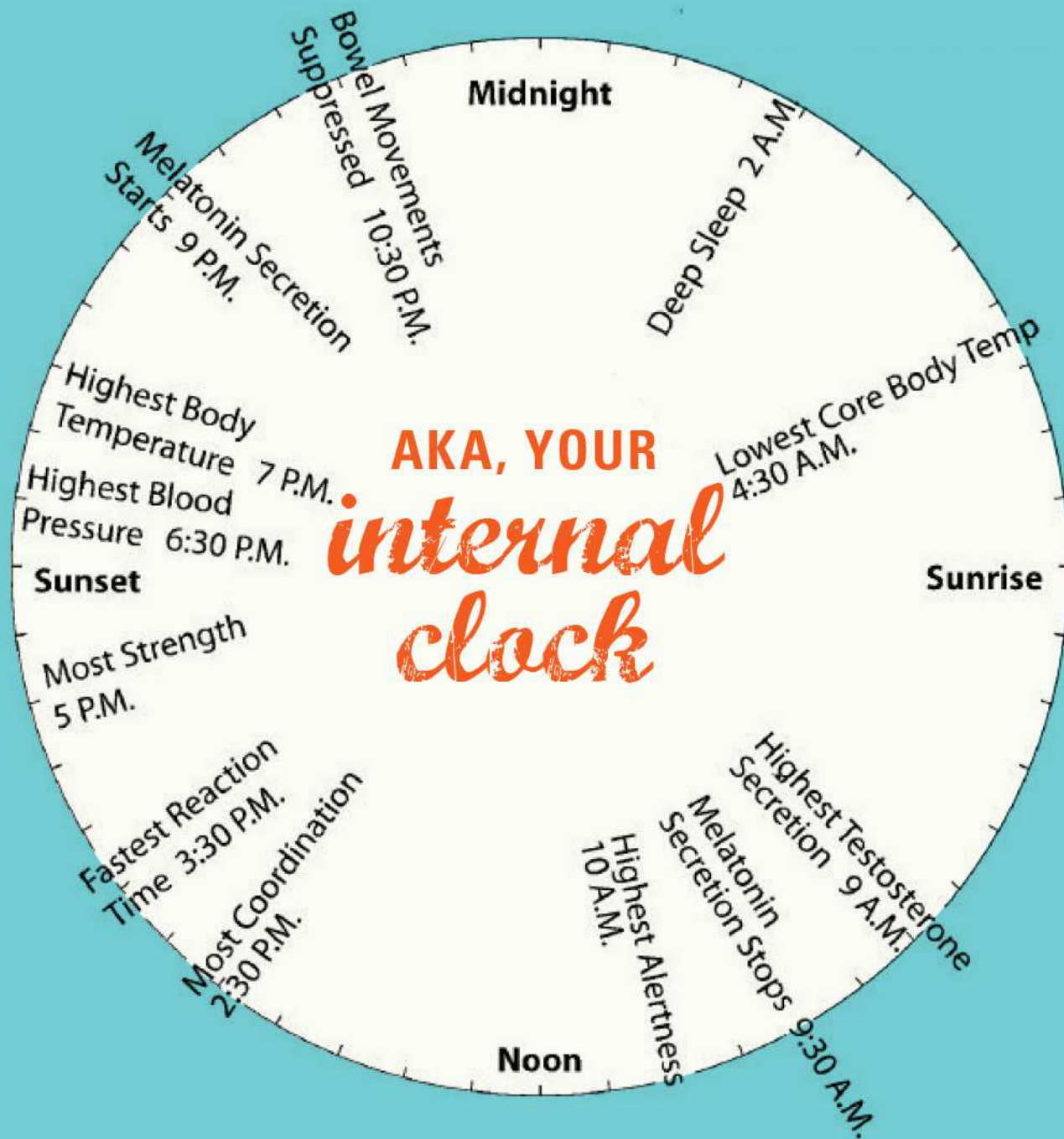
A vintage black and white photograph of a man sleeping in a chair. The man is wearing a light-colored shirt and a dark tie, and is resting his head on his hand. The chair has a patterned cushion. In the background, there is a small table with a lamp, a stack of books, and a newspaper. The text "THE IMPORTANCE OF THE circadian rhythm" is overlaid on the right side of the image.

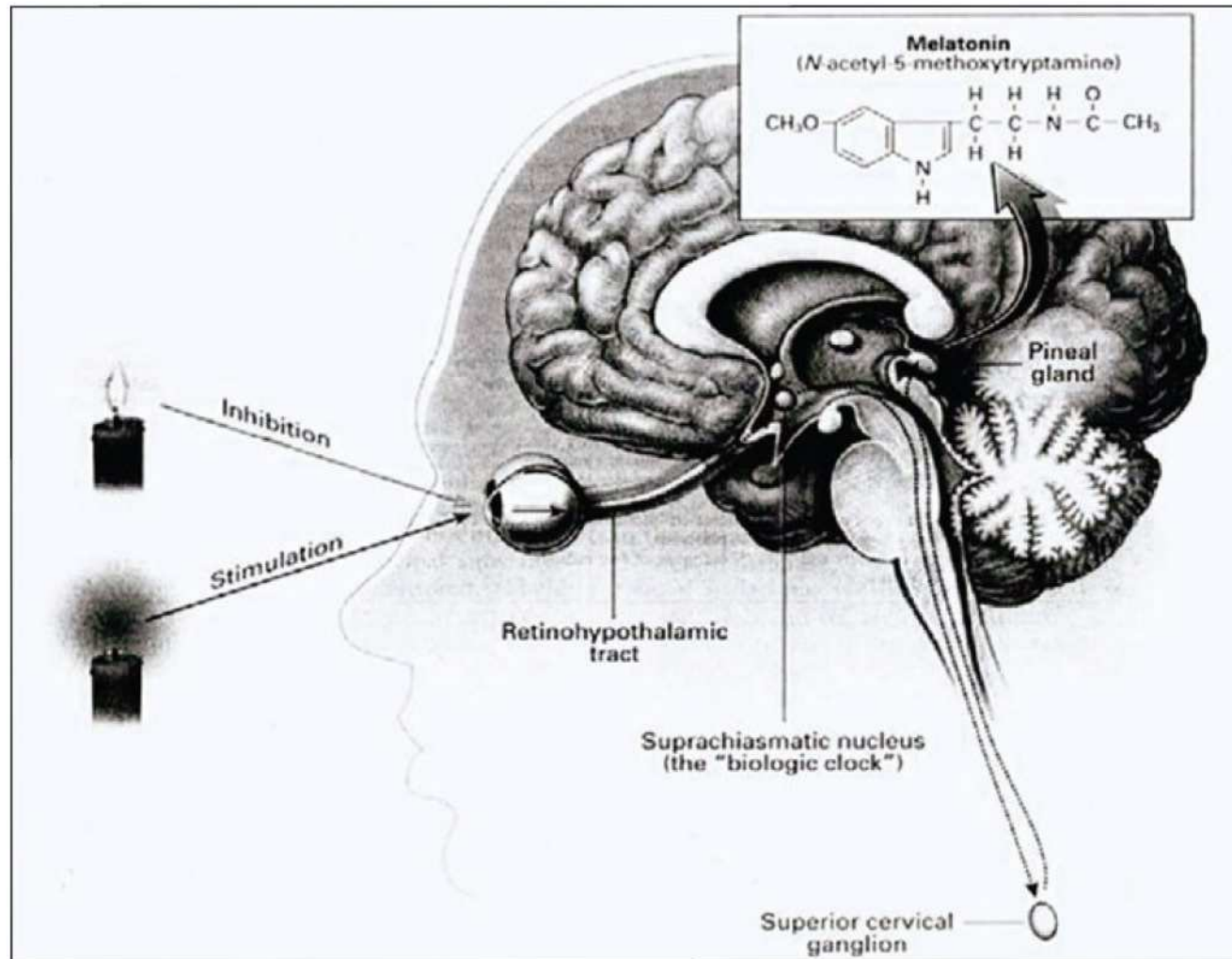
THE
IMPORTANCE OF THE
*circadian
rhythm*

I. Spektren der Fixsterne und Nebelflecke,

verglichen mit dem Sonnenspektrum und den Spektren einiger Nichtmetalle.







suprachiasmatic nucleus



*shift
work*

**LEADS TO
HIGHER RATES
OF CERTAIN
CANCERS,
DIABETES AND
DISEASE**

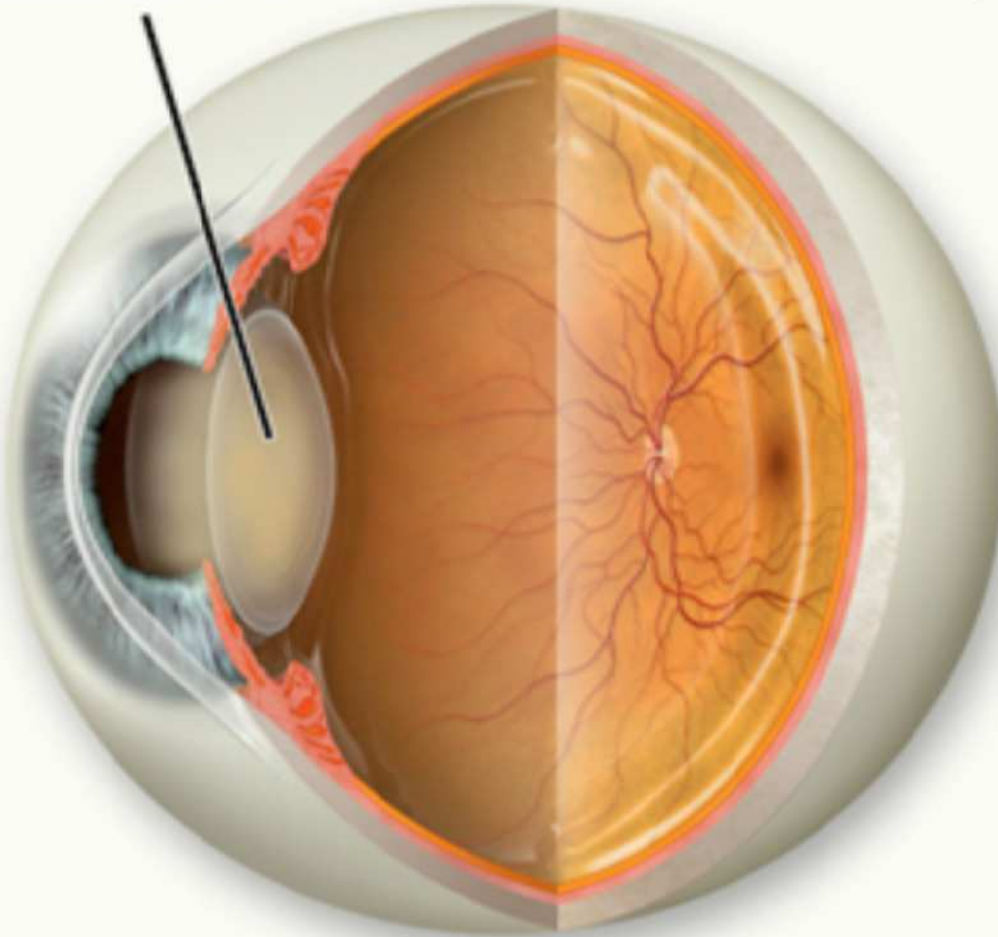
your eyes get

50%

*less light than
they need when
you hit 45*



CATARACT

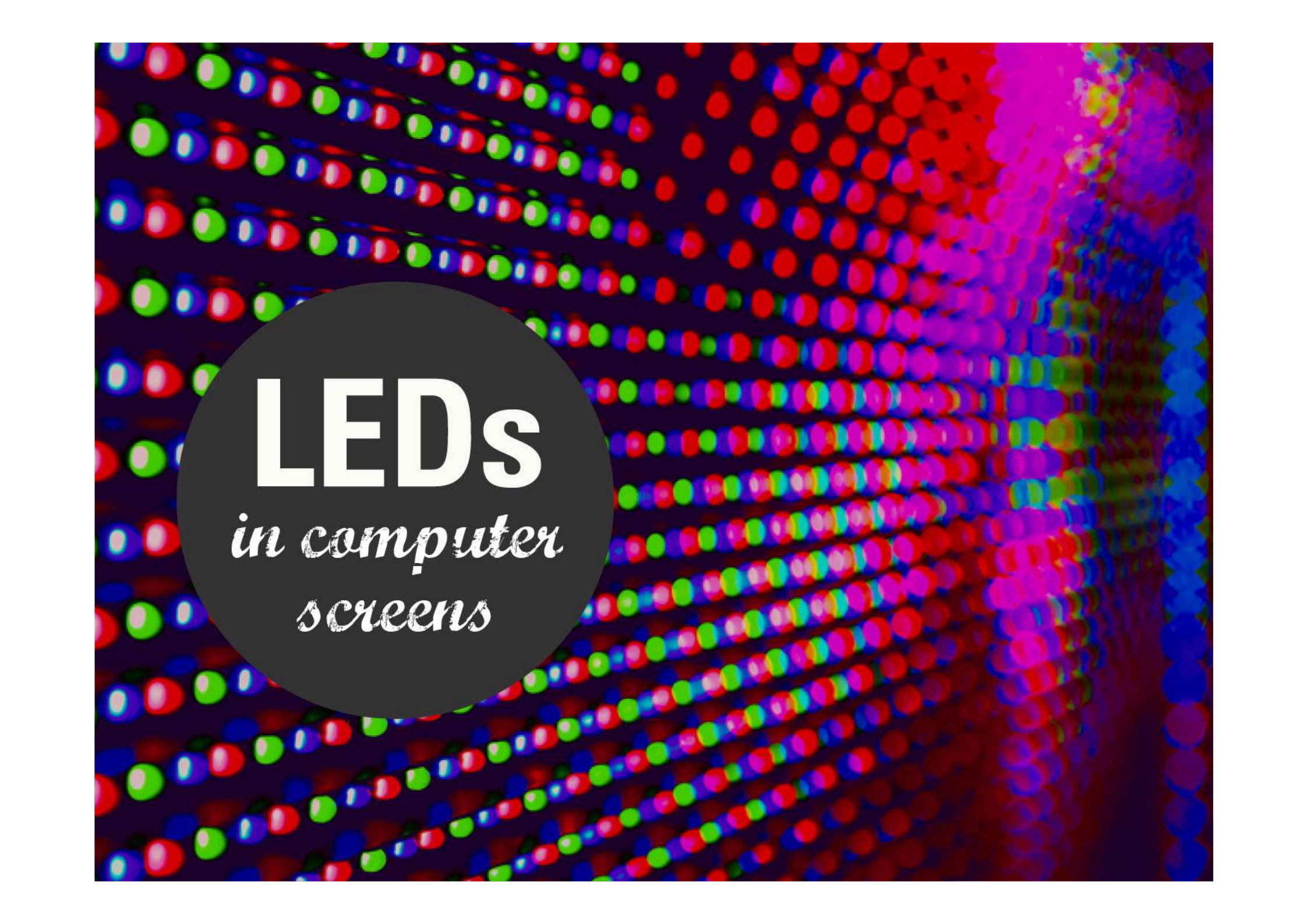


*healthy
eyes*

**IMPROVE YOUR
QUALITY OF LIFE**

THE MANIPULATION OF *lighting*





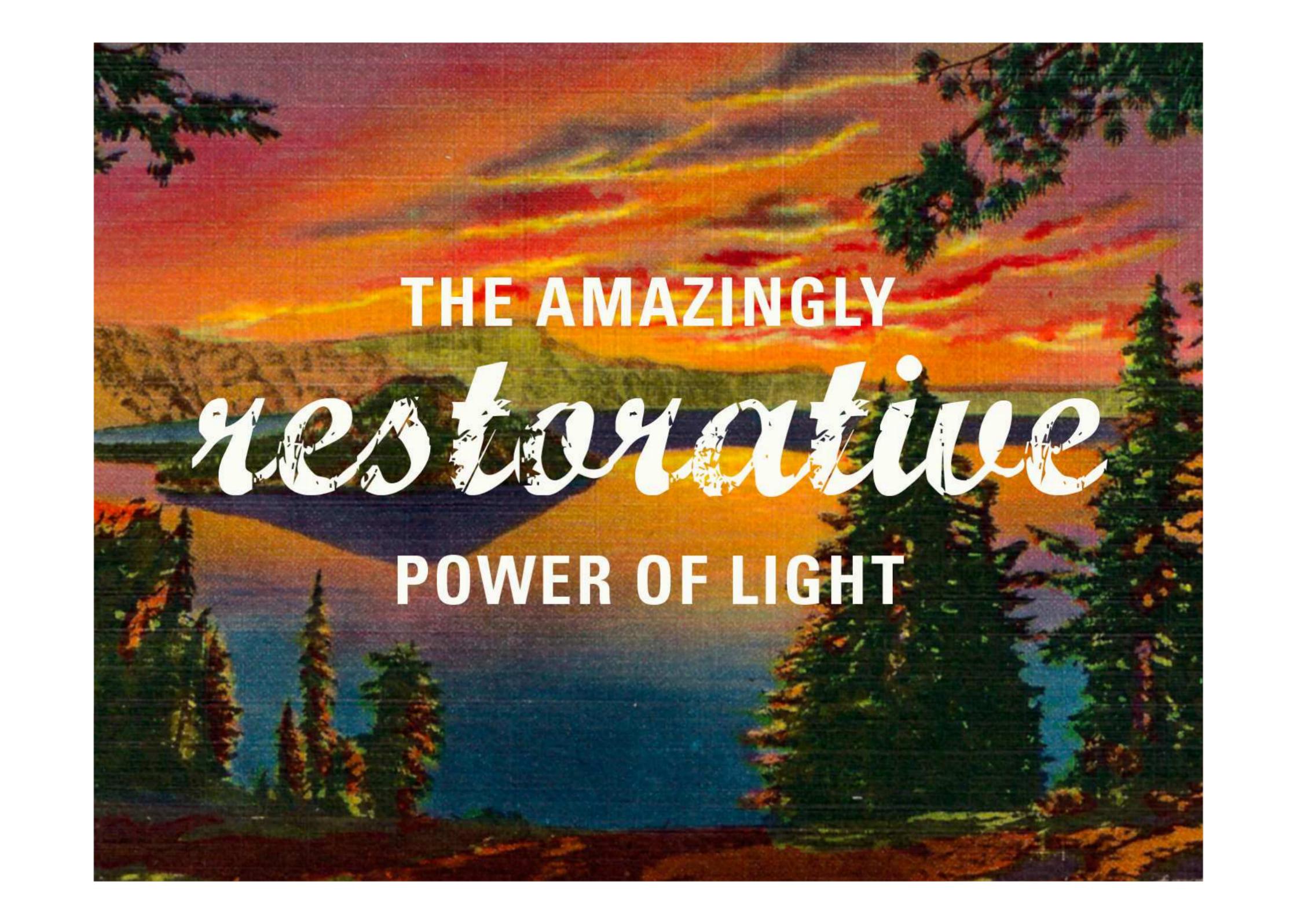
LEDs

*in computer
screens*

A photograph of an airplane cabin interior. The cabin is dimly lit with a strong purple or blue ambient light. Rows of seats are visible, stretching into the distance. Each seat has a small screen on its backrest, which is illuminated with a red light. The ceiling of the cabin is also visible, with recessed lighting. A dark circular overlay is positioned in the upper right corner, containing the text "LEDs in airplanes".

LEDs

in airplanes



THE AMAZINGLY
restorative
POWER OF LIGHT



IMMERSIVE ENVIRONMENTS / BIOPHILIC DESIGN

*seeing vs.
thinking*



The background is a painting of a landscape. In the foreground, there's a field with dark, expressive brushstrokes in brown and black, suggesting furrows or tracks. To the left, there's a cluster of tall, thin trees in shades of green and yellow. In the background, there are rolling hills or mountains under a pale, hazy sky. The overall style is impressionistic or expressionistic.

THE
Savannah
IMAGE EXPERIMENT

THE SAVANNAH IMAGE



SONOMA COUNTY JAIL INTAKE HUB



WAITING ROOM BEFORE



WAITING ROOM AFTER





the results

LOWER

*levels of fatigue
and stress*

HIGHER

*scores on
cognition tests*

FEWER

*incidents in the
intake hub*

A detailed botanical illustration in a classic scientific style, featuring various plant parts. At the top center is a large umbellifer with multiple stems radiating from a central point, each ending in a small flower or bud. To the left is a long, curved, segmented structure, possibly a seed pod or fruit. To the right is a large, textured, diamond-shaped structure, likely a seed or fruit. Below these are several other plant parts, including a cluster of small flowers, a single flower with a long stem, and a small, branching plant. The entire illustration is rendered in a dark, muted green color on a light background.

Biophilic Design

**"THE LOVE OF LIVING THINGS
OR SYSTEM."**



WE ARE WIRED FOR
survival

A teal-tinted photograph of Cookie Monster from Sesame Street. He is sitting at a table covered with a dark cloth. In front of him are four small white plates, each containing two cookies. The background is a teal-colored wall with vertical slats. The text "AND WE ARE REALLY GOOD AT" is in a white, bold, sans-serif font. Below it, the words "pattern" and "recognition" are written in a white, stylized, cursive font.

AND WE ARE
REALLY GOOD AT
pattern
recognition



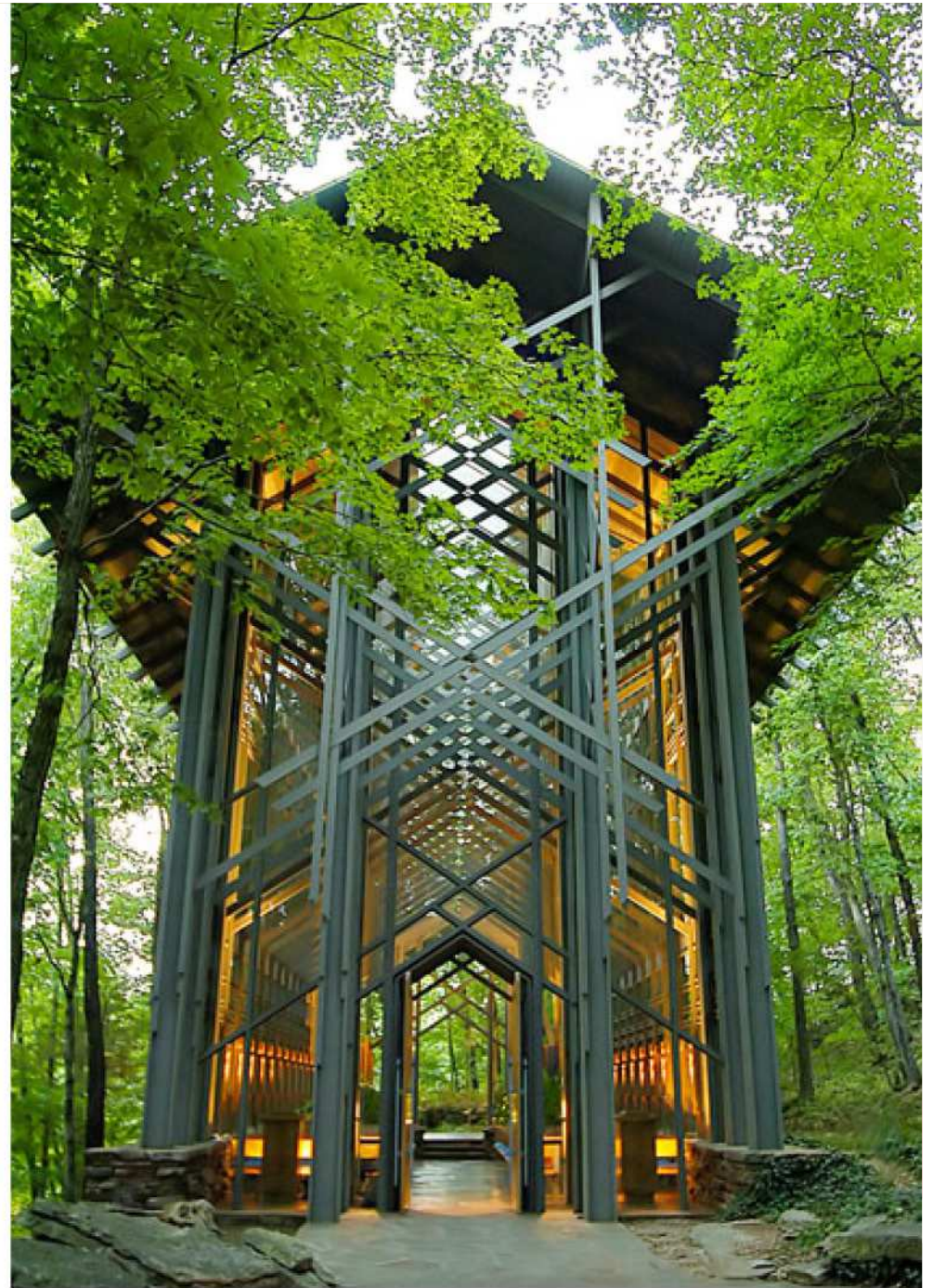
where

**DO YOU PREFER TO SIT
IN A RESTAURANT?**

A detailed painting of a forest scene. A large, ancient tree with thick, gnarled roots and dense foliage dominates the center. In the foreground, a path leads through tall grass and reeds. Several animals, including deer and a fox, are visible. The background shows a body of water and more trees. The overall color palette is dominated by greens and browns, with a slightly muted, painterly quality.

trees or wood

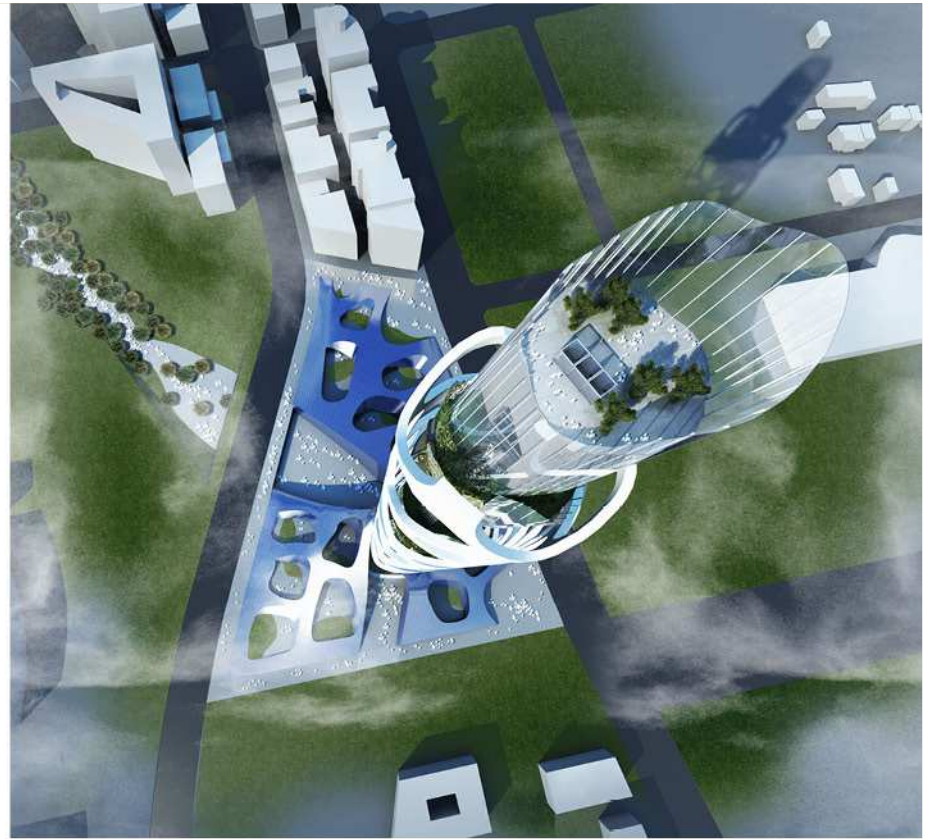
**BRING COHERENCE AND A
QUIETING SENSE OF SCALE**



THORNCROWN CHAPEL



ENTANGELED BANK



TAIWAN TOWER



water
**IS CALMING AND
STRESS REDUCING**



FALLING WATER



BEIJING NATATORIUM

Jahari Courtyard

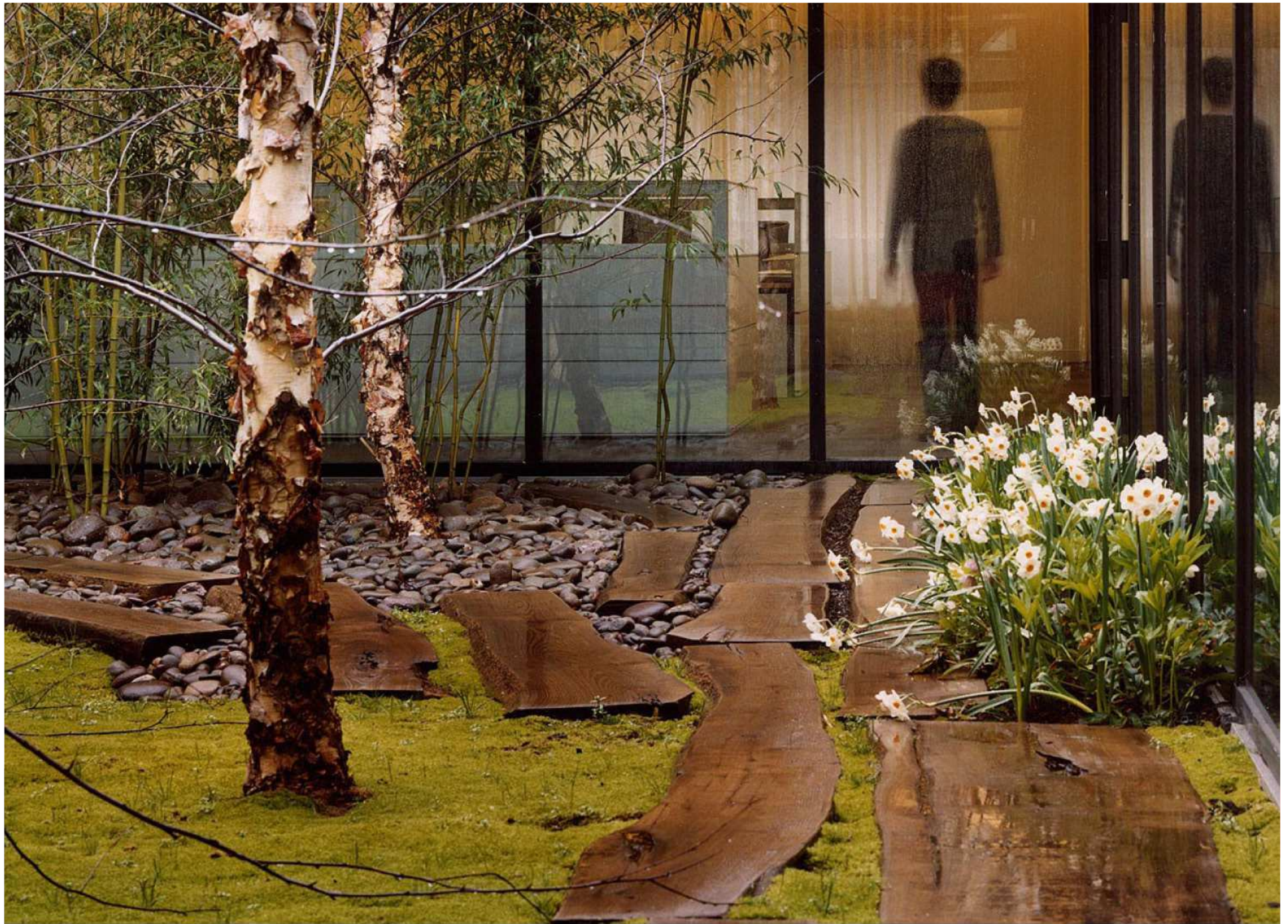




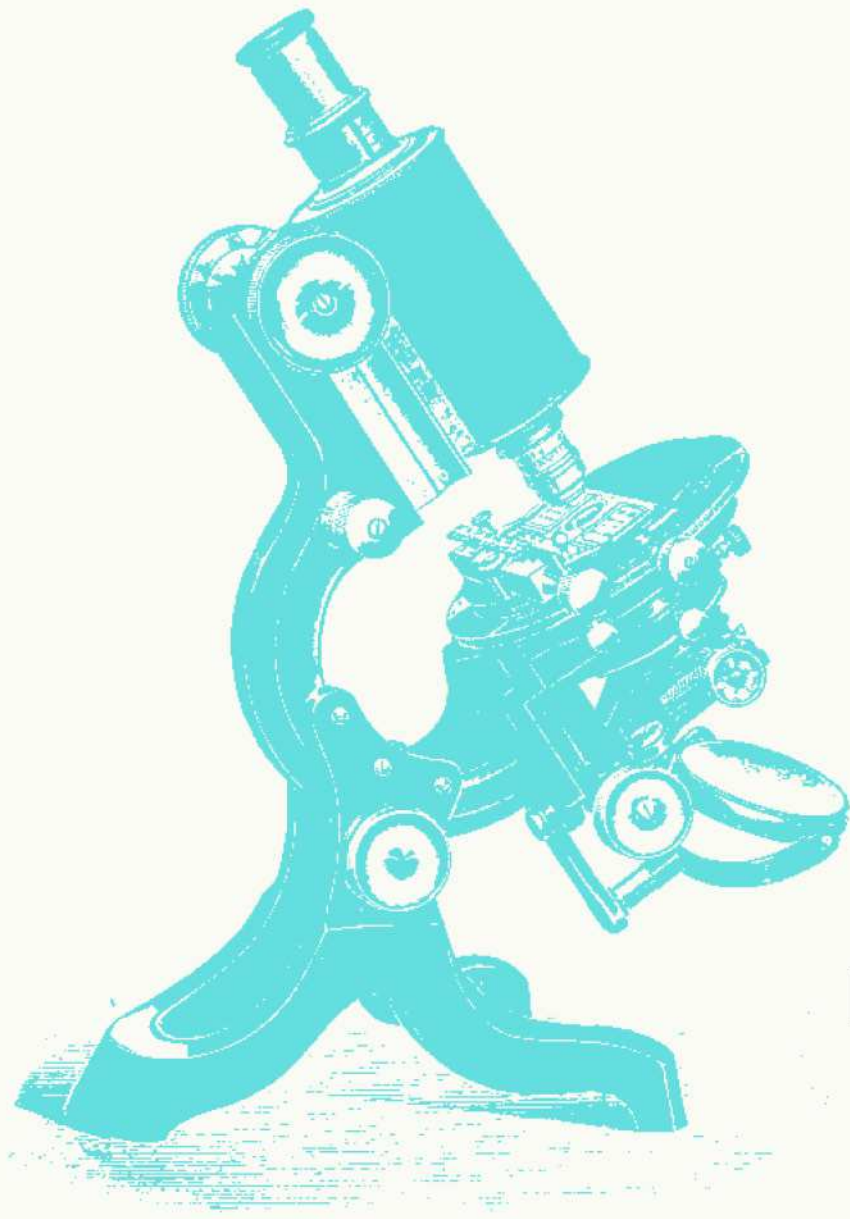
TAHARI COURTYARD



TAHARI COURTYARD



TAHARI COURTYARD



1

**ENRICHED ENVIRONMENTS /
SALUTOGENIC DESIGN**

2

**CHRONOBIOLOGY &
CIRCADIAN RHYTHM**

3

**IMMERSIVE ENVIRONMENTS /
BIOPHILIC DESIGN**

REFERENCE LIST:



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Figueiro, Mariana G., Bullough, John D. & Rea, Mark S. Spectral Sensitivity of the Circadian System. <http://streetlightingresearch.org/programs/lightHealth/pdf/spectralSensitivity.pdf>.

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Kellert, Stephen R., Heerwagen, Judith H. & Mador, Martin. (2008). *Biophilic Design*. John Wiley & Sons, Inc.

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Pauley, Stephen, M. MD FACS. (2004, March). *Lighting for the Human Circadian Clock*. <http://www.darkskysociety.org/handouts/pauley.pdf>.

THIS IS YOUR BRAIN ON SPACE

any questions?