

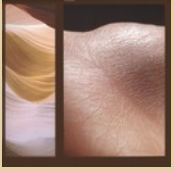


SAARBRUECKEN SENSORY PERCEPTION WORKSHOP

Marille Hahne and Jill Scott

Perception requires various elements to be organized so that related ones are grouped together

Zurich University of the Arts (ZHdK) Switzerland



SENSORY PERCEPTION

GENERAL Sensory Perception

“Its time to create a new interpretative meta-field that bridges the humanities-neuroscience divide.”

Barbara Maria Stafford

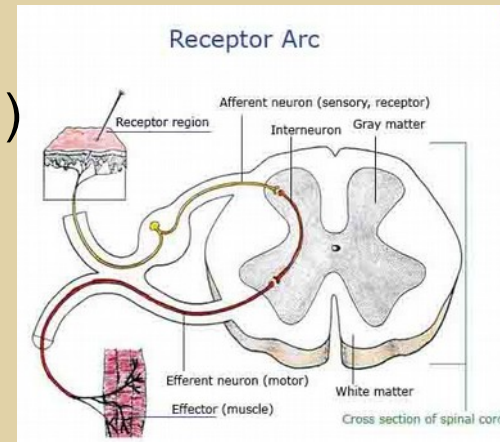
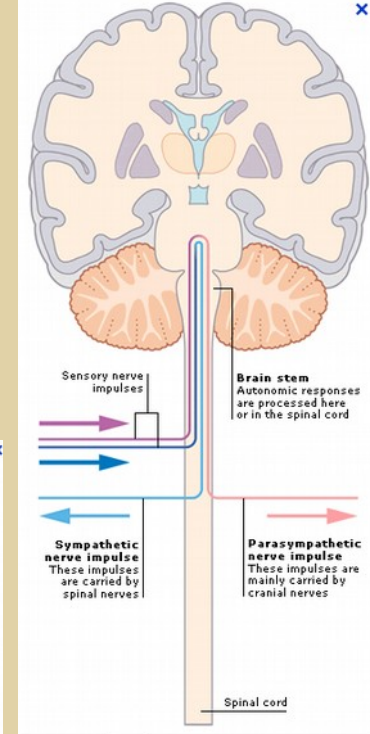
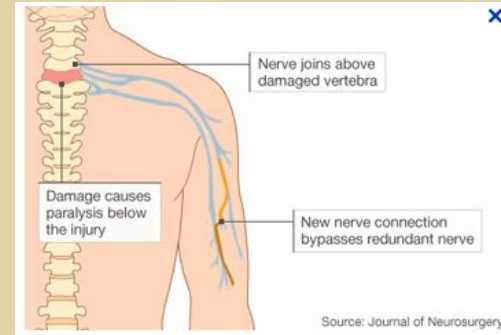


SENSORY PERCEPTION

1. Peripheral Nervous System:
5 Senses:
(taste, touch, smell, sight, proprioception)

2. Central Nervous System
(spinal cord and feedback to the brain)

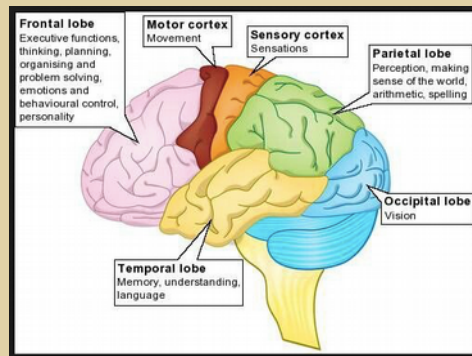
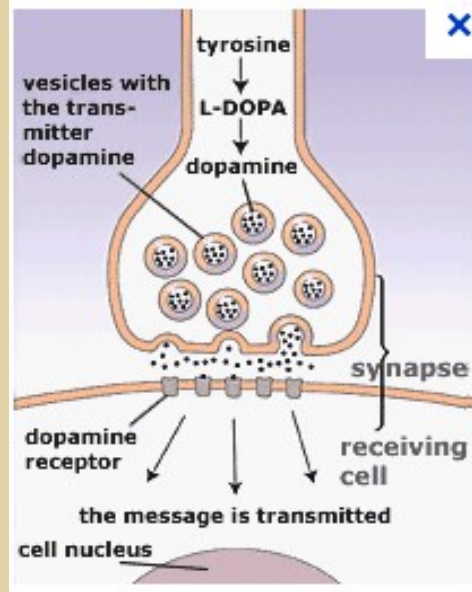
3. Automated Nervous System
(reflex- direct feedback loop
-afferent - sensor muscle-reaction)





Neuroscience and Cognition

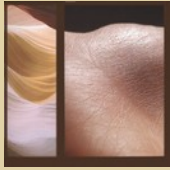
SENSORY PERCEPTION



Neuroscience: insight into the genetic control of neural system, development, degeneration, disease and function mechanisms of the nervous system and resultant behaviours (animal models - wet-labs)

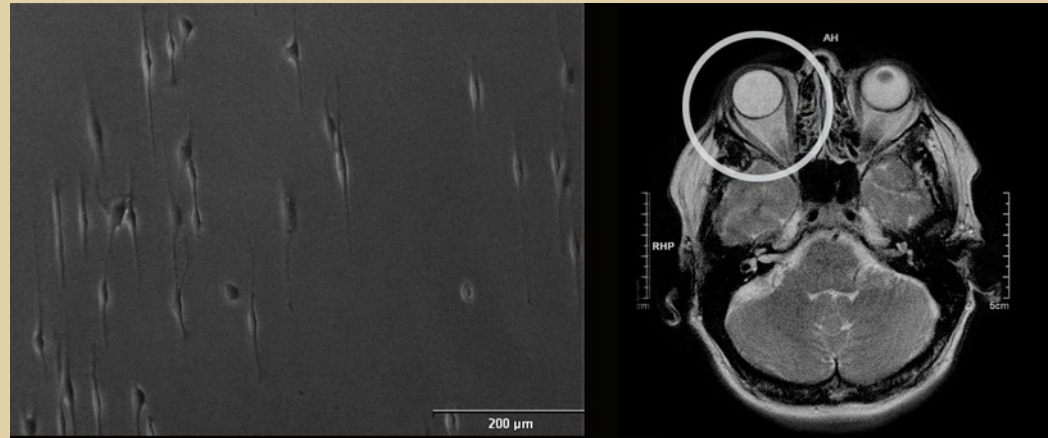
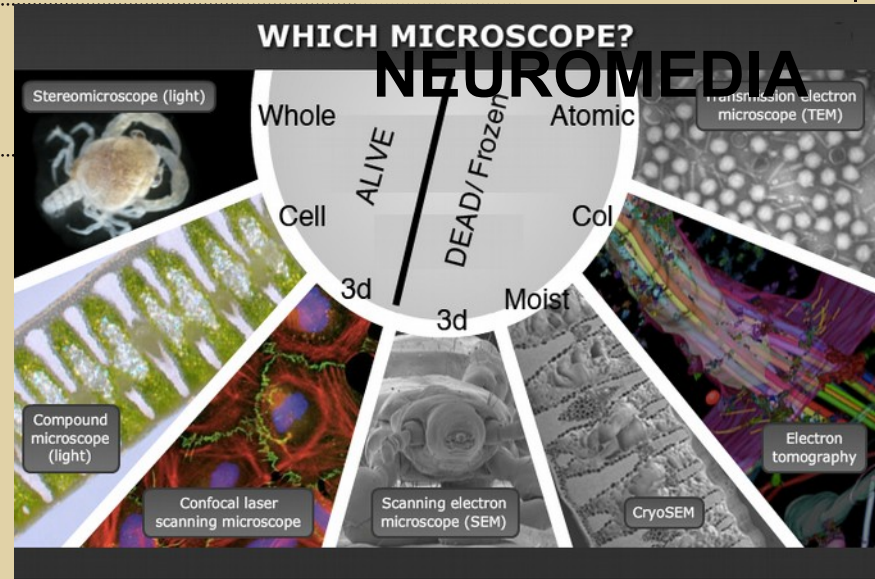
Cognitive science: understand the mind - “how we think” and its relation to “what we think” (psychological/ emotional behaviour - human subjects)

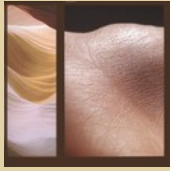
Cognitive Neuroscience: biological substrates underlying cognition with a specific focus on the neural substrates of mental processes (animal and human subjects)



IMAGING THE BODY

“Scientific cinema is part of a broader tendency in society towards the technological surveillance, management and physical transformation of the individual body and the social body“.
(Lisa Cartwright)





What is NEUROMEDIA?

Perception “at the heart of both disciplines”

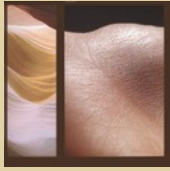
- trillions of efferent (sensory) and afferent (motor) feedback loops
- transmissions through our networked cortexes - flexible associations

Hybrids of **artistic interpretation** and **neuroscience research**
about how our sensory perception might be stimulated

Collaborative attempts to demystify the complexity of perception and brain plasticity

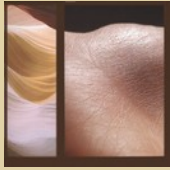
Artworks with interactive technologies combining the viewers own perceptive modalities and behaviour with scientific research in the same subject

Combinations of self-reflection and scientific objectivity



The **NEUROMEDIA** Series: 2003-2019

1. Neural Development: **SOMABOOK 2009**
2. Visual Perception: **THE ELECTRIC RETINA 2007**
3. Tactile Perception: **e-SKIN 2003**
4. Skin and our Environment: **DERMALAND 2012**
5. Hearing Loss: **AURALROOTS 2015**
6. The Evolution of Vision: **JELLYEYES 2017**
7. The Phenomena of Flavour: **AFTERTASTE 2019/2020**



Collaboration with neuroscientists encourages artists to think about differently about the body as a medium:

-explore methodologies in science through hands-on-access to “wet-lab” and “live” cellular and molecular representations. Use these materials as potential art materials

-think about embodiment of the users in neural feedback loops in relation to their environment

-make analogies between animal and human subjects

-be concerned about new roles for themselves in the fields of representation about ability, disability or impairment

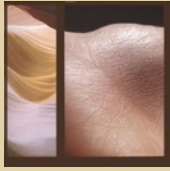
-create interpretations for know-how transfer about our own molecular and cellular structures from robust scientific inspiration



YOUR IDEAS

Possible Themes for your prototype projects

- Learning
- Stress
- Language
- Aging
- Sleep
- Drugs
- Neural Impairment



WORKSHOP THEMES

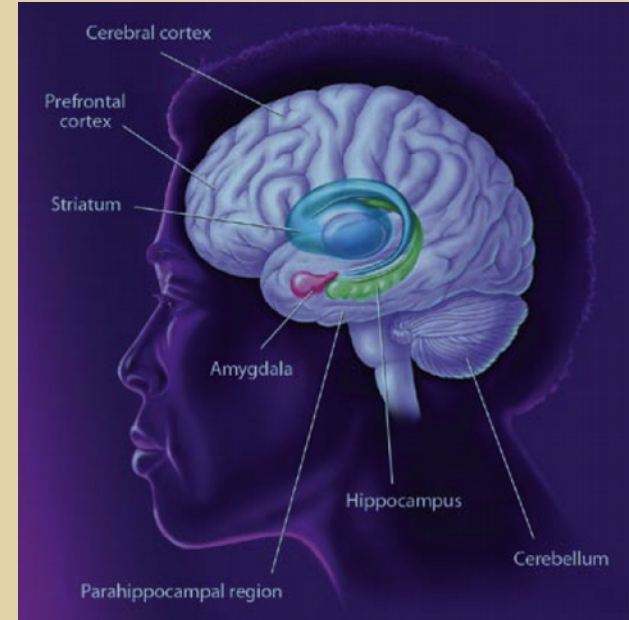
LEARNING and MEMORY

Different brain areas and systems mediate distinct forms of memory.

The hippocampus, parahippocampal region,

The cerebral cortex (including prefrontal cortex)

Different forms of nondeclarative or behavioral, memory are supported by the amygdala, striatum, and cerebellum





VISION

Sensory Perception

“one system processes shape, another color and yet another movement, organization and spatial orientation”

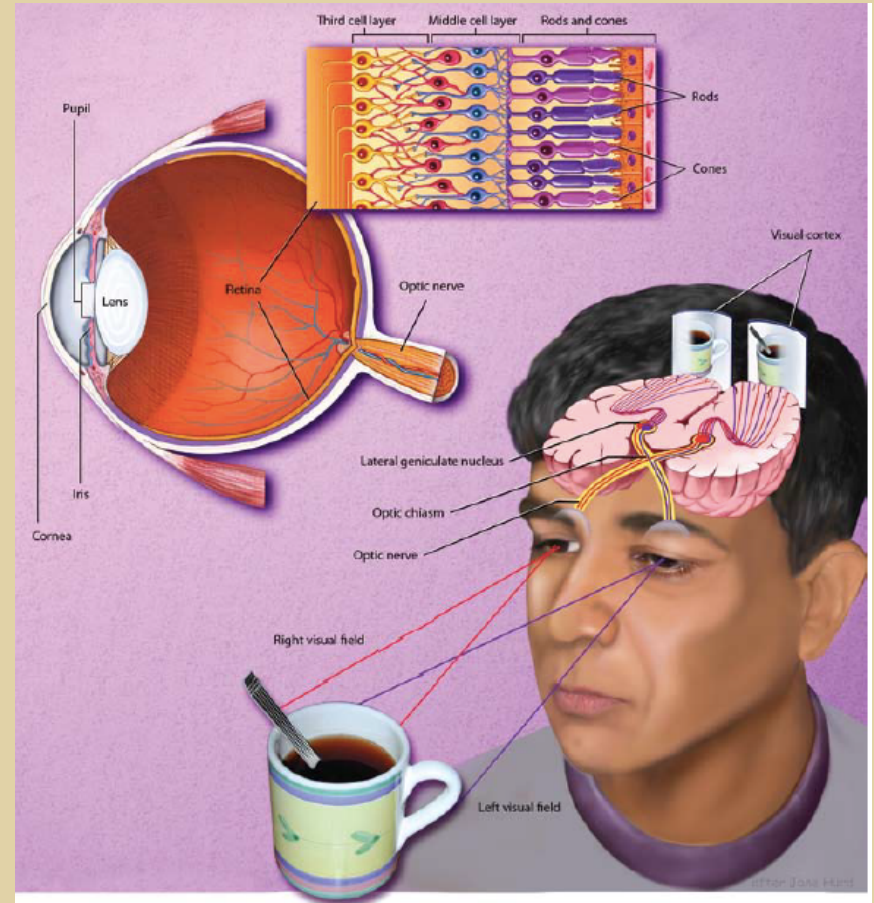
Brian Primer



VISION

NEUROMEDIA

- VISION.
- The cornea and lens
- a camera, million visual receptors — composed of rods and cones Retina- red, green, blue
- Rods and cones
- optic nerve, and the optic chiasm,
- lateral geniculate nucleus
- the visual cortex.

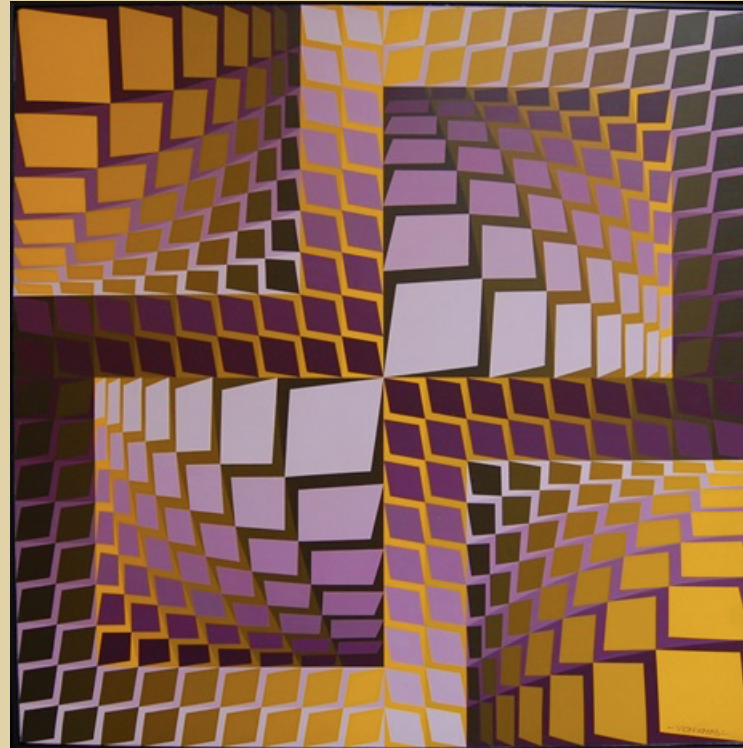




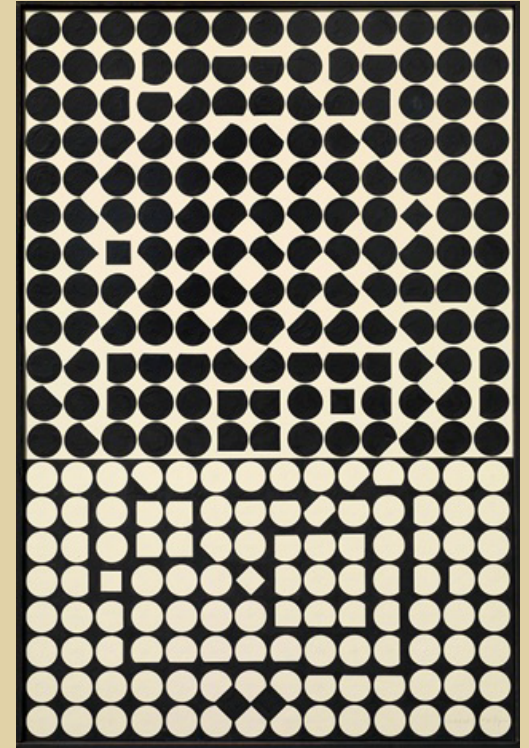
VISION

NEUROMEDIA

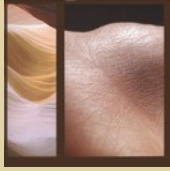
Opp Art
influenced
by
Neuroscience



Bridget Reilly 1960



Victor Vasarely
1950



VISION

NEUROMEDIA

SIGHT

SELECTIVE ATTENTION and there are many more
here

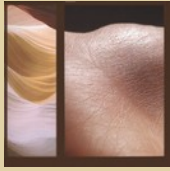
<http://www.theinvisiblegorilla.com/videos.html>

10 Mind blowing Optical illusions

<https://www.youtube.com/watch?v=-IWk5NkxQF8>

Powers of Ten

<https://www.youtube.com/watch?v=55Gpm1Q0abk>



Visual Perception: ELECTRIC RETINA NEUROMEDIA

The Visual System : Your eyes are the eyes of a fish!

The Stephan Neuhauss Lab

Research Focus:

-aspects of photoreceptor adaptation, mechanisms of synapse formation and function, cone specific facets of visual pigment regeneration, as well as behavioural consequences of wiring defects of the optic nerve (cone dominated zebra fish retina)





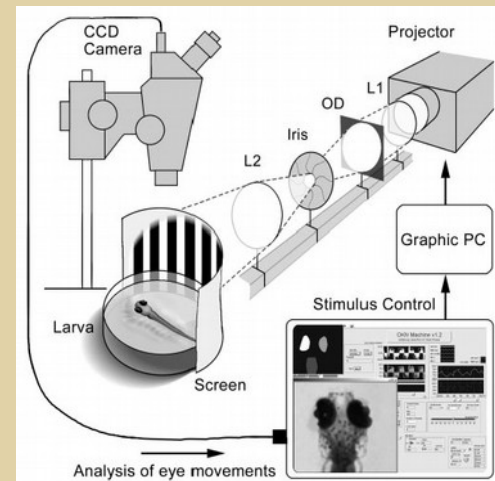
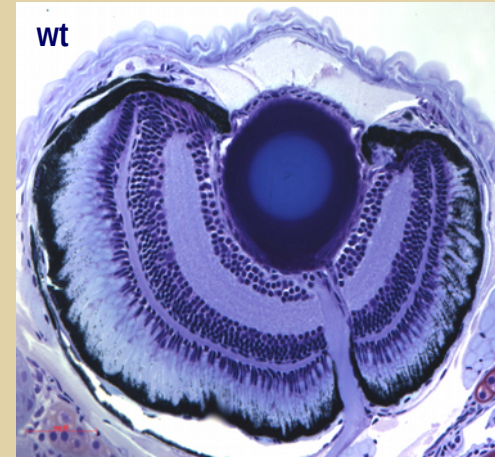
Visual Perception: ELECTRIC RETINA NEUROMEDIA

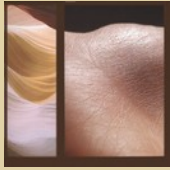
Scientists at this lab

-invent experiments to measure behaviour and understand human impairments through Retinal Zebra Fish Research

-utilize Histology, DNA analysis, Electromagnetic Response, Opto-Kinetic Response as evidence of eye disease, degeneration and genetics

The Optokinetic Response (OKR)
in zebra fish larvae mutants





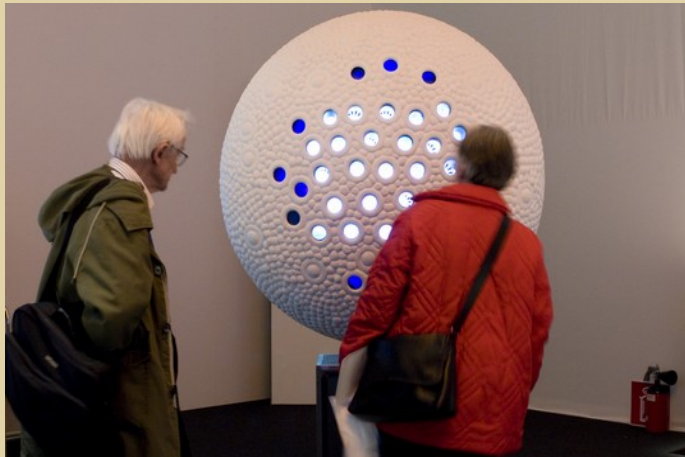
Visual Perception: ELECTRIC RETINA NEUROMEDIA

Position

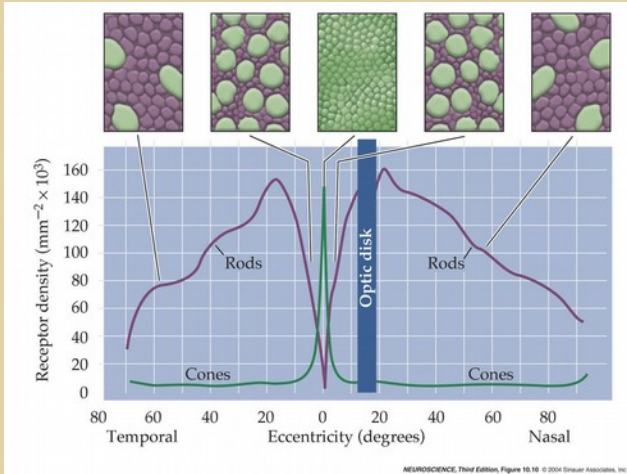
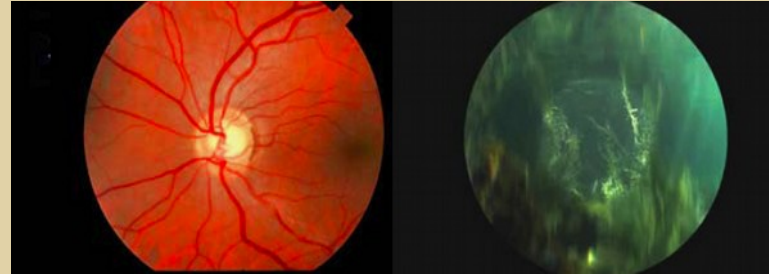
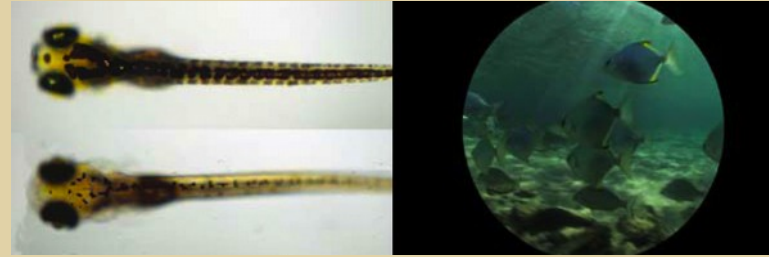
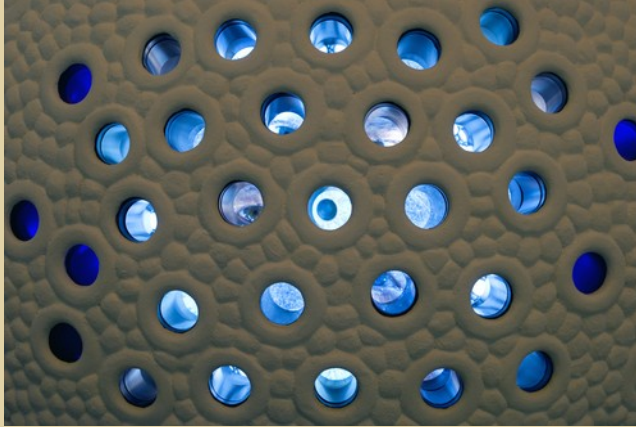
Viewer stands "inside the brain"
looking out the
retinal photoreceptors

Projection on the wall

displays the behavioural symptoms

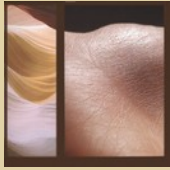


Visual Perception: ELECTRIC RETINA NEUROMEDIA



Animated Scientific Evidence in Cones
-genetic deficiency cognitive or retinal impairments congenital nystagmus (Belladonna) light adaptation

1. Fish Noir-Mutant - Protein Deficiency
2. Glaucoma-Optic Nerve Disease



Visual Perception: ELECTRIC RETINA NEUROMEDIA

Aims

To raise viewers awareness about eye disease and resultant perceptual behaviour and bodily reaction

To use scale as a metaphor for learning about vision

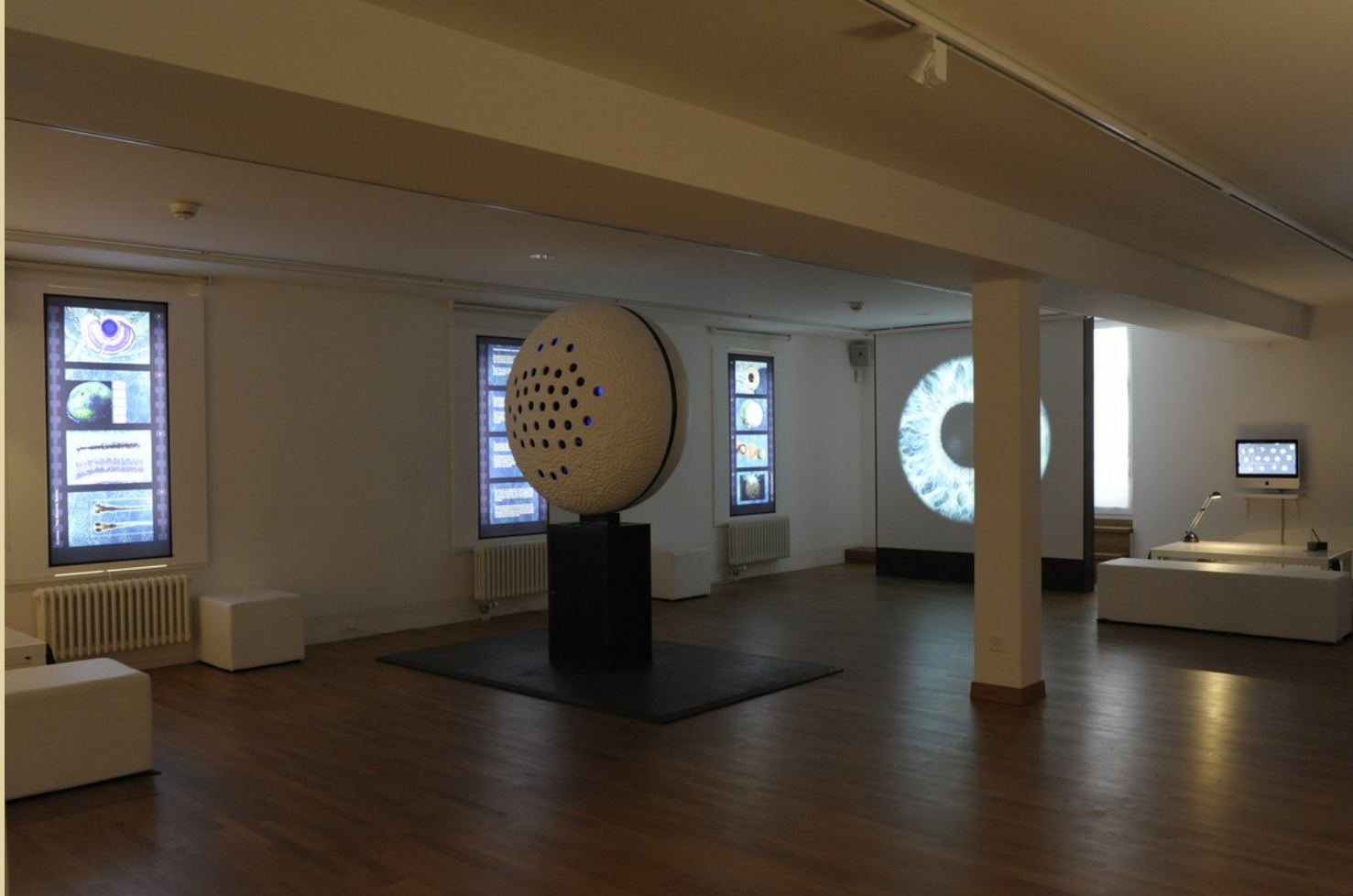
To represent the relation between mutant behaviour and visual perception

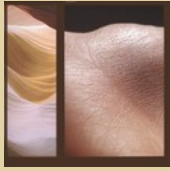
To humanize the scientific research and deepen the understanding of the interdependent complexity between the eye and the brain



Kulturama Science Museum (Scott)

NEUROMEDIA





Evolution and Vision: JELLYEYES

NEUROMEDIA

Evolution of the eyes of 3 characters: **Humans, Squids and Jellyfish**

Co-evolution

- symbionts are essential for survival of coral, algae, squid and jellyfish
- our interventions change these interdependencies

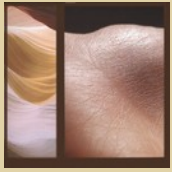
Structural Evolution

- Margulis: evolution of the cilia in the photoreceptors

Comparative Evolution

- Margulis ponders on looking through the eyes of other species





Evolution and Vision: JELLYEYES





Evolution and Vision: JELLYEYES

NEUROMEDIA



GENETICS

SURVIVAL

HABITAT

OPSIN

RELATIONS

ADAPTATION



reproduction

destruction

chordates

"In looking for gradations by which an organ in any species has been perfected, we ought to look exclusively to its lineal ancestors"
Charles Darwin

molluscs

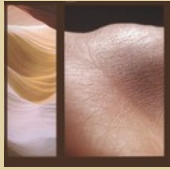
pigment

photoreceptors

metazoans

symbiosis

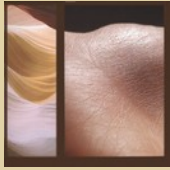
endosymbiosis



Evolution and Vision: JELLYEYES

NEUROMEDIA

"Jellyeyes"
by Jill Scott
at the Zoological Museum
Zurich, 2017



SMELL AND TASTE=Flavour Sensory Perception

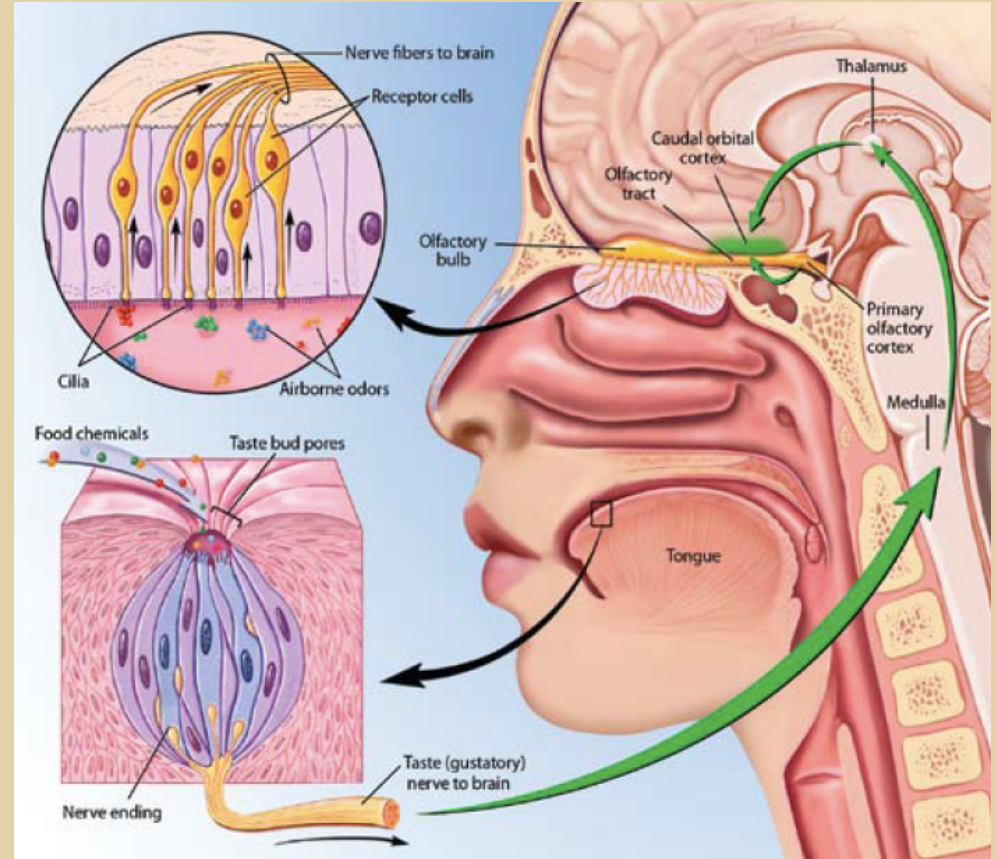
„Smell is a potent wizard that transports us across thousands of miles and all the years we have lived

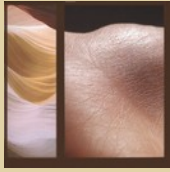
Helen Keller



NEUROMEDIA

SMELL CILIA receptors –
for odour molecules
Whose axons go to the
olfactory bulb. To the
primary
olfactory cortex. And the
limbic system -emotions





NEUROMEDIA

TASTE

taste buds 5,000 to 10,000.

100 receptors in each taste bud respond to

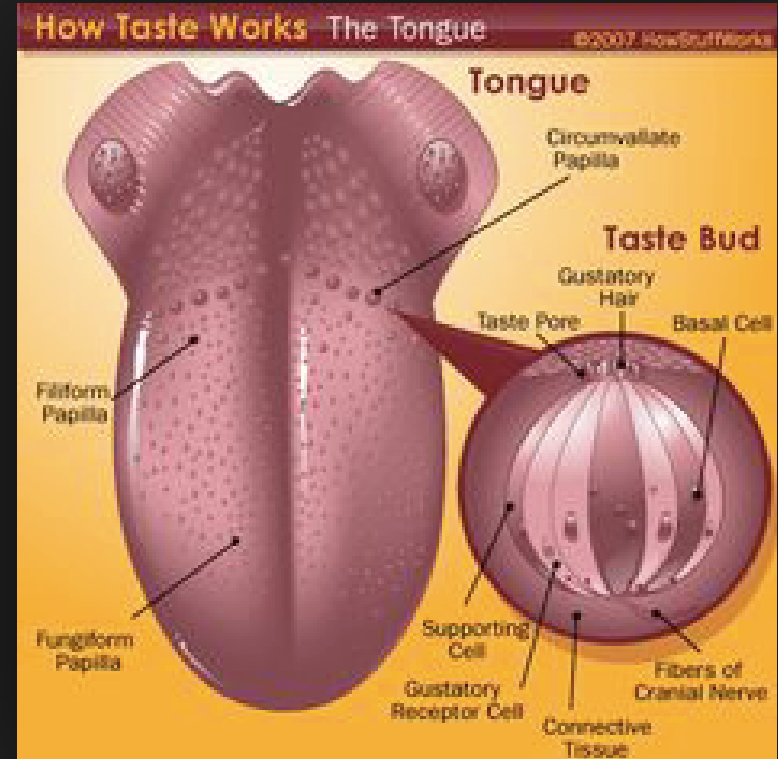
Stimuli-sweet, salty, sour, bitter, and umami

cranial nerves and taste centers in the brain.

FAVOUR

Taste and smell form flavor in the caudal

(back) part of the orbital cortex.





NEUROMEDIA



Paul Bach y Rita

brain

plasticity and sensory substitution

and so he was interested to

take one sense and use it to detect
another:

<[http://nro.sagepub.com/cgi/
content/abstract/2/5/260](http://nro.sagepub.com/cgi/content/abstract/2/5/260)>.





NEUROMEDIA

TASTE

Janet Lawrence

Elixia Bar japan other places.

<http://www.janetlawrence.com/elixir/>





NEUROMEDIA



THE SCENT OF SYDNEY (2014-15) CAT JONES

Body In Mind, Sansom Institute and School of Medicine and Pharmacology, University of Western Australia.



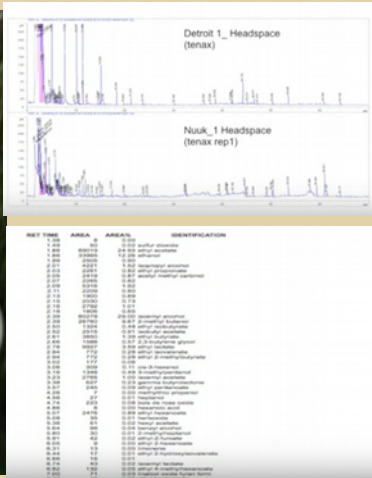
NEUROMEDIA

SMELL

Sissel Tolaas- Uses industrial tool (Headspace to measure chemical odor- then manufactures them in her lab- below)

<https://www.youtube.com/watch?v=jXh1UFu2YKc>

<https://www.researchcatalogue.net/view/7344/7350/40/40>



Abstract Molecules



NEUROMEDIA

SMELL Sissel Tolaas continued..

Smell as a learning tool with software called the nose
Smell is about Tolerance,
(We cover up our unpleasant smells to fit in- we have a right to know what fits in)

Awareness (Smells can document histories-of inhabitants for example- their breath after drinking)

Navigation based on Smell-Berlin
Or Pollution smells of a place

ST(62) + PGh (76)
x Rp (100), 10 IsoEsuper,
neira 2,765 00Adear de678...

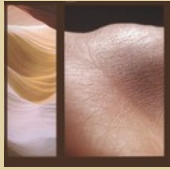




NEUROMEDIA

SMELLSissel Tolaas-. Navigation binding technology into any material : eg. Paint.





HEARING and LISTENING

Sensory Perception

“it’s the first sense to develop and the last to go.”

Jill Scott



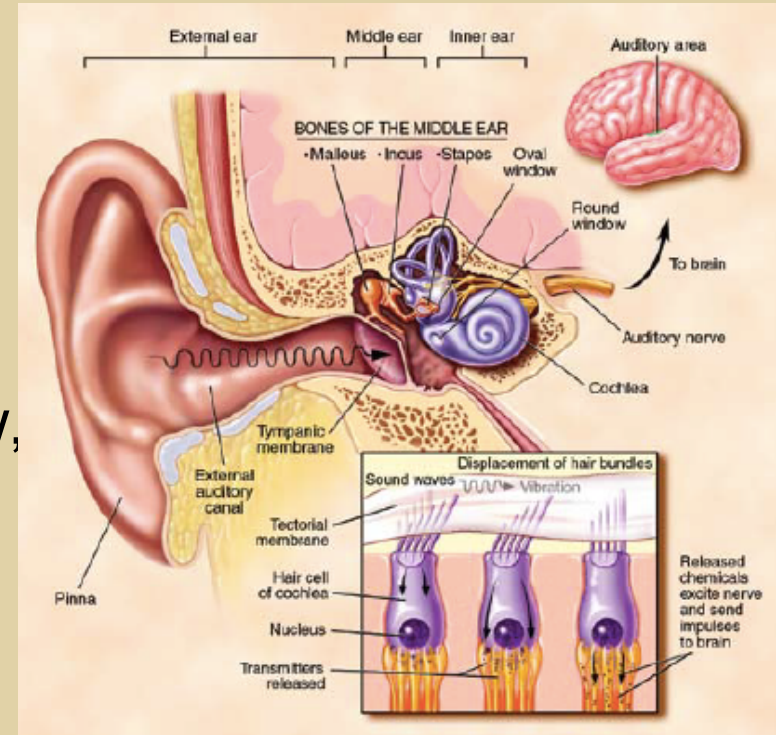
NEUROMEDIA

HEARING.

the external ear — the pinna
auditory canal, the tympanic
membrane (eardrum)
the malleus (hammer)
stapes (stirrup). the oval window,

Inner ear

cochlea + stereocilia
the auditory nerve
mid brain
The auditory cortex





HEARING

Online hearing test

https://www.audiocheck.net/testtones_hearingtestaudioiohp

Singing MRI Tyley Ross

<https://www.youtube.com/watch?v=J3TwTb-T044>

Victoria Vesna (Acoustic Aquarium)

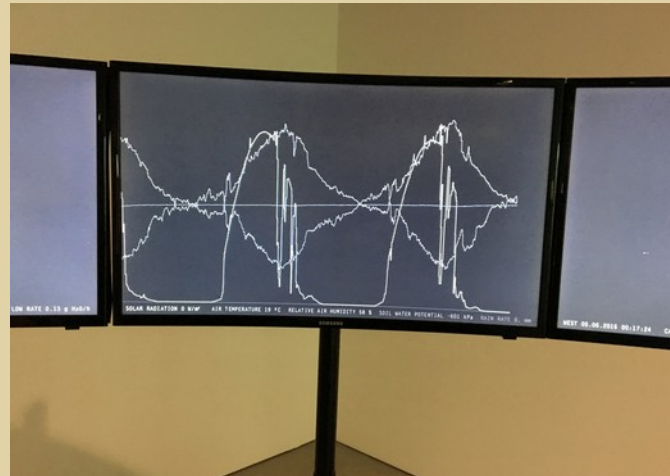
<http://victoriavesna.com/index.php?p=projects&item=0>

<http://noiseaquarium.com>



Marcus
Maeder.

The
sound of
water,
photosynt
hesis



NEUROMEDIA



[http://www.domizil.ch/
marcus_maeder/musi
c.html](http://www.domizil.ch/marcus_maeder/music.html)



Film: Dusk Chorus: Fragments of Extinction

Features EcoAcoustic Researcher: **David Monacchi**

<https://vimeo.com/209585874>

Listen to recordings- dry forest, swamp etc.

<http://www.fragmentsofextinction.org/listen-to-ecosystems/africa/drylandforest01/>



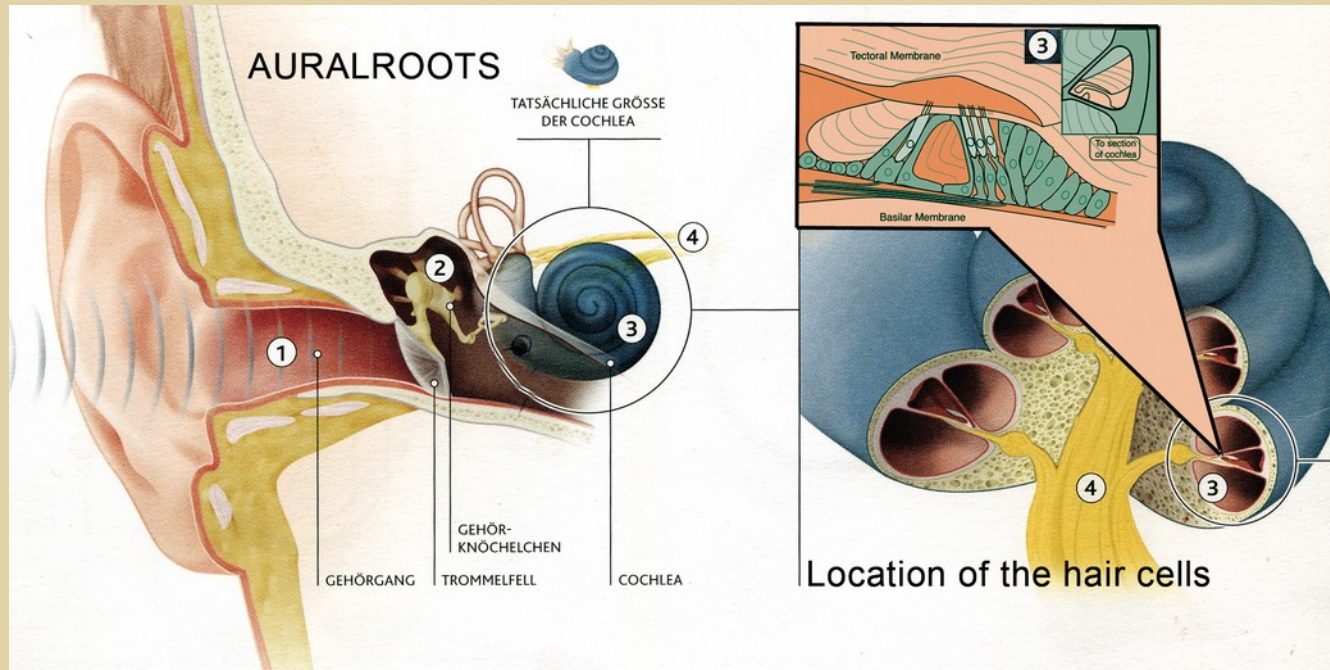
Sound Perception: AURAL ROOTS

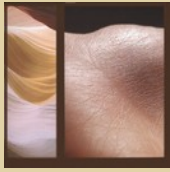
NEUROMEDIA

AURALROOTS- University Hospital Zurich- Symbiotica in Perth

-Tactile and auditory senses

-Stereocilia - top of hair cells in the Cochlea-organ of Corti
convert vibrations of the fluid in the inner ear into electrical signals.

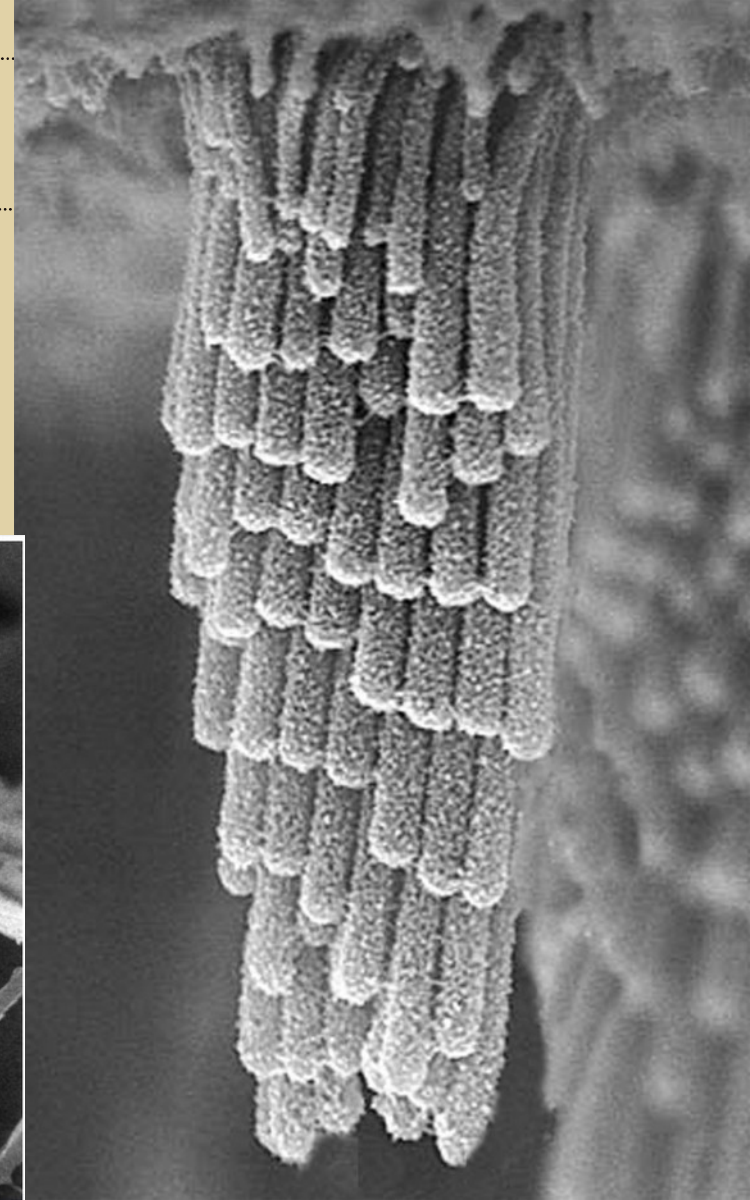
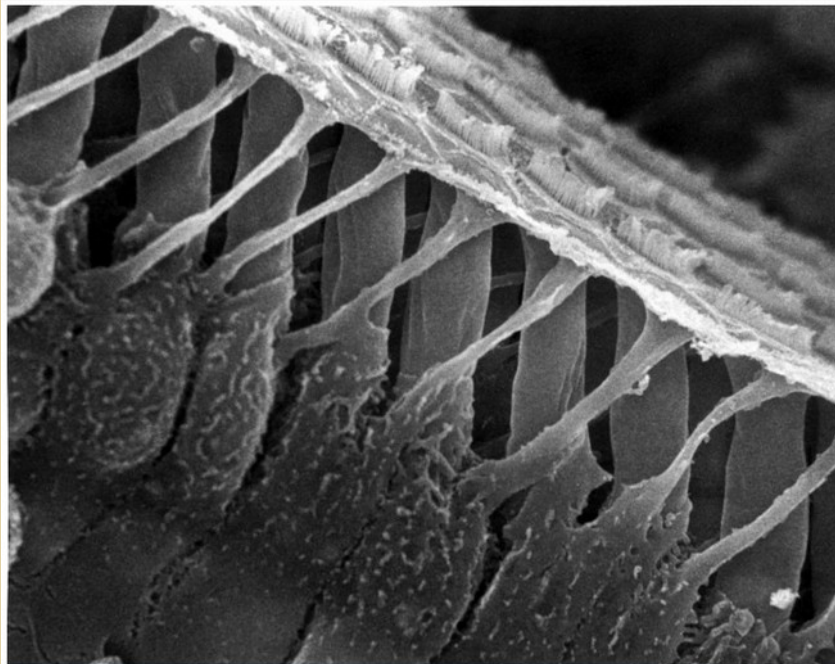


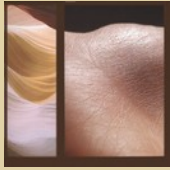


Sound Perception: AURAL ROOTS

-scale

the hair cells (Scanning Electron Microscope)
-shifts in sound and visual information
as they are manipulated.

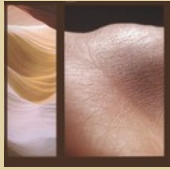




Sound Perception: AURAL ROOTS

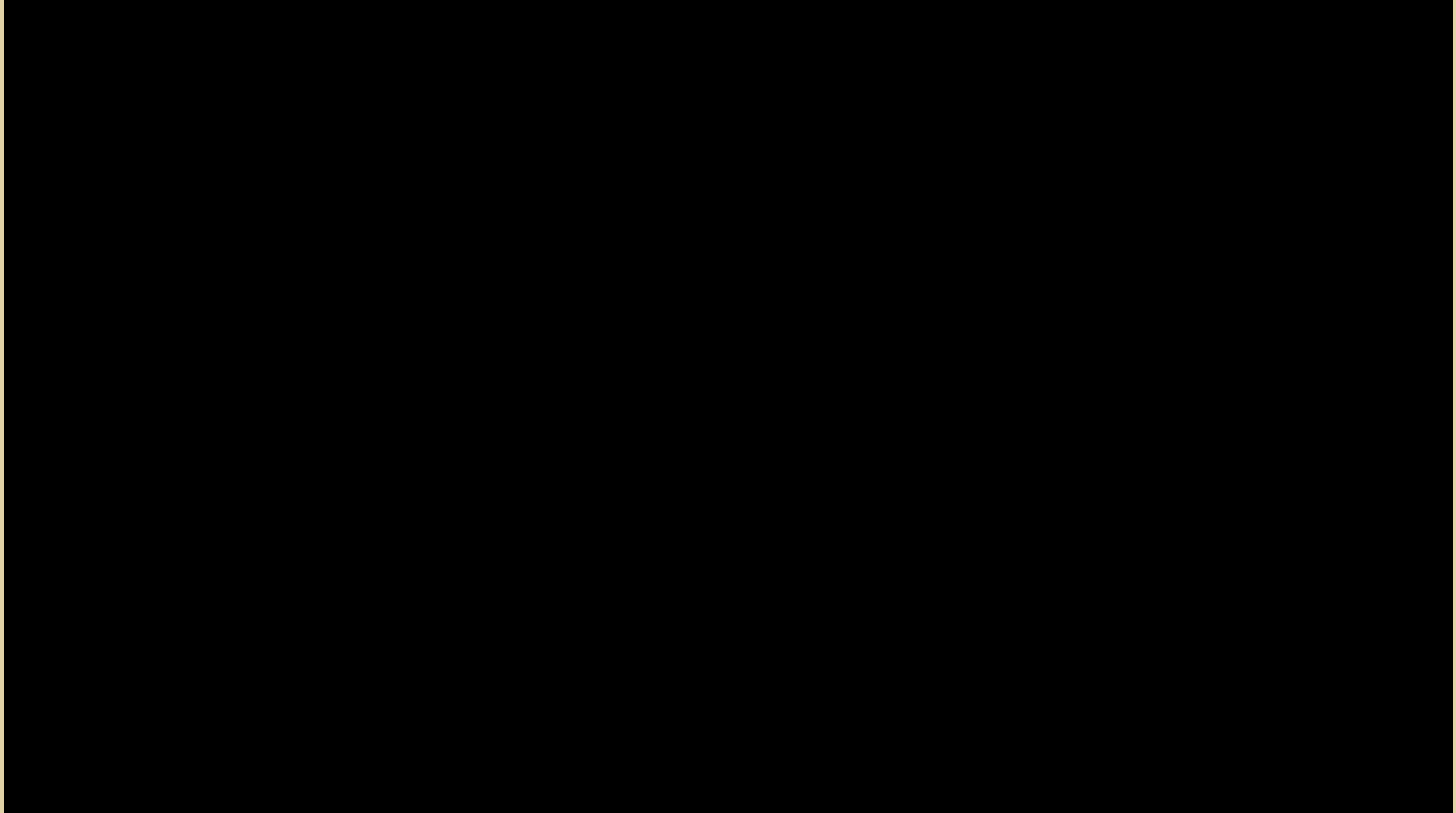
NEUROMEDIA

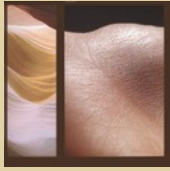




Sound Perception: AURAL ROOTS

NEUROMEDIA



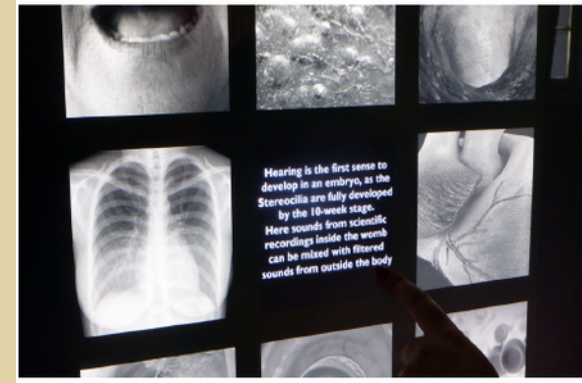


Sound Perception: AURAL ROOTS

NEUROMEDIA



Tactile interaction -the stereocilia as an instrument / mixing tool

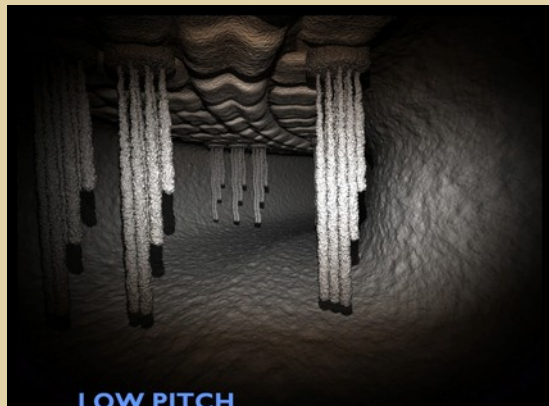


Different pitches - access to the cochlea-by touch screen

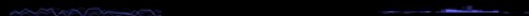


Sound Perception: AURAL ROOTS

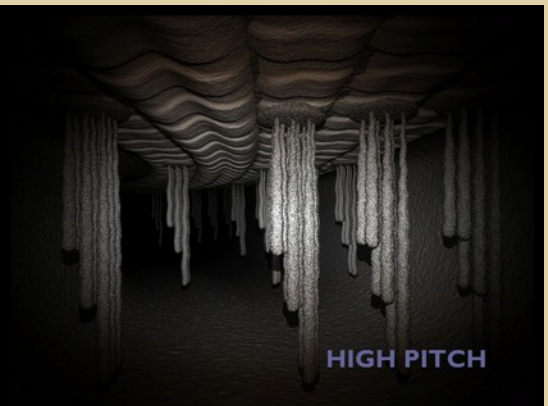
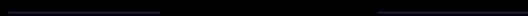
NEUROMEDIA



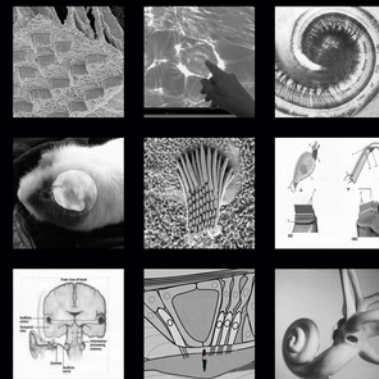
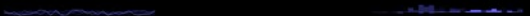
LOW PITCH



MID PITCH



HIGH PITCH





IN THE WOMB

AURALROOTS- Neuromedia

Inner Ear Cilia (Harmonics)	Outer Ear Cilia (Volume)
Low constant voice	Bass Voice
Bowl movements	Freeway
Wooshes of blood	Freezer
Mother breathing	Truck Diesel
Mothers voice- singing	Constants from the outside
Mothers heart beating	Drum and drum roll
Consonants	Low voice constantants
Deep bubbles from the blood	Paino low notes
Digestion	River low notes



Hearing as an embryo in the womb,

River low tones



Truck Diesel

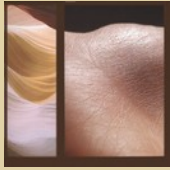


Deep bubbles from the blood



Consonants



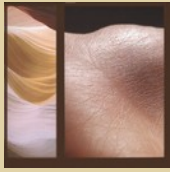


TOUCH and TACTILITY Sensory Perception

“Our focus must be on “ubiquity, tangibility and most of all,
shared awareness, intimacy and emotion”

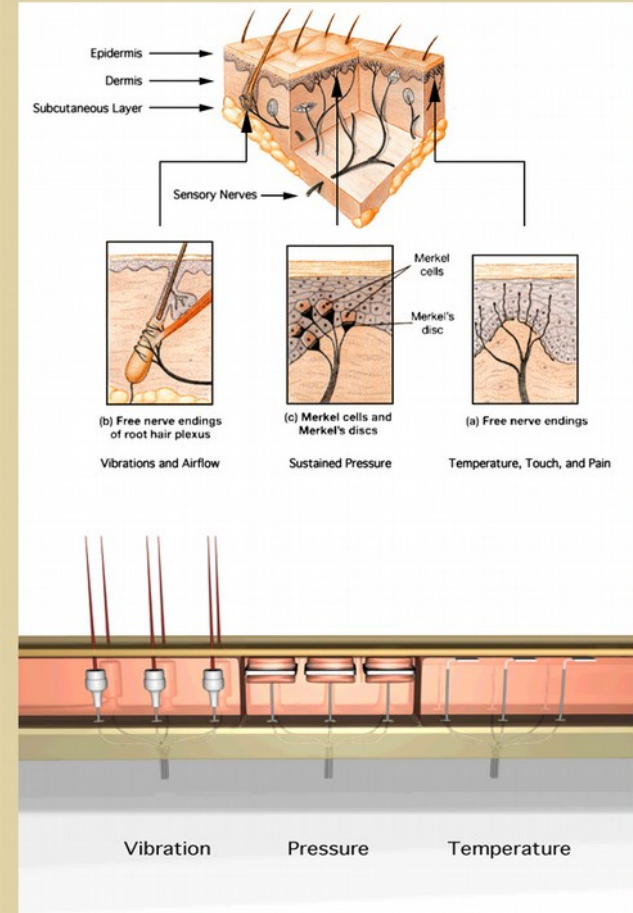
”

Paul Dourish



NEUROMEDIA

- 1. temperature**
 - surgical sensors
- 2. pressure**
 - pressure pads
- 3. vibration**
 - piezzo vibration sensors
- 4. proprioception**
 - infra-red (tracks user)
 - tilt sensors (track interface movement control the 2D plane visual layers on the screen)

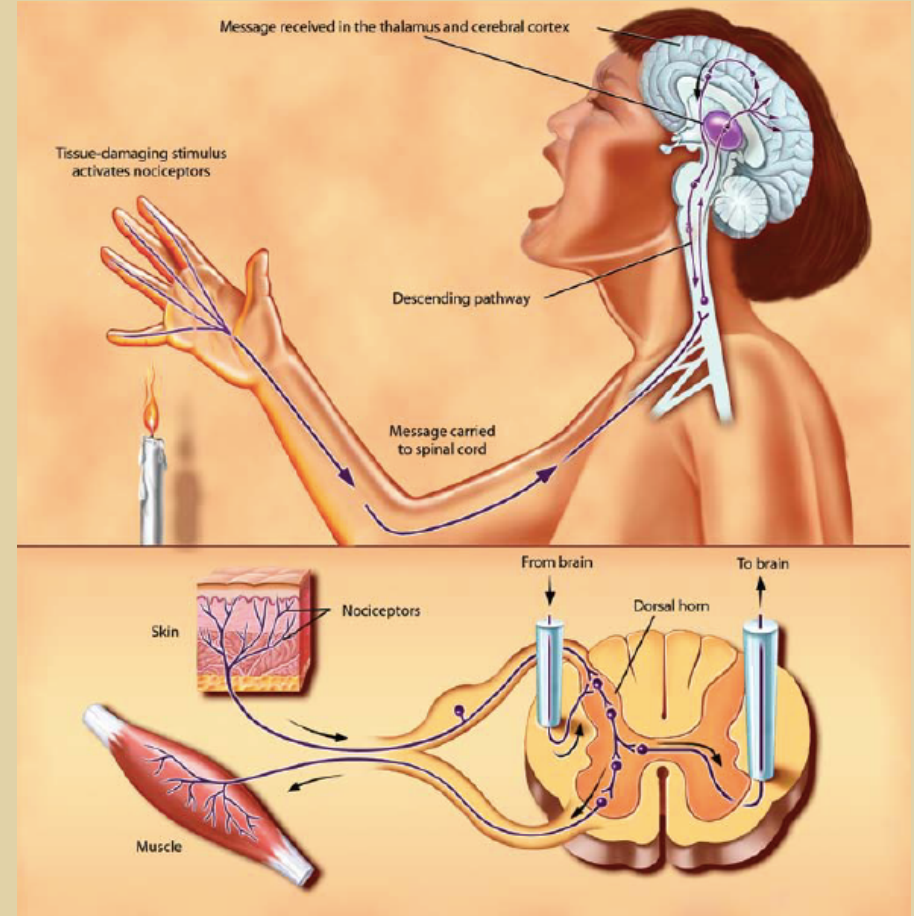


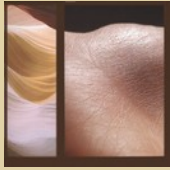


NEUROMEDIA

Pressure Temperature
sensors Spinal cord
Brainstem, thalamus
cerebral cortex

Endorphins (natural
opiate)
are suppressors
or not
in the mid brain



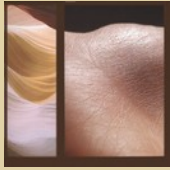


Tactile Perception: e-SKIN



Touch- size, shape and texture
Musée de la Main, Lausanne
2011





Tactile Perception: e-SKIN



Control of Sound and Image in Room



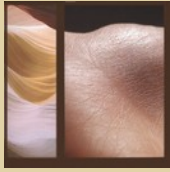
Communication with other Dancers
Pressure Sensitive Fabric



Gesture Recognition with Accelerometers



Welcome Trust, London
2005



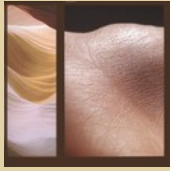
TOUCH AS TRIGGER POINT

Eskin

Beyond Hierarchy
(Handshake Box).

Figurative History
(Joining Hands)





NEURAL DEVELOPMENT

NEUROMEDIA

My Own Experience :

(Neuroscientist: Esther Stoeckli)

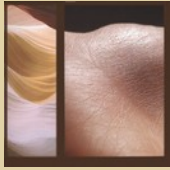
Neurobiology Labs: The Institute of Molecular Life Sciences, University of Zurich

Neural Development (Stoeckli)

Research Focus: molecular mechanisms underlying neural circuit formation with a focus on axon guidance

Development of the vertebrate nervous system; spinal cord development; analysis of gene function in vivo (chicken embryos) by in ovo and ex ovo RNAi (RNA interference);

Therefore >developmental diseases of the nervous system



Neural Development : SOMABOOK

NEUROMEDIA

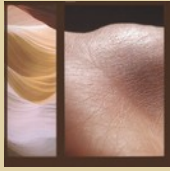
Aims:

To use tactile feedback in order to access neuroscience research

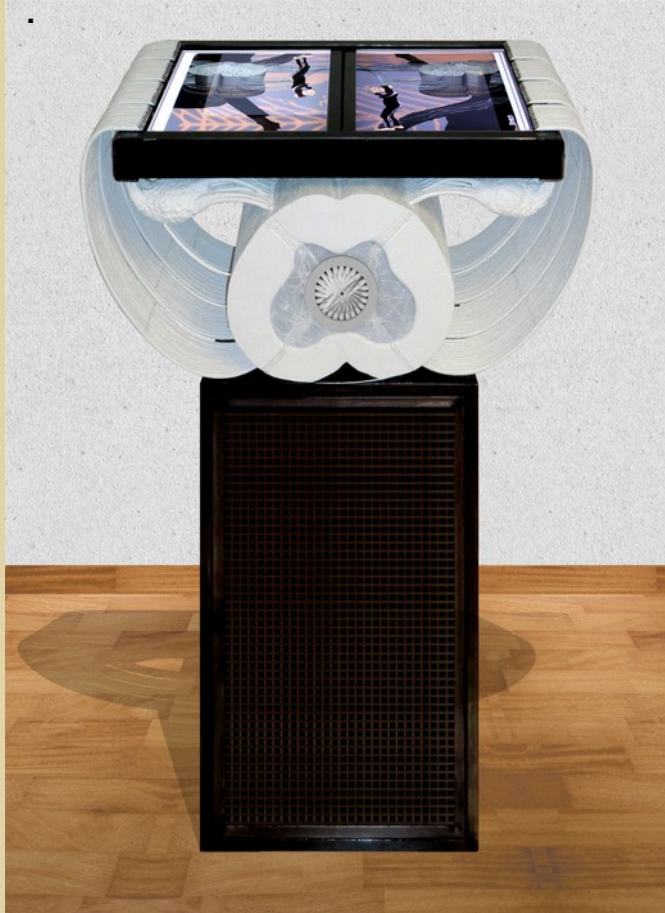
To shift the artist's role toward a communicator of more scientifically robust research about neural impairment - raising public awareness

To learn more about molecular and neural research in a novel way



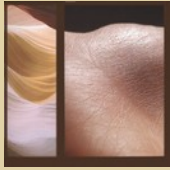


Neural Development : SOMABOOK NEUROMEDIA



Somatic Cortex:

5 overlapping representational maps help us to function/be embodied in our environment:
Texture, Shape and Size, Stretch,
Translation and Correlation



Neural Development : SOMABOOK

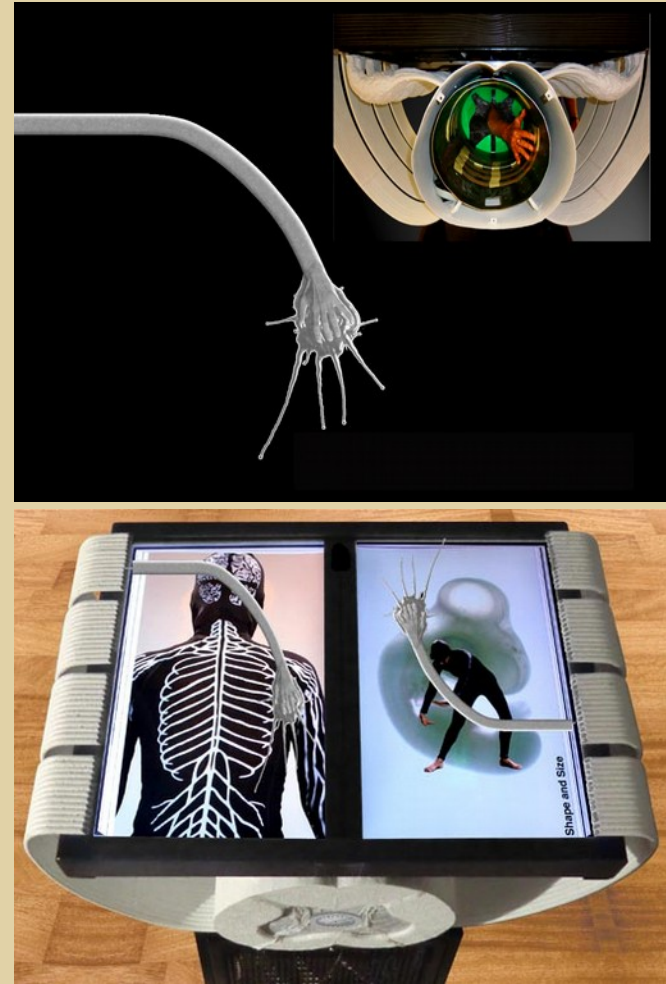
NEUROMEDIA

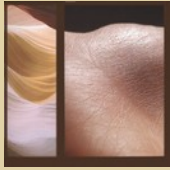
Interaction:

used the viewers' tactile perception to compare inappropriate connections of axons

showed resultant loss of functions of molecular activity (tactile hand-axon)

interpreted growth patterns, movement and coordination through movement (dancer)





PROPRIOCEPTION

Perception of the Body in the Environment

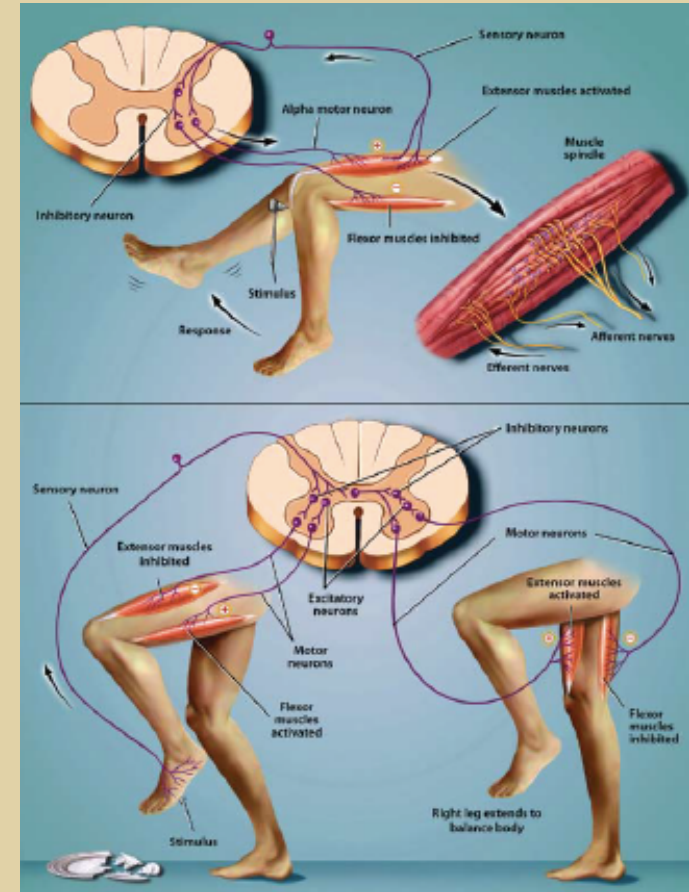
“The body shapes the way we think.”

Ralph Pfeiffer AI



NEUROMEDIA

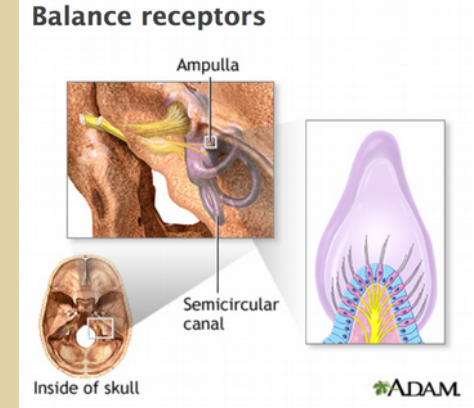
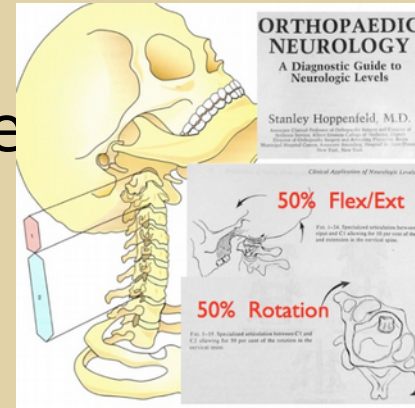
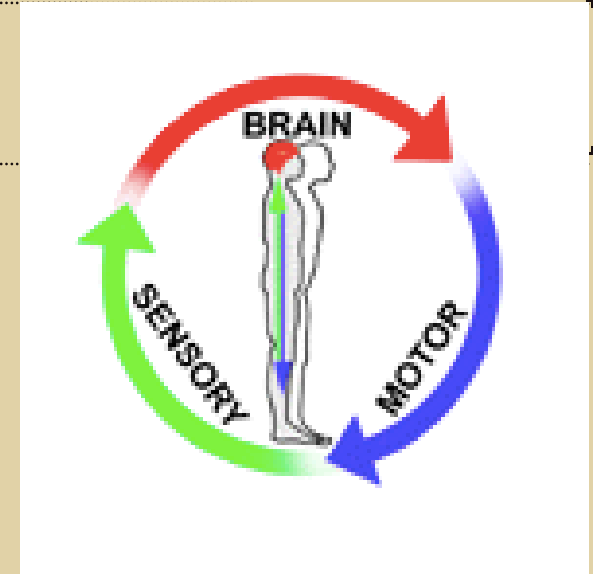
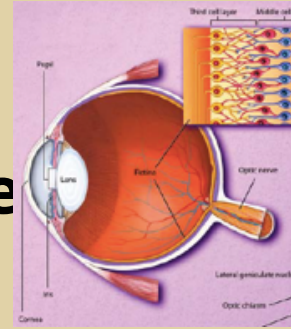
- MOVEMENT
- Automatic stretch reflex -muscle
- spindle sensory fibers
- to motor neurons
- causes joint flexor (closer) or extensor (opener)
- Afferent nerves-muscles to brain
- efferent nerves -
- motor commands from
- spinal cord to muscles.
- Burn=Flexion withdrawal-

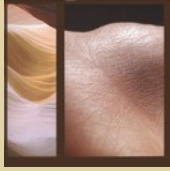




PROPRIOCEPTION all sense with these sensors:

1. Vestibular System
2. The Visual System
3. Mechanoreceptor System joint and muscles





NEUROMEDIA

PROPRIOCEPTION all sensors with these se

RIGHT BRAIN LEFT BRAIN

Multisensory perception: Video by Cat Jones

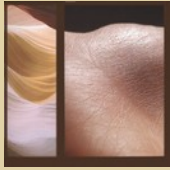
<https://catjones.net/2016/08/11/somatic-drift>



NEUROMEDIA

Nicole Ottiger at the Brain Mind Institute

AIL Film with Olaf Blanke: Brain Mind I



THANK YOU!

More Art Information:

www.jillscott.org

www.z-node.net

www.marillehahne.com

www.artistsinlabs.ch

Books:

“CODED CHARACTERS”

ED. Marille Hahne. 2002 Hatje Cantz

“NEUROMEDIA: ART AND NEUROSCIENCE RESEARCH”

2012. Eds: Ester Scoeckli and Jill Scott. Springer

“3 x ARTISTS-IN-LABS BOOKS”

2006-2016 Springer and DeGruyter