

sensory integration network

Introduction to Sensory Integration
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Slides used were developed by the
SI Network Lecture Team



sensory
integration
network

What would you like to get out of
this morning?

Learning objectives

- By the end of this lecture, you will:
 - Understand the term “Sensory Integration”
 - Have an overview of the sensory systems and the neuroscience of sensory processing
 - Have experienced a simulation of sensory processing dysfunction
 - Have some strategies to support people with sensory processing difficulties

Sensory systems?



5 senses you will be familiar with:

- **Visual** = seeing what is ahead and to the side in our immediate environment
- **Auditory** = hearing and locating sounds
- **Tactile** = sense of touch, discriminating physical qualities of external objects, pressure, temperature and pain
- **Olfactory/gustatory** = smelling and taste

2 additional, less familiar senses:

- **Proprioception** = sense of where our body parts are
- **Vestibular** = sense of movement and balance



“Sensations are ‘food’ or nourishment for the nervous system, the brain needs continuous variety of sensory nourishment to develop and then to function”

Ayres 1979

The term *Sensory Integration*?



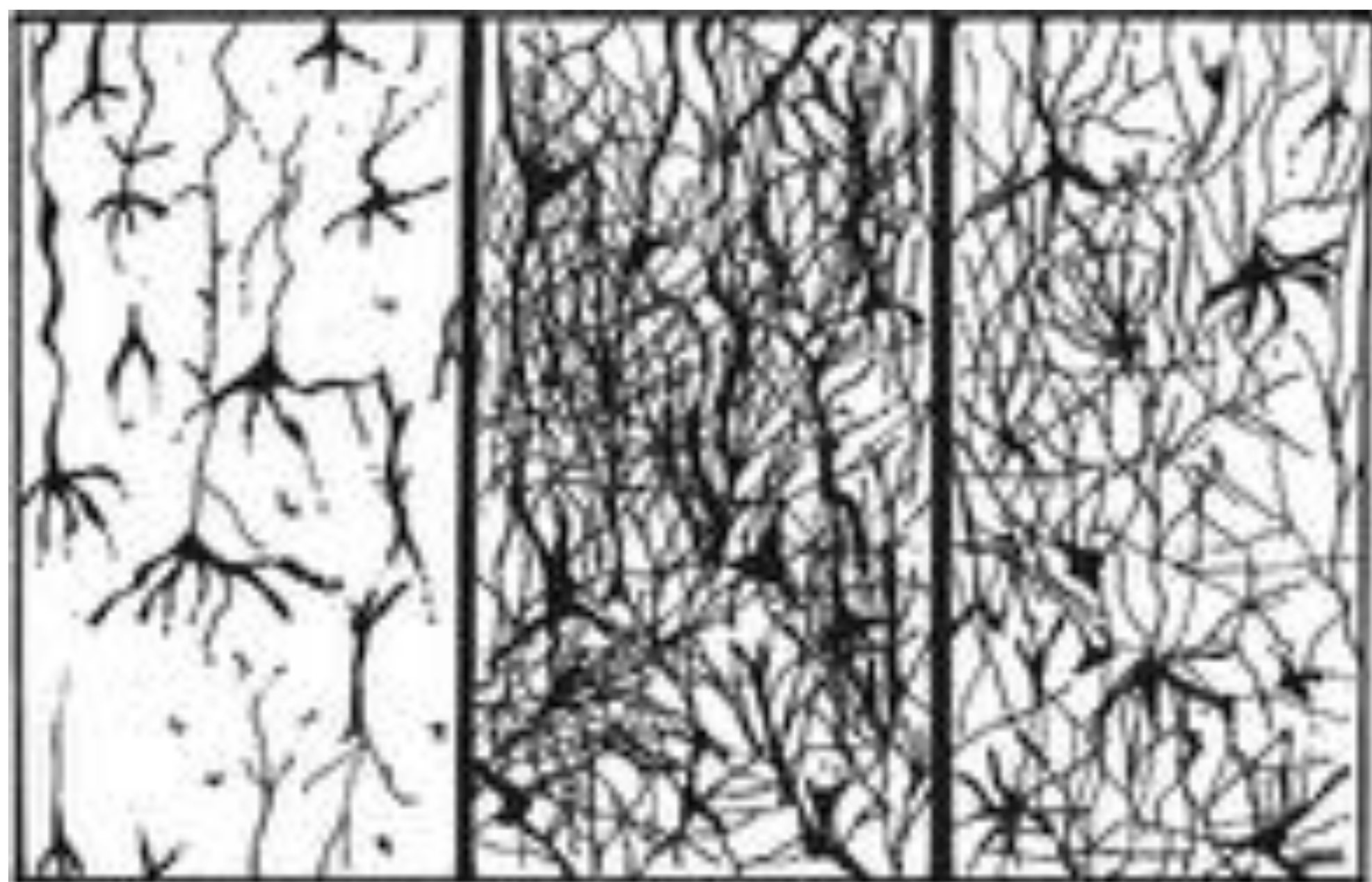
Our debt of gratitude to Dr A. Jean Ayres

- 1920-1988
- Occupational Therapist and Psychologist
- Researcher-1960s until her death, researched the way the brain processes information for use; developed assessment tools; clinical work



Sensory Integration

- SI has 3 inter-related elements of practice
 1. A **theory** of normal development (sensory processing)
 2. A means of analysing & describing the behaviours we see, **evaluating** disordered sensory processing (Sensory Integration dysfunction)
 3. A specific approach to **intervention** (Sensory Integration Therapy)

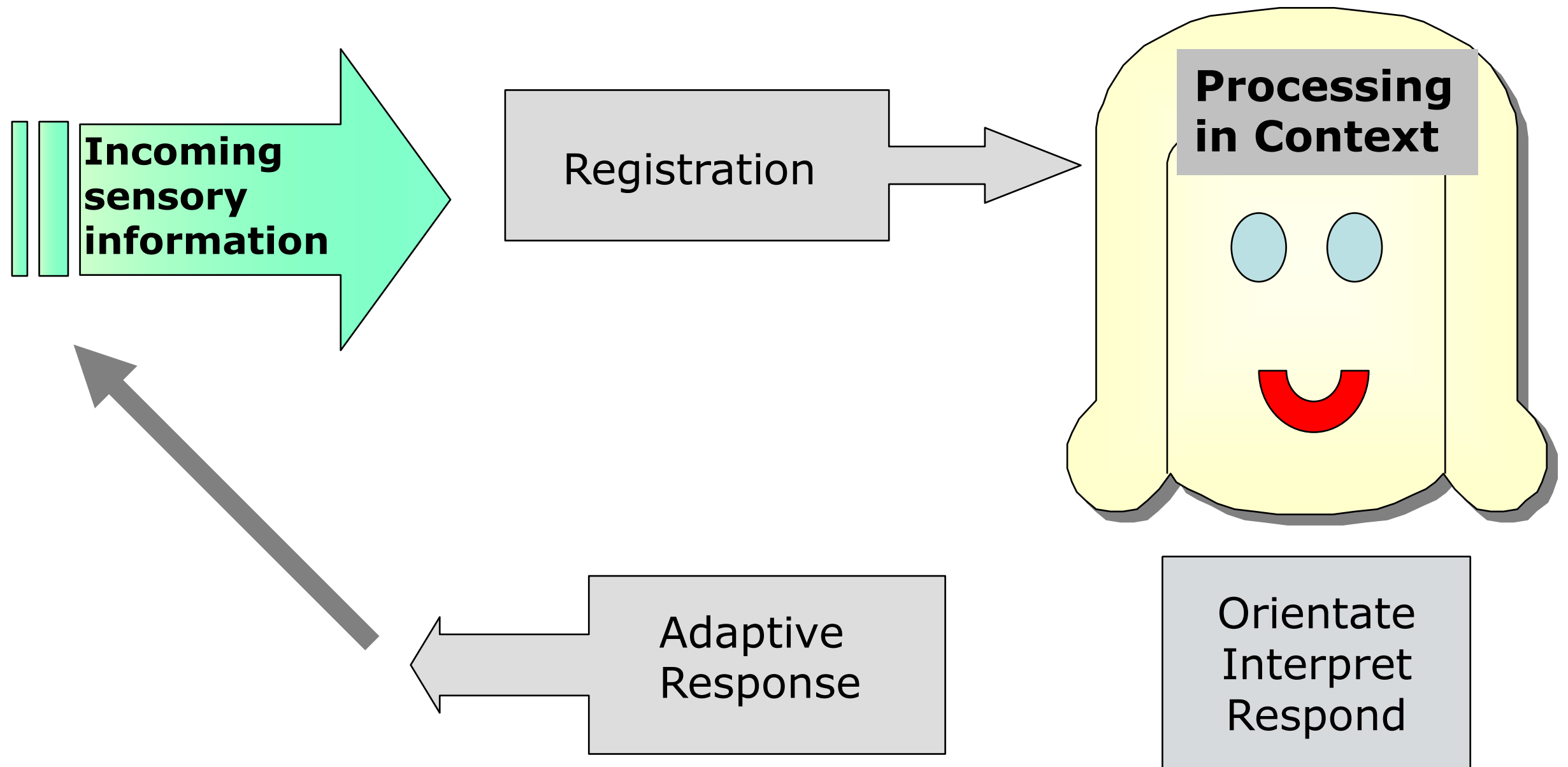


at a child's birth

at 7 years of age

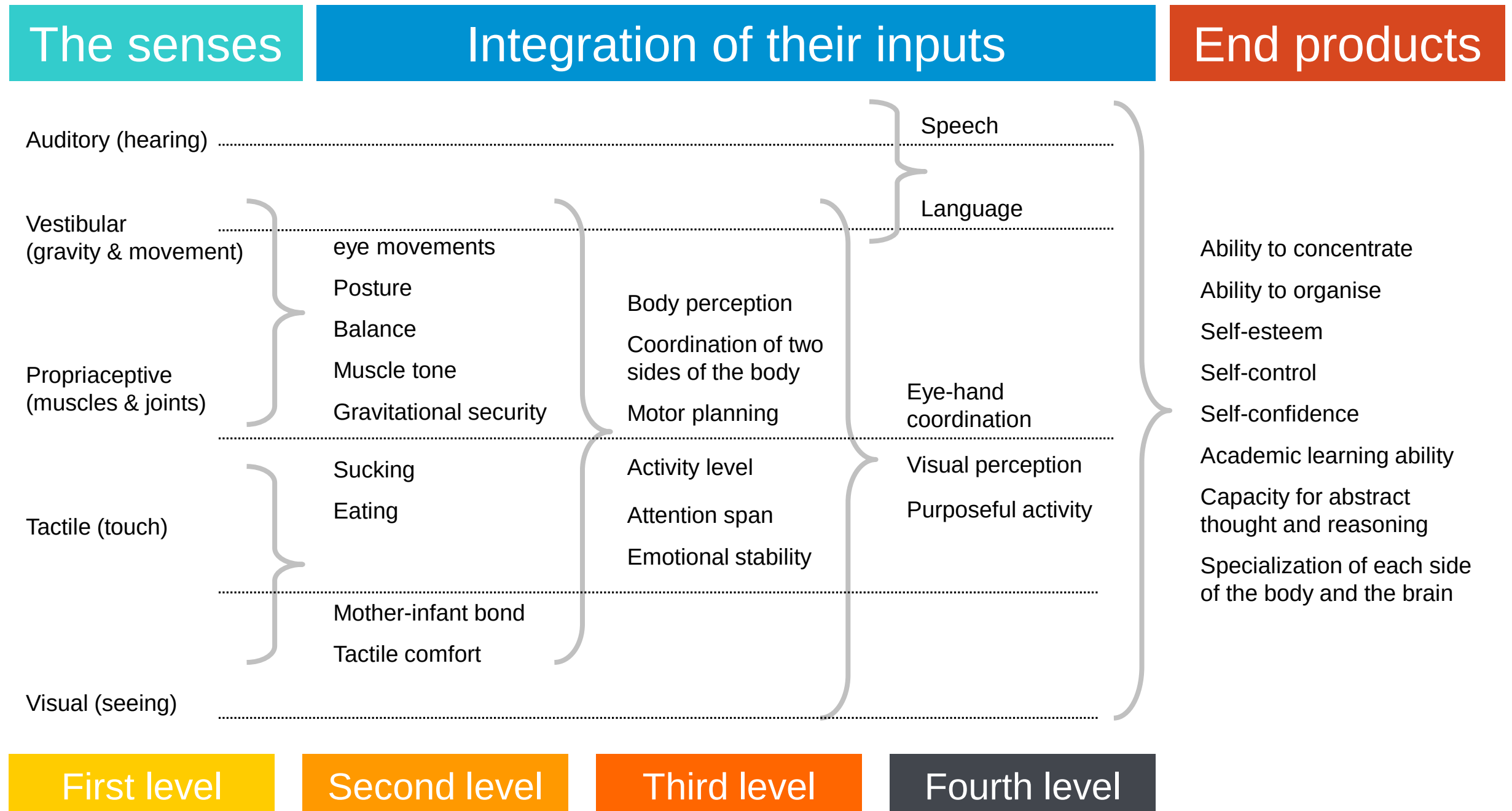
at 15 years of age

Sensation is the **only** pathway the human system can use to receive information from the environment.



Smith and Turner 2004

Sensory Integrative Processes





“because humans are sensory beings and sensation is inherent in all occupations, the sensory integration framework is relevant to occupational therapy practice beyond pediatrics”

Irene Watling, PhD, OTR/L, Stefanie Bodison, MA, OTR/L, Diana A. Henry, MS, OTR/L, CWT, and Heather Miller-Kuhaneck, MS, OTR/L, BCP

Sensory Integration: It's Not Just for Children
AOTA -SIS Quarterly - December 2006



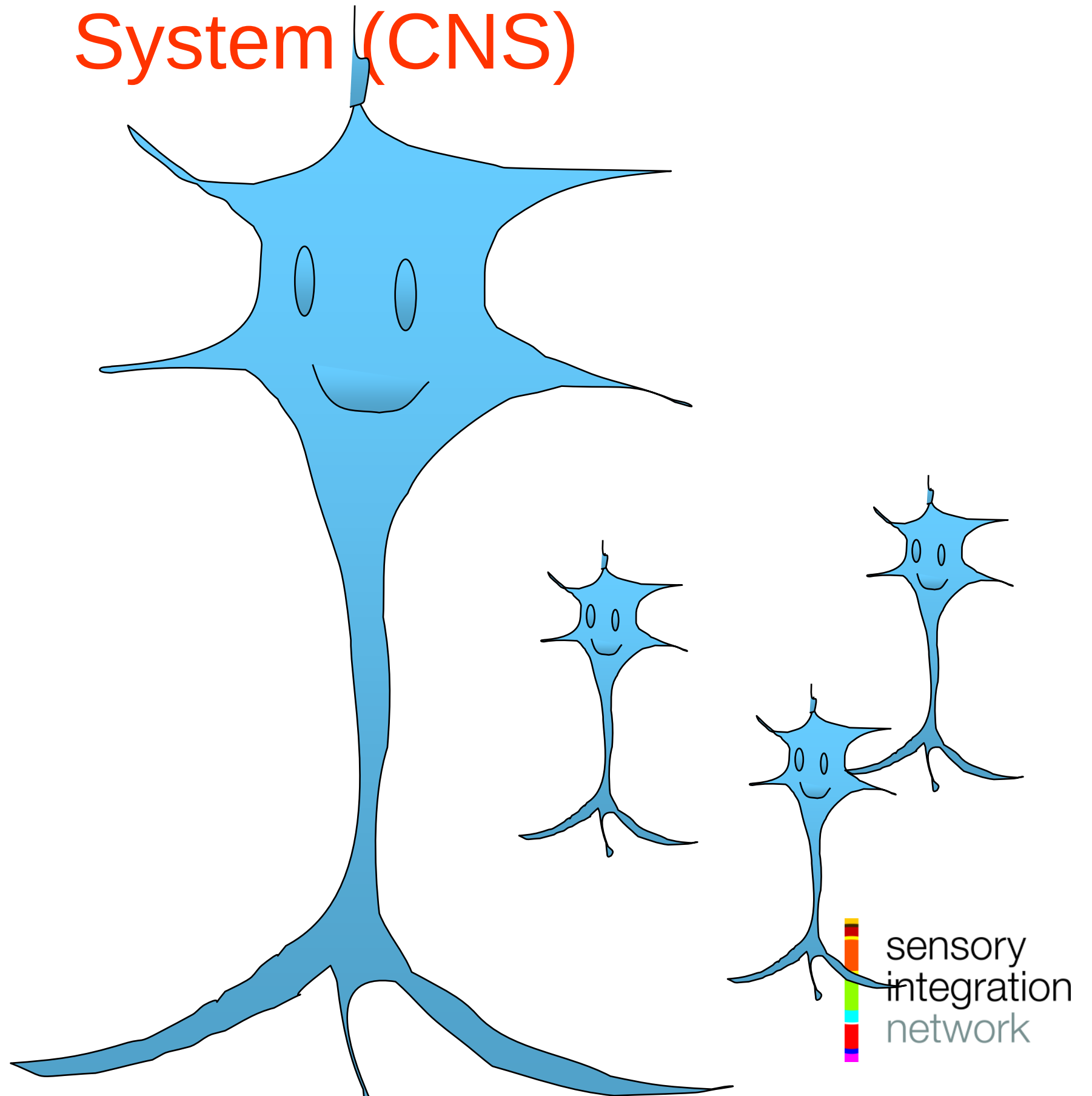
Sensory Integration Therapy

- **Sensory Integration Therapy** is specialist and specific assessment and intervention implemented by Occupational Therapists, Physiotherapists and Speech and Language Therapists who hold post-graduate certification in SI.
- **Other professions have a role in creating sensory-aware living and learning environments.**

**‘The essence of being
human is embedded in the
sensory events of our
everyday lives’.**
Dunn 2001



Introduction to the Central Nervous System (CNS)



The Neuroscience of Sensory Processing

Neuroscience is the empirical study of the brain and connected nervous system. The brain is the organ that enables us to adapt to our environment—in essence, to learn.

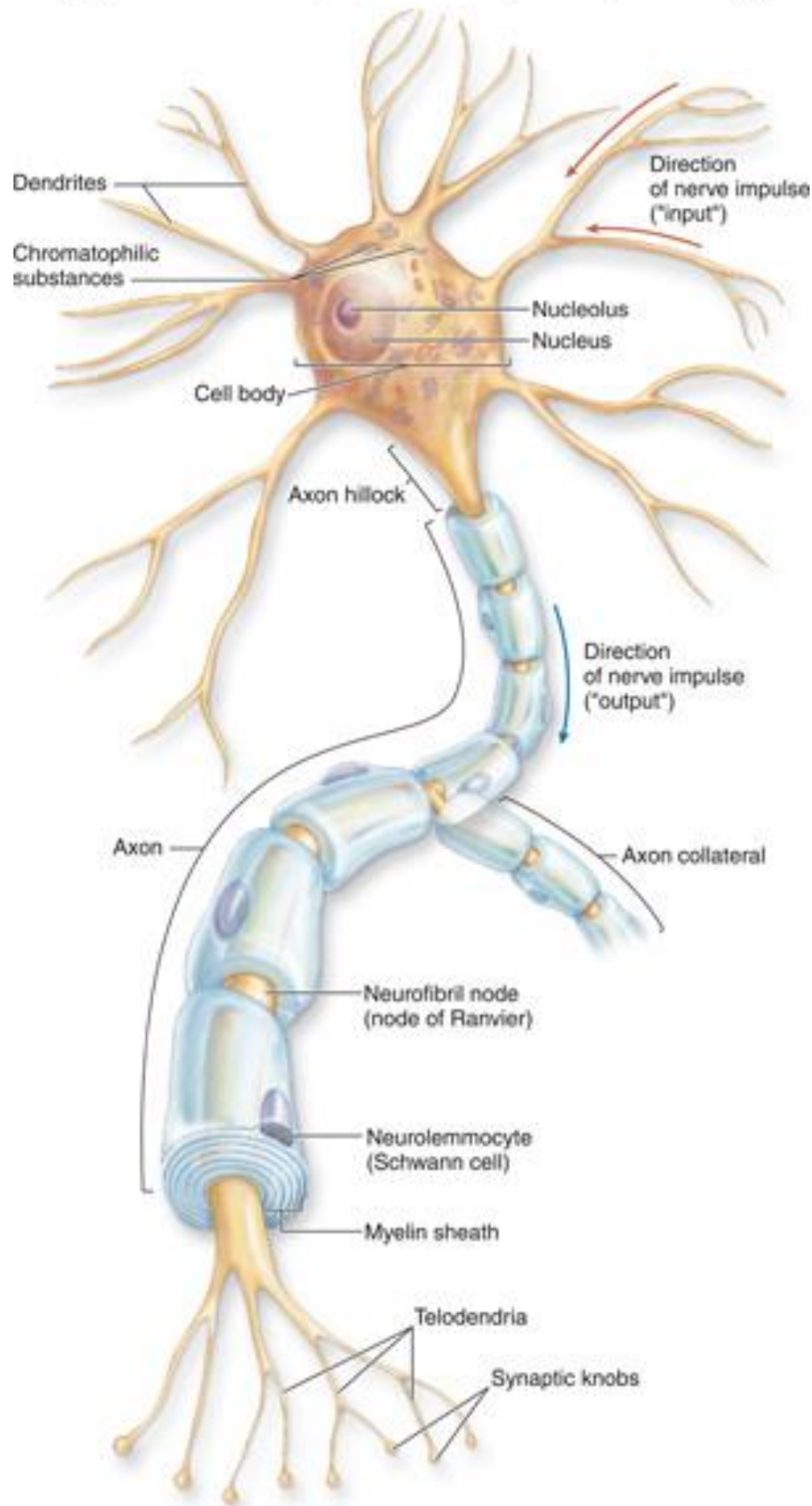
The Royal Society (2011)

See behaviour – think sensory

- Neuroscience is a young discipline
- Tools to see the living brain in action only recently developed (fMRI, PET, CAT) and not widely available
- Currently principal diagnostic route for sensory processing disorder is therefore observation and analysis of non-normative behaviour

Neurons

- Cells which respond to electrochemical stimulation
- Core building blocks of sensory system
- Form dense, communicating networks
- Typically insulated by a fatty sheath (myelin)



How three of the sensory systems connect to the CNS

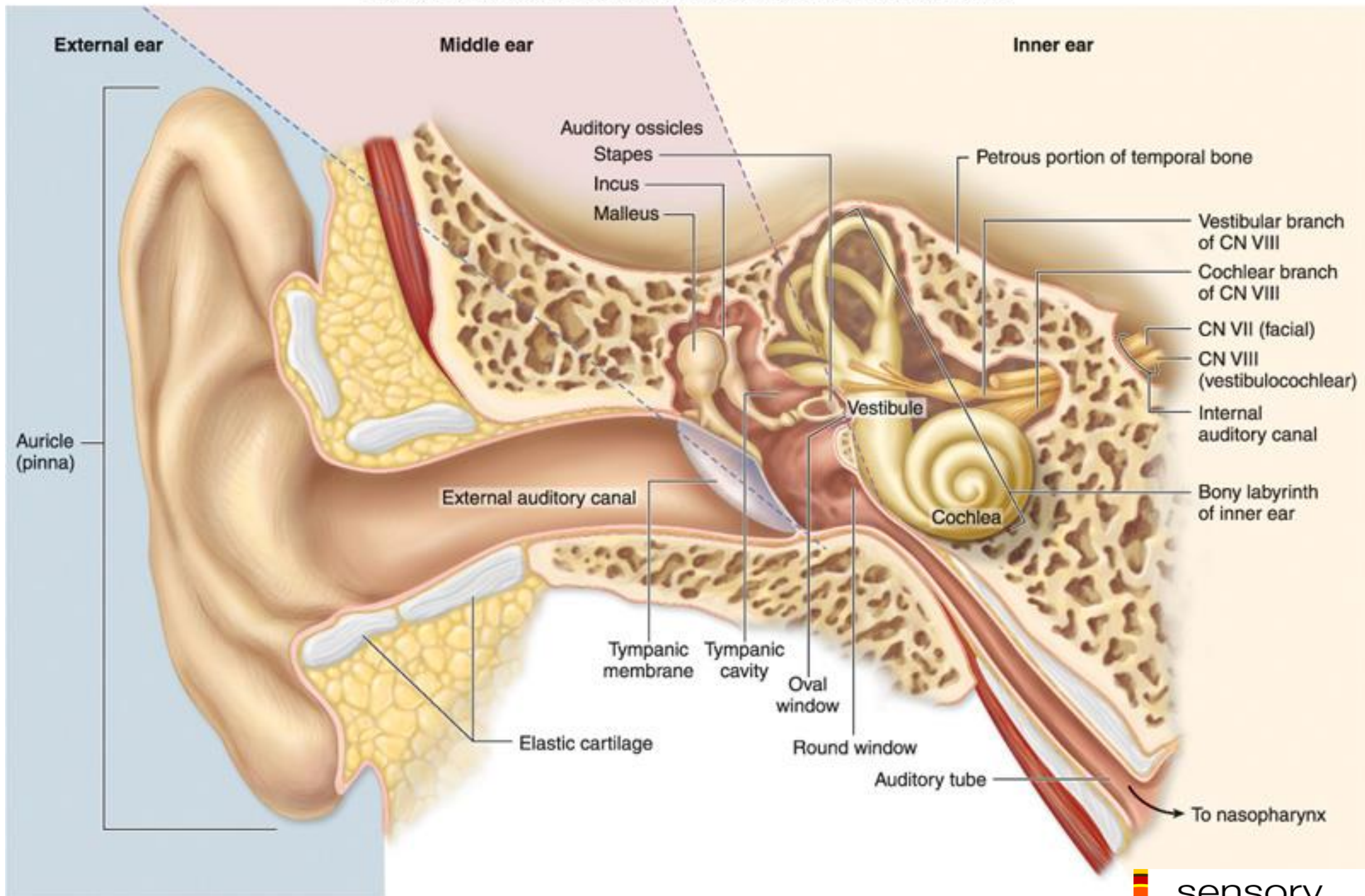
- Vestibular
- Tactile
- Proprioception



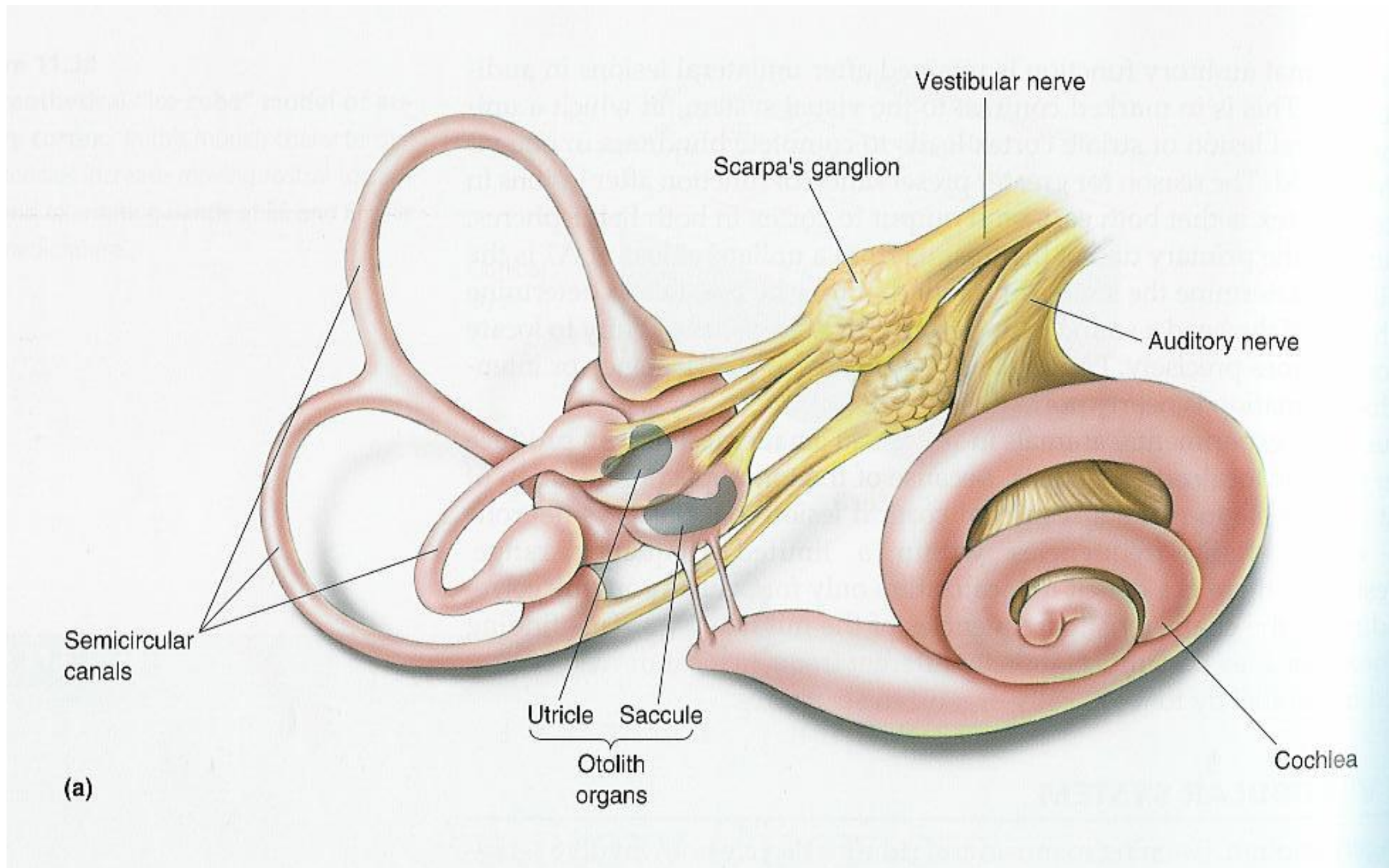
How each of the sensory systems connects to the CNS

- **Vestibular**
- Tactile
- Proprioception





Vestibular Labyrinth



Vestibular receptors are in the inner ear and the vestibular nuclei

Bear et al (2001, p.386)

Vestibular – Balance and Head Movement

- Organs of balance are the otoliths and semi-circular canals on top of the cochlea.
- Stimulated by movement of the head.
- Gives information about movement and rotation in all directions.
- Also has a role in maintaining posture and organising motor actions



How the sensory systems connect to the CNS

- Vestibular
- **Tactile**
- Proprioception

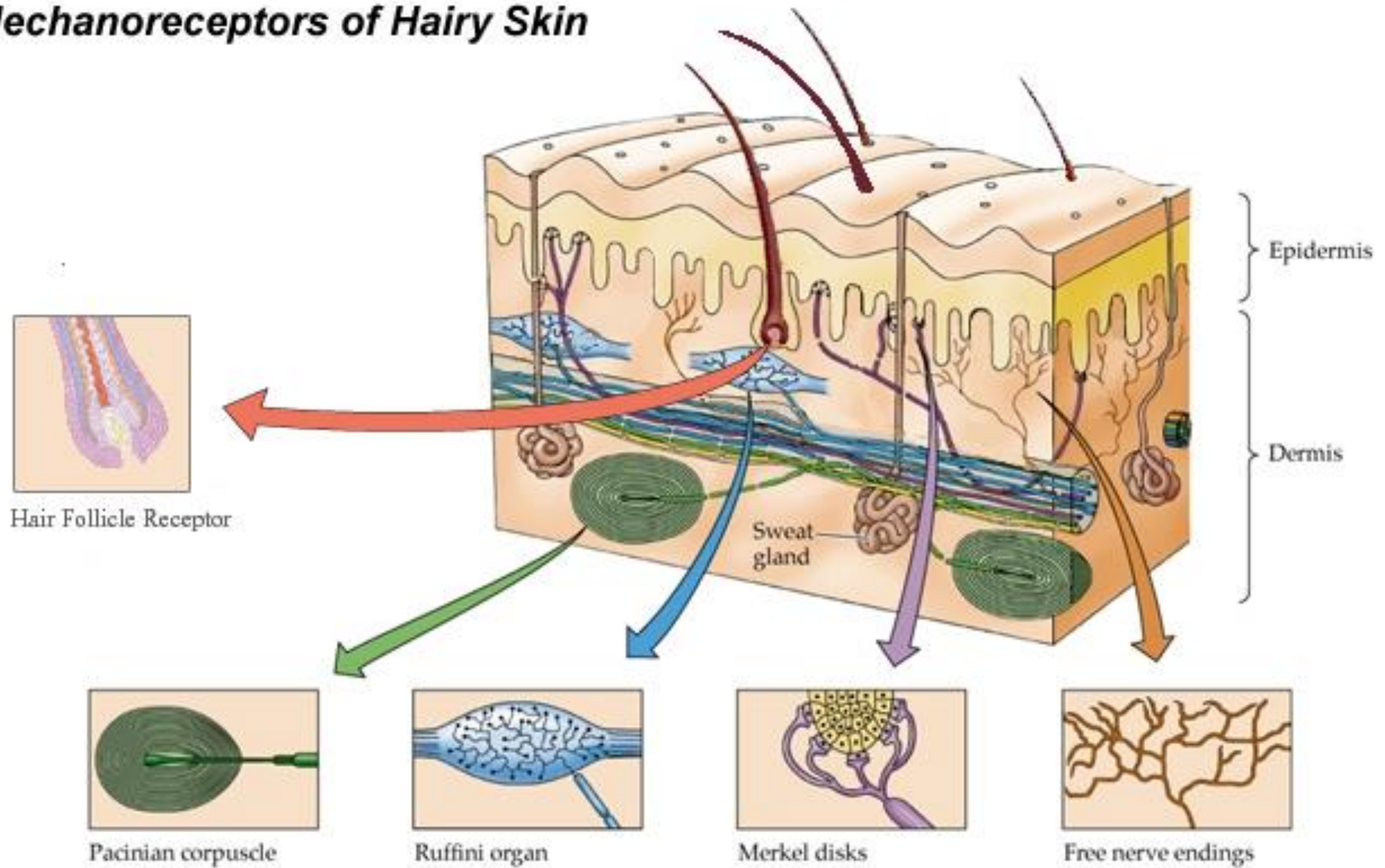


Tactile System

- Organ of touch is the skin all over the body
- Different kinds of nerve receptors at different depths in the skin for light, unexpected touch; deep touch; pain; temperature
- Different neural pathway for touch around the head and face.
- Purpose of touch is discrimination and has a strong emotional and social role
- Helps to form body scheme
- Basis for motor planning/praxis



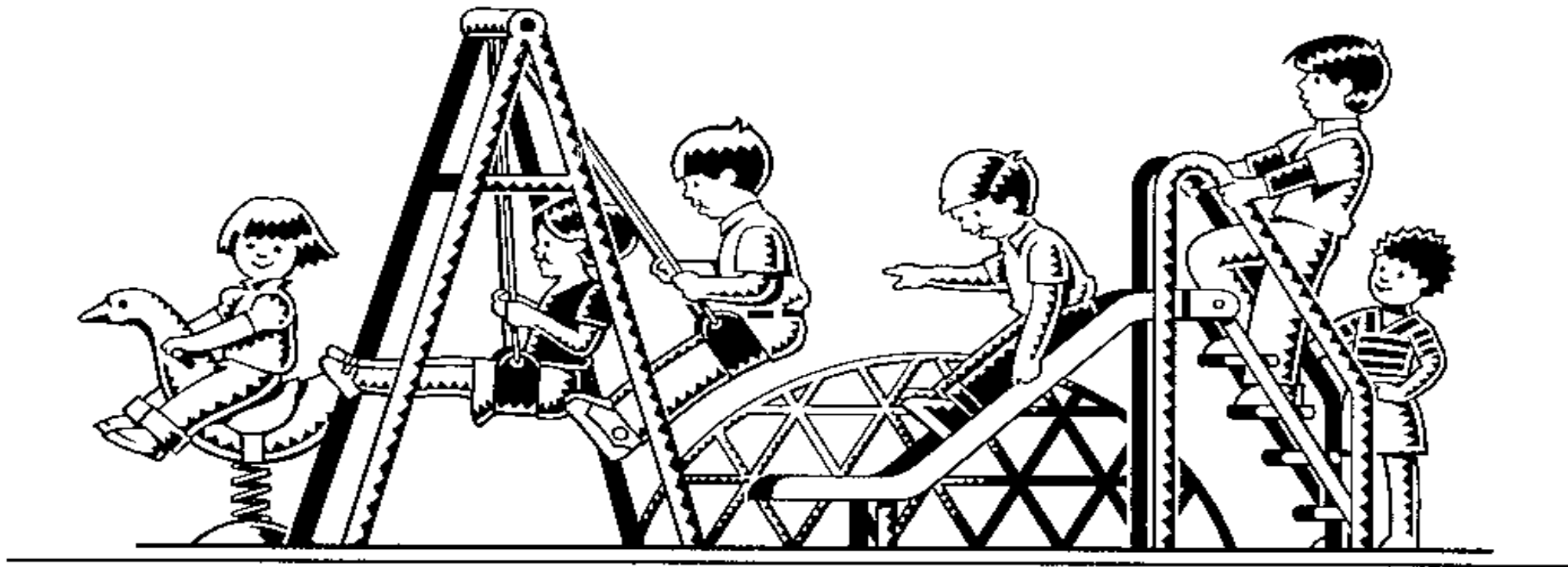
Mechanoreceptors of Hairy Skin



courtesy of http://www.hhp.uh.edu/clayne/6397/Unit4_files/image019.jpg

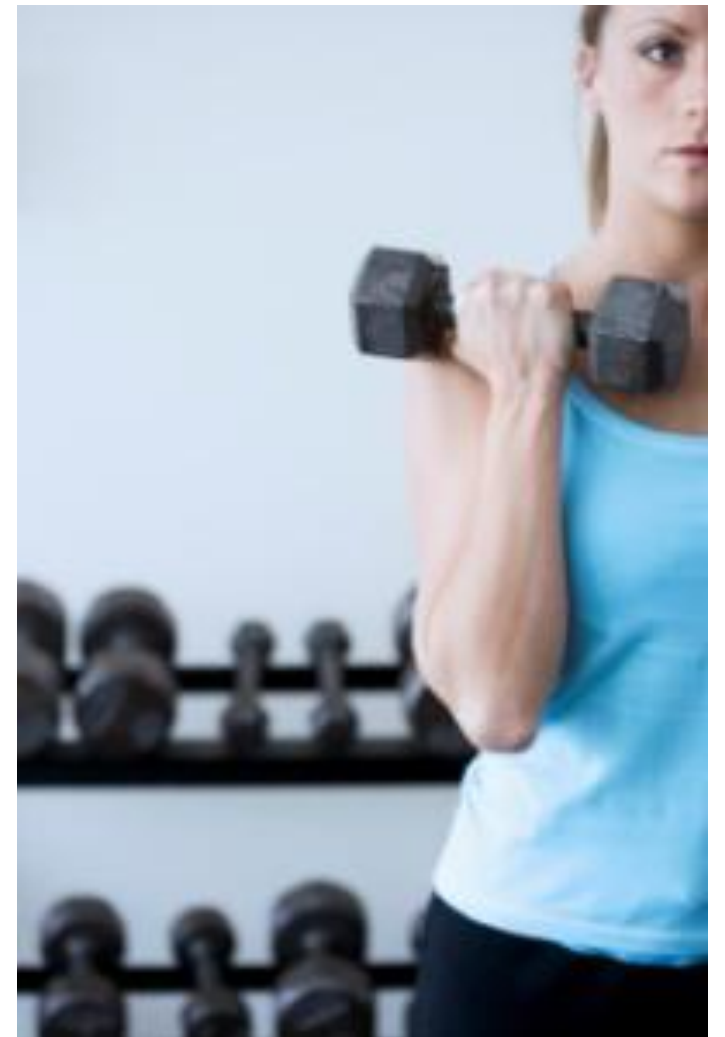
How each of the sensory systems connects to the CNS

- Vestibular
- Tactile
- **Proprioception**



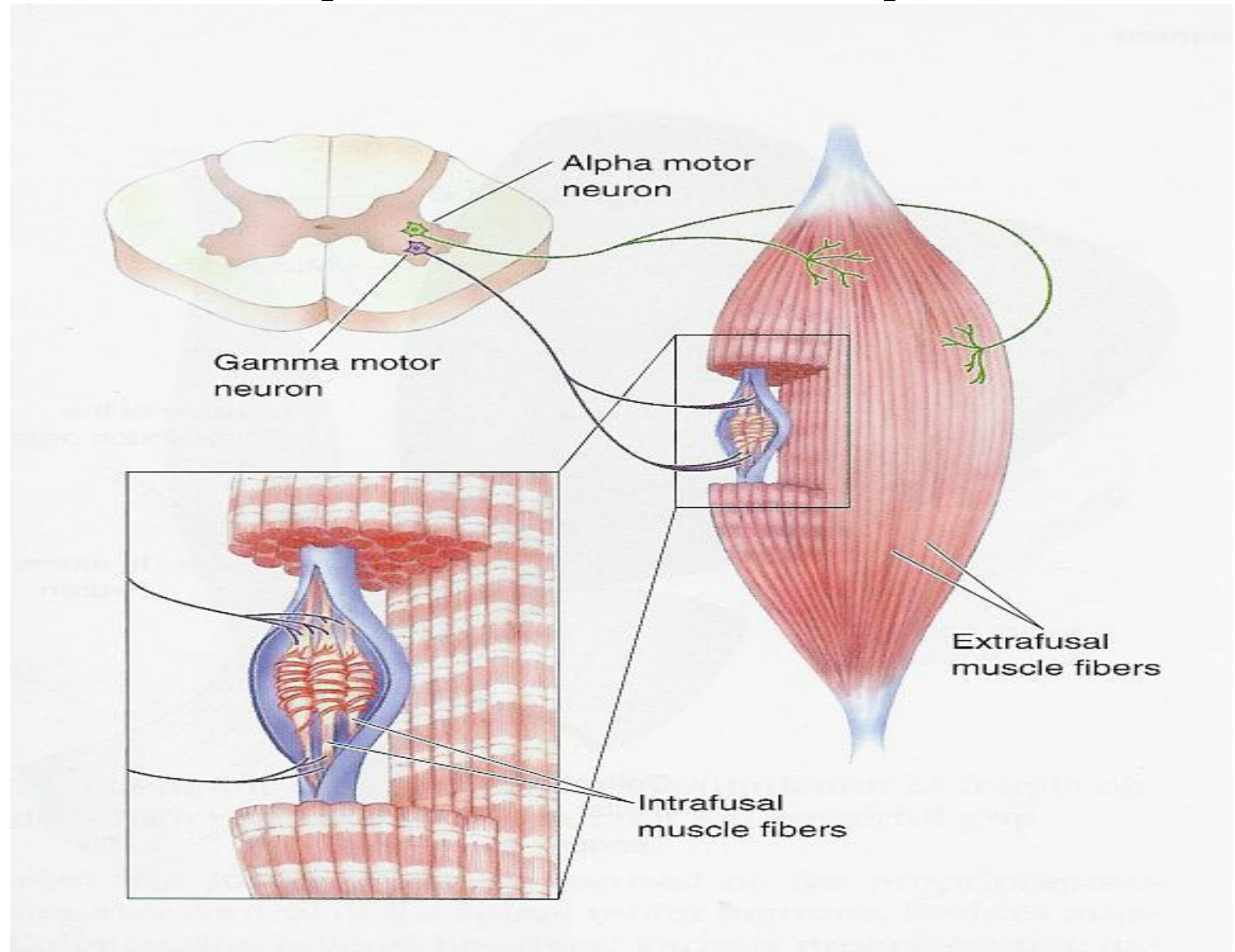
Proprioception

- Organs of proprioception are the receptors in muscles and joints.
- Stimulated by movement of pairs of muscles (“heavy work”)
- This system leads to body awareness.
- Assists with automatic adjustment of the body
- Skilful manipulation without vision



Proprioceptive receptors

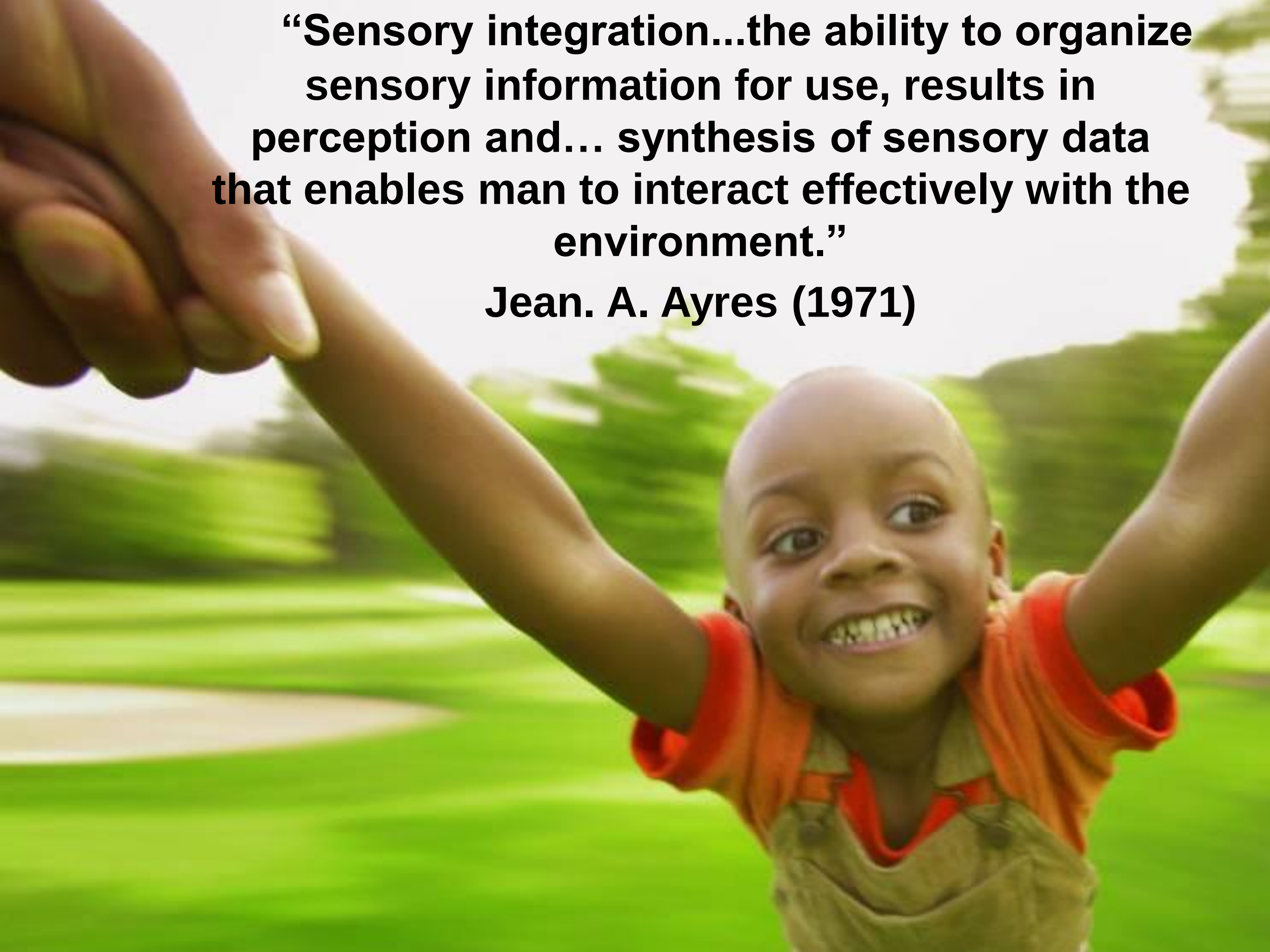
Proprioceptive receptors are in the muscle spindles, mechanoreceptors of the skin, ligaments and joints.



Muscle spindle: Alpha and gamma motor neurons and the muscles they innervate
Bear et al 2001,p.454

“Sensory integration...the ability to organize sensory information for use, results in perception and... synthesis of sensory data that enables man to interact effectively with the environment.”

Jean. A. Ayres (1971)

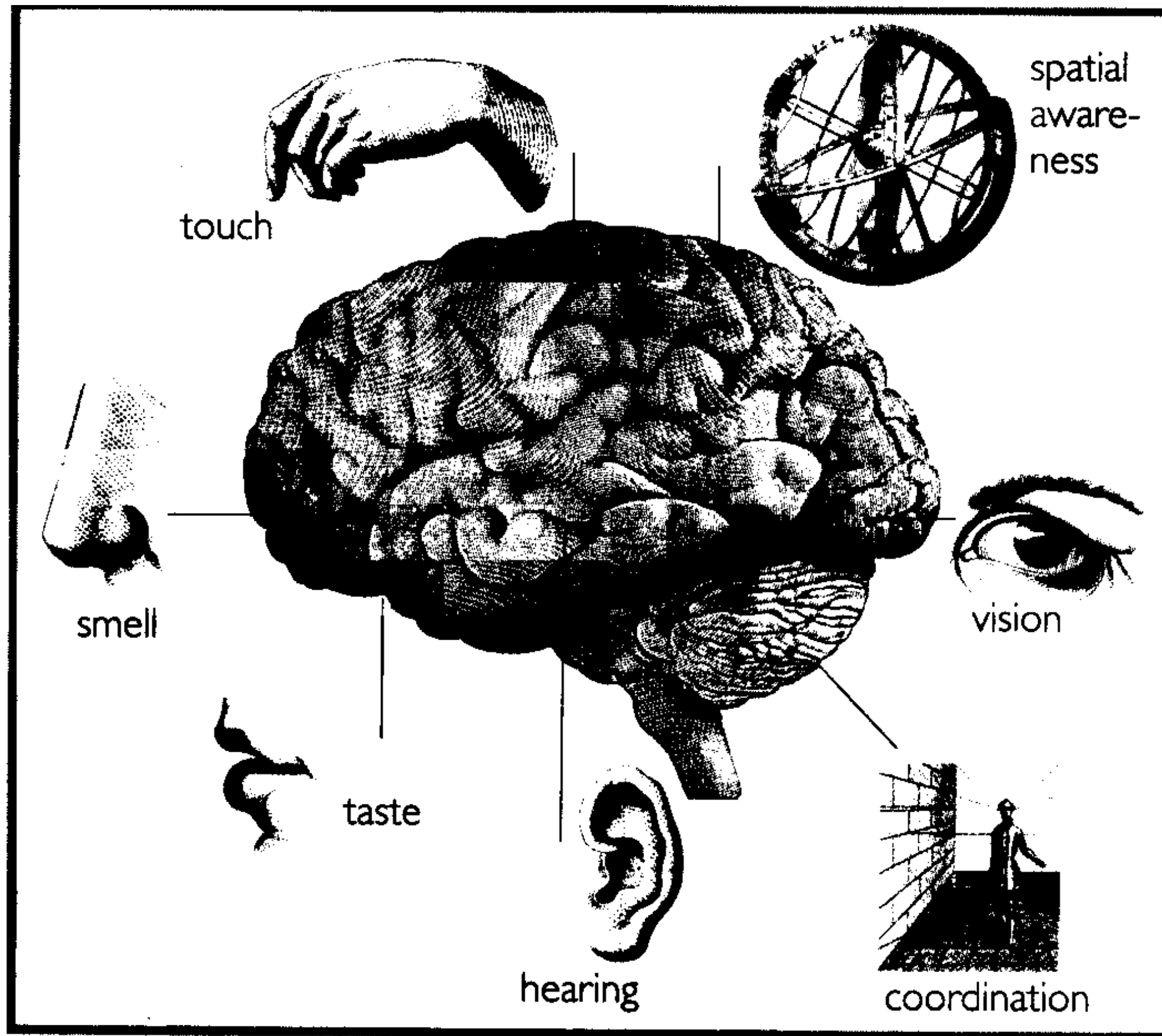


Nervous system pathways and Central Nervous System

Pathways or tracts transmit sensory information to the central nervous system (CNS)

Various structures in the brain help to interpret this information:

Reticular formation, thalamus, limbic system, parietal lobe (somatosensory cortex), frontal lobe (primary motor cortex).



Assessment tools



- Skilled observation in school, home and other environments

- Sensory histories/questionnaires such as the *Sensory Profile* (Dunn, 1999) or the *Sensory Processing Measure* (Parham & Ecker, Kuhaneck et al, 2007) or *Sensory Integration Inventory and User's Guide* (Reisman & Hanschu, 1992).

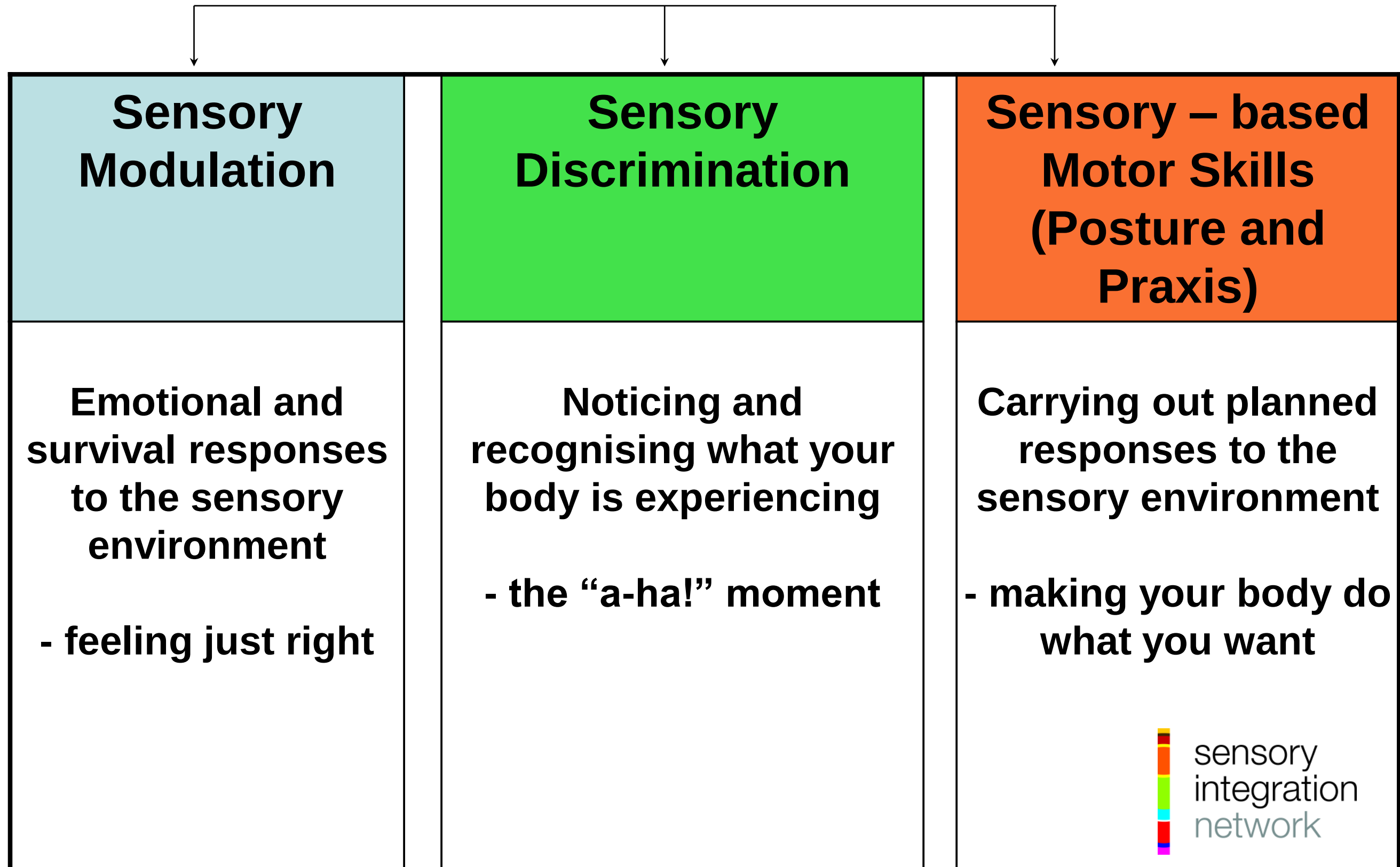


- *Sensory Integration and Praxis Test (SIPT)* for those children with intelligence in the 'normal range'.

An Experience of Disrupted Sensory Processing

- Practical activities to give you a flavour of what it is like when your sensory systems don't give you the kind of feedback you need to be able to participate confidently.

Sensory Processing Functions



Sensory Registration and Discrimination

- Registration = the “a-ha!” moment
- The point at which your nerve receptors recognise something has happened

Sensory Modulation

- Feeling Just Right-

Under-reactive
Over-reactive
Sensory craving

Skilled observations are
needed considering responses
to sensory input.

Sensory Under-reactive

- Lethargic
- Slow completing tasks
- Poor discrimination
- Difficult to motivate
- Can fall asleep quite easily
- May become restless/fidgety after long periods of seated work
- May be sensation seekers



Sensory Over-reactive



- Fight or flight response to non-noxious sensations (sympathetic nervous system)
- Responds quickly and intensely
- Poor habituation
- Accompanying emotional states : anxiety, depression, anger
- Distractibility, disorganisation, impulsivity, hyperactivity
- Functional performance difficulties
- Poor social participation, poor self-esteem

Sensory Craving



- Actively seek or crave sensory input
- Seeking behaviour may lead to socially unacceptable behaviour
- Secondary behavioural characteristics may include impulsiveness, carelessness, restless, hard to calm, attention seeking
- In your face and in your space



Tactile information

Under reactive

- Drops items often
- Clumsy pencil grasp
- Messy dresser/ eater
- Unsure where their bruises come from

Seeker

- Fidgeting
- Stroking
- Exploring items with hands
- Loves messy play

Over reactive

- Overreacts to unexpected touch
- Doesn't like grooming
- Difficulty standing in line
- Dislikes labels/clothing
- Difficulty sitting in groups
- Picky eater – dislikes mixed textures/temperature preferences





Auditory information



Under reactive

- Not responding to instructions, name
- Slow response to novel environmental sounds
- Poor auditory discrimination even in low levels of background noise

Seeker

- Shouting
- Banging objects to make a noise
- Putting music up very loud

Over reactive

- Difficulty blocking out background noise
- Sensitive to lawnmowers, hairdryers, vacuum cleaners
- Difficult coping in assembly, PE, lunch halls
- Covers ears
- Creates own noise to overshadow background noise
- Challenging behaviour in order to leave

Vestibular information

Under reactive

- Poor balance
- Reduced protective reactions to movement
- Clumsy
- Sedentary – prefers table top activities to sports and active play

Seeker

- Bounces up and down
- Constantly moving
- Can't sit still at desk/on carpet
- Spins round
- Rocking

Over reactive

- Over-reacts when feet are elevated from the ground
- Avoid swings
- Avoids having feet elevated
- Fear of stairs or steps
- Motion sickness



Visual information

Under reactive

- Difficulty finding equipment in visually busy backgrounds
- Struggles to locate friends in playground
- Struggles to find where they are on the page



Seeker

- Looking at shiny objects
- Flickering fingers
- Enjoys flashing lights and colours

Over reactive

- Doesn't like bright lights
- Prefers darker rooms
- Covering or shading eyes
- Excessive blinking, eye watering when change in ambient lighting conditions
- Wears peaked caps, keeps hood up indoors or insists on keeping their hair long over their face

Oral information (Oral-tactile, olfactory, gustatory)

Under reactive

- May have unclear speech (language skills unaffected)
- Eating difficulties
- Messy eater, slow eater
- Dribbling, chapped lower lip

Over reactive

- Doesn't like having teeth brushed
- Picky eater – specific flavour preferences, restricted diet
- Preference for bland foods or uses ketchup as a flavour masker
- Gagging at strong smells

Seeker

- Mouthing and biting
- Puts unusual things in mouth
- Likes strong flavours and smells
- Makes peculiar mouth movements



Proprioception information

Under reactive



Over reactive

- Clumsy
- Bumping into objects
- “All thumbs”

Seeker

- Banging hands/ pencils on desk
- Rough with peers
- Bumping and crashing deliberately into objects
- Loves rough and tumble play

Is this a sensory response or a communicating behaviour?

Is it Sensory or Is It Behaviour?

Carolyn Murray Slutsky and Betty Paris

Sensory



Does this behaviour
obtain or avoid a
sensory experience
(internal/systemic)



What kind of sensory
input is sought or
avoided?



Is there an underlying
sensory processing
issues that can be
remediated?

Communication



Does this behaviour
obtain or avoid an
object, activity or
attention?



Does it work?



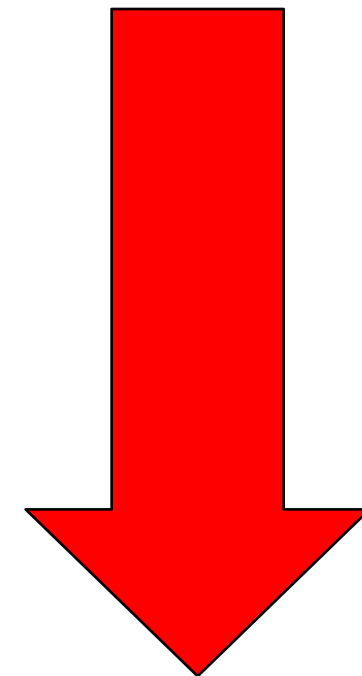
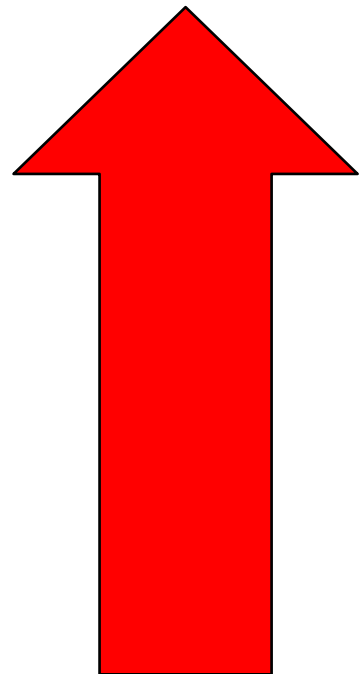
Is it socially
acceptable?

**SEE
BEHAVIOUR
AND
THINK
SENSORY**

Under-reactors
need more

Over-reactors
need less

- INTENSITY
- DURATION
- FREQUENCY
- NOVELTY



Tactile Support Strategies

Under reactive

- Varied touch activities
- Contrasting tactile substances within learning activities (sandpaper letters)
- Fidget toys
- A good scrub with the bath towel

Over reactive

- Do not approach from behind
- Use firm pressure not light touch
- Individual should control touch
- Forewarn
- Avoid sitting/standing in the middle of large groups or lines.
- Position away from traffic ways



Strategies for Auditory Support

Under reactive

- Give strong auditory cue (clap)
- Gain eye contact before giving instructions
- Individual should be close to sound source
- Use other sensory systems (visual)
- Short and clear directions – information chunking, pause more often
- Allow individual to make noise or find headphones for sound

Over reactive

- Reduce auditory stimuli (room acoustics, echoes, background noise)
- Do not talk over background noise
- Make noise/ speak in eyeline of individual
- Visual instructions
- Quiet corner or retreat
- Wear ear plugs/headphones
- Avoid going to noisy environments
- Forewarn individual



Strategies for Vestibular Support

Under reactive

- Structure movement activities into routine before seated work
- Lean against objects when requiring balance/ sit down
- Supportive seating
- Move n sit cushion for work at desk
- Structure movement in lessons
- Activities requiring different positions of body

Over reactive

- Allow individual to control
- Do not force individual into movement situations
- Equipment that is close to ground/ allow feet to touch ground in movement
- Slow rhythmical/predictable movement first
- Avoid fast movements before settled activity
- Individual may work better in different orientations (lying down)



Strategies for Visual Support

Under reactive

- Highlight area of attention
- Remove visual clutter
- Bright colours
- Clear borders
- Visually moving activities
- Computers

Over reactive

- Avoid fluorescent or bright lights
- Allow wearing of a peaked cap
- Reduce visual distractions
- Allow time to retreat from bright environments
- Avoid flickering and flashing lights
- Forewarn about bright environments



Strategies for Oral Support

Under reactive

- Strong flavoured foods
- Vibration (electric toothbrushes etc.)
- Z-Vibe
- Sucking, blowing, making noises, whistles, blowing raspberries
- Crunchy snacks
- Sour and fizzy foods
- Aromatherapy oils in playdough
- Use smell as part of communication system

Over reactive

- Deep pressure to lips and palate
- Chewing: tube, neutral gum
- Forewarn
- Build choice into activities
- Use bland tasting foods
- Reduce the pressure on children to eat foods they are unsure of
- Avoid strong perfumes, scented cosmetics, fabric conditioners, air fresheners
- Work away from areas with food smells



Strategies for Proprioceptive support

Under reactive

- Pushing, pulling, moving heavy objects
- Door frame pushes
- Push-ups, handstands
- Yoga positions and stretches
- Sitting cross-legged
- Chairs with sides and backs
- Dance sacks
- Digging in the garden or sandpit



Posture and Praxis

- Making your body do what you want
- In typically developing babies and children, each motor milestone is underpinned by sensory processing developments.

Postural development





A person with a Postural Disorder may appear:

- Unmotivated, indifferent, “lazy”
- Weak, limp
- Tires easily, appears tired most of the time
- Gives up when challenged physically & cognitively
- Difficulty with physical endurance especially in competitive games

A person with good postural control can develop



Good eye-hand control



Good bilateral co-ordination



A person with poor praxis and motor planning

- Difficulty learning new skills
 - May prefer sedentary play/books
 - Repertoire of play limited
- Difficulty transitioning
- Difficulty transferring skills/generalising
- Reduced confidence especially in new situations
- Withdrawn/shy
- Chatty/clowning

Next Steps

- what you can do to help -

- Recognising the signs of Sensory Processing Disorders and referring for assessment and treatment if needed
- Creating a sensory-aware school environment
- Build a sensory preference chart for each child
- Building on your knowledge and skills

Individual Sensory Preference Chart

This can be made up for each child to assist parents, therapists and teacher to communicate with each other and other caregivers.

Typically the chart would list the daily activity, the sensory input, the application and the purpose

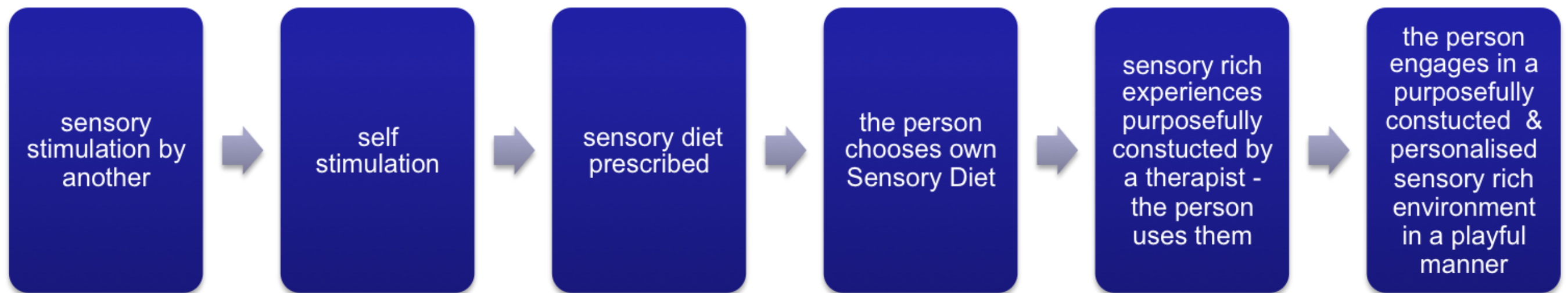
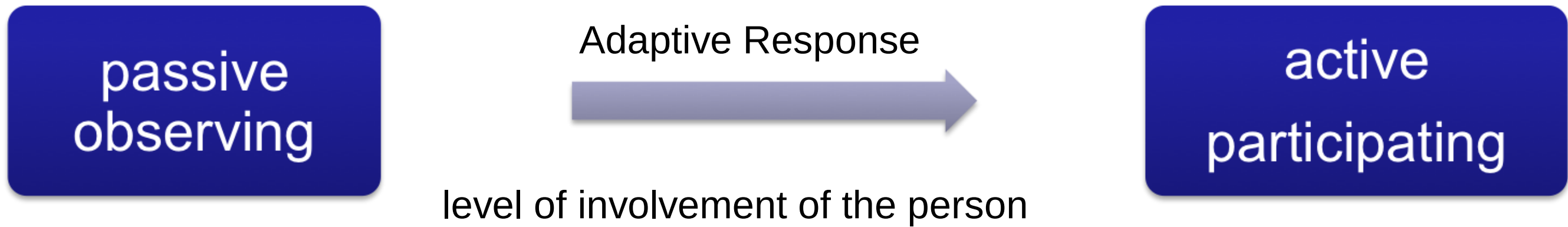
Individual Sensory Preference Chart

Name: *Mark*

DOB: *07/08/2002*

Date: *26 Jan 2014*

Daily Activity	Sensory Input	Application	Purpose
<i>Meal , Adult initiated</i>	<i>Three-sided booster chair Non-slip mat</i>	<i>Each meal</i>	<i>Keeps him focussed and in seat</i>
<i>School breaks</i>	<i>Movement toys, beanbag chair, box of chewies</i>	<i>Available for child; or adult initiated</i>	<i>Helps him refocus and take a break from structure</i>



Sensory input



sensory integration network

SenITA

A pragmatic Randomised Controlled Trial of **Sen**sory **I**ntegration **T**herapy versus usual care for sensory processing difficulties in **A**utism Spectrum Disorder in children: impact on behavioural difficulties, adaptive skills and socialisation (**SenITA**)

£1,2 million grant from NIHR – HTA.

SenITA

Children 4 – 11 yrs, with ASD/or on ASD pathway,
in mainstream or special class, South Wales or
some sites in England

To express an interest in participating in the study:

<http://senitastudy.weebly.com/>

For further information:

- www.sensoryintegration.org.uk
- Specific courses for teachers are held e.g. 'Alert' programme (1 day) and 'Understanding Sensory Processing in everyday life' (2 or 3 days)
- Sensory Integration on Facebook

Thank you for your time and attention.

Any questions?

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