

Pineal Gland Histology & lesser known facts

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Medical Science

- » Pineal body
- » Epiphysis cerebri
- » Glandula superior
- » Glandula pinealis Lt)
- » Conarium (Gr)
- » Konarion (Gr)

(Galen c 130 – c 210 AD)

Religious texts

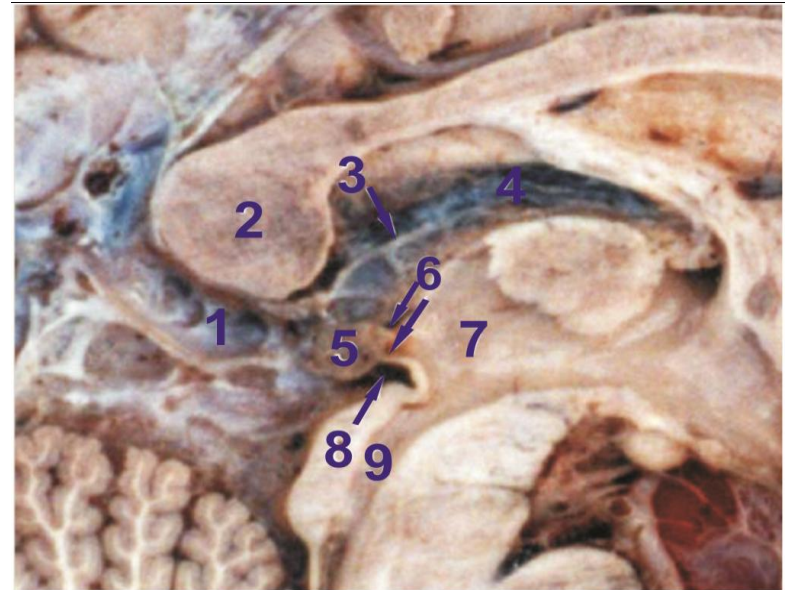
Western philosophy

- **Seat of the soul**
(Rene Descartis, 1596 – 1650)
- **God organ**
- **Pineal eye**
- **Third eye**

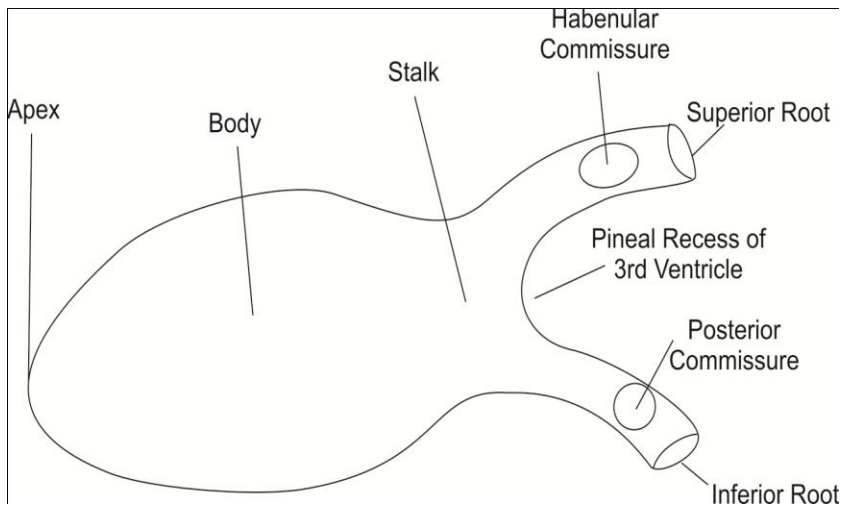
Eastern philosophy

- **Eye of Shiva**
- तीसरा तिल
- तीसरी आँख
- दिव्य चक्षु
- **Eye of Dangma (Tibet)**
- **चश्म-ए-बातिन (Persian)**

Dissected specimen



Gross Anatomy



- Piriform in shape
- Apex
- Body
- Stalk
- Roots- 2
- **Maximum** size by **2 years** (*Masayuki et al., 1996*).
- **No decrease** thereafter (*Tapp and Huxley, 1971*)

Histology

Very **sketchy** information in *text books*.

Enormous literature in *Journals & Reference books*.

Points of interest in **HISTOLOGY**.

➤ **Capsule**

➤ **Trabeculae**

➤ **Parenchyma. having**

– Pinealocytes

– Peptidergic neuron-like
cells

– Phagocytes

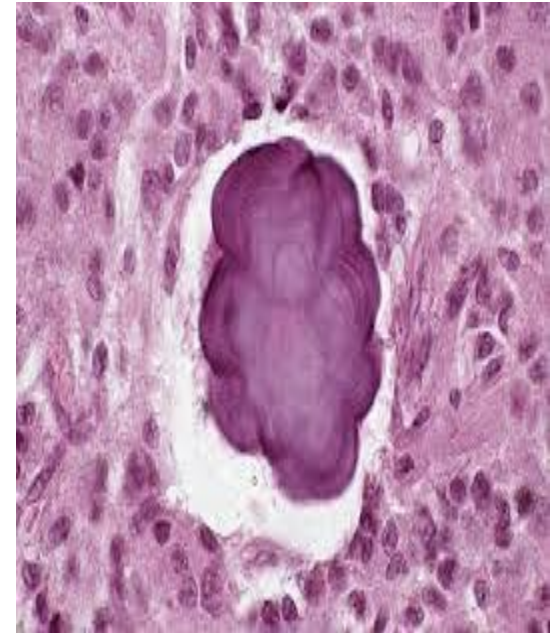
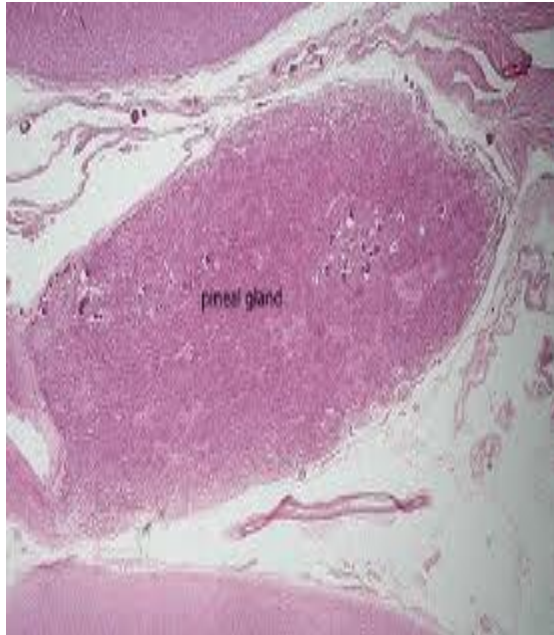
- Lamellate calcareous bodies.

- Calcite micro crystals.

- Blood vessels.

- Nerve endings

Histology

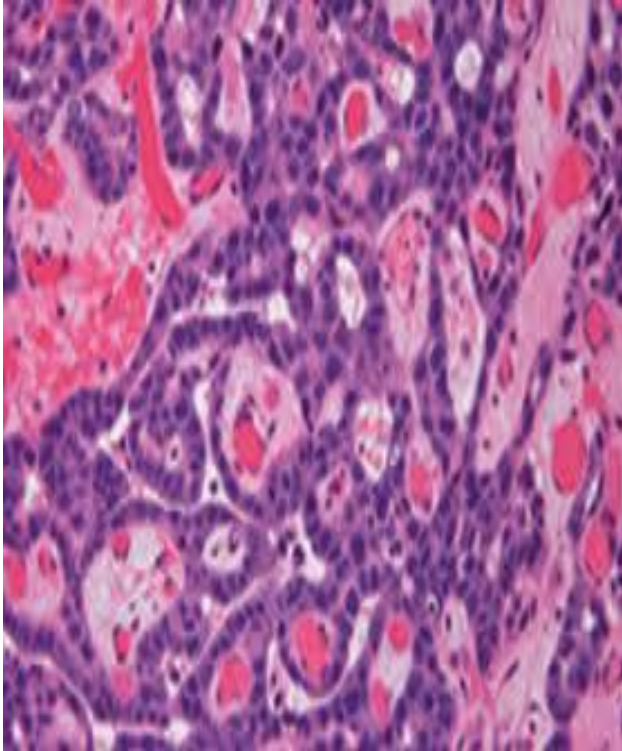


Histology



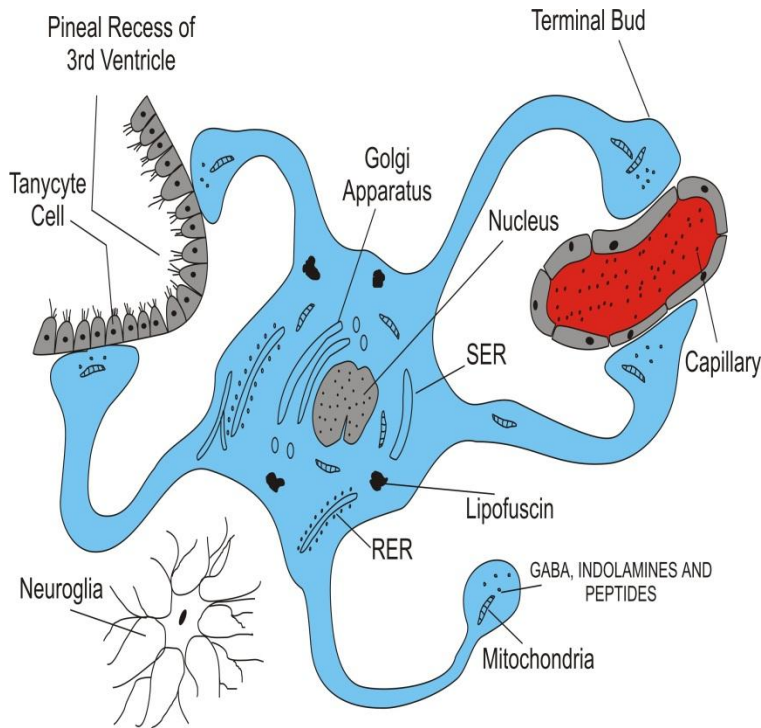
- Capsule.
- Trabeculae.
- Parenchyma.
 - Pinealocytes or chief cells.
 - Peptidergic neuron like cells.
 - Neuroglia – astrocytes.

Histology



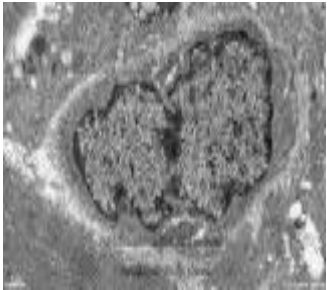
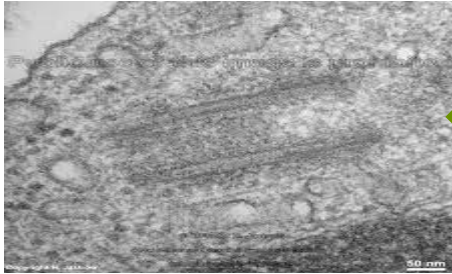
- **Parenchyma (contd.)**
 - **perivascular phagocytes.**
 - **interstitial cells.**
 - **Blood vessels, blood sinuses.**
(vascularity next only to kidney)
 - **Nerve endings: 3 types**
 - sympathetic,**
 - parasympathetic &**
 - sensory.**

Pinealocyte



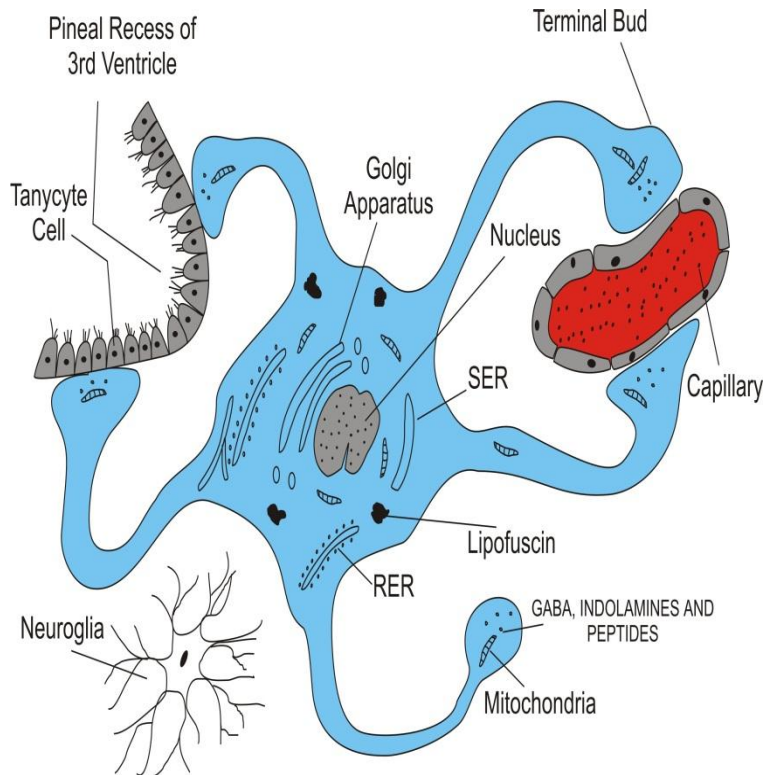
- **95%** of cell population.
- **Highly modified neurons.**
- **Arranged as cords & clusters.**
- **Body – polyhedral.**
- **Processes : 4 – 6.**

Pinealocyte



- **Nucleus.**
- **Golgi apparatus.**
- **RER & SER.**
- **Mitochondria.**
- **Microtubules.**
- **Lipofuscin pigment.**

Pinealocyte



- **Terminal buds** end on blood capillaries and wall of ventricle of brain for to and fro transfer of molecules in blood and CSF.
- Membranous bags resembling **CONES of Retina**.
- Hormones –
 - Indolamines
 - DMT

Types of Pinealocyte

Light type

- Out number dark type.
- Round of oval cell body.
- Round nucleus.
- Rich in vesicles and ribbons.

Dark Type

- Variable shape.
- Numerous nuclear in- folding forming nuclear pellets.
- Pigment in cytoplasm.

Third type

- Very small cell type.
- Extremely thin.
- Elongated cell bodies.
- Elongated nucleus.

Koshy & Vittevel [*J. Anat. Soc. India*, 2001, 50 (1): 01-06].

Al Hussain [*Folia Morph* 2006 vol. 65 (Aug (3): 181-187].

Histology

Peptidergic Neuron-like Cells

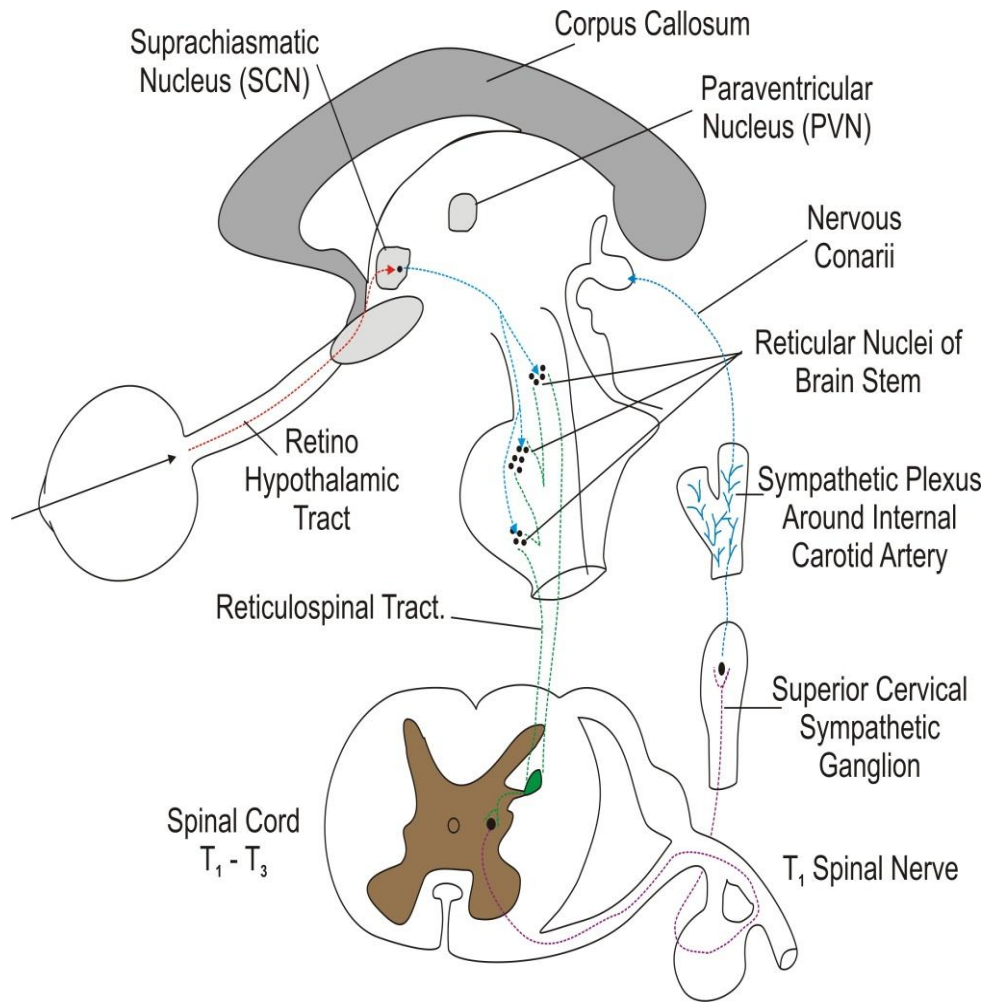
- ❑ These cells have been **histochemically** identified in the pineal parenchyma.
- ❑ Their classification based on the hormones synthesized and secreted is yet to come.

Nerve supply

Nerve endings: 3 types

- ❑ Sympathetic: for secretion.
- ❑ parasympathetic & sensory: for feed back.

Phototransduction cascade of light signals



5 to 7 neuron pathway

- **Retina..... 1st**
- **SCN.....2nd**
- **Mid brain..... 3rd**
- **Spinal cord (T1).....4th**
- **Sup Cer Sym Gang....5th**
- **Plexus around ICA**
- **Nervous conarii**
- **Pineal gland**

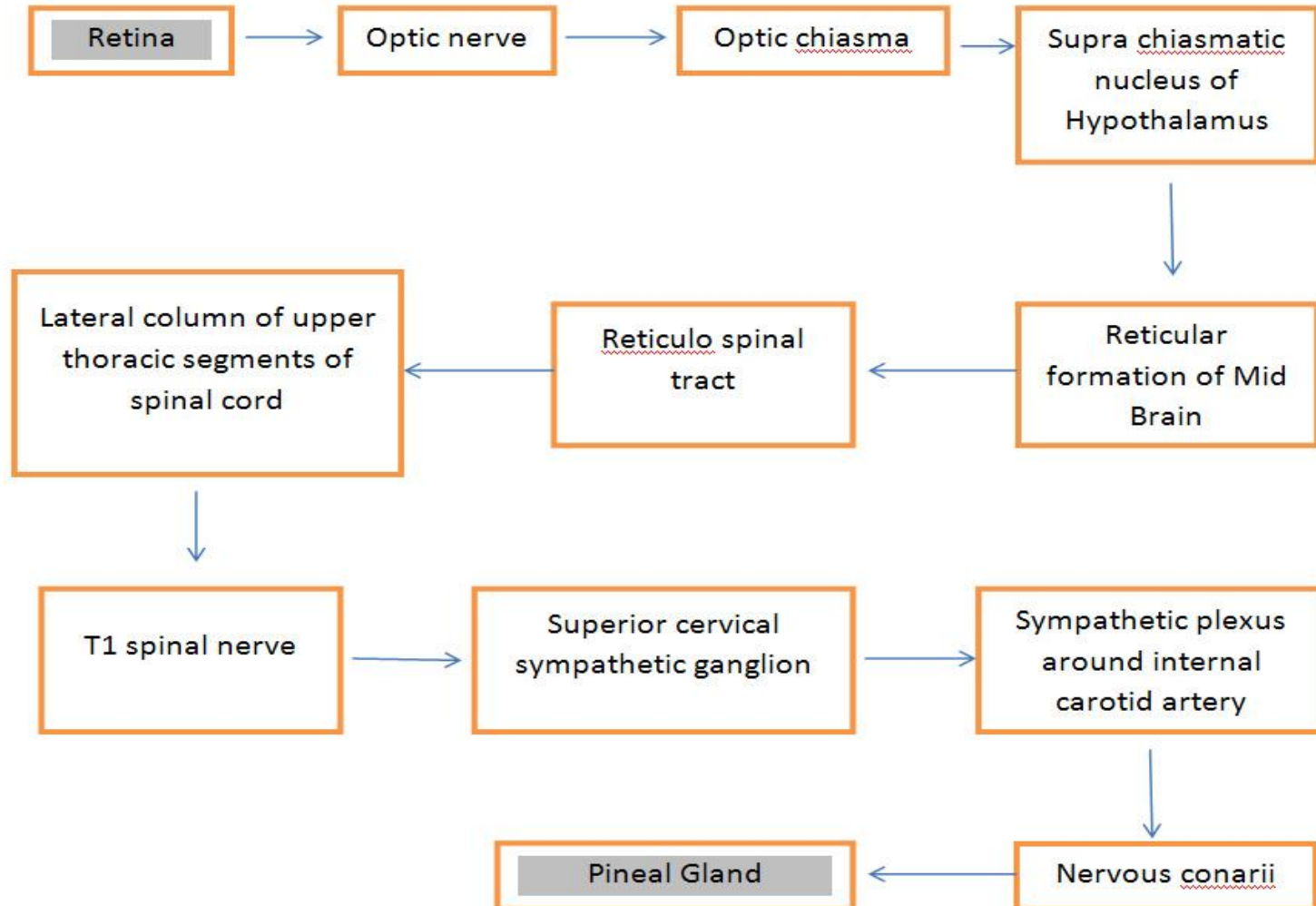
(Singh IB , 2006)

(Standering et al. 2008)

(Gunasegaran JP, 2010)

(Pal GP, 2012)

Flow chart of light stimuli reaching Pineal Gland (Photoreceptor cascade)

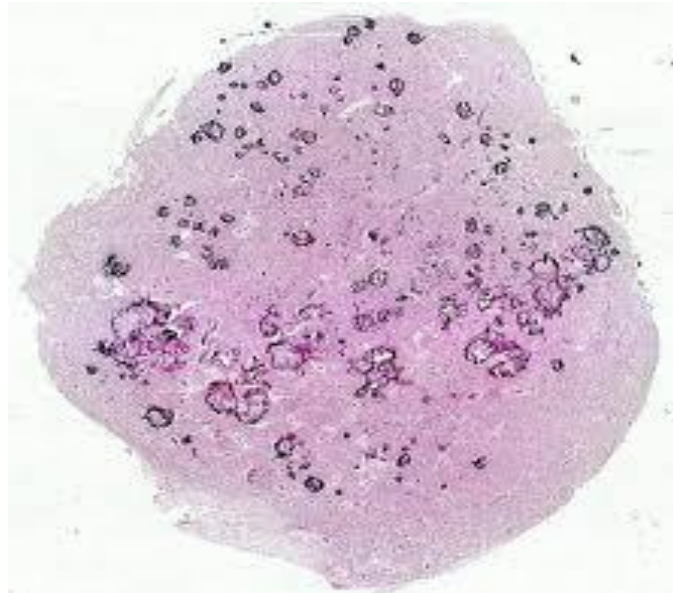


A new nerve tract of Pineal gland

- **D. Larry Sparks** (1998) reported the presence of both myelinated and non-myelinated fibers connecting the pineal gland and the pre-tectal area.
- A previously unreported paired fiber tract was observed associated with the anterior inferio- ventro-lateral pineal gland. This paired tract appears to be physically separate and distinct from the posterior commissure.
- These tracts form a structural component of the wall of the pineal recess. The fibers coursing in this paired tract are myelinated, and are of two different sizes (1–3 mm diameter and 5–8 mm diameter) as determined by electron microscopy. Fibers from these tracts invade the pineal gland and can be traced a short distance into the lateral pre-tectal area.
- The precise point of origin and termination for this paired tract is unknown.

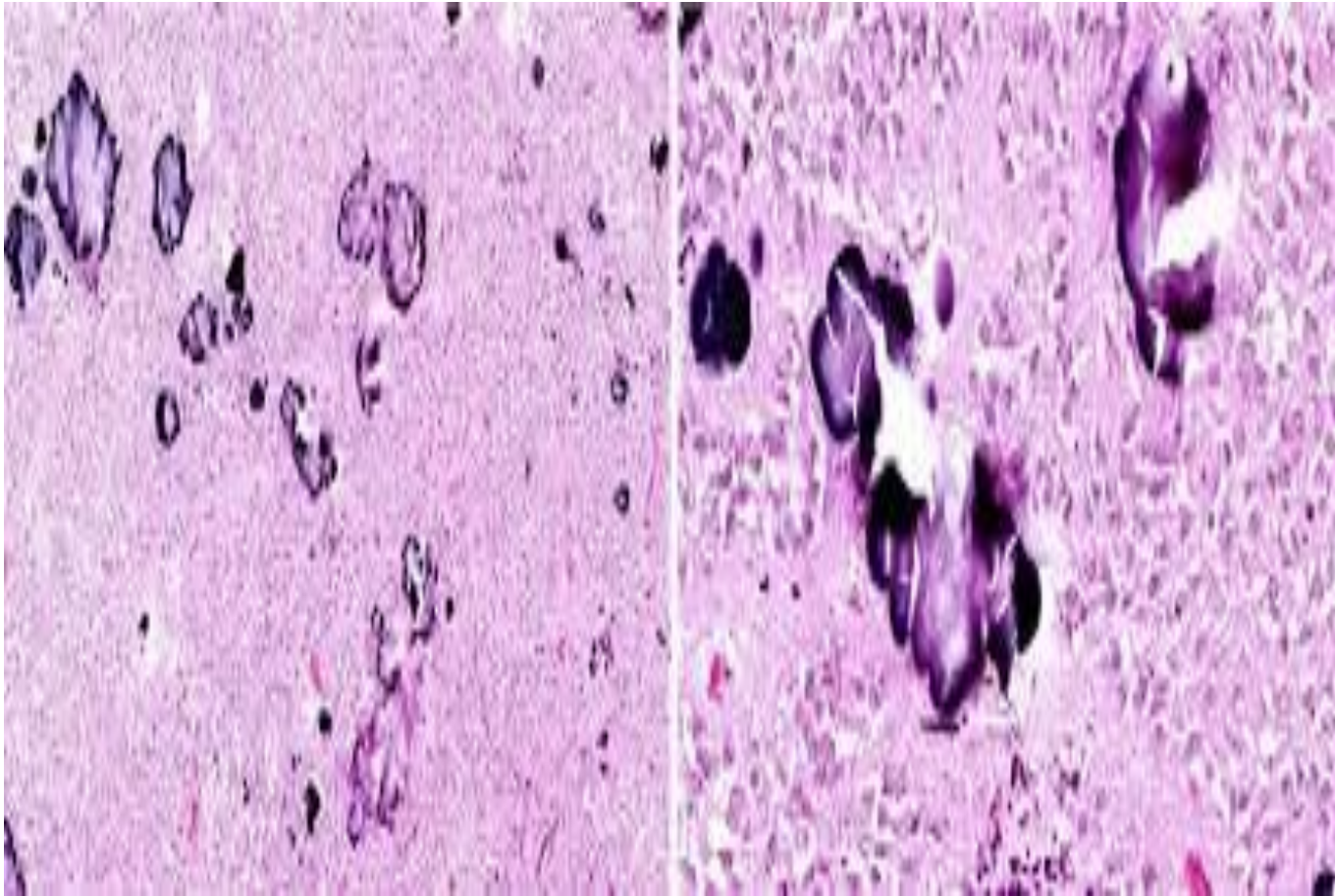
Pineal Gland - Minerals

Medical Scientists / Physicists, Electrical / Electronic engineers have been differently interested since early '60s.



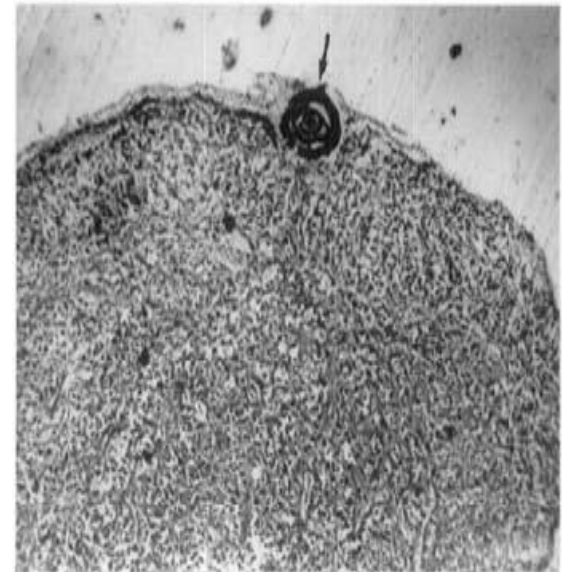
H & E Stain showing minerals

Minerals in Pineal Gland

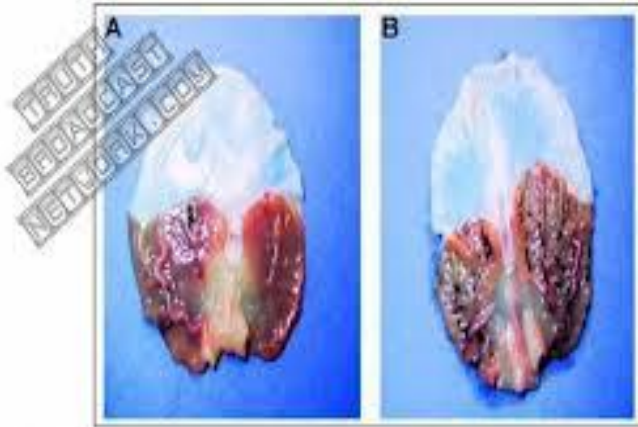


Lamellate calcareous bodies

- Both intra pineal and extra pineal.
- May result in to distortion of shape of the gland.
- At many places found attached to the cytoplasmic membrane of pinealocytes.



Fluoride in Pineal Gland



A pineal gland. Fluoride is deposited here as a result of consumption of fluoridated water.

- Pineal is the **prime target** of fluoride accumulation.
 - **Magnetic forces** attract fluoride to the pineal gland.
 - Fluoride is **strikingly high** in the Pineal gland (Luke 2001).
 - soft part (Non-calcified)
approx. **300 ppm**
 - hard part approx. **21,000 ppm**
-

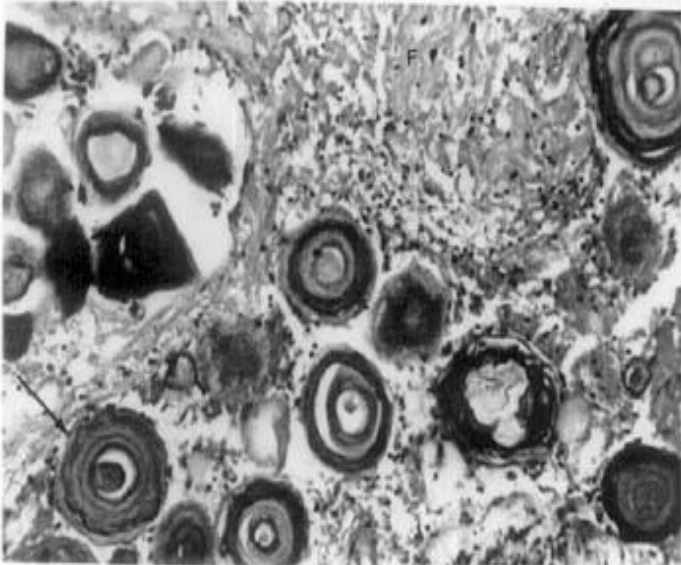
- **Jennifer Luke (1997)**, *British scientist from University of Surrey, in England. Ph.D thesis.*

Fluoride in Pineal Gland

- **Drinking Water:** ~ 4 mg / Lit or 4 ppm
 - **Plasma:** 0.017 ± 0.011 ppm
 - **Breast milk:** 0.006 ± 0.002 ppm
 - **Tooth paste:** 1000 to 1500 ppm
 - **Pineal gland:** 300 to 21000 ppm
-
- **99%** of body fluoride is found in **calcified tissue**.

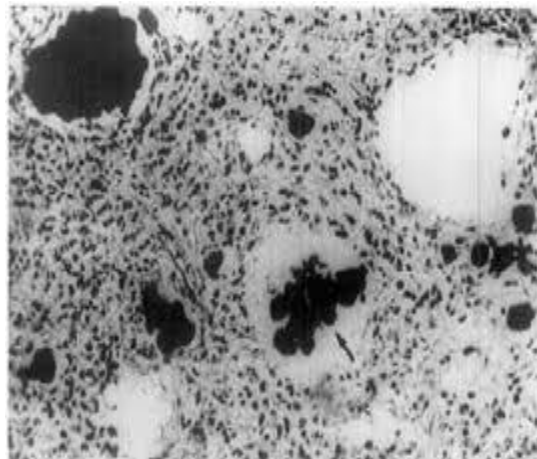
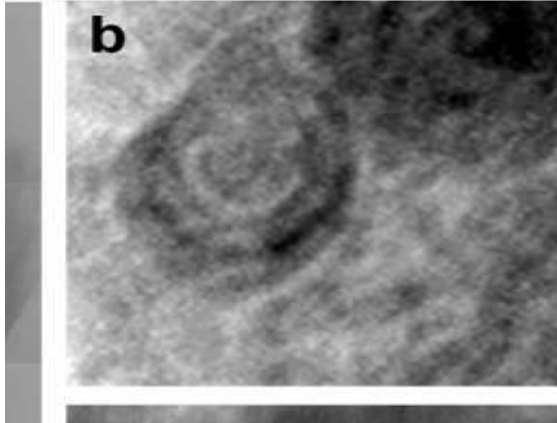
Why this **high concentration** in the pineal ?

Calcification in Pineal Gland



- For long the calcareous bodies have been regarded as signs of **aging and degeneration**.
- can occur at **any age**, even as early as **2 years of age** (Scharemborg & Liss 1965) .

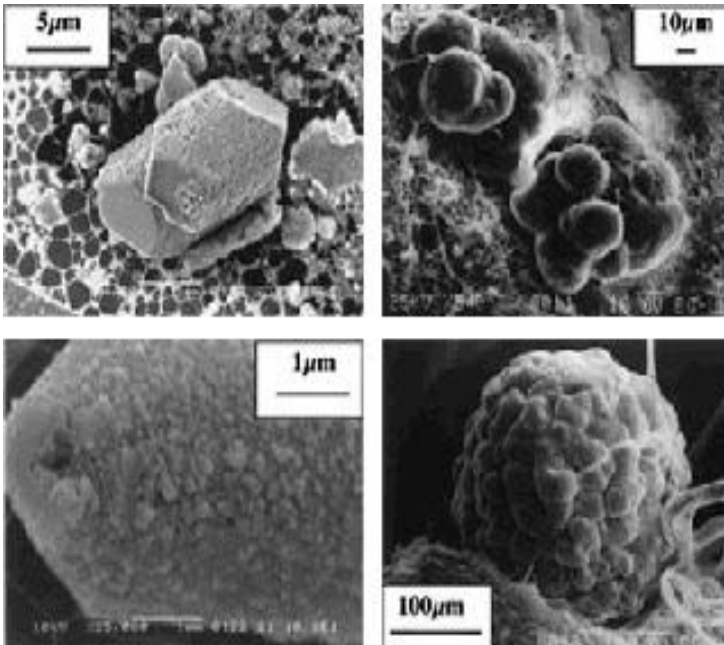
Calcification in Pineal Gland



➤ **Salts** of calcium, magnesium, phosphorus, ammonium, aluminum & fluoride arranged as:

- **Concentric lamellate calcareous deposits:** Corpora arenacea, acervulus (Lt), psammoma (Gr) bodies.
- **Scattered:** Brain sand, Calcite micro crystals.

Calcification in Pineal Gland



- calcite micro crystals.
- hexagonal in shape.
- found floating in pineal parenchyma (Lang et al. 1996).
- Non-uniform distribution and variable size.

Calcification in Pineal Gland

- Chemically - **hydroxyapatite crystals** which are also found in the bone minerals (Mabie & Wallace 1975).
- **Difference**In bone they form a **hard matrix** , in Pineal gland they are embedded **in soft matrix**.
- **Bacconnier 2002** first reported **100 to 300 micro-crystals / cu mm** in 20 human pineal s.
- The crystals **expand and contract** due to the presence of normally occurring electromagnetic field around us.

Calcification in Pineal Gland

- ↓ number of functioning pinealocytes (Kunz et al.1999)
- ↓ melatonin production (Kunz et at. 1999)
- **impairment** of sleep wake cycle (Mahlberg et al. 2009).
- Higher in **Alzheimer's** disease (Mahlberg et al. 2009).

Functions of Pineal gland

- For long the pineal gland has been regarded as a vestigial structure with no functional importance and that it degenerated with age.
- The Pineal gland evolved to **improve the vision** about 500 million years from now (David Klein, 2004), Chief of Neuroendocrinology of NICHD, USA

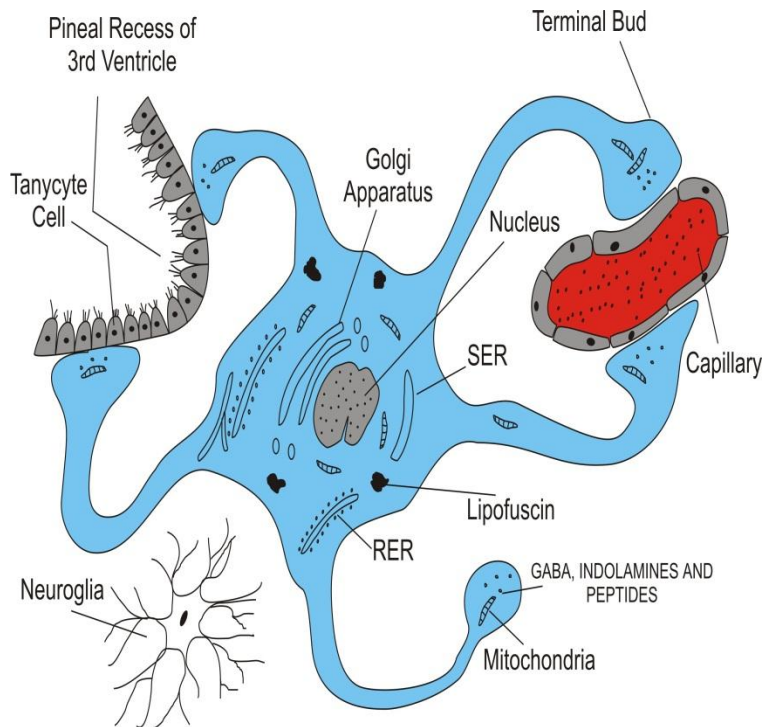
Functions

- **Till 1917 except for**
 1. **gross anatomy .**
 2. **intimate association with various **spiritual** phenomena.**
 3. **extract of cow pineal lightened the colour of frog skin, etc. **nothing else was known.****
- **Scientists consciously **avoided any work /experiment on pineal gland** because of its association with various spiritual phenomena.**

Functions of Pineal Gland

- In **1958** Aron B. Learner et al. from Uni. Of Yale (USA) in a mile stone research discovered **Melatonin** in the Pineal extract.
- Secretions require **sympathetic stimulus**.
- **Functions are regulated by light and dark**
 - ↑ in dark
 - ↓ in light

Functions of Pineal Gland



- Secretions are discharged both in **blood** capillaries and in **CSF**.

Functions of Pineal Gland

- **Indolamines** – synthesis and secretions, e.g.,
 - **MELATONIN**
 - Serotonin
 - 5- HT
 - Norepinephrine
 - Tryptophan
- **Melatonin** is also known as ‘**chronobiotic molecule**’ and regulates **circadian rhythm** together with SCN.
- **Peptide group of hormones** – synthesis and secretion. They inhibit pituitary thyroid parathyroid adrenal cortex adrenal medulla ovary.... Testis pancreas (endocrine).

Functions of Pineal Gland

□ Secretions— peptides

- Arginine vasolocin- ↓ gonadotropin hormone.
- Pineal antigonadotropin.
- Gonadotropin releasing hormones..
- Prolactin releasing & inhibiting hormone.
- Thyrotropin releasing & inhibiting hormone.
- Neurophysin – prohormone.
- **More hormones are to be discovered.**

Functions of Pineal Gland

- **Thermoregulation**.....↑regulated by pineal. ↓ regulated by SCN
- DMT – (Di-methyl tryptamine) There is **massive release of DMT** from pineal gland close to death, which is responsible for near death experience (NDE).
- (Strassman (2001) proposed the theory that DMT could be the **“Spirit molecule”**.

Di-methyl-tryptamine

- **NDE are both auditory and visual.**
- **Strassman 2001** demonstrated that **DMT** production is **stimulated** at the time of
 - medication,
 - Child birth,
 - Sexual ecstasy,
 - extreme physical stress,
 - near death &
 - death.

Circadian rhythm and Pineal Gland

- The pineal gland is a **control tower for the Biological Clock** is the classical concept.
- However, It is **doubtful in the human beings** as this function has been by and large taken over by **Supra Chiasmatic Nucleus**.
- Light sensing capabilities in **retina, iris, skin & pineal gland**.
- In cell culture each of them have **independent rhythm**.
- **Retina**, in human beings might **have its own Clock** which could also be **set and reset** like Biological Clock after jet lag.
- **Location** of the clock in retina is **not yet known**.

Infrared energy and Pineal gland

- Infrared energy waves have **lower frequency with longer wave length** in the light spectrum.
- They correspond with **lower emotional energies and moods**.
- Strong pulses of infrared energy affect brain and **especially calcite micro crystals**. Resulting into:-
 - sleepiness
 - crying
 - agitation
 - depression
 - anxiety
 - Apathy
 - aggression
 - fear
 - terror
 - hopelessness
 - grief
 - death

Other unique functions

- **EM fields: 60 Hz** suppress the activity of **Pineal gland** in our homes, work place and out side (Burch James et al. 1999). and reduce **melatonin** production.
- They interact with **Global System for Mobile (GSM) waves** which could constitute a new mechanism for **electro-mechano-transduction** for pinealocyte membrane.
- **Pineal Gland in Birds:** Calcite micro crystals (magnetite) works as magnetoreceptor to align the body in space and therefore works as **Instrument of navigation**.

Other unique functions

- **Blind men:** It is postulated that the pineal might be performing a **similar function**.
- **Gottfried de Puruker 2011** that
“ The pineal gland vibrates gently when ever we have a hunch. It vibrates more strongly when we have intuition or a sudden flash of intuitive understanding.”

Other unique functions

- Calcite micro crystals emit **cold light** in the range of **blue & green** (Atari 1982). **Piezoluminescence**.
- Pineal calcifications are also **piezoelectric** (Cady 1964).
- Electricity produced is in the frequency range of **mobile communication**.
- These crystals are capable of tuning into **radio stations without the use of electricity**.

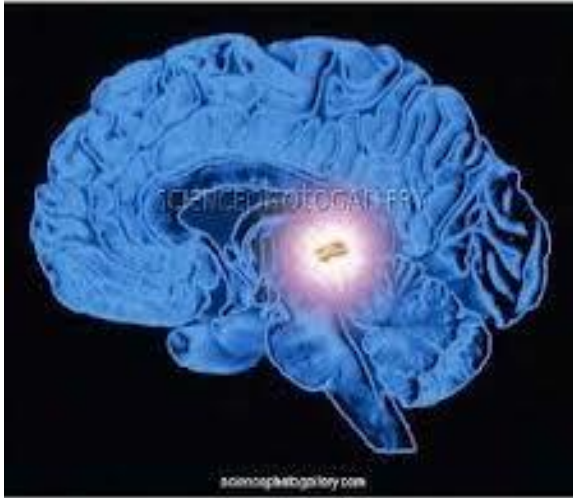
Piezoelectricity in pineal gland

- Pineal calcifications are **piezoelectric** (Cady 1964).
- Piezoelectricity means **electricity resulting from pressure** or in response to the applied mechanical stress (Reiter 1993).
- This is in the frequency range of **mobile communication**.
- These crystals are capable of tuning into **radio stations with out the use of electricity**.

Piezoelectricity in pineal gland

- These crystals turn sound vibrations into electrical current and thus used in the microphones.
- Cell phones and microwave emitting devices have an **adverse effect** on the pineal gland by changing the way these crystals function in the gland.
- These crystals also **interrupt the synthesis of melatonin.**

Piezoluminescence in Pineal gland



- Emission of light due to pressure upon solids.
- Calcite micro crystals emit **cold light** in the range of **blue & green** (Atari 1982).
- This phenomenon also occurs in certain **marine fishes**.

Solar flare and Pineal Gland



Solar flare--Pineal glands is **stimulated**.

Infrared energy --
Evening sun ↑

Ultra violet --
Morning sun ↑

Solar flare and Pineal Gland

- On **1st September 1859** **Richard Carrington** for the first observed Solar Flare (storm) with the help of an optical telescope.
- They **keep happening** in varying quantum and frequency.
- Published in New Scientist 1998 - there is a **direct connection** between solar flares and human **biological phenomena**.
- Due to **sudden spurt in EM activity** Pineal gland is **stimulated** during solar flare producing excessive melatonin.

Summary of factors influencing Pineal functions

Stimulated

- Darkness
- Sympathetic stimulus
- Pineal tumors
- Solar flare
- UV light - morning sun
- Infrared – evening sun

Depressed

- Light
- EM Field
- Infrared energy- strong pulse
- Mobile phones
- Microwave emitting devices.
- Strong magnetic field
- Fluoride accumulation
- Calcium deposits
- Alzheimer's disease
- Stress
- High altitude
- Nutritional imbalance

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