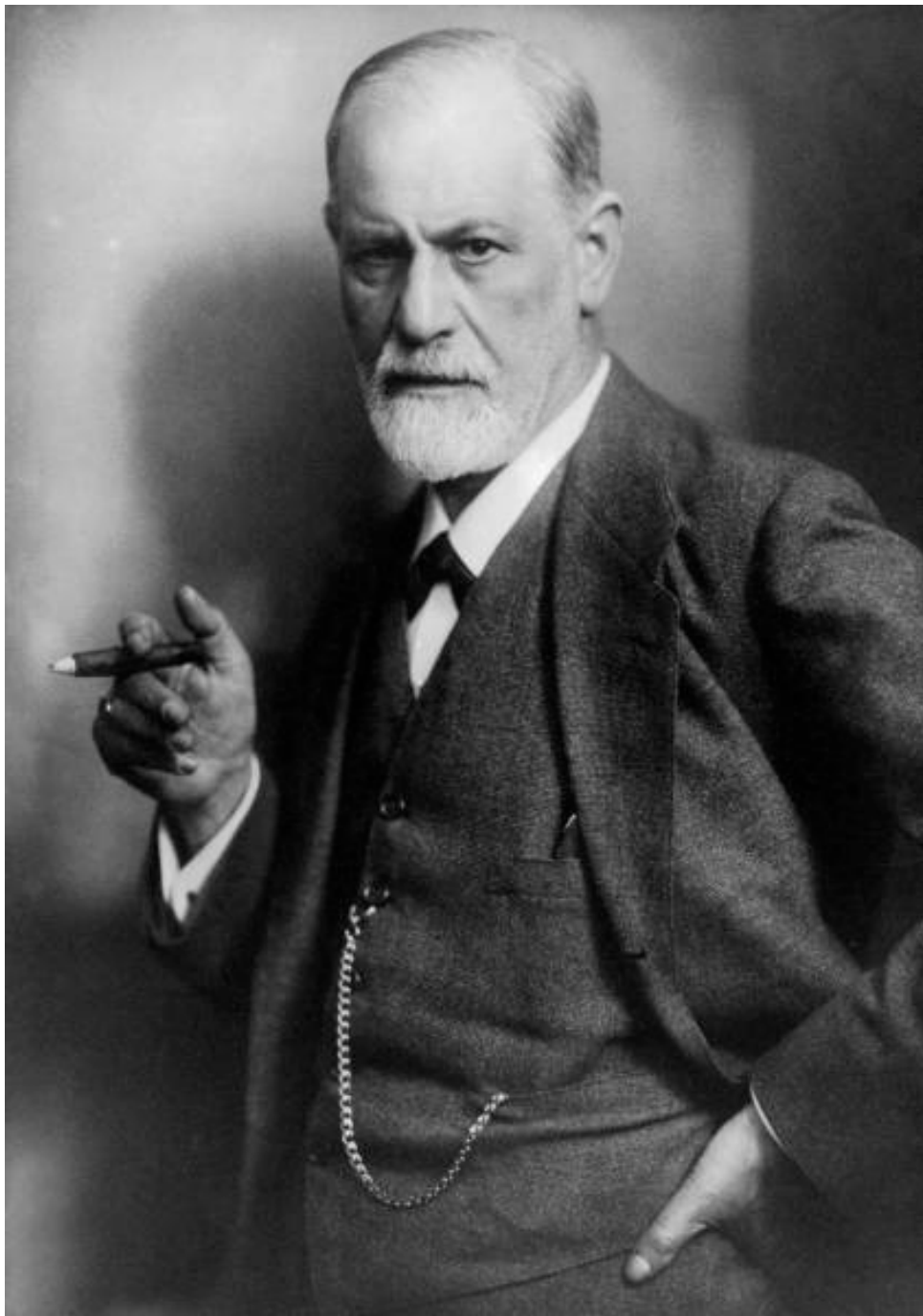




Neuroscience: What's Freud got to do with it?



Freud 101

- **Psychoanalysis:** a set of psychological and psychotherapeutic theories, and associated techniques
 - importance of *early childhood* in determining adult personality
 - importance of *irrational drives* in behaviour and thought
 - irrational drives are *unconscious*
 - attempts to bring these drives into awareness meet psychological resistance in the form of *defense mechanisms*
 - conflicts between conscious and unconscious, or repressed, material can materialise in mental or emotional *disturbances*
 - liberation from effect of unconscious material through bringing material into consciousness

This decline is regrettable, since psychoanalysis still represents the most coherent and intellectually satisfying view of the mind... My purpose in this article is to suggest one way that psychoanalysis might re-energize itself, and that is by developing a closer relationship with biology in general and with cognitive neuroscience in particular.

(Kandel, 1999)

Freud: neuroanatomist

- A decade in basic neuroscience (1875-1885, Institute of Physiology, Vienna)
- histological studies of nervous tissue in the lamprey and crayfish
- 14 papers
- Contributions to various issues:
 - emanation of nerve fibres from nerve cell somata
 - existence of fibrils (microtubules) within nerve fibres
 - movement of nucleoli in nerve cells
 - role of the nerve cell as unit of the nervous system
 - structure and development of medulla oblongata
 - described the white matter tracts connecting spinal cord and cerebellum

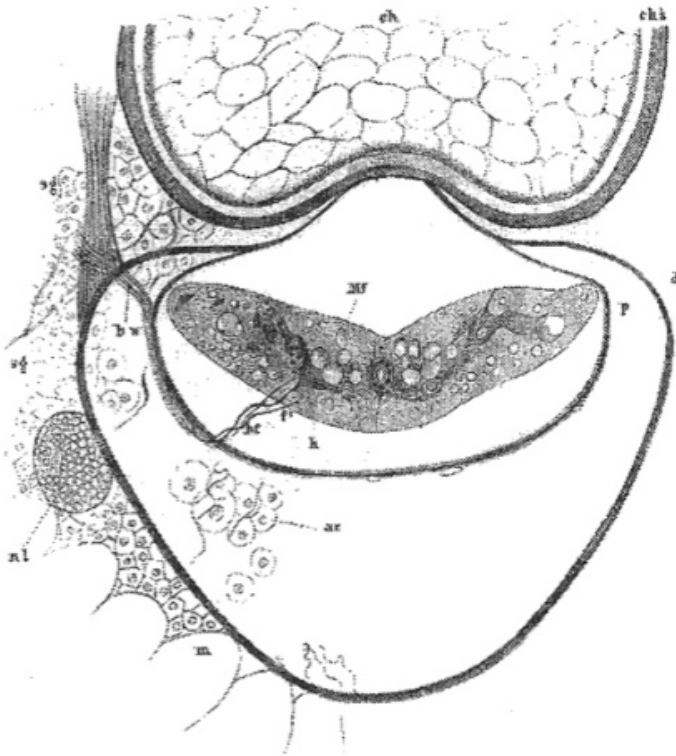
A NEW HISTOLOGICAL METHOD FOR THE STUDY OF NERVE-TRACTS IN THE BRAIN AND SPINAL CHORD.

BY DR. SIGM. FREUD,

Assistant Physician to the Vienna General Hospital.

In the course of my studies on the structure and development of the medulla oblongata I succeeded in working out the following method, which will be found a powerful aid in tracing the course of fibres in the central nervous system of the adult and the embryo.

Pieces of the organ are hardened in bichromate of potash, or in *Erlicki's* fluid (2½ parts of bichromate of potash and ½ of sulphate of copper to 100 parts of water), and the process of hardening is finished by placing the specimen in alcohol; thin sections are cut by means of a microtome and washed in distilled water. The washed sections are brought into an aqueous solution of chloride of gold (1 to 100) to which is added half or an equal volume of strong alcohol. This mixture is to



Die Structur der Elemente des Nervensystems.

Von

Dr. Sigm. Freud,

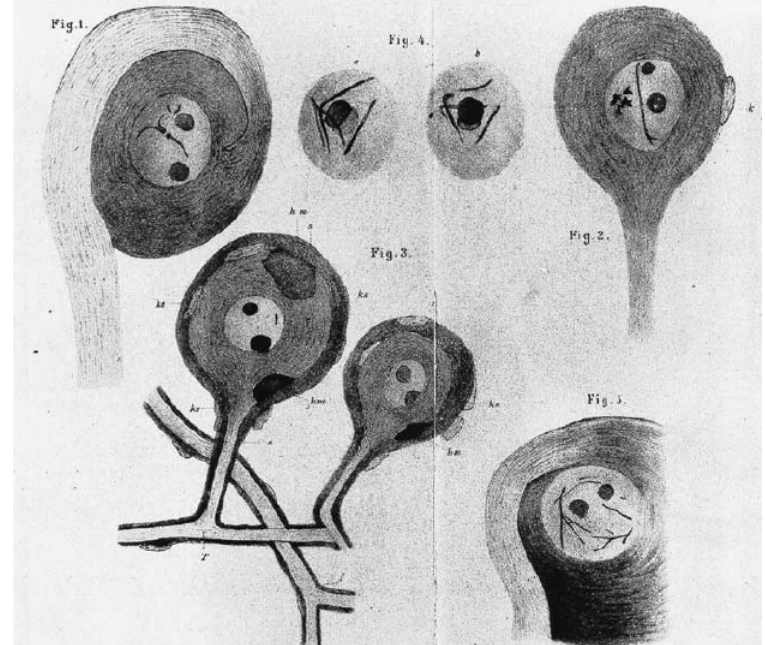
Secundärarzt im allgemeinen Krankenhause.

(Nach einem im psychiatrischen Vereine gehaltenen Vortrag.)

Sehr bald, nachdem Nervenzelle und Nervenfasern als die wesentlichen Bestandtheile des Nervensystems erkannt worden waren, begannen die Bemühungen, die feinere Structur dieser beiden Elemente aufzuklären, wobei die Hoffnung von Einfluss war, aus der erkannten Structur Schlüsse auf die physiologische Dignität derselben ziehen zu können. Es ist bekanntlich nicht gelungen, nach einer dieser beiden Richtungen befriedigenden Aufschluss und Einigung zu erzielen: dem einen Autor gilt die Nervenzelle als körnig, dem anderen als fibrillär; die Nervenfasern oder deren wesentlicher Bestandtheil, der Achsen-cylinder, dem einen als ein Fibrillenbündel, dem andern als eine Flüssigkeitskule, und dem entsprechend wird die Nervenzelle hier als der eigentliche Herd der Nerventhätigkeit gewürdigt, dort zur Bedeutung eines Kernes der Schwann'schen Scheide degradirt.

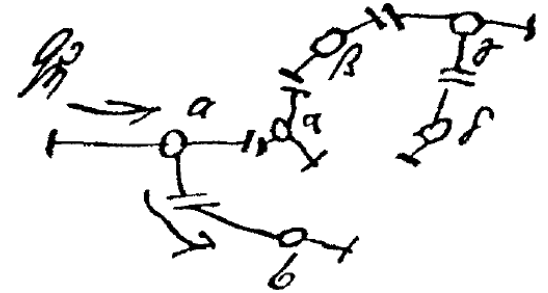
Da ich nun glaube, dass in meiner Untersuchung „Ueber den Bau der Nervenfasern und Nervenzellen beim Flusskrebs“ eine wohl begründete Lösung des uns beschäftigenden Problems gegeben ist, will ich mir erlauben, den Inhalt derselben an dieser Stelle vorzubringen. Vorher muss ich es aber rechtfertigen, dass ich den Flusskrebs zum Object meiner Untersuchung gewählt, oder dass ich den

S. Freud: Über den Bau der Nervenfasern und Nervenzellen beim Flusskrebs.



Freud: theoretical neuroscientist

- 'Project for a Scientific Psychology' (1895)
- 'Quantity' Q
- 2 neuronal types
 - those “which allow Q to pass through as though they had no contact-barriers (=synapses)”
 - those “whose contact-barriers make themselves felt, so that they only allow Q to pass through with difficulty or partially. The latter class may, after each excitation, be in a different state from before and they thus afford a *possibility of representing memory*”
- Synaptic plasticity
 - latter neurons “are permanently altered by the passage of excitation” as a result of their contact barriers being “brought into a permanently altered state”, “becoming more capable of conduction” and “less impermeable... We shall call describe this state of the contact-barriers as their degree of *facilitation*”



From Schott, G.D. (2011) 'Freud's *Project* and its diagram: anticipating the Hebbian synapse'

Freud and Pavlov

- *The individual will have made an important advance in his capacity for self-preservation if he can foresee and expect a traumatic situation of this kind which entails helplessness, instead of simply waiting for it to happen. Let us call a situation which contains the determinant for such expectation a danger situation. It is in this situation that the signal for anxiety is given.*

(Freud, 'Inhibitions, symptoms and anxiety', 1927)

- Suggestion that mental defenses substitute for actual flight/fright/fight in response to *internal danger*

Freud and Pavlov

- Controlling trains of thought
 - 5-HT inhibits trains of thoughts predicted to lead to negative terminal states (pruning)
 - reflexive, Pavlovian pruning leads to optimistic values due to underexploration of negative states
 - low 5-HT and ‘depressive realism’

Serotonin, Inhibition, and Negative Mood

Peter Dayan¹, Quentin J. M. Huys^{1,2*}

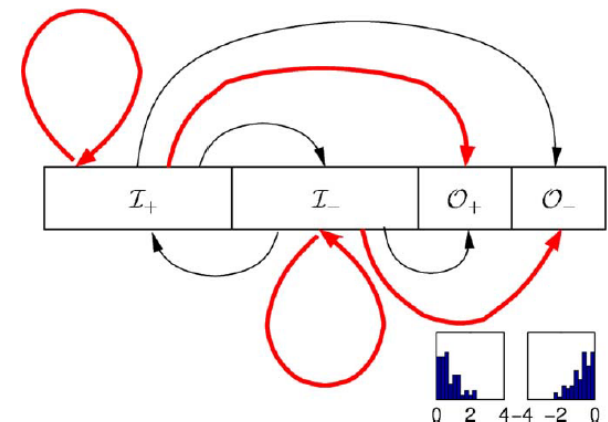


Figure 1. Markov Models of Thought

Defense mechanisms and the brain: the case of anosognosia

- Anosognosia: apparent lack of awareness of a disability, resulting from physiological damage (typically right parietal stroke, with paralysis of left side of body)

denial

VSR: Mrs D, how are you feeling today?
FD: I've got a headache. You know, doctor, I've had a stroke so they brought me to the hospital.
VSR: Mrs D, can you walk?
FD: Yes. (*FD had been in a wheelchair for the past two weeks. She cannot walk.*)
VSR: Mrs D, hold out your hands. Can you move your hands?
FD: Yes.
VSR: Can you use your right hand?
FD: Yes.
VSR: Can you use your left hand?
FD: Yes.
VSR: Are both hands equally strong?
FD: Yes, of course they are equally strong.

confabulation

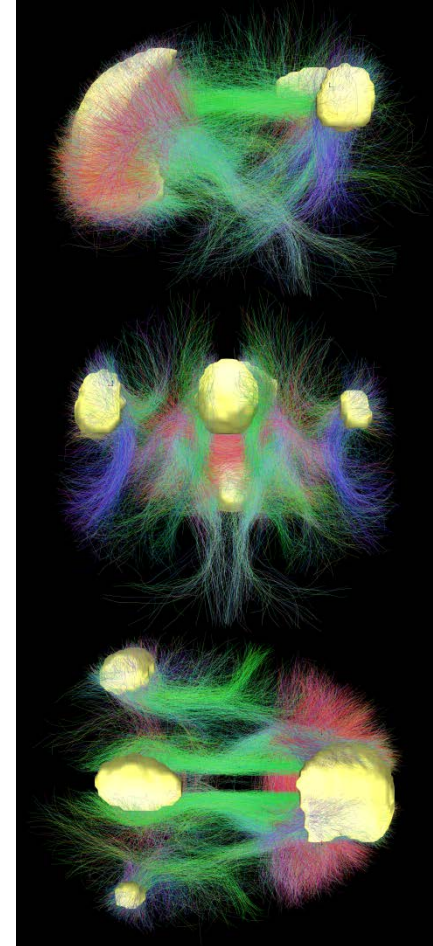
VSR: Can you point to my nose with your right hand?
FD: (*She followed the instructions and pointed to my nose.*)
VSR: Mrs D, point to me with your left hand.
FD: (*Her hand lay paralyzed in front of her.*)
VSR: Mrs D, are you pointing to my nose?
FD: Yes.
VSR: Can you clearly see it pointing?
FD: Yes, it is about two inches from your nose.

- Patient willing to acknowledge a paralysis under a different interpretation
- Ramachandran: defense mechanisms allow creation of a coherent belief system to ensure stability of behaviour
- Hemispheric specialization:
 - left hemisphere deals with small, local anomalies by trying to impose consistency
 - right fronto-parietal area registers more significant discrepancies and promotes belief revision
(c.f. Sperry split-brain studies)

The DMN and the ego

Carhart-Harris and Friston (2010)

- ‘Default-mode network’ (DMN)
 - ‘resting state’ pattern of activity which consistently decreases during goal-directed cognition (Raichle, 2001)
 - associated with “self-referential processing, autobiographical recollection, mind-wandering and theory of mind...”
 - connectivity matures over development, functional connectivity weak in the elderly, ADHD, and impulse control disorders
 - large amount of evidence for limbic-suppressive functions
 - recollection of distressing memories and emotions in PTSD correlates with mPFC deactivations and medial lobe activations; blockade of these memories associated with mPFC activations



The DMN and the ego

- primary (id) vs secondary (ego) processes
- primary process
 - primitive mode of cognition, ‘protoconsciousness’
 - dreaming, psychosis, temporal lobe aura
 - sensations of fear/dread, perceptual distortions/hallucinations, deja vu/reliving phenomena, disturbed sense of self
 - high-amplitude low-frequency (theta) discharges in limbic and paralimbic regions

- Theory of the mind
 - *id*: inherited, fixed, the instincts (pleasure principle)
 - *ego*: derives from portion of id, intermediates between id and external world; self-preservation; control over the instinctual demands (reality principle)
 - *superego*: precipitate of parental influence
 - *...an action by the ego is as it should be if it satisfies simultaneously the demands of the id, of the super-ego and of reality...*
 - *...the id and the super-ego have one thing in common: they both represent the influences of the past (the id the influence of heredity, the super-ego essentially the influence of what is taken over from other people), whereas the ego is principally determined by the individual's own experience, that is to say by accidental and current events.*

Psychological determinism

- Idea that little of what one's psychic experience occurs by chance; (deterministic) unconscious mental processes explain the unfolding of such events ('psychodynamics')
- Purpose of free association to observe such data
-

- Theory of instincts
 - innate needs expressed by the id
 - ego is concerned with self-preservation and with ‘discovering the most favourable and least perilous method of obtaining satisfaction, taking the external world into account’
 - super-ego role in the limitation of satisfactions

- Theory of psychosexual development
 - oral phase: ‘To begin with, all mental activity is centred upon the task of providing satisfaction for the needs of that zone [the mouth].’
 - sadistic-anal phase: ‘... satisfaction is then sought in aggression and in the excretory function.’
 - phallic phase: ‘... intellectual activity in the service of sexual investigation’
 - genital phase
 - inhibition of development leads to sexual disturbances: fixations to conditions at earlier stages

- The mental qualities
 - The *conscious*
 - The *preconscious*: everything in the unconscious state that can easily exchange to the conscious state
 - the *unconscious*: that which has no easy access to consciousness
 - there can be variation in how easily unconscious content may be made conscious, the amount of resistance
 - idea that we can distinguish a *primary process* in the unconscious id, and a *secondary process* in the preconscious ego

- Dreams

- distinction between the manifest dream material and the latent dream thoughts
- efforts of the ego leads to dream distortion
- wish fulfillment; ‘... every dream is an attempt to put aside a disturbance of sleep by means of a wish fulfillment. The dream is thus the guardian of sleep.’
- dreams are psychoses; can the theory of dreams be applied to neuroses and psychoses?

- Free association

- the injunction to say anything that comes to mind, providing the data for analysis

- Transference
 - reproduces the patient's relation with his parents

- Parapraxes
 - slips