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## History of neurology

# Antoine Ritti (1844–1920), forgotten alienist and innovative theorist on the pathophysiology of hallucinations

## Antoine Ritti (1844–1920), un aliéniste oublié, concepteur d'une théorie innovante des hallucinations

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### ARTICLE INFO

#### Article history:

Received 16 November 2010

Received in revised form

23 January 2011

Accepted 28 January 2011

Published on line 2 June 2011

#### Keywords:

History of neurology

Hallucination

Ritti

Luys

Subthalamic nucleus

#### Mots clés :

Histoire de la neurologie

Hallucinations

Ritti

Luys

Noyaux sous-thalamiques

### ABSTRACT

Antoine Ritti (1844–1920), now forgotten, was an “alienist” or psychiatrist who formulated a theory of hallucination based on thalamic dysfunction, as described in his thesis defended in 1874. Ritti was a student of Jules Luys and used the anatomical-functional discoveries of his teacher to explain that an automatic activity in the thalamus, by stimulating the cortex without reception of sensory information, created autonomous representations, perceived by the patient but not by his entourage, a process occurring spontaneously to some degree. Hence, Ritti seems the first author to introduce the concept of sensory deprivation and release of subcortical function into the pathophysiology of hallucinations. This innovative theory, which gave subcortical structures a role in high-level cognitive function, is very resonant today but was ignored for several decades after Ritti published his work.

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### RÉSUMÉ

Antoine Ritti (1844–1920) est un « aliéniste » oublié, concepteur d'une théorie des hallucinations basée sur un dysfonctionnement du thalamus, exposée dans sa thèse soutenue en 1874. Élève de Jules Luys, il utilisa les découvertes anatomico-fonctionnelles de son maître pour expliquer qu'une activité automatique du thalamus, stimulant le cortex sans réception d'informations sensorielles, autonomisait, spontanément en quelque sorte, des représentations perçues par le malade et non pour son entourage. Ritti semble ainsi le premier auteur à introduire le concept de déprivation sensorielle et de libération fonctionnelle sous corticale dans la physiopathologie des hallucinations. Ce concept novateur de libération d'activités des structures sous corticales dans le fonctionnement cognitif élaboré trouve actuellement pleinement son sens mais fut ignoré pendant plusieurs décennies après ses travaux.

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doi:10.1016/j.neurol.2011.01.020

Today's definition of hallucination, from the Latin *hallucinare*, meaning to be deceived, remains that of Jean-Etienne Esquirol (1772-1840) in 1817, namely: "to firmly believe one is actually perceiving a sensation, whereas no object capable of provoking this sensation is within range of the senses". Esquirol went on to outline a pathophysiological theory that: "the supposed sensations during hallucinations are images and ideas reproduced by memory, associated with the imagination and personified by habit" (Esquirol, 1832; Bercherie, 2004).

Since François Boissier de Sauvages de la Croix (1706-1767) and his *Nosologia Methodica* (1768), hallucinations had been explained by damage to the sensory organs, even though they were classified as mental disturbances involving tinnitus (tinnitus, i.e. the imaginary perception of a clear, sharp sound that does not exist outside the ear) and mental disturbances involving vision (imaginary perception of a visible object that does not exist outside the eye). This theory of damaged sensory organs was re-asserted by Achille Foville (1799-1878) in 1824 and by Louis-Forentin Calmeil (1798-1895) in 1849.

In 1842, Jules Baillarger (1809-1890) noted that "the understanding of hallucinations varies widely among authors; some consider them a purely physical symptom, of which buzzing in the ears is the simplest example; others see them as a particular type of delirium that generally only differs from delirious thinking by its form. The former believe that those who hallucinate are truly affected as if they were seeing and hearing, etc.; the latter, on the contrary, believe that these patients are mistaken, and feel none of what they report". In the introduction to his book entitled *Des hallucinations*, published in 1852, Alexandre Briere de Boismont (1797-1881) proposed the following definition: "To see and hear what no eye or ear perceives, to be convinced of the reality of sensations which are met only with disbelief by others". At the same time he expressed doubt as to their causes: "Studies of cadaveric lesions associated with insanity do not provide any satisfactory indications for hallucination. Consequently, we share the opinion of most physicians on this point, namely that the pathological anatomy of hallucinations remains to be elucidated".

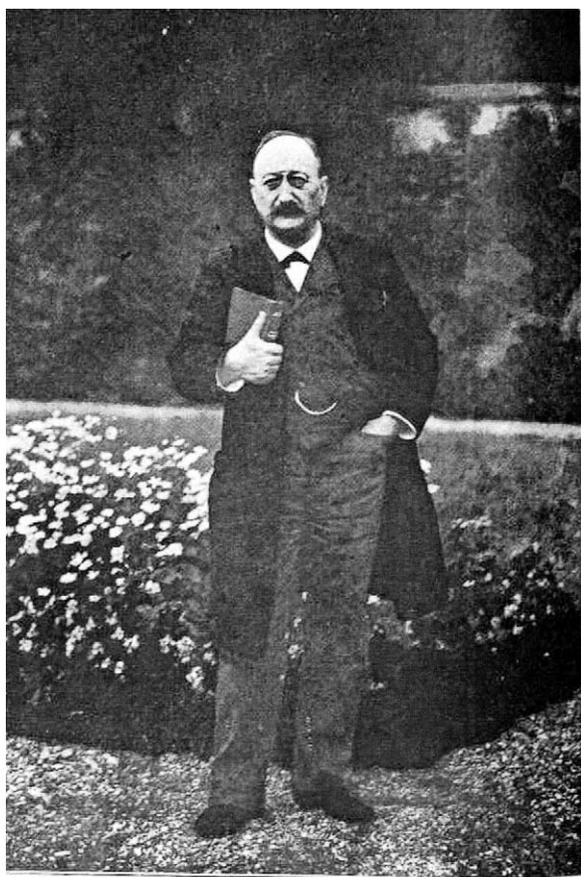
This sums up the conceptual difficulties faced by the psychiatrists of the 19th century. In contrast to the moral and religious, or romantic ideas on insanity which prevailed at the end of the 18th century in Europe, the 19th century saw the emergence of a major debate on its anatomical-pathological origins, notably after the 1822 description by Antoine Bayle (1799-1858) of general paralysis as a distinct pathology, and the doctrines of anatomist Franz Gall (1758-1828), founder of phrenology, which focused on "brain areas". Benedicte-Augustin Morel (1789-1873), student of Claude Bernard, developed the theory of "degenerescences" for cases where no lesion examined during autopsy could explain the patient's mental problems (Bogousslavsky and Moulin, 2011). All of these concepts would have a significant influence on Jules Luys (1828-1897), one of the major brain anatomists of the 19th century and Ritti's teacher. Luys's reputation suffered in the final years of his career, when he conducted highly criticized experiments on hysteria. He lost his way perhaps as a result of his severe deafness. Nonetheless, his early and middle career was marked by several seminal scientific contributions. He

became a hospital physician in 1862 and published two fundamental works, indicative of his intellectual prowess at the time: "Recherches sur le système nerveux cérébrospinal, sa structure, ses fonctions et ses maladies" (Studies of the cerebrospinal nervous system, its structure, functions and maladies) in 1865, and the first photographic atlas of the brain entitled *Iconographie photographique des centres nerveux* in 1872. In the latter, he described the "gray regions of the brain", previously ignored, i.e. the thalamus and the basal ganglia. This innovative work was enhanced by his own invention, in 1856, of a novel microtome for ultrafine sectioning of the brain. The goal he set for himself through these investigations was articulated by a quote from anatomist Jean Cruveilhier (1791-1874), with which he began his thesis, defended in 1857: "Les causes métaphysiques s'évanouiront à mesure que l'anatomie pathologie de texture fera des progrès" (metaphysical causes will vanish as the pathological anatomy of textures progresses). This bears witness to his organic conception of neurological and mental diseases (Luys, 1865; Parent and Parent, 2011). In 1862, Luys was appointed chief physician of the La Salpêtrière infirmary where he remained for only two years. Jean-Martin Charcot, two years older, arrived the same year as director of the main medical service for elderly women of the same institution. Charcot became interested in hysteria mainly after 1870. For him, hallucinations were an integral part of hysterical nosology and they appeared in a designated phase of the exotic manifestations of la grande hysteria. Hallucinations were considered as physiologically based, but Charcot never proposed any specific physiological or anatomical origins. (Charcot, 1888; Richer, 1881). In 1864, following the sudden death of Louis-Victor Marcé (1828-1864), Luys was placed in charge of the Maison de Santé d'Ivry, a renowned mental health centre in the suburbs of Paris. Ritti became his interne (house officer) there in 1870 (Defaux, 1985).

Following a short biography of Ritti, we will see how he developed his concepts on the mechanisms of hallucination, in an attempt to answer questions raised by Baillarger and Briere de Boismont. He wrote: "Surprised that, in general, pathological physiology does not occupy a larger place in treatises and essays on mental alienation, I set out to counter this tendency herein. The physiological theory of hallucination, which I intend to present with all the development it requires and all the evidence it calls for, comes from Dr Luys. I have founded this theory based on the work of this eminent physiologist" (Ritti, 1874). This quotation should be understood as a student's tribute to his teacher. The theory developed by Ritti, although based on his teacher's anatomical descriptions, is entirely novel. In his "Traitement de la folie" (Treatment of madness), published in 1893, Luys offered only a vague explanation: "I have demonstrated that the cranium, like the thoracic cage, contains multiple organs closely linked, whose organic elements form a vast complex, and that relative to the cerebral lobes, the basic regions of the brain are in a comparable situation to that of the heart relative to the pulmonary parenchyma. I have thereby shown that these basic nervous apparatus synergistically associated in the conditions of normal life, must be fatally joined in pathological conditions, and consequently these same regions must give the acts of psychic life a highly particular aspect and modality" (Luys, 1865).

## 1. Antoine Ritti

Ritti (Fig. 1) was an “alienist”, to use the terminology of his time. For Philippe Pinel (1745–1826), the founding father of modern psychiatry in France, alienation, or loss of a normal condition, is a mental ailment resulting in an inability to lead a normal social life, a definition which distinguishes the patient from the marginal vagabond. Pinel’s treatise (*Traité médico-philosophique sur l’aliénation mentale et la manie*) was published in 1801. His student, Jean-Etienne Esquirol joined him in 1811 and they became specialized in the care of “alienated patients”. The term “alienist” was coined as a result. In Germany, Johann-Christian Reil (1759–1813) created the term “Pyschiaterie”, which would take precedence at the end of the 19th century (Postel, 2004; Quételet, 2009). Born in Strasbourg on 6th February 1844 to a profoundly Catholic family of merchants and farmers, Antoine Ritti broke ties with them at the age of 20, refusing the religious life they hoped he would pursue, and enrolled at the medical school in his native city. Won over by the positivist philosophy of Auguste Comte (1798–1857), his active support for these ideas is revealed in his first writings in *La Pensée*



ANT. RITTI (1844-1920).

*Photographie prise en 1909.*

**Fig. 1 – Antoine Ritti 1844–1920.**

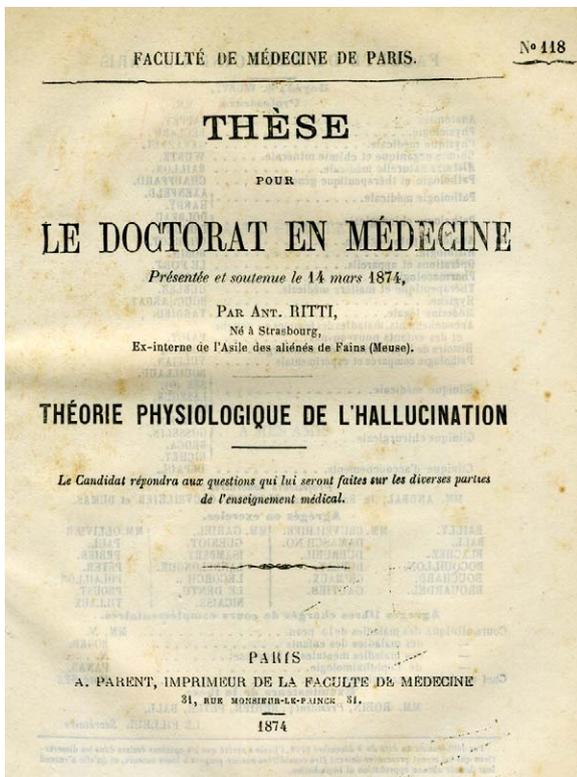
Antoine Ritti 1844–1920 (*Ann Med Psychol.* 1920;XII°vol;10° série:p. 100. *Bibliothèque inter-universitaire de médecine. Paris 6°*).

*Nouvelle* (1869). When the Franco-Prussian war broke out, he went to Paris and worked at the Lariboisière hospital during the Paris Commune uprising. In 1871, his internat (house officership) led him to work with Luys in Ivry, where he met Baillarger, Charles Lasègue (1816–1883), Jules Falret (1824–1899), Henri Legrand du Saule (1830–1886), Ludger Lunier (1822–1885) and Benjamin Ball (1833–1893). These contemporaries produced their own psychiatric writings, but, unlike Ritti in his thesis (Fig. 2), did not attempt an anatomical-functional theory of mental disorders. Concurrently, Ritti took classes with Jean-Martin Charcot (1825–1893) and Théodule Ribot (1839–1916). At this time, he also established strong friendships that would influence him throughout his career as a physician and prolific writer. His friends included Louis Peisse (1802–1880), philosopher and founder of the *Société Médicopsychologique*, and Amédée Dechambre (1812–1886), coordinator of the monumental *Dictionnaire Encyclopédique des Sciences Médicales* Dechambre (1864–1889). Ritti wrote 20 chapters for the latter work. A fellow Alsatian, Dechambre introduced Ritti to Emile Littré (1801–1881), also a determined positivist. Ritti dedicated his thesis not only to Littré, but also to Baillarger, Jacques Moreau de Tours (1804–1884) and, above all, to Luys (Fig. 3), who was the main instigator of his work. Baillarger appointed Ritti assistant inspector of the psychiatric asylums in the Seine



**Fig. 2 – Jules Luys 1828–1897** (private collection from the author).

Jules Luys 1828–1897.



**Fig. 3 – Cover page of Ritti's thesis (private collection from the author).**

*Page de couverture de la thèse de Ritti.*

Department. This support led to his and Jules Christian's (1840–1907) appointment as chief physicians at the Charenton asylum in 1878. These two Alsatians worked together in harmony for nearly 30 years. This daily contact with hospital patients formed the basis of his numerous publications, notably his *Traité clinique de la folie à forme circulaire* (Clinical treatise on “circular insanity”), published in 1880, and a text affirming the syphilitic origin of general paralysis in 1884. Elected in 1881 as secretary general of the Société médicopsychologique, Ritti was the driving force of this organisation for 38 years, until his death on 23rd January 1920. This long tenure obligated Ritti, known to have a special talent for veneration, to write no less than 13 eulogies, which remain invaluable for their historical quality (Baillarger, Cotard, etc.). These eulogies appeared in the *Annales médicopsychologiques*, a publication that benefited from Ritti's scrupulous servicely as editor-in-chief for no less than 30 years (Defaux, 1985; Vernet and Ritti, 1920).

## 2. Ritti's explanation of hallucinations

Starting his explanation with a positivist argument, Ritti first described the law proposed by Auguste Comte for interpreting the history of knowledge and then applied it to hallucinations. This law describes three successive periods in the acquisition of knowledge:

- a theological period – the person hallucinating is seen as being under the control of an evil divinity;

- a metaphysical period – the person is recognised to be ill and victim to “movements of animal spirits”;
- a scientific or positivist period – the person presents a symptomatology with a recognised semiology that is explained by demonstrated anatomical-functional dysfunction.

Having situated himself squarely in the third period, Ritti then developed a theory based on the anatomical discoveries of his teacher, Jules Luys. In his 1865 treatise entitled *Recherches sur le système nerveux, sa structure, ses fonctions et ses maladies* and the accompanying atlas, Luys described the subcortical structures, in particular identifying several nuclei in the thalamus and, below that, an area that he named “the accessory band of the superior olive”. In 1877, Auguste Forel (1848–1931) renamed this area the corpus Luysii. Luys identified four nuclei in the thalamus:

- anterior olfactory nucleus;
- centromedian visual nucleus;
- centre posterior somatosensory nucleus;
- posterior auditory nucleus.

He surmised that there were connections with the brain stem and postulated a modulatory role for the thalamus, i.e. that it served as an intermediary between voluntary cortical structures and automatic brain stem structures (Parent and Parent, 2011). Ritti consolidated approximately 30 observations published in France and England, the earliest from the beginning of the 19th century, in which “the lesion, successively invading both halves of the thalamus, successively caused the total destruction of the sensory impressions that the thalamus collects”.

He then described experiments making use of targeted lesions, without indicating which animal was used, in which the “anterior thalamus was destroyed, resulting in loss of smell; a more posterior part was also destroyed, resulting in loss of hearing”. Based on this description, he made the following argument: “We have emphasised the important role in sensory perception played by the ganglia cells in the thalamus, arranged in distinct clusters and forming four centres. Located anatomically between the external sensory organ and the receiving organ, which transforms the sensations into ideas, the cells are shaken by impressions from the outside; they elaborate on these impressions, which stay there for a certain time then radiate into the cortical cells where they are perceived [...]. In the physiological conditions of intellectual functioning, stimulations from the thalamic centres are incessantly causing, in the waking state, cells in the cortical layer of the brain to vibrate. [...] Consequently, the cells of the cortical substance of the brain perceive only mediately, and by the intermediary of cells of the thalamic centres, the external incitations. In the abnormal state, the reverse takes place. The entire mechanism underlying the intellectual and moral faculties then works spontaneously, as if the brake that moderates and directs this very complicated apparatus was broken”. In this passage, Ritti described an experimental loss of function by lesions in the subcortical centres, isolating the sensory receiving organ from the cortex. His novel contribution was

to conceive of hallucination as an independent activity of the subcortical centres that stimulated the cortex in the absence of sensory organ input. In this way, he reversed the experimental data, moving from the notion of loss of function to that of release of function. He thus viewed hallucination as a positive phenomenon that unleashed downstream function in the context of a focal lesion or without lesion. This notion is important, because it extends “cortical localisation” theory from a simple nuclear concept of anatomical function and presents nuclear pathologies as subcortical gates blocking functions that are generated cortically. Since the thalamus was thought to process sensory input, the observations also introduced the concept of sensory deprivation into the pathophysiology of hallucinations (Berrios, 1996). “In the normal state, sensory nerves are excited by external objects; during hallucination, on the contrary, an internal excitation, that of the sensory ganglia, results in representations perceived by the patient as objective, as if an external impression had excited the sensory nerve”. Ritti concluded his work with a summary: “The different phenomena that make up the morbid process of a hallucination: (1) spontaneous activity of thalamic cells, this activity being provoked by various causes; (2) radiation of this spurious activity to the cells of the cortical substance and (3) subsequent entrainment of these cortical cells, which implement these erroneous materials with the same logic as if they were real”. In this way, Ritti explained the persistence of hallucinations following destruction of the sensory organs and how they “move successively through various senses”.

### 3. Current theories

The thalamus is part of the subcortical structures. It can be divided into four distinct functional territories based on the topography of the related regions of the cerebral cortex: a sensory-motor territory, an associative territory that handles cognition, a limbic territory that handles emotional and motivational information, and a group of median activating nuclei implicated in wakefulness. These structures play a major role in planning and in the execution of motor or behavioural programmes. These models have provided an explanation for various motor problems, such as tremor, dystonia, dyskinesia, chorea and ticks. They have also provided a parallel model of dysfunction in obsessive compulsive psychiatric disorders and Gilles de la Tourette syndrome (Carrera and Bogousslavsky, 2006; DeLong and Wichmann, 2007; Utter and Basso, 2008).

Hallucinations are rarely described in relation to dysfunction in these circuits, which most often provoke cognitive deficits of varying seriousness (Scheibel, 1997). GR. de Freitas and J. Bogousslavsky, in their chapter on thalamic infarcts (Donnan et al., 2002), report on the only two published observations, with anatomical verification, of hallucinations associated with thalamic lesion: Noda et al., (1993) and Tatu et al., (1996). These are the only two cases of the 28 compiled since 1936 (with anatomical details, autopsy or MRI) involving right unilateral damage to the paramedian (thalamoperforate) territory of the thalamus (Schuster, 1936). These lesions

on the right are more “psychiatric”, involving, for example, pseudoconfusional or even manifold states. Bilateral and left unilateral lesions do not primarily involve hallucination, and this is also true of lesions in other vascular territories of the thalamus: polar, posterior choroidal and inferolateral (or thalamogeniculate). By contrast, memory and cognitive problems are frequent, notably with lesions in the paramedian and/or polar territories. In clinical neurology, hallucinations most often involve cortical lesions in the corresponding sensory areas (simple or complex hallucinations/metamorphopsia from occipital lesions, auditory hallucinations from lesions in the lateral temporal cortex, etc.). By contrast, somatognostic hallucinatory phenomena such as supernumerary limb syndrome can occur with subcortical hemispheric lesions, which are the only lesions leading to (as the result of limited damage) paralysis associated with complete sensitive/proprioceptive deafferentation, which is necessary for the phantom limb phenomenon to take place (Carrera and Bogousslavsky, 2006; Staub et al., 2006; Tatu et al., 1996).

Observations of brain-damaged patients do not generally point to a thalamic lesion as the sole explanation for hallucinations: peduncular hallucinosis involves lesions in the pons, posterior thalamus and cerebellum. Whereas auditory hallucinations are, in rare cases, associated with individualisable lesions, visual or olfactory hallucinations, for example, may point to chronic intoxication (alcohol), a tumour or a CVA with variable lesion sites but involving subcortical loops in which the thalamus participates. The thalamus also plays a role in our three states of consciousness: wakefulness, deep sleep and REM sleep. Hypnagogic or hypnopompic hallucinations are frequent and physiological, or form part of the semiological profile for narcolepsy, migraine or epileptic states, or neurodegenerative disorders (Berthier et al., 1993; Feinberg and Rapcsak, 1989; Kölmel, 1991).

### 4. Conclusion

In his *Traité des hallucinations* (Ey, 1977), Henri Ey (1900–1977) considers Ritti’s thesis as one of the most important texts on this theme written during the second half of the 19th century, alongside those of Legrand du Saulle and Brierre de Boismont. However, Louis Delasiauve (1804–1893), Falret and François Leuret (1796–1851), who left a more lasting mark on the history of psychiatry, only saw hallucination as a disorder of the “cerebral mantle” (Lhermitte, 1951), as did Carl Wernicke (1848–1905). Ritti can thus be considered the pioneer of a theory developed in 1890 by Theodore Meynert (1833–1892) in Germany, positing subcortical participation in mental pathologies, and as a pioneer of the contemporary understanding of hallucinatory phenomena, even though his anatomical-functional explanations now appear dated.

### Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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