



### J van Gijn

(1942) studied medicine in Leiden and trained as a neurologist in Rotterdam and London (Queen Square). His MD thesis (1977) was on the plantar reflex. From 1983-2007 he was professor and chairman of the University Department of Neurology in Utrecht. His main research interest used to be stroke, but after retirement it is shifting towards somatisation and the history of neurology.

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#### Selected further reading

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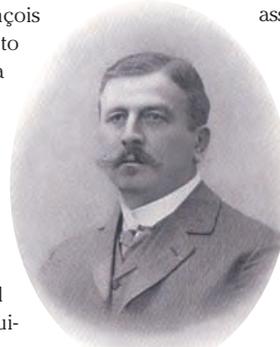
# Joseph Babinski 1857-1932

The name of Joseph Félix François Babinski is inseparably linked to the upgoing toe phenomenon, a reliable sign of pyramidal tract damage or dysfunction. His discovery of the sign, in 1896, crowned the development of the neurological examination. In the 19th century physical examination in general was in the ascendancy, reflecting the demise of the time-honoured but theoretical notion of disease as a disturbed equilibrium between liquid components (fluidism). In its place came the new, 'organ-oriented medicine', based on post-mortem observations (solidism). Percussion and auscultation of internal organs, early in the 19th century, were followed by tests to assess the function of the nervous system: ophthalmoscopy (1851), skin sensation and position sense with their different pathways (1855), spasticity (1860), language disorders (1861), individual muscles and their innervation (1860s), tendon reflexes (1875) and skin reflexes (1853-1876).

Babinski's parents were Polish refugees. Revolts were rife around 1848, also in Poland, where nationalists fought against occupation by Russia and Austria. Defeat upon defeat led to a steady stream of refugees to Paris, at that time the hub of political and intellectual freedom. One of them was the engineer Alexandre Babinski. In Paris he married a compatriot, Henriette Weren. They had two children: in 1855 Henri and in 1857 Joseph. Employment was difficult to obtain; from 1862 the father worked as a construction engineer in Peru. In 1870 he came back to enlist in the army of his new country, in the war against Germany. From then on his health deteriorated – he suffered from Parkinson's disease – and it fell upon Henri, a mining engineer, to go abroad and support his parents as well as the medical education of his younger brother Joseph.

During his residencies (1879-1885), Joseph performed morphological and microscopic studies. These resulted in an article about the muscle spindle and a thesis on multiple sclerosis. In 1885 he became Charcot's 'chef de clinique', without ever having served under him as a resident. He had submitted his thesis in a competition of the Paris hospitals, just missing the gold medal, but instead was offered the post as a kind of second prize. In those times Charcot was deeply engaged in the study of hysteria. He regarded it as a localised, albeit functional disorder of the central nervous system. Charcot mainly used the history as the key instrument in making a diagnosis, whereas Babinski came to rely more and more on assiduous physical examination.

Near the end of the 1880's Joseph generated enough income to take his turn in supporting the family, and to move to a more spacious apartment at the Boulevard Hausmann (170bis, 3rd floor). Henri returned from his foreign travels and gradually



The photograph probably dates from 1904, a few years after Babinski discovered the 'toe phenomenon'

assumed the role of housekeeper. After the death of their parents (the mother in 1897 and the father in 1899), the two brothers continued to inhabit the same apartment for 30 more years, in a close and harmonious relationship. Henri would serve as secretary, driver and, above all, cook; under the pseudonym 'Ali Bab' he published a tome on gastronomy that was as authoritative as it was weighty; it went through several editions.

In 1892 Joseph failed in the competition for the academic rank of assistant professor ('professeur agrégé'). The examination was traditionally riddled with nepotism and intrigue, but in that year it even developed into a public scandal. The main culprit was Charles Bouchard (1837-1915), a former pupil of Charcot, now full professor and chairman of the jury. Bouchard, believed to be consumed by ambition and envy, contrived to include all three pupils of his own among the five candidates who passed (from a total of sixteen). Neither a series of incensed articles in the 'Progrès Médical' nor a petition to the responsible minister reversed the outcome. Babinski never tried again. Meanwhile (from 1890) he had left Charcot's 'Salpêtrière' and started to practise in 'La Pitié', where he was nominated chief in 1895 and would remain until his retirement.

As was usual in those times, Babinski spent only mornings at the hospital; in the afternoon he would see private patients. It is said that, when ward rounds at the Pitié encroached upon the time for lunch, a sister might come up to the chief and whisper in his ear that Henri's soufflé was nearing perfection. Joseph's appearance was un-French: of long stature, with steel-blue eyes, thoughtful and deliberate in his words and gestures. The traditional ward round did not suit him – he preferred to have the patients brought in. The room reserved for that purpose was always full with residents and visitors. Patients were already undressed on entering; the history was limited to a few laconic questions, soon followed by the most important part of the encounter – the neurological examination. He was especially looking for objective signs – elicited with pin, patella hammer and electrical stimulator. All this took place in silence, occasionally interrupted by a brief comment. Then, rather abruptly, he would summon the next patient. His scientific work was by no means restricted to semiology: among the subjects he also published on were brain tumours, involuntary movements, bulbar and cerebellar disorders, disorders of spinal cord, peripheral nerves and muscle, and hysteria (a condition he called 'pithiatisme', to dissociate it from female sexuality).

In 1922 Babinski retired, at the age of 65. Meanwhile he had been awarded many distinctions, especially from abroad. His successor, L.H. Vaquez (1860-1936), allowed him to continue a weekly clinical demonstration. Also, Babinski con-

tinued to attend the monthly meeting of the French Neurological Society, which he had helped to found in 1899. In 1930 it became more difficult for him to move around; after Henri had died, in the autumn of 1931, he lost interest in life. He passed away on October 29, 1932. He was buried with his relatives at the Polish cemetery in Montmorency.

The plantar reflex had been known to physicians since 1868, but only as a flexion response of the entire leg. Subsequently this synergistic response was rediscovered a number of times, each time under a different name. Sometimes movements of the toes were noted as part of the synergy, in one direction or another. The authors in question attached little importance to these observations, yet some later 'historians' would misinterpret these as prior discoveries. Babinski was the first to study the responses of the toes in a systematic fashion. His initial report was brief, reflecting an oral communication before the Société de Biologie. He had undertaken a systematic study of hemiplegic patients, with the aim of finding objective signs that were characteristic for organic disease and thus could help in distinguishing it from hysterical hemiplegia. His efforts resulted in a large series of signs, to all of which he devoted a separate publication. The toe reflex was only one of these new signs, though it would prove by far the most important. Babinski observed that in normal subjects stroking of the sole of the foot resulted in a downward movement (flexion) of the toes, together with flexion in the ankle, knee and hip, whereas in patients with hemiplegia the toe response was 'transformed': the toes went up (extension), especially the big toe. Before that he had found the organic contracture of the hand (1893). After the 'toe phenomenon' followed hypotonia of the arm (1896), weakness of the platysma muscle (1900), involuntary hip flexion on rising from a supine position (1900), involuntary pronation of the arm (1907) and abnormal passive movements of the arm during movements of the trunk (1909).

One year later, in 1897, Babinski associated the 'toe phenomenon' ('phénomène des orteils') specifically with dysfunction of the pyramidal tract. At the same time he drew a parallel with the plantar reflex in newborns, in whom the pyramidal system is not yet fully developed. The next year he provided more details, in an article structured as a clinical demonstration. Importantly, he had now observed the abnormal toe sign not only in structural but also in metabolic disorders: epilepsy, intoxication with strychnine, or meningitis. The term 'Babinski sign' was first used in 1898, by the Belgian neurologist Arthur van Gehuchten (1861-1914).

The pathophysiology of the phenomenon is different from the 'transformation' Babinski initially envisaged. Paradoxically, the toe extensors – and not the flexors – take part in the flexion synergy, as shown by Sherrington's work in spinal animals. In a physiological sense the toe extensors (anatomical term) are actually flexors, as they shorten the limb on contracting. As the pyramidal tract becomes fully myelinated, between the first and second year of life, two functional changes occur. Firstly the influence of the pyramidal tract, strongest on distal muscles, and – in the leg – on flexors (in a physiological sense), excludes the upgoing movement of the great toe from the shortening synergy of the leg. Secondly, this suppression clears the way, so to speak, for the normal (downward) response of the toes; that response stands on its own as a monosegmental skin response, very similar to abdominal skin reflexes. With lesions of the pyramidal system the 'neonatal' state of affairs returns.

The great acclaim that befell the Babinski sign has prompted many epigones to stake their claim with regard to sites of stimulation other than the sole. In the pursuit of everlasting fame all eyes were on the toes alone. Many lost sight of the principle that pathological toe response was part and parcel of a complex synergy: on the efferent side many flexor muscles of the leg are involved, and on the afferent side the synergy can be elicited from a multitude of skin sites. Also, in the day-to-day interpretation of plantar responses, it is useful to take account of the flexion synergy of the leg: an upgoing toe is a Babinski sign only if it is accompanied by activity in other flexor muscles of the leg. ♦