

Blix, Magnus Gustav

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Magnus Gustaf Blix (1849-1904)

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The following article is based on a paper, 'Magnus Gustaf Blix (1849-1904): Neurophysiological, Physiological, and Engineering Virtuoso', published in the Journal of the History of the Neurosciences, vol. 9, no. 3, 2000, pp. 238-249. The permission by Swets & Zeitlinger B. V. to reprint parts of that paper is gratefully acknowledged.

Magnus Gustaf Blix (Figure 1) was born on 25 December 1849 at Säbrå, a village located in the sparsely populated northern parts of Sweden. His clergyman father died when he was three years old, and his mother had to rear the boy and three siblings under reduced circumstances. Nevertheless, he was allowed to study and entered the medical school of Uppsala University in 1871. He became a licensed physician in 1879, and defended his doctoral thesis one year later. After that he pursued an academic career, but also practised medicine to a certain extent during the 1880s. In 1885, he became the first ever professor in physiology at Lund University, and later, albeit reluctantly, the University's vice-chancellor in 1899. He died from an abdominal inflammation on 14 February 1904.

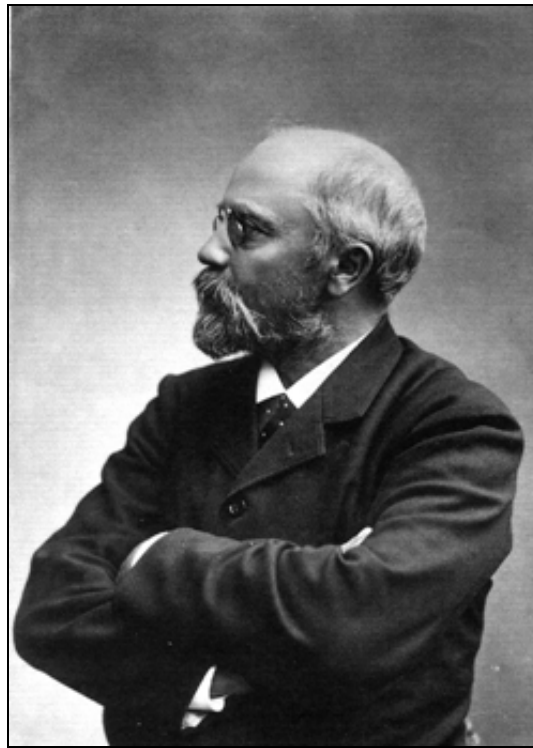


Figure 1: Magnus Blix (1849-1904) (from Johansson 1928).

Blix pursued post-doctoral studies with Étienne-Jules Marey and Adolf Fick, and was well known among contemporary physiologists through repeated travels to laboratories in the western half of Europe, as well as participation in physiological congresses. He received many scientific awards during his lifetime, and his obituaries reflect the esteem of renowned international colleagues.

Blix contributed conspicuously to three different physiological disciplines, viz. muscle physiology, visual physiology and somatosensory physiology, ranked according to the amount of publications. However, he is nowadays probably best remembered for being the first to demonstrate the modal character of cutaneous sensory messages in 1882-83. He had found that electrical stimulation of different points on the skin surface could evoke distinct, either cool or warm sensations, and generally only one or the other. He then constructed the temperature stimulator shown in Figure 2.

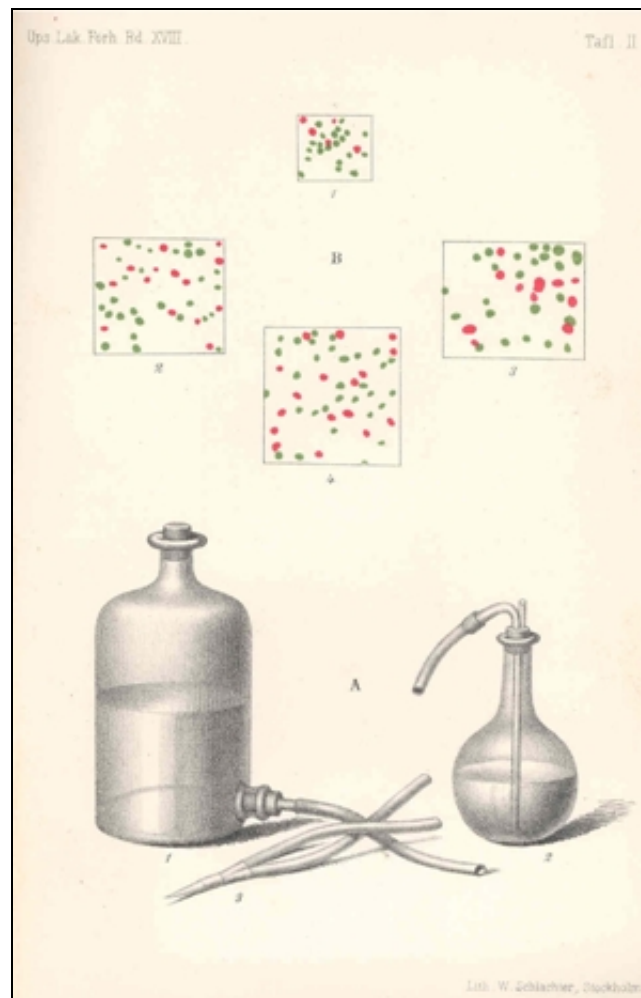


Figure 2: A. Blix's apparatus for temperature stimulation. The closed bottle to the left, with a tube protruding at the bottom, contained cold water. The flask to the right was half-filled with water, and had two pipes penetrating the stopper: one short pipe providing passage of air between inside and outside; one long pipe with one end below the fluid level, and tubing attached to its bent upper end. The water in the flask was heated over a flame. The tubes from the two water bottles were joined at the Y-shaped, silver plated, hollow cone shown in the middle. When the bottle to the left was raised above the flask, cold water flowed through the metal tip decreasing its temperature. When this bottle was instead lowered, water would flow in the opposite direction, and the warm water from the flask would raise the tip's temperature. B. 1. Cool (green) and warm (red) spots on the back of Blix's hand. 2. His wrist. 3. His elbow. 4. The back of J. H. Andersson's left hand (from Blix, M. (1882) *Upsala Läkareföreningars Förhandlingar*, vol. 18, Plate II).

With this equipment he showed that a lowered skin temperature evoked cool sensations from spots located on separate places of the skin, and raised skin temperature evoked warm sensations from different places. The distribution of 'cool' and 'warm' spots is also illustrated in Figure 2. Further investigations with a tactile stimulator illustrated in Figure 3 revealed the presence of special touch spots, located between the cool and warm spots, shown on a map included in Figure 3. Afterwards, two other investigators, Alfred Goldscheider of Berlin, Germany, and Henry H. Donaldson of Baltimore, Maryland, confirmed and extended Blix's findings in 1884-85. Neither of them had known about Blix's work, or one another, when they started their investigations, but both of them acknowledged the priority of Blix's findings in their reports.

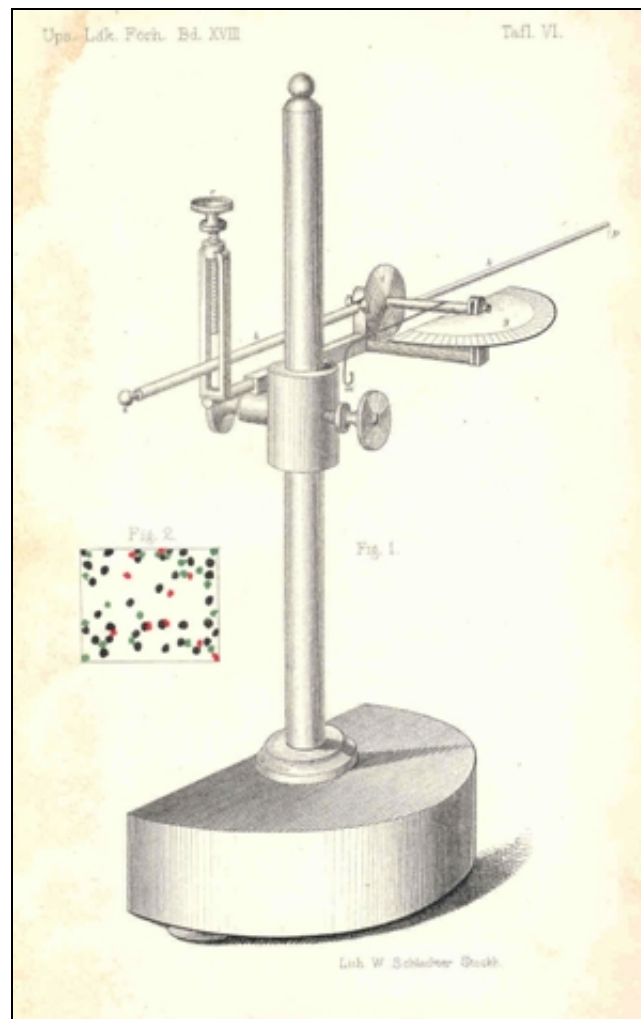


Figure 3: Blix's tactile stimulator. A horse hair was mounted perpendicularly at the end of the horizontal bar pointing away from the viewer. The hair was allowed to drop down on the skin, and the weight of the stimulus was controlled by means of counterbalance, and its speed by the distance of the fall. After adjusting the force to just above threshold for a sensitive spot, Blix probed the surrounding skin with the same stimulus. He found the neighbouring skin to be insensitive except for other isolated sensory spots. Inset square marked Fig. 2 shows a map of touch spots (black), cool spots (green), and warm spots (red) found on the skin of Blix's own wrist (from Blix, M. (1883) *Upsala Läkareföreningars Förhandlingar*, vol. 18, Plate VI).

Blix's doctoral thesis dealt with ophthalmometry. As instructor in physiology, he taught medical students how to use the ophthalmometer of Hermann Helmholtz. He was able to improve that instrument, and thereafter measure the thickness of the cornea, and the depth of the eye's anterior chamber. He was also able to visualise reflections of the posterior corneal surface, a task that Helmholtz himself had found too difficult. Blix also constructed a visual perimeter with graphic registration of the field of vision, and published papers about visual perception. He had studied Brücke's of 'isochromatic induction', i.e. a black surface's tendency to capture the colour of the surrounding territory. He had also studied Poggendorf's illusion, the illusory non-alignment of the two visible parts of a slanting line that is covered across its middle by a vertical bar.

Blix's very first paper (1874) dealt with the length/tension relationships of active and resting muscles. During the years, he constructed at least three different instruments for the same purpose, and Figure 4 shows his of 'muscle indicator' of 1891. In a series of four papers published at the beginning of the 1890s he was able to refute Weber's theory that muscle activity can be expressed entirely in terms of changes of the muscle fibre's elastic condition. He also showed that a muscle's isometric force varies with its length. This classical finding is usually included among the arguments supporting Huxley's 'sliding filament' theory of muscle contraction. Blix also constructed a thermo-galvanometer of utmost sensitivity, which allowed him to establish the heat production

of resting muscle. It was demonstrated at the physiology congress in Torino, Italy, 1901. The British physiologist J. N. Langley purchased this instrument, and later gave it to a young A. V. Hill. In that way, it became a launching platform in Hill's Nobel prize-winning discoveries concerning the production of heat in muscles.

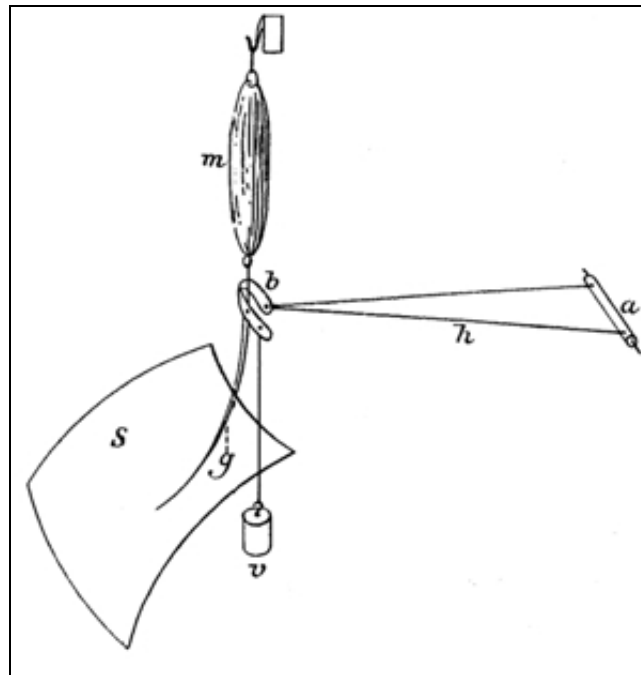


Figure 4: Blix's 'muscle indicator'. The lever marked **h**, made from two 0.9 mm-thick steel bars, which meet and are attached to the bow marked **b** at one end, and are fastened apart from one another to the readily mobile horizontal axis marked **a** at the opposite end. A change in length of the muscle **m** will cause the lever and the attached stylus **g** to move vertically and cause a vertical line to be drawn on the spherical drawing surface marked **s**. A change of the muscle's tension will cause the bow **b** to rotate due to torsion in the lever **h** caused by the eccentrically placed weight **v**. The stylus then moves sideways instead (from Blix, M. (1891) *Skandinavisches Archiv für Physiologie*, 3: 295-318).

Blix had remarkable engineering talents and constructed everything from a mixer tap for showers to optical instruments, and the above-mentioned very complex thermo-galvanometer. In the later part of his life he was able to employ H. Sandström, an academically educated engineer of remarkable competence. By reputation, the two were together working on an airplane, combustion engine at the time of Blix's death. Aviation was another branch of Blix's wide interests, and he also published papers about the flight of birds. It seems clear that Blix amply deserved the pronouncement by physiology's Nestor, Karl Ludwig, that he was 'ein Mann glänzenden Geistes', a man of brilliant brainpower.

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