Angelo Mosso's First Steps in Physiology

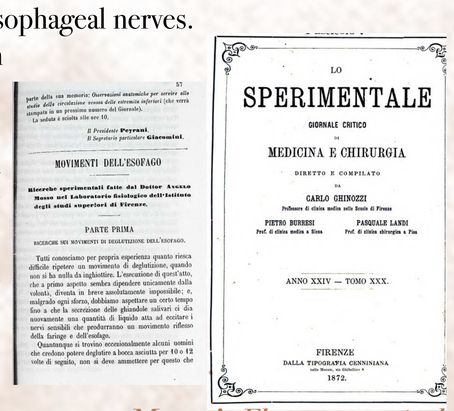
While the intellectual biography of the "mature" Mosso is widely documented through publications, exhibitions, congress etc., his apprenticeship performed in the Seventies of the nineteenth century in Florence, Leipzig and Paris is less well known, and we are convinced that his training with important figures of physiology, such as Jacob Moleschott, Moritz Schiff, Carl Ludwig, Ernst von Brücke and Étienne-Jules Marey is worthy of note. This period is herein illustrated in order to throw light on the later, more complete formation of Mosso which put him in a position to carry out sensory and muscle physiology experiments at the level of those performed in the most important German and French laboratories. When Angelo Mosso was a student, he was forced to enroll as cadet officer at the School of Military Health of Florence, where in 1870 he overcame the examination for appointment as a Medical Officer. In 1862 Moritz Schiff, brother of chemist Hugo, was called by Carlo Matteucci to teach comparative anatomy at the Museum of Physics and Natural History in Florence. Schiff also conducted research in physiology, especially on the nervous system (central and peripheral) along with his assistant Alexander Herzen. The two scientists, supporters of Darwinism, were also advocates of animal experiments, a practice that Mosso had already learned from Filippo de Filippi at the University in Turin. This new approach allowed to study the animals' reactions to stimuli, with the help of special instruments to elicit, observe and measure such responses

1872-1874 Florence

Mosso stayed here for two years and performed his initial experiments, by studying blood transfusion and cerebral "irritation" caused by the closure of the carotids. The report on his early research appeared on "L'Imparziale" and "Lo Sperimentale".

Moritz Schiff

In 1873 Mosso published a paper, in which he demonstrated that the esophagus movements are not blocked following the ligature or the cut of a part of its length, but only after the section of esophageal nerves. This showed that the esophageal peristalsis was caused by the innervation descending from the nerve centers to the three esophageal branches. In Florence Mosso met Giulio Ceradini, coming from German laboratories, where he mastered the graphical method and physical approach to physiology. Ceradini published a work on the mechanism of the semilunar valves of the heart, and was invited by Johann N. Czermak to stay in Leipzig, but following his wife's desire he preferred to return to Italy. However, he did not like Schiff's research approach and he left Florence and moved to Genoa. As a result of his relationship with Ceradini, Mosso realized the methodical superiority of the German school and decided to improve his skills in Leipzig



Mosso's Florence period articles

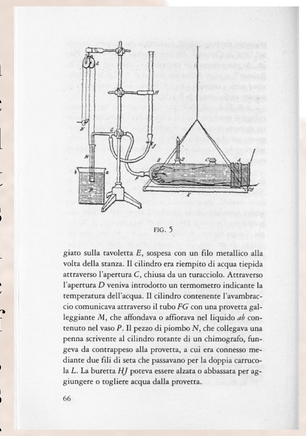
Giulio Ceradini

1874-1875 Leipzig

Carl-Ludwig-Institute for Physiology

Carl Ludwig

At the time, Carl Ludwig was already a leading figure - along with Emil du Bois Reymond, Hermann von Helmholtz and Ernst Brücke – of the so-called *Berliner physikalische Gesellschaft,* which aimed to eradicate vitalism from the study of the living phenomena. Mosso stayed in Leipzig in 1872-74 and performed experiments on vision, on the movements of the iris vessels and blood vessels, but mostly he devoted himself to the design of laboratory instruments. The use of these devices was the most appropriate means in order to apply the method of the mechanics and physical chemistry to physiology, without the danger of falling into metaphysical explanations of the living beings. Ludwig proposed to him to design the plethysmograph to record the volume of slow oscillations of the organs generated by the expansions and contractions of the vessels, so regardless of heart rhythm. Wundt judged the plethysmograph conceived by Mosso as "greatly improved" compared to the models already in use. Mosso could record the movements of the forearm volume dependent on the alternating rhythm of vascular expansion and contractions and deduced that it was possible with this instrument "also write those emotions that are not painted on the face, or that are revealed too weakly with heartbeats and shortness of breathing "



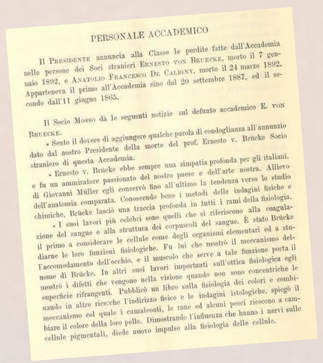
The forearm until the elbow was inserted into a glass cylinder supplied by Greiner and Friedrichs (in Stützerbach), 48 cm long, of from 8 to 10 cm in diameter, closed at one end by an elastic rubber sleeve (supplied by Pirelli and Casassa, Milano), placed on a tablet suspended with a wire from the ceiling. The cylinder was filled with water through an opening closed by a plug, and a thermometer was introduced into the other opening. This apparatus connected through a tube with a float tube that fell or emerged in the liquid contained in the vessel (to the left). A piece of lead connecting a pen to the rotating cylinder of a kymograph acted as a counterweight to the tube. At the contraction of the forearm vessels an amount of water corresponding to the decrease of volume was aspirated from the tube, and this produced the lifting of the float and the consequent lowering of the counterweight recorded on the kymograph the volume change. Vice versa for the expansion, which caused the water pushed towards the float, making lift the counterweight

1875 Paris

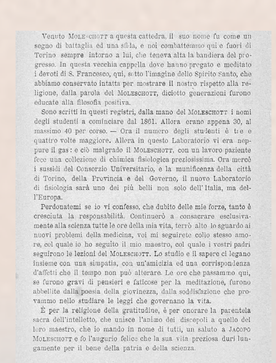
Although he received invitations for a position of assistant Professor in Heidelberg and Kiel, Mosso preferred to complete in Paris the acquisition of the methodology learned in Leipzig. The study of the *graphische Methode* started under the guidance of Ludwig was perfected with Étienne-Jules Marey, who had it already applied in *Du mouvement dans les fonctions de la vie* (1868). This approach corresponded perfectly to the ideal that Mosso cultivated, namely that it was necessary an automatic recording method capable of writing all movement phenomena. He went even beyond, because he was persuaded that only the instrumental apparatus allowed to treat mental states as something visible and measurable: «beating of the heart, trouble breathing, trembling of the muscles, blood velocity, word, thought and perception, leave a lasting impression with the graphical method of self.» In Paris he also met Jean-Martin Charcot, from whom He had the opportunity to see applied hypnotic techniques. This investigation was at the intersection between the realms of the *psychic* and the *physical*, and responded to Mosso's desire «not to worry about that [these] phenomena are higher and form a complex of things that we call soul or spirit». With this "legacy" Mosso was ready to return to Turin in 1875

Angelo Mosso and Étienne-Jules Marey

Obituaries and memories in which Mosso recognizes the work carried out by his teachers in physiology



Eulogies of Bruecke and Ludwig



Jubilee celebration of Moleschott

Germana Pareti

UNIVERSITÀ DEGLI STUDI DI TORINO

Dipartimento di Filosofia e Scienze dell'Educazione

Istituto di Bioimmagini e Fisiologia Molecolare CNR

AA.VV. Biografie di Angelo Mosso, in A. Mosso, Le origini della civiltà mediterranea, Milano 1912
M. Sinatra, La psicofisiologia a Torino: A. Mosso e F. Kiesow, Lecce 2000

Acknowledgements
I would like to thank Prof. Emeritus Piergiorgio Strata

Graphic design by Giorgio Borla