Review

Santiago Ramón y Cajal at Clark University, 1899; his only visit to the United States☆

Duane E. Haines*

Department of Anatomy, The University of Mississippi Medical Center, 2500 North State Street, Jackson, MS 39216-4505, USA

ABSTRACT

In 1899, at the invitation of G. Stanley Hall, the great psychologist and President of Clark University, Santiago Ramón y Cajal, and four other European scientists of significant note, were invited to participate in the Decennial Celebration of Clark. Cajal, accompanied by his wife, arrived in Worcester, via New York, to much acclaim and praise in the local press. His three lectures, all delivered in French and illustrated with large color drawings made upon his arrival at Clark, were concerned with previously unpublished observations on the structure of the human cerebral cortex. The full text of these lectures and 31 illustrations (in black and white) were published, in English, in a large Decennial Volume prepared by Clark University. At the culmination of the Clark Celebration, Cajal, and the other invited attendees, received the honorary Doctor of Laws degree. Cajal, ever the scholar, visited many sites of interest in the Northeastern US prior to his return to Spain including Columbia, Harvard, and the University of New York. This paper details the events surrounding Cajal’s visit to Clark University, his only visit to the United States.

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☆ This paper is generally based on papers presented by the author at the Annual Meetings of the Society for Neuroscience and the International Society for the History of The Neurosciences in 2003 (Haines, 2003a,b). The translations of the letters in French were aided by the use of a 1903 Edition of Heath’s French and English Dictionary in an effort to capture the flavor of the language of the period (Boielle, 1903).

* Fax: +1 601 984 1655.
E-mail address: dhaines@anatomy.umsmed.edu.

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1. Introduction

In 1899 the world was anticipating the new millennium. In the rapidly expanding field that we now call neuroscience, many new discoveries had recently been made, were being made, or, as the century turned, would capture the attention of the scientific world. For example, Fritsch and Hitzig (1870) and Ferrier (1876) had provided compelling evidence of cerebral cortical influence/control over motor functions of the contralateral upper and lower extremities; the Golgi method of impregnating nerve tissue was developed and gained devotees (including Cajal) who were publishing exciting new images of the microscopic structure of the nervous system; Waldeyer had formulated a view of the nervous system that soon became known as the neuron doctrine; and many other important discoveries were being made (see Shepherd, 1991; Finger, 1994; Marshall and Magoun, 1998).

At about this time, Santiago Ramón y Cajal was vigorously applying the Golgi method, and his own modifications thereof, to studies of the nervous system. Cajal most likely began exploring the potential of the Golgi chrome-silver method in 1887 and by 1888 began publishing a series of papers using this method with his own emendations (Cajal, 1989, Shepherd, 1991). By the late 1890s, Cajal was completing a series of studies on the human and mammalian cerebral cortex (Cajal, 1989). Right after the turn of the millennium, Cajal and Golgi would share the 1906 Nobel Prize in Physiology and Medicine. It is against this backdrop of exciting historical events and new ongoing discoveries that we consider Cajal’s only visit to the United States.

2. Clark and his university

Jonas Gilman Clark (Fig. 1) was born February 1, 1815, within about 20 miles of Worcester, Massachusetts, the town that some 70+ years later would be the location of the University bearing his name (Koelsch, 1987). Although lacking any formal higher education above the common schools, Clark was an energetic and self-motivated young man. His mother encouraged hard work, dedication, and a “…love of books and reading…” (Koelsch, 1987). This particular fact would, during particularly difficult times for his fledgling University, bring an important benefit: that of an excellent library and funds for the purchase of books.

An excellent summary of Clark’s life and activities leading up to the establishment of his University is provided by Koelsch (1987) and will be only briefly summarized here. Clark spent his early years in Massachusetts where, by about 21 years of age, he owned a carriage manufacturing business and married his wife, Susan Wright Clark. This initial business evolved into more profitable endeavors, such as the manufacture of chairs and tinware, which gave Clark the resources to expand his horizons. He divested his holdings in Massachusetts in the early 1850s, and moved to California, where he used his capital to develop businesses that imported a variety of goods from the East and that manufactured high-end furniture from California hardwoods. These enterprises grew and by 1860 were enormously successful, making Clark a wealthy man. At age 45, Clark, due to health reasons, liquidated his California holdings and returned to the East, reportedly with a “…large amount of California gold…” (Koelsch, 1987). The Clarks purchased property in New York City, in Worcester, and traveled extensively in Europe. In his maturing years and...

Fig. 1 – Jonas Gilman Clark (1815–1900), c. 1860. (From Koelsch, 1987, with permission.)
perhaps related to his persistent health problems, Clark began to conceive a plan for a more lasting legacy. During his trips to Europe, Clark rekindled an interest of his youth and began to collect “...a good library of rare and finely bound books...” (Ross, 1972). During these European trips, Clark also visited universities and therein laid the seed of an idea that would eventually germinate into a plan that would become Clark University (Veysey, 1965; Ross, 1972; Koelsch, 1987).

Between 1881 and 1885 Clark purchased the main body of the property that would become the location of Clark University and crystallized his vision of what the University would be (Ryan, 1939; Veysey, 1965; Koelsch, 1987). While Clark’s original thinking was to establish an institution of higher learning for young men (apparently at the undergraduate level), this concept morphed into that of a University that would emphasize research and graduate training, and not classroom attendance, lectures, or routine testing. Major influences in this transition were: opinions expressed by some individuals who would become members of Clark’s new Board of Trustees; the suggestions (helpful or otherwise) of neighboring institutions of higher learning; and Hall’s view of higher/graduate education (he was on the faculty of Johns Hopkins when recruited to Clark as its first President). In other words, it would be a University that dedicated itself to graduate training, and it would not have undergraduate programs (Ryan, 1939; Ross, 1972; Veysey, 1965; Koelsch, 1987): a laudatory goal, but not a sustainable one.

A board of trustees was selected; half of the eight were graduates of Harvard University. This was both good and bad for Clark (Story and Wilson, 1899; Veysey, 1965). In March of 1887, an Act of Incorporation was passed by the Massachusetts Legislature “... for the purpose of establishing and maintaining in said city of Worcester an institution for the promotion of education and investigation in science, literature and art, to be called Clark University” (Story and Wilson, 1899). On April 3, 1888, G. Stanley Hall was invited to be the first President of the University (he accepted on May 1), and the University was formally opened October 2, 1889 (Story and Wilson, 1899; Ross, 1972 Veysey, 1965).

3. Granville (G.) Stanley Hall

It would not be possible to view Cajal’s visit to Clark University without a brief comment on G. Stanley Hall (Fig. 2). Hall was president of Clark at the time of Cajal’s visit (Hall was actually President from 1888 to 1920), Hall conceived the idea to have the Decennial Celebration, and Hall invited Cajal to the event.

G. Stanley Hall was a brilliant, eccentric, strong-willed, intellectual giant in his time (Ross, 1972). In 1887, when the founding of Clark was approved by the Massachusetts Legislature, Hall was on the faculty of Johns Hopkins and in the process of founding his own project, The American Journal of Psychology. The tone of the letter inviting Hall to consider the position as President of Clark University made it clear that the Board of Trustees did not have a hidden agenda, but that Hall would have considerable freedom to follow his own lead; a plan that suited Hall’s personality and vision just fine (Story and Wilson, 1899).

Hall accepted the Presidency of Clark in May of 1888 and was immediately given a leave of absence for one year (at full pay) to tour European Universities for the purpose of “… gathering educational literature and collecting information and advice from leading authorities...” (Story and Wilson, 1899). Upon his return, Hall took up residence in Worcester (at 94 Woodland Street) (Anonymous, 1899b). Clark University formally opened in October of 1889 with Hall at the helm. Within about three years of the opening, Jonas Clark, after festering and on-going disagreements with Hall (regarding the direction in which the University should go), squabbles with the Board of trustees, and a perceived lack of community interest/support, lost interest in his educational experiment and essentially withdrew; much of the implied (promised?) financial support in these early years never materialized (Veysey, 1965; Koelsch, 1987; Ryan, 1939). There began a long period of financial difficulties for the University on the one hand, but the acquisition of truly outstanding faculty on the other. For example, members of the Biology Group in 1891–1892 included individuals who had made, or would make, important scientific contributions, such as C.O. Whitman (founder of the Journal of Morphology), H.H. Donaldson, and Franklin P. Mall (Fig. 3).

4. The invitation, trip, and arrival

As the 10th anniversary of Clark University approached, Hall conceived a plan to celebrate its accomplishments, create interest and publicity for the University, and to possibly offer a podium from which his own administrative contributions and accomplishments could be show-cased. To celebrate this 10th year, Hall decided to hold a great scientific conference to
which he would invite what he considered to be some of the
great scientific minds of the period.

It is interesting to note that all invitees were from Europe,
one was from the United States. However, this must be viewed within the context of higher education of that time and the factors surrounding the founding of Clark. First, in the late 1800s it was commonplace for talented U.S. scientists and students/scholars to seek research training, or Graduate and/or Medical degrees, in European Universities. Such opportunities were, for the large part, simply not available in the U.S. or, if available, the quality was not comparable to that available on the Continent. If one could muster the resources, one went to seek training in Europe; Europe was viewed as the source of academic, research and intellectual excellence. Second, Jonas Clark, the benefactor of the University, during his several trips to Europe, visited universities and centers of higher learning, continued to collect books, and became enamored with the European approach to education with its emphasis on scholarship. Clark also consulted with American educators as the concepts that would germinate into Clark University were formulating in his mind (Koelsch, 1987). Indeed, Clark wanted to “…incorporate the best features of American and continental European universities…” (Koelsch, 1987). It is also important to realize that Jonas Clark was very well acquainted with Leland Stanford (from Clark’s California years), who was also in the process of founding a university in memory of his teenage son who had died of typhoid fever (Stanford opened in 1891). Third, Hall was well-acquainted with the European system and European scientists; he had founded a successful journal, published extensively, and spent about a year visiting European universities, making many contacts and new academic friends, and collecting information the year before Clark opened. Recognizing these issues, it is not surprising that Hall looked to European scholars as his prime source of candidates.

In March of 1899, Santiago Ramón y Cajal (Fig. 4; at that time he was the Chair/Professor of Normal Histology and Pathological Anatomy at the University of Madrid) received an...
invitation from Hall to participate in the Decennial Celebration of Clarke University. After a delay of about two weeks, Cajal responded in the affirmative in a letter dated April 2, 1899.² Cajal’s positive response to Hall’s invitation is shown in Fig. 5, and a translation follows:

Mr. Stanley Hall
Respectable Mr. Rector of the University of Clark:
In reply to your kind letter of the 19th of March in which the Learned University of Clark has granted me the honor of inviting me to celebrate with a scientific lecture the 10th anniversary of its creation, I have the pleasure of responding that I accept the request and am available to read in French (with necessary practical demonstrations) a lecture on the texture of the human cerebral cortex, in which I will expound, in summary, on my latest research, yet unpublished, about such an important argument.

I will depart from here the 15th or 20th of June before which date you should be able to draw for me, if so much is your kindliness, the amount of money designated as reimbursement for travel expenses. Some of my friends who have visited your country find somewhat insufficient said travel expenses of 500 dollars, believing that for fulfilling travel with some ease from Madrid (especially if it is necessary to visit a few University cities of the Union) the need would be 600 or 700. I, in any case, I am content with the amount proposed and although I am not rich I can pay as the Rector if it becomes a necessity from my own stock of money.

² In his Recollections Of My Life, Cajal states “In June 1899... there reached my hands a courteous invitation from the American university of Worcester (Clark University)...” this clearly implies that the initial invitation came in June. However, Cajal’s response to this invitation mentions the date of the initial invitation (March 19) and the last page of Cajal’s response is clearly dated “Madrid 2 April, 1899”.

Fig. 5 – First (A), second (B), and third (C) pages of the letter of 2 April 1899 from Cajal to Hall. (Clark University Archives, with permission.)
Cajal was ing what to do (Cajal, 1989). As stated in his Recollections, response reflected his hesitation and consternation concern—

“…preparing on also be translated reaffirms that he will present his lectures in French (this may as a result of Cajal’s request in his April 2 letter).

The delay between the arrival of the invitation and Cajal’s response reflected his hesitation and consternation concerning what to do (Cajal, 1989). As stated in his Recollections, Cajal was “…deeply surprised and perplexed…”, “…could not understand how a humble Spanish investigator should have been thought of in the United States…”, and “I was assailed by doubt…” One of Cajal’s main concerns appeared to be the recent, and negative, outcome for Spain, of the Spanish-American War and the international political fallout related thereto. In fact, Cajal seemed to view the outcome of this international event in a rather personal way; within the context of his doubts concerning a trip to Clark he referred to himself as “…a professor belonging to a vanquished and humiliated race” (Cajal, 1989). After consultations with friends and colleagues, the political press (of all things!), and government officials including, the Minister of Education, all of whom gave their enthusiastic support, Cajal accepted Hall’s invitation.

The content of Cajal’s response (Fig. 5) is interesting and informative on several fronts. He accepts the invitation, indicates that his lecture will be delivered in French, and that the content will be largely based on unpublished observations on the human cerebral cortex. As indicated in this letter, Cajal initially sees one presentation (“…a lecture…) but by the time he arrives in New York (see below) his thinking on this point has changed. In this April 2 letter Cajal also addresses the issue of travel costs. From the clear wording in Cajal’s letter (“…find somewhat insufficient said travel expenses of 500 dollars…”), it is obvious that Hall has offered this particular figure in his March 19 letter; but based on the advice of friends who had traveled to the United States, Cajal is, in his letter, diplomatically negotiating a modification in the amount.3

A second, and undated, letter from Cajal to Hall outlines further details of the trip to the U.S., including the probable date of arrival in New York (Fig. 6). In this letter, Cajal reaffirms that he will present his lectures in French (this may also be translated “…lessons…”), indicates that he plans on preparing on “…some pieces of paper of a large size some drawings in color; so that one may better follow my lessons…”, and he requests that English translations be made available for the audience if at all possible. Of particular note is Cajal’s mention of bringing “…some microscopic preparations”. Cajal ends this letter with a characteristically gracious salutation. The following is a translation of this undated letter:

Very dear and honorable Colleague:

In response to your courteous and kind reply I have decided to undertake the trip. I will make my departure on 24 June Saturday on a liner of the General French Transatlantic Company (Havre) and I will arrive in New York the 1st or the 2nd of the month of July. I expect that we will have two or three days for preparing my lecture and for executing within a table, or with some pieces of paper of a large size some drawings in color; so that one may follow better my lessons. I will bring also some microscopic preparations.

The lecture will be worded in French, but it would be good that my audience have in its hands an English translation with figures. I hope that one of your friends will be so kind as to translate, during these four days which we have available before the lesson, the English version. The permanent figures perhaps could be added afterwards, at the time of the final publication.

In thanking you for your exquisite generosity, I forgo your amiable hospitality and your [?]? promise to send someone to welcome me to New York for I do not like to cause any problems and trouble.

I renew, very dear and honorable colleague, the expressions of my friendship.

S. Ramon Cajal

Cajal and his wife traveled from Madrid to Paris where he had the opportunity to visit with friends and scientific colleagues (Cajal, 1989). On about June 20th, they embarked “…at Havre for New York in a ship of the French line…” (this may also be called Le Havre or Le Havre-de-Grâce) for a crossing that took 12 days (Cajal, 1989). En-route, Cajal became acquainted with three of his fellow travelers who had also been invited to the celebration at Clark University: A. Forel, A. Mosso, and E. Picard. By his own account (Cajal, 1989), Cajal made friends with all three, especially Forel, with whom he shared a common interest in the nervous system. Their discussions covered a wide range of topics of mutual interest (“…divine and human…philosophy, science…politics…”), and included the behavior of ants, a particular, and lifelong, interest of Forel’s (Forel, 1937; Cajal, 1989).

In a third letter dated 2 July, 1899 (Fig. 7), Cajal writes to Hall (note the inadvertent misspelling of Hall’s name) on stationary of the American Hotel in New York. Cajal indicates that he and his wife arrived in New York on July 2, offers further details of his future travel plans, and some additional thoughts on his presentations at Clark.4 Cajal again brings up the point of needing adequate time to prepare his visual aids (it would seem that this was heavy on his mind), and he notes that he is indifferent to the

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3 In his Recollections, Cajal refers to June, 1899 as the time when the “…invitation…reached my hands…” and, in the same paragraph, to the fact that “To defray expenses of the trip, the official invitation enclosed a cheque for six hundred dollars”. Based on the known date of the initial invitation (March 19, 1899), the content and date (April 2, 1899) of Cajal’s response, and the reference to a specific amount for travel expenses of “…six hundred dollars…”, it is clear that the June communication was not the initial invitation but a follow-up to an earlier exchange. It is likely that this June letter contained the travel stipend that was successfully negotiated as a result of Cajal’s request in his April 2 letter.

4 It is clear from the date on Cajal’s letter, and from his direct statement “…we…arrived in New York on 2 July sunday…” that he and Senora Cajal arrived in the United States on this date and not in the middle of June as indicated in his Recollections (Cajal, 1989).
number of lectures but suggests that his data would support three presentations. His suggestion of three prevails. The following is a translation of this July 2 letter:

New York 2 July 1899
Mr. Stanley Hale (sic)
Very honorable and dear Colleague,
As I have told you we have made the trip on the liner The Champagne and we have arrived in New York, Sunday 2 July. This same evening we will leave for Boston and we hope to finish our trip the day after tomorrow or even tomorrow if we are not left too tired. I travel in the company of my wife. This is why I would like to stay in a hotel.
The number of lectures is indifferent. The material is sufficiently extensive for making three lessons. But what will compel me to prepare with a little more work will be my lessons, which are accompanied by demonstration with the aid of large drawings. It will be therefore necessary that between the two lectures, we will have at our disposal a day at least for executing the drawings.
Your very devoted Colleague
Cajal

In his Recollections, Cajal (1989) describes his impressions of New York, perhaps best summed up as “...the stupendous city of the skyscrapers, of the multimillionaires, of the enslaving trusts, and of the suffocating heat.” Cajal is impressed with the vigor of the laborers, especially in the heat, the Statue of Liberty, St. Patrick’s Cathedral, and with many other landmarks and shops within the city. He also describes a small hotel fire (presumably in his hotel), the scramble to leave the building via a fire escape, and makes observations on the psychology of individual reactions when “...called forth by terror”.

Professor and Senora Cajal arrived in Worcester on July 4, 1899, accompanied by Professors W.E. Story and A.G. Webster, of the University, and took up residence in the Bay State House for the duration of the celebration.
Anonymous, 1899b). Cajal had been offered accommodations in private residences, but had indicated to Hall that he preferred a hotel over the generosity of private accommodations since Senora Cajal was accompanying him on this trip. Stephan Salisbury, a wealthy businessman in the community and member of the Board of Trustees of Clark University, was Cajal’s official host (Fig. 8). Cajal spoke well of Salisbury as a person, of his generosity and philanthropy to the community, of his general reserve concerning American women (he was a bachelor), but of his respect for Spain and Spanish women (Cajal, 1989). Salisbury’s standing in the Worcester community, and his personal wealth, was such that he was the largest single contributor to the costs of the Decennial Celebration; he provided 20% of the approximately $5000.00 needed to offset the expenses of the event (Anonymous, 1899c,d; Story and Wilson, 1899).

5. Ramón y Cajal, one of the famous honored at Clark

Cajal was one of five notable European scientists invited to Clark, all of whom were lauded repeatedly, and graciously, in the public press before and during the celebration (Anonymous, 1899a,b,c,d,e,f,h, and j). A sampling of the headlines in the local press during the time period of July 4–10, 1899 provides a flavor of the general enthusiasm for the celebration, for the invited scientists and their talks, and for the attention to the University (Figs. 9A–D). Many of the newspaper articles contained informative discussions of the presentations. It was clear in the press that all of these scientists were invited due to their high standing in the international research community. Three were what could be
called biological scientists, as broadly defined, and two were in the fields of mathematics and physics. The participants are briefly summarized here in alphabetical order.

5.1. Professor Ludwig Boltzmann (Fig. 10A)

Boltzmann, praised in the press as the “...foremost living authority in mathematical physics...” (Anonymous, 1899g) was Professor of Theoretical Physics at the University of Vienna. Described as “...a large man, of massive frame...bushy hair and thick dark beard...” (Anonymous, 1899c), Boltzmann spoke a little English, but lectured in German. His lectures, a total of four under the general title “Über die Grundprinzipien und Grundgleichungen der Mechanik”, were well received and detailed in the press (Anonymous, 1899c,d,e). Boltzmann’s lectures were also printed in German in the Decennial Celebration Volume (Story and Wilson, 1899). He, like Cajal, was accompanied by his wife.

5.2. Professor August (Henri) Forel (Fig. 10B)

Forel, for many years, had been Professor of Psychiatry at the University of Zürich, and was also recent Director of the Burghölzli Asylum (he retired that position in 1898; Forel, 1937) at the time of his visit to Clark University. According to those present Forel was reasonably fluent in English (he had learned English as a young man to facilitate his correspondence with Charles Darwin; Forel, 1937), but delivered his two lectures in German (Anonymous, 1899d, Story and Wilson, 1899). Although Forel spoke in German on “Hypnotism and Cerebral Activity” and on “A Sketch of the Biology of Ants”, his talks were printed in English in the Decennial Volume. Forel’s talk on ants was especially well-received (“There was an unusual interest in the lecture of Prof. Forel on ants”) and was discussed in some detail in the lay press (Anonymous, 1899f, g). Interestingly enough, the lay press recognized Forel for his contributions to the “…neurone theory…” (neuron doctrine?) in the following context; “Prof. Cajal is the foremost worker among those who have established in detail the correctness of Forel’s neurone theory in many parts of the brain which Forel has not worked out expertly” (Anonymous, 1899f). Forel’s work was certainly one essential element in the overall development of the neuron doctrine. Forel was truly a Renaissance man with scholarly accomplishments in diverse areas. He was internationally recognized for his research and publications on ants (he had started this work before he was eight years of age, published a major book on the topic at about 25 years of age, and maintained this interest throughout his life Forel, 1937); following the Clark conference he planned on studying ants in the US, specifically in North Carolina (Anonymous, 1899f; Shepherd, 1991). Forel had studied under greats such as Meynert, Leydig, and Gudden, had made many important contributions to the understanding of brain anatomy, and had developed new insights in the field of psychiatry and human behavior (Forel, 1937). The name Forel also appears on several widely known eponymous terms in the field of neuroscience. Forel was also accompanied by his wife.

5.3. Professor Angelo Mosso (Fig. 10C)

Mosso was Professor of Physiology and the Rector of the University of Turin. The press described Mosso as a scientist “…whose researches in physiological psychology are epoch-making…” (Anonymous, 1899g). His lectures, two in number, were on somewhat divergent topics. The first, entitled “Psychic Processes and Muscular Exercise”, was a combination of physiology and behavioral aspects of movement including a variety of references to the brain and nervous system. Basically, he encouraged a balance between mental and physical activity based on the age of the child (Anonymous, 1899g). The second, “The Mechanism of the Emotions”, was much more of a physiological discourse on changes in bodily functions under certain observed conditions. Mosso (an Italian) spoke in German, but his papers appeared in English in the Decennial Volume.

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Footnote: Switzerland does not actually have a national language that is applicable to the entire country. The author has Swiss colleagues who are fluent in German and/or French. In fact, when I asked one of my Swiss colleagues about this particular point, he replied that those Swiss who live toward the German border speak German and those who live toward the French border speak French. Such was probably the case for Forel. In his autobiography, Forel (1937) only very briefly mentioned his trip to Clark, literally just a few sentences. It is interesting to note that Forel, who abstained from the consumption of alcohol in any form, takes the time to comment on his visit at Clark; “At this university I noted that the American savants, though extremely temperate, were followers of the Germans in the matter of beer-drinking.”
5.4. **Professor Émile Picard (Fig. 10D)**

Picard, described in the press as “...perhaps the greatest mathematician living...” (Anonymous, 1899c), was Professor of Mathematics at the University of Paris. He delivered three lectures; the titles and text of these presentations in the Decennial Volume (1899) and his presentations at the time were all in French. The titles of Picard’s presentations were “Sur l’Extension de quelques Notions Mathématiques, et en particulier de l’Idée de Fonction depuis un Siècle”, “Quelques Vues Générales sur la Théorie des Équations Différentielles”, and “Sur la Théorie des Fonctions Analytiques et sur quelques Fonctions Spéciales”. The published versions of Picard’s presentations contained many mathematical formulae, which would seem to confirm the view that “His talk was... extremely technical and appreciable only to those who understood the language perfectly.” (Anonymous, 1899d).

5.5. **Professor Santiago Ramón y Cajal (Fig. 4)**

Cajal is identified in the program as Professor of Histology and Rector of the University of Madrid, although his full academic title was Professor of Normal Histology and Pathological Anatomy. Of all the participants at this celebration, the press was the kindest and most laudatory to Cajal. This basically took two forms. The first included numerous comments of personal praise such as he “...has blazed new paths in histology and neurology...” (Anonymous, 1899a), “...is one who has carried his researches farther and studied more deeply than any other...” (Anonymous, 1899e), “...no worker has accomplished more than Professor Ramon y Cajal [sic]” (Anonymous, 1899g), and many others. The second included comments clearly relating to the fact that the writer(s) were cognizant of the fact that Cajal was from a country that had recently lost the Spanish-American War (in 1898). While quite friendly, these comments were clear in their intent to extend (overly so?) the hand of friendship to the great Spanish scientist. Examples of these are, “When Prof. Cajal was introduced, he received a rousing ovation from the audience, both on account of his reputation, and as a representative of what is best in the country the United States has known so intimately of late.,” and “That one of the visitors is a Spaniard, who stands for the best traditions of the most brilliant era of his country’s history, is a matter of peculiar significance and sincere congratulations. His coming is proof of that community of spirit which is the boast of science and which knows no bounds but the fullness of the earth.” (Anonymous, 1899e,j).

Cajal presented his three “lessons” in French, but they were titled and published in English in the Decennial Volume.6 The titles were “Comparative Study of the Sensory Areas of the Human Cerebral Cortex”, “Layers of the Large Stellate Cells”, and “The Sensori-Motor Cortex”. Like Boltzmann and Forel, Cajal was accompanied by his wife.

6 There is abundant evidence that Cajal’s lectures were delivered in French. First, reference is made to this in the local newspapers (Anonymous, 1899d); second, Cajal clearly states this will be the case in two of his letters to Hall (see earlier in text); and third, this is clearly stated in the Decennial Celebration volume (Story and Wilson, p. 18—“Professors Picard and Cajal lectured in French...”). A survey of these sources, and of Cajal’s Recollections, reveals no mention that a Spanish version of Cajal’s presentations was prepared or available. Cajal’s comment in his undated letter (see earlier in text)—“The lecture will be worded in French, but it would be good that my audience have in its hands an English translation...I hope that one of your friends will be so kind as to translate...”) indicates that the English translation for the audience, and possibly the Decennial volume, was most likely prepared form the French.

Fig. 9 – Newspaper headlines representative of the period July 4–10, 1899 from the Worcester Telegram, July 4 (A), Worcester Telegram, July 6 (B), Worcester Spy, July 7 (C), and Worcester Telegram, July 9 (D). (Clark University Archives, with permission.)
his audiences, as seen by the comments in the press (Anonymous, 1899e): “Prof. Cajal used during his lecture a number of colored charts, his own work since arriving in Worcester, of sections of brain matter, cells and tissues, highly magnified. He also allowed the audience to examine the original sections under the microscope.”

Fig. 10 – The other honorees who attended the Clark Decennial Celebration; L. Boltzmann (A), A. Forel (B), A. Mosso (C), and È. Picard (D). (From Story and Wilson, 1899, with permission.)
In 1889, Cajal had faced a very skeptical audience at the Meeting of the German Anatomical Society (the Anatomische Gesellschaft) and he used the method of actually demonstrating the results that he was describing by using several microscopes set-up with his own slides (Cajal, 1899; Shepherd, 1991). This approach was enormously successful at that time; Albrecht Kölliker, the Dean of German Histologists, became enthusiastically convinced of Cajal’s results and was Cajal’s earliest and perhaps greatest champion. Cajal used the same very successful approach at Clark even though the audience was clearly not skeptical! By 1889, the veracity of Cajal’s observations was without question.

Cajal utilized his detailed presentations from Clark as the basis for later, and more comprehensive, treatments of the same topics including his great Spanish work Textura del sistema nervioso... and its French translation Histologie du Systeme Nerveux... as well as in other publications (DeFelipe and Jones, 1988). In fact, a comparison of the illustrations published with Cajal’s papers in the Decennial Celebration volume (Cajal, 1899a,b,c) with those in his Histologie... reveals that most of the 1899 illustrations were also used in this later tome.

### 6.1. The first lecture (Cajal, 1899a)

This initial presentation, entitled Comparative Study of the Sensory Areas of the Human Cortex, was actually divided into two parts which represented the content of the first and second lectures (Cajal, 1899a, b). He starts by briefly reviewing the unicist doctrine (which basically states that all cortical regions are the same in structure and their functional differences are based on their respective connections) and the pluralist doctrine (which basically states that the different functions of different cortical areas are reflected in the structure of each respective cortical area). Cajal notes that his results favor the latter view.

Cajal focuses his observations on the visual cortex and describes nine layers; from without to within these are 1) plexiform layer, 2) layer of small pyramids, 3) layer of medium-sized pyramids, 4) layer of large stellate cells, 5) layer of small stellate cells, 6) second plexiform layer, or layer of small pyramidal cells with arched axon, 7) layer of giant pyramidal cells, 8) layer of medium-sized pyramidal cells with arched ascending axon, and 9) layer of fusiform and triangular cells. Cajal (1899a) notes “The number of layers could be easily increased or diminished...the number...which I adopt is somewhat arbitrary. By distinguishing, however, nine layers, I have followed a criterion of individualization which seems to me the most convenient and suitable for my exposition of the cortex as a mechanism composed of elements at a certain level which differ in special morphological features from those of neighboring levels”.

The rest of this first lecture describes details of the outer three of his nine-layered plan of this particular sensory cortex (Fig. 10). In the plexiform layer Cajal describes small cells, and their processes, that are largely intrinsic to this layer, the patterns and distributions of ascending fibers from pyramidal cells located in deeper layers, and neurogial cells. He notes that the latter are largely the same as those previously mentioned by many other investigators. His description of the second layer, the layer of small pyramids, mentions that these cells have apical dendrites that extend into the plexiform layer, basal dendrites that ramify largely within this layer, and a small diameter descending axon. The details offered for this layer are comparatively brief. The description of the third layer, the layer of medium-sized pyramids, naturally summarizes the dendritic patterns of this particular cell type. This layer also contains stellate, fusiform, or triangular-shaped cells that give rise to ascending, descending and horizontal axons. Cajal notes that this layer of the visual cortex contains what he calls dwarf cells that have fine-diameter processes and “...bipinnicled...” cells. These latter cells, found in visual and auditory cortices, have small fusiform cell bodies from which vertically oriented dendritic and axonal plexuses radiate.

### 6.2. The second lecture (Cajal, 1899b)

This lecture, entitled Layer of the Large Stellate Cells, continued the theme introduced in the first lecture, that is, the description of the nine-layered sensory cortex. It starts with the fourth layer, the layer of large stellate cells, and proceeds to the ninth layer.

Cajal described his fourth and fifth layers as containing, respectively, predominant populations of large and small stellate cells (Fig. 11). He notes that cells of slightly different shape (fusiform, triangular) may have axonal plexuses that form characteristic patterns; these axons may extend into layers external and internal to the layer containing the cell body. Cajal describes the fiber plexuses of the fourth and fifth layers in some detail and specifies those that arise from cells located in these, or adjacent, layers versus those from “...exogenous...” sources, primarily the geniculocalcarine radiations.

The sixth layer, second plexiform layer, was described as “...poor in cells...” but containing small “…pyramidal or ovoid elements...” some with processes that extended to other layers. Cajal described the seventh layer, the layer of giant pyramidal cells, as containing “…irregular and discontinuous files of giant pyramids...” with few basal dendrites that distribute horizontally, apical dendrites that may extend into the first layer, and axons that extend through layer nine. The amount of text devoted to these two layers was comparatively short.

In the eighth layer, the layer of medium-sized pyramidal cells, Cajal noted that there were also cells of triangular and fusiform shape. Cajal mentions a unique axonal trajectory for the cells of this layer; the axon leaves the soma, descends, and then sends an arching recurrent branch that ascends into the more external layers. Cajal indicated that this “...very strange...” pattern is seen in infant and adult visual cortex. The ninth layer, layer of fusiform and triangular cells, was described by Cajal as containing cells of various shapes, some with very short axons, and radiating dendrites. Cajal’s description of the eighth and ninth layers was also brief.

### 6.3. The third lecture (Cajal, 1899c)

The title of this lecture, The Sensori-Motor Cortex, continued the general theme established by Cajal in his first presentation; that is defining the cortex on the basis of its cellular...

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7 Throughout the text, Cajal (1899) states that Kölliker wrote to him saying, “I have discovered you and I wish to make my discovery known in Germany”.

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structure. Also, as done in the first lecture, Cajal used terminology for this cortical region that met his criteria as defined in his initial lecture. For this cortical region he described six layers; 1) plexiform layer, 2) layer of small and medium-sized pyramids, 3) external layer of giant pyramids, 4) layer of small stellate cells, 5) internal, or deep, layer of giant pyramids, and 6) layer of polymorphic cells. These are markedly similar to contemporary terminology.

Cajal described the plexiform layer, the first layer, as similar in its cellular content to that of the comparable layer in the visual area and as containing dendritic processes of cells residing in all of the deeper layers. He also commented that this layer in the motor cortex is “…notably thick…” Cajal spends very little time on the layer of small and medium-sized pyramids, the second layer, “…because they are so well known…”, but does describe the cells in this layer with short axons and the trajectory of these axons. Cajal’s description of layer three, the external (or superficial) layer of giant pyramids, notes that “…this layer contains the well-known large pyramids…” of other authors and invokes the names of Golgi, Betz, Lewis, and others. He briefly summarizes the dendrites and axonal patterns of the cells of this layer.

Cajal devotes more attention to the fourth layer, the layer of small stellate cells, and describes different cell types based on the length of their axons. He first mentions the more common small pyramidal cells and the relatively “…scarce…” stellate cells both of which have long axons. He then describes stellate, fusiform, and “…spider-shaped cells…” that have short axons and “…bipancicled…” cells that are essentially similar to those seen in the visual cortex. Cajal clarifies the patterns of afferent fibers to the cortex that distribute to the fourth, and adjacent, layers. He notes that these afferents form small ascending and descending plexuses and horizontal fascicles that extend for “…great distances”.

The fifth layer, layer of the giant and medium-sized pyramids, was described by Cajal in terms (even in 1899) that would be familiar to any contemporary neuroscientist. He described a layer dominated by very large elongated pyramidal/conical-shaped cell bodies with dendrites radiating from their bases, and a stout apical dendrite ascending, and occasionally branching, to the first layer of the cortex. The axon arises from the base of the cell and, while descending to the white matter core of the gyrus, may give rise to collaterals to the fifth and sixth layers. In addition, Cajal specifies several other smaller cell types in the fifth layer that are generally smaller and are triangular, stellate, or fusiform-shaped and characterized by the distribution patterns of their axonal plexuses. Certainly striking are those stellate cells that form

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Fig. 11 – Fig. 4 from Cajal’s first lecture illustrating the outer three layers of the visual cortex of a human infant. (From Story and Wilson, 1899, with permission.)
Fig. 13 – Fig. 30 from Cajal’s third lecture illustrating the pericellular arborizations that enclose the large pyramidal cells of layer 5. (From Story and Wilson, 1899, with permission.)

Fig. 12 – Fig. 9 from Cajal’s second lecture illustrating layers 4, 5, and 6 of the visual cortex of a human infant. (From Story and Wilson, 1899, with permission.)
“...terminal nests...in the 5th layer between or below the giant pyramids” (Fig. 12). The sixth layer, layer of polymorphic cells, was briefly described as similar to that of the ninth layer of the visual cortex, being composed of smaller and medium-sized triangular, stellate, and fusiform cells whose axons enter the white matter core and dendrites ascend into more external layers.

At the conclusion of this third lecture, Cajal very briefly comments on how the acoustic, olfactory, and association cortices compare to those more detailed descriptions in his lectures. In addition, Cajal provides “...anatomico-physiological conclusions...” that support a pluralist view of structure-function. For example, he argues that different cortical regions have structural features that appear to be characteristic of that specific region but may also share some features with other regions; that certainly some of these features are also seen in mammals other than humans; and that afferent fibers arriving at the cortex are, in part, unique to that region. While it is clear that all the areas of the cortex share some features in common, it is abundantly clear that each cortical area has features that are unique to that area and that these features are undoubtedly related to functional differences (Fig. 13).

7. Epilogue

The culmination of the Decennial Celebration was held on Monday morning, July 10, 1899. The celebrants were in academic regalia; many guests and dignitaries were present; and, as one would expect, there were speeches all around (Anonymous, 1899g,h; Story and Wilson, 1899). Greetings were read from many notables, including President William McKinley, other officials of the U.S. government, and numerous representatives of academic institutions worldwide. The Decennial Address was delivered by G. Stanley Hall, President of the University. This gave Hall a podium from which he extolled (and perhaps embellished a bit) the successes of Clark University. In spite of Jonas Clark’s precipitous withdrawal (both practically and financially) from the University in its very early years, and his inability to attend the celebration, Hall was extremely gracious to the benefactor of the University (Hall, 1899; Koelsch, 1987; Anonymous, 1899j).

In his rather long speech, Hall (1899; Anonymous, 1899h) summarized a number of academic developments and events in the U.S. that took place during the 10-year period...
of the Clark Decennial. These included the establishment of institutions of higher learning, the advent of new scientific journals, of advancements in educational methodology, and Hall’s perception of a renaissance in academia in the last part of the century. Interesting enough, Hall graciously acknowledged the successes of The University of Chicago even though Chicago had raided Clark in the early 1890s and captured some of its outstanding faculty (such as Whitman and Donaldson). Hall covers this profoundly difficult period of Clark’s early life with what can only be described as diplomatic delicacy.

Hall highlighted the high quality of his past and present faculty, noting their individual successes at Clark and at other institutions. He acknowledged that Clark’s survival of a difficult period was the result of individual effort, sacrifice, and cooperation, and that it was now a strong, productive, and stable University with a future to anticipate. Hall spent some time discussing the changing educational landscape, the relationship between institutions of higher leaning, and their responsibility to the public sector. Hall put the best light on the first 10 years of Clark, praised all of its past accomplishments and current programs (even the summer school), and pointed out some immediate needs but, overall, saw a strong future.

Following Hall’s address, and a brief benediction, the University “...conferred, for the first time...” honorary degrees on the five foreign dignitaries with the following declaration: “By virtue of the authority vested by the Commonwealth of Massachusetts in the Board of Trustees of Clark University, and by them delegated to me, I now create you Doctor of Laws, honoris causâ, and by this token [presenting diploma] invest you with all the dignities thereunto appertaining” (Fig. 14) (Story and Wilson, 1899). Each recipient responded and Cajal (1899d) graciously thanked the University and complimented the creation of a university “...devoted...to the labor of teaching...” and to “...giving impulse to pure science.” Using Germany as an example, Cajal drew a parallel between industry, scientific status, and wealth of a nation (aniline dyes, optics).

After departing Worcester, Cajal and his wife visited Niagara Falls, Boston, Cambridge, and New York (Anonymous, 1899i; Cajal, 1989). Cajal’s visit to Harvard University “...aroused my sincere admiration and noble envy.” He was greatly impressed by Harvard’s faculty, its many impressive buildings, the Medical School, library, and its several Museums. He enjoyed his visit to the Boston City Library and, in his Recollections (1989), recounted an exchange with a librarian who enthusiastically denounced the Spanish press for, in the view of the librarian, provoking the late war. In New York, Cajal visited Columbia University, the University of New...
York, and West Point. While he was quite complimentary to these New York universities, Harvard clearly garnered his greatest praise.

Upon his return to Spain, Cajal completed the final emendations to his presentations at Clark and submitted these to Hall for publication in the special volume published by the University entitled “Clark University 1889–1899 Decennial Celebration”; this volume was dated 1899. Although there are no editors listed on the title page of this Volume, William E. Story and Louis N. Wilson are identified as “Editors” on page iv of the Preface; Story was a faculty member of the University and Wilson was the University Librarian. Recognizing this fact, the Decennial Celebration Volume is listed in the reference section of this paper under their editorship. With his final draft, Cajal included a short letter dated 17 October, 1899 (Fig. 15) in which he acknowledged several individuals by name and paid his respects to Hall. The following is a translation of this October 17 letter:

Very dear colleague and friend:
I am sending to you by mail, protected, the printed sheets as well as the manuscript of my lectures at Clark University. I have revised the text that seems to me well translated, and I have added a few paragraphs and especially explanations of the figures with the corrections to those on the sheets. Furthermore, I have included some new drawings corresponding to the text of the third lecture (motor cortex). I give my regards as well as those of my wife to your kind secretary Mr. Nelson and to your excellent friends Mr. Salisbury, Mr. Hodge, Mr. Webster and wife, Mr. Meyer, Mr Perot [sic] and receive kindly dear President and Colleague the assurance of my most complete friendship.
S. Ramon Cajal
Madrid 17 October 1899

Fig. 16 – The celebrants who participated in the conference on psychology and pedagogy at the Twentieth Anniversary Conferences of Clark University in 1909. Standing in the back row from left to right A.A. Brill, E. Jones, and S. Ferenczi. Sitting in the front row from left to right, S. Freud, G.S. Hall, and C. Jung. (From Koelsch, 1987, with permission.)

8. The tradition continued

Undoubtedly buoyed by the clear success and the wide positive attention gained from the 1899 celebration, Hall and the University planned an even larger celebration with the Twentieth Anniversary Conferences of 1909. One of the several twentieth year events, which featured lectures by Sigmund Freud and Carl Jung (Fig. 16), reflected Hall’s abiding interest in psychology as broadly defined. As had

9 Of the individuals mentioned by name in this 17 October, 1899, letter, Salisbury has been mentioned earlier in this paper, and “Mr. Nelson” is identified as the Secretary to Hall. Although there were two Hodges at Clark in 1899, the “Mr. Hodge” in Cajal’s letter is certainly Clifton F. Hodge, who was an Assistant Professor of Physiology and Neurology, and the “Mr. Webster” was Arthur G. Webster who at the time was an Assistant Professor of Physics. Adolf Meyer, who had actually studied under A. Forel in 1891 and was described as “…an old friend…” of Forel’s at the time of his 1899 visit, was the “Mr. Meyer”. “Mr. Perot” was Joseph DePerott a gifted mathematician and linguist who Cajal described as a “…somewhat eccentric Russian professor of mathematics who displayed splendid long hair reaching his waist...he had learned Spanish without forgetting French, Russian, Polish, German, and Italian, which he spoke perfectly”.

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Cajal, Freud received an honorary Doctor of Laws degree; Anna Freud (the daughter of Sigmund Freud), who was a participant in the sixtieth year celebration in 1949–1950, received the same honorary degree as her father (Koelsch, 1987).

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