

The fiction works of Santiago Ramón y Cajal

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ABSTRACT

Introduction. As well as being the author of a valuable body of scientific work, Santiago Ramón y Cajal also wrote biographies, essays, and fiction. This study analyses the author's fictional work.

Development. In his youth, Cajal wrote poems, a robinsonade novel, and an adventure novel inspired by the work of Jules Verne, which were lost during his time as a military physician. In 1905, he published the educational collection *Vacation stories*, which aimed to give scientific explanations for superstitious ideas. In 1973, the story *Life in the year 6000* was published for the first time by one of Cajal's granddaughters; in the story, Cajal anticipates telemedicine and cloning.

Conclusions. The main subjects of Cajal's fiction works are science, the scientific method, laboratory work, and the use of microscopes and hypnosis; the stories are educational, aiming to dispel superstitious beliefs in favour of scientific explanation. He presents methods of social control, such as the use of chemical substances, vaccines, and hypnosis, and anticipates new technologies, genetic modification, cloning, and telemedicine.

KEYWORDS

Cajal and science fiction, *Vacation stories*, fiction works of Cajal, physician writers, narrative by Cajal, stories by Cajal

Introduction

Santiago Ramón y Cajal (1852-1934) is considered the father of neuroscience due to his important scientific contributions, which earned him the Nobel Prize in Physiology or Medicine in 1906. A histologist from Petilla de Aragón, Cajal described the neuron doctrine in opposition to Gerlach's reticular theory, favoured by Camillo Golgi, with whom he shared the Nobel Prize. He left an important legacy of scientific works, with *Texture of the nervous system of man and the vertebrates* (1897-1904) being a key text.¹⁻⁸

Cajal studied the transmission of nerve impulses, neuroplasticity, and the degeneration and regeneration of the nervous system, and made greatly significant

contributions to the development of modern neuroscience.⁹ His humanistic side is also noteworthy: Cajal was interested in history, philosophy, literature, archaeology, astronomy, chess, hypnosis, photography, and painting.¹⁻³

The Nobel laureate wrote numerous essays and autobiographical works: *Recollections of my life* (1901-1904), *Advice for a young investigator* (1899), *Café chats* (1920), *The psychology of artists* (1902), *The world seen at eighty* (1934), and fictional works that provide greater understanding of the great histologist.¹⁻⁴

This study analyses the fiction work of Santiago Ramón y Cajal and reflects on this humanistic side of the Spanish Nobel Laureate.



Figure 1. Santiago Ramón y Cajal as a captain in Cuba. Izquierdo Vives, 1874. Spanish Army Museum

Methods

We searched for fiction by Santiago Ramón y Cajal, references to these works in his biography, and scientific studies addressing his fiction writings, in order to analyse this aspect of his personality.

The results are divided into subsections: first steps in fiction, *Vacation stories*, and *Life in the year 6000*.

Development

While Cajal is primarily known for his scientific work, we must not overlook his forays into narrative, essays, and poetry. Some of these writings were lost during Cajal's time as a military physician (Figure 1), which began in Zaragoza and Catalonia and continued with his transfer to Cuba. These hard, turbulent times were characterised by adventure, patriotism, sickness, and disappointment, and left a mark on the young Cajal, who

was severely ill on his return to Spain.¹⁰ Some of Cajal's early writings were lost during these trips, as is noted in his autobiography, but others were conserved and enable us to better know this interesting facet of the man.^{1,3,11-13}

First steps in fiction

From childhood, Cajal showed great enjoyment of reading and drawing, and showed his zeal for innovation and teaching with *Estrategia lapidaria* ("Stone strategy"), a manual he wrote as a boy to teach better use of the slingshot. This desire to share his knowledge was still apparent in his book *Vacation stories*.^{1,14,15}

At high school in Huesca, he presented a three-act play in hendecasyllabic verse as a class project; he later wrote novels, stories, and essays. He was also a keen reader from a very young age. His father was happy for him to read scientific or informative texts, but considered

fiction to be a waste of time. Cajal would read his mother's romance novels, but needed other subject matter. At the age of 14 he would sneak into the sweet shop run by a neighbour in Ayerbe, where he would secretly read books by Alexandre Dumas (1802-1870), François-René de Chateaubriand (1768-1848), Miguel de Cervantes (1547-1616), Pedro Calderón de la Barca (1600-1681), and Francisco de Quevedo (1580-1645). *Robinson Crusoe* (1719) by Daniel Defoe (1660-1731) left a great impression on Cajal, and he wrote a robinsonade describing a castaway and his adventure, which Rafael Salillas entitled "Cajal's island"; the story clearly showed the influence of Defoe, Emilio Salgari (1862-1911), and Jules Verne (1828-1905).^{1,3,15-17}

In *Recollections of my life*,¹⁸ Cajal writes of his incursions into literature, although he ascribes little value to his results, and speaks of bitter disillusionment:

Thanks to the good offices of my friend Jimeno, certain of the local newspapers generously published some of my poems, filled, as I realized later, with *ripios* and commonplaces. I remember that of all my effusions, the one which had most success among my fellow students was a certain humorous ode written upon the occasion of a noisy student strike.

The ode, entitled "Oda a la commune estudiantil" ("Ode to the student commune"), is included in the collection *Escritos inéditos* ("Unpublished writings"),¹⁹ and refers to a student strike against a university professor, naming students and lecturers. These unpublished texts also include three other poems: "La sonrisa de una rubia" ("The smile of a blonde girl"), "María," and "Los ojos de mi morena" ("The eyes of my dark-haired girl").

To María, a friend of his sisters and his first love, he wrote: "My heart was free/before I saw your eyes/smiled as I contemplated the sun/and in eternal spring/dreamt full of happiness and joy." In "Los ojos de mi morena," he expresses the following: "When in the morning/your black pupils/look peacefully/out to the blue sky,/I die of envy/I die of jealousy/even of the heavens/when you behold them."

Some of Cajal's articles were published under the pseudonym Doctor Bacteria; these were those he classed as "philosophical-scientific recklessness" or "half-joking critiques."¹⁶

Influenced by Verne, he wrote a work of science fiction during his formative years (1871-1873); the book was lost, but is mentioned in his autobiography.¹⁸ The protagonist

is a traveller the size of a microbe who voyages to Jupiter, enters a cutaneous gland, and navigates the human body on a red blood cell.^{16,18}

Verne became popular in Spain in 1868, when the publishing house Gaspar y Roig released an elegant Spanish-language edition of many of his works, including the original illustrations. The newspapers of the day disseminated photographs of Verne and news of his life, and Cajal was not unaware of this popularity.²⁰⁻²²

Amalio Gimeno (1852-1936), a friend of Cajal's, published a similar story, also inspired by Verne, entitled *Un habitante de la sangre: aventuras extraordinarias de un glóbulo rojo* ("A bloodstream inhabitant. The extraordinary adventures of a red blood cell"), on the trials and tribulations of an erythrocyte travelling through the circulatory system. The novel was published in Valencia in 1881, although it had already been published as a serial in the medical newspaper *El Genio Médico-Quirúrgico* in 1871.²³

In his memoirs, Cajal laments the loss of his story, and mentions Gimeno's novel, which may have been inspired by Cajal's lost text.¹⁸

Similar stories have been told in cinema; for example, in the 1966 film *Fantastic voyage*, an adaptation of a story by Otto Klement and Jerome Bixby, a submarine and its crew are miniaturised and enter the body of a scientist to repair an intracranial haematoma. The film served as inspiration for a novel of the same title by Isaac Asimov, an animated series, and a painting by Salvador Dalí. In 1987, Asimov wrote the novel *Fantastic voyage II: destination brain*. Another title is *The prodigious chip* (1987), in which a miniaturised pilot enters the body of a hypochondriac. The same resource is used in the animated series *Once upon a time... Life* to teach children about the functioning of various organs and systems of the body. Voyages through the body are also used in *Being John Malkovich* (1991) and *Osmosis Jones* (2001), in which a white blood cell fights a lethal virus.¹

The Catalan psychiatrist Juan Giné y Partagás (1836-1903) also cultivated science fiction for educational purposes, publishing *Misterios de la locura* ("The mysteries of madness," 1890), *La familia de los Onkos* ("The Onkos family," 1888), which compared diseases to revolutionary uprisings, and *Un viaje a Cerebrópolis: ensayo humorístico de dinámica cerebral* ("A trip to Cerebropolis: lighthearted essay of cerebral dynamics,"



Figure 2. Front covers of the Colección Pulga editions of Cajal's *Vacation stories* (Source: javiercoria.blogspot.com, ©Javier Coria)

1884), which lightheartedly recounts voyages through the human body, specifically describing the inhabitants of Cerebropolis, who are visited by neighbours from Cerebelopolis and become entangled in fights and arguments.^{24,25} This dramatised trip through the nervous system includes references to the senses, intelligence, consciousness, freedom, and sleep, among other human faculties.²⁵

Vacation stories

Cajal had a special interest in science fiction, and in 1905 published *Vacation stories* (Figure 2), a collection of five stories written between 1885 and 1886 with the subtitle “pseudoscientific narratives,” which referenced scientific progress and largely focused on psychology, microscopy, and bacteriology. The purpose of the stories

was entertainment and social criticism, but they were also intended to educate and to debunk false beliefs and superstitions through scientific explanation. We can reflect upon and find a moral in each story.^{1,3,16,26,27}

Cajal could have been the first Spanish writer to produce science fiction similar to that of H.G. Wells, but the first edition of *Vacation stories* was never formally distributed. He gave some copies to friends and relatives, and the collection had a minimal impact. He may have feared criticism, or that the social critiques in his fiction may have negatively influenced his research. *Vacation stories* was not translated to English until many years later, which also hindered its dissemination. The collection was first translated into English in 2006 by Laura Otis, and the English translation of *Life in the year 6000* was published in 2017.^{28,29}

The book begins with a foreword in which Cajal explains that he had written 12 semi-philosophical, pseudoscientific short stories that he had not previously dared publish on account of what he considered to be their eccentric ideas and unpolished style. He also states his intention to publish the remaining stories if the first five were well received, although he ultimately did not do this.³⁰

He adds that the subtitle “pseudoscientific narratives” is intended to reflect that the stories, which he defines as more or less eccentric reflections or as outlets for his ideas, are based on facts or rational theories within the biological sciences and modern psychology.^{3,30,31}

The stories present complex social and moral dilemmas related in some way to scientific advances or the lack or inadequacy of scientific education among the population. Cajal's stories reflect his thoughts on politics, morality, religion, science, and education; like Verne, he also presents rational hypotheses based on recent scientific developments.³

In *For a secret offense, secret revenge*, the first story in the collection, the brilliant microbiologist Dr Forschung comes upon two intertwined hairs in his laboratory; assuming them to belong to his wife and his young assistant, he is overcome with jealousy and performs microscopic and biochemical analyses and uses a magnifying glass to search for other hairs or fibres. To obtain definitive evidence of the infidelity, “he set up four Marey receptors under the feet of the aforementioned piece of furniture so that they were hidden by the carpet.

These were linked via rubber tubes to a receiving device he had installed inside a cabinet.” The receptors would be activated by considerable weight and would record any movement.^{13,26,30,32}

One night, he found a recording that definitively proved the betrayal:

The graphic record began with subtle inflections, but minutes later, the curves seemed to have been seized by a sudden fit of illness, exhibiting great mountains and valleys. The rhythm then assumed an unwonted liveliness, which became a gradual crescendo until, at last, the allegro movement came—a bold, extremely high, and valiantly sustained plateau. After a magnificent pause, the inscription came to an end, returning languidly and meekly to its primitive state of repose... to the straight line, perhaps, of disillusion and fatigue...³⁰

This description preceded that of Master and Johnson, who between 1959 and 1966 scientifically described the human sexual response (excitation, plateau, orgasm, and resolution); this work is shown in the television series *Masters of sex*.^{1,33}

Having confirmed the betrayal, the doctor decided to infect his assistant with the tuberculosis bacillus, and his wife also contracted the infection. He sent both to a clinic in Switzerland for convalescence. The assistant died shortly thereafter, and the wife resumed contact with her husband, who saved her with an antituberculous serum he had developed. Forschung also researched an elixir of eternal youth. This longing for eternal youth recalls Oscar Wilde’s (1854-1900) book *The picture of Dorian Grey*, published in 1890. The scientist was unable to create the coveted elixir, but did succeed in creating a substance, seniline, that had the opposite effect. His wife ingested it, aged, and no longer attracted other men; her husband’s concerns were allayed and he ceased his scientific research into possible infidelity. This second part could well have been published as an independent story.^{1,3,26,30}

Cajal was probably one of the first authors to reference population control through drugs. He considered that seniline could be used to control the behaviour of prostitutes, criminals, the insane, socialists, and anarchists, suppressing free will and modifying criminal or antisocial impulses.³⁰

We should consider ethical aspects of Dr Forschung’s research, as he tests seniline on prostitutes, prisoners, and mentally ill people; in other words, people who are

vulnerable or easily manipulated, either due to their socioeconomic situation, imprisonment, or incapacity to consent. This is without mentioning the criminal poisoning of his assistant, which served two purposes: it restored his honour, and led to an important scientific discovery that he published in a journal.³⁰

The story shares the title of a work published by Calderón de la Barca in 1637, which deals with imperilled honour and the need for reparation. The same theme appears in the 1624 story *La prudente venganza* (“The prudent revenge”) by Lope de Vega (1562-1635), which defends the restoration of honour through blood, and *Tamar’s revenge* (1621) by Tirso de Molina (1579-1648).³

In *The fabricator of honour*, Dr Alejandro Mirahonda invents a serum that maintains peace and harmony in the village of Villabronca. What his neighbours do not know is that no such serum exists, and the doctor is conducting an experiment with them, using hypnosis to control free will.^{3,26,30}

The use of hypnosis for various ends is frequently seen in film, for instance in *Whirlpool* (Otto Preminger, 1949), in which a woman is made to commit crimes, and the hypnotist uses the technique on himself to control pain following an appendectomy. On the subject of pain relief through hypnosis, Cajal published an article entitled “Pains of labour considerably attenuated by hypnotic suggestion” in the journal *Gazeta Médica Catalana*. The patient described in the article was probably his wife, who gave birth to a child shortly before the publication of the paper. Cajal concludes that under the effects of hypnosis, the delivery was fast and pain was notably reduced.³⁴⁻⁴⁰ This demonstrates how Cajal’s scientific interest in hypnosis, which was very popular in the latter decades of the 19th century, is reflected both in his research articles and in his fiction.

According to Gamundí, the histologist came to study suggestion, hypnosis, the unconscious, and spiritualism in order to better understand the inner self, with a similar attitude to that shown by the authors Ivan Pavlov (1849-1936) and Sigmund Freud (1856-1939).^{34,35}

During Cajal’s time in Valencia (1884-1887), he performed numerous experiments on suggestion, hypnotism, and spiritualism, as he describes in his biography: as Cajal himself states, in addition to his febrile laboratory work, he was able to dedicate time to other activities. He was part of a gastronomic and sports

society (“Gaster club”), with whom he spent time on excursions, fine dining, and some experiments, which led them to test the findings of Jean Martin Charcot (1825-1893) and other authors on sleepwalking and suggestion, studying the effects of these techniques on patients and healthy subjects.³⁴⁻⁴⁰ This interest in hypnosis is clearly reflected in *The fabricator of honour*.

For a secret offense, secret revenge also refers to suggestion, when he describes the attraction of the scientist’s wife to his assistant as “a simple effect of suggestion—fiery and overwhelming, if you will—but in the end fleeting, like all suggestions. Because of this, as soon as the hypnotist disappeared, the enchantment ended.”³⁰

The mass deception of *The fabricator of honour* recalls Cervantes’ interlude *Tableau of marvels* (1615), inspired by an Eastern fable that was adapted numerous times, for example in *The Emperor’s new clothes* by Hans Christian Andersen (1805-1875). In the interlude, Chirinos and Chanfalla are cunning puppeteers who intend to play a trick on the townsfolk, as does Mirahonda in the town of Villabronca (neither the village nor the doctor in Cajal’s story were named randomly). The troubadours convince the audience that the marvels of their show will only be visible to those who are not converted Jews or illegitimately born. Mirahonda tricks his neighbours with an elixir of his own invention that, he says, will do away with base passions and calm wicked instincts. Both stories involve the desire to deceive, although the purposes and methods are different.⁴¹

All members of the audience in Cervantes’ piece claim to have seen the wonders, when in reality they had only been shown an empty box, as none wanted to be mistaken for a converted Jew or a bastard. This was one way in which Cervantes mocked the social mores of the day and the importance given to appearances.⁴¹ Ramón y Cajal also used his fiction for social critique.

Once more, the protagonist of *The accursed house* is a physician. Julián makes his fortune in America and returns to Spain to marry his fiancée, but unfortunately loses everything in a shipwreck and doubts whether he will be able to win his love’s hand. One day, he discovers an abandoned mansion with a terrible story: several owners, livestock, and crops had died, and there is talk of ghosts and malignant spirits to justify these facts. Julián solves the mystery, which is none other than the presence of fungi and microbes. The young doctor buys the mansion for a very low price, sanitises the house,

cultivates the earth, and raises livestock, recovering a good financial position, and is able to marry his fiancée. The purpose of this story is educational: using science and technology to dispel absurd superstitions.^{3,27,30,32}

A similar plot is seen in Jules Verne’s *The castle of the Carpathians* (1892).³ Smoke, strange noises, and the beautiful voice of a deceased opera singer emanate from a castle. These are believed by all to be caused by some kind of spell, and local people believe that the castle is haunted by the spirit of the singer, until it is revealed that an inventor had recorded her voice on some cylinders so that the baron, a keen follower, could continue listening for eternity. The mystery was solved through the application of science and technology to superstition and ghost stories.

The protagonist of *The corrected pessimist* is Juan Fernández, a physician who is frustrated after failing a public examination that would have paved the way for him to enter one of Madrid’s most significant scientific circles and provided the income he needed to marry his fiancée. When he complains of the limited tools available to defend humans against microscopic pathogens, he is visited by a deity of science, who gives him the gift of microscopic vision for one year. While the power initially seems greatly beneficial, this is not truly the case, as he is unable to prove any of his observations; moreover, as his vision is so magnified he is able to detect every imperfection, and is unable to perceive beauty. This experience helps him to shake off his pessimism, to become more self-confident, and to better himself and succeed.^{3,30,32}

With his description of such a powerful microscope, Cajal anticipates the invention of the electron microscope, designed between 1925 and 1930 by the German researchers Ernst Ruska and Max Knoll, based on previous studies by De Broglie and the observations of Ernst Abbe in 1873.^{42,43}

The natural man and the artificial man also features science, in a dialogue between two old friends who received very different educations, one based on science and the other on religion.^{3,26,32,44}

One explains that since a young age he was excited by science and the search for truth, and that his teacher had fostered his taste for observation, organised memory, and critical spirit. His teacher’s advice included

“be yourself, not anybody else” and “sculpt your brain, the only treasure you possess.”³⁰

Life in the year 6000

In 1973, Encarnación “Nana” Ramón y Cajal, daughter of Jorge Ramón y Cajal and granddaughter of the Nobel laureate,⁴⁵ and her husband García Durán (1915-1994)³ celebrated the new year by submitting a copy of a manuscript stored since the 1880s, probably a draft of one of the stories not included in the *Vacation stories* collection. The text was incomplete, probably either because it was a first draft that Cajal had not finished or because part of the manuscript had been lost. The story is published in García Durán and Alonso Burón’s¹⁹ work on the unpublished writings of Santiago Ramón y Cajal.

The story presents numerous changes in social relationships, education, philosophy, politics, poetry, and religion, but mainly addresses advances in medicine.^{3,29}

Social relationships are changed: love has disappeared, having been found to be caused by a microorganism and to be responsible for many people having been sent to prison, mental asylums, or hospitals. Vaccination is obligatory and has led to numerous benefits, as love was only a source of displeasure and a waste of time. This is a further example of social control, as seen in other stories using seniline and hypnosis. Philosophy, poetry, theatre, and religion are considered vain pursuits, a waste of time better spent on scientific work, and are even treated as mental illnesses caused by germs. Regarding education, teachers have been replaced by phonographs and projectors that play lessons time and again. This idea anticipates the concept of remote learning through the use of modern technology.²⁹

Time travel is another recurrent theme in science fiction. The first work exploring the idea is *The time ship* (1887), by Enrique Gaspar (1842-1902). The first draft, written in 1881, was an operetta in three acts; it was subsequently adapted into a novel. Other examples include *The time machine* (1895) by H.G. Wells, which revisited the story *The chronic Argonauts*, published in *The Science School Journal* in 1888; *A Connecticut Yankee in King Arthur’s court* (1889) by Mark Twain (1835-1910), with several cinematic adaptations; and such films and television series as *Back to the future* (1985), *The ministry of time* (2015-), *Outlander* (2014-), *Travelers* (2016-2018), and *Time after time* (2016-2017). In these stories, visitors to the past or future use time machines, doors that take

them to different ages, fantastical cars, sacred stones, or time portals. In *Life in the year 6000*, the protagonist thinks to himself that it would be interesting to have a latent life, living a day in each century, absorbing all the knowledge of each age. When he falls asleep, he experiences a sensation of slowly drying out and wrinkling, of his blood thickening without fully coagulating, as though he were undergoing a process of preservation or curing. This brings him to the year 6000, where he emerges into a world shaken by an earthquake and is hydrated by the rain.²⁹

In this new age, the astonished traveller from the 19th century is hosted by the tricuspid engineer Dr Micrococcus, who shows him the great advances in nutrition, diagnosis, surgery, genetics, and vaccination, which have improved longevity and quality of life through the eradication of nearly all diseases. He also tells him that only one medical degree exists, mechanical biology or biological engineering, and describes the genetic engineering that enables the creation of people specifically designed for certain purposes, the production of artificial eggs and chicken, and the creation of mammals and even humans; Cajal therefore anticipated the development of genetic engineering and cloning.²⁹ These issues and their ethical limitations are also addressed in H.G. Wells’ *The island of Dr Moreau* (1896), in which the protagonist creates hybrid species.

The year 6000 is dominated by technology, with health and disease being defined according to mathematical calculations, and all such distractions and frivolous pursuits as idealism, poetry, mysticism, love, and philosophy have been suppressed. Even eating is different: its only purpose is to nourish the brain, with other body parts presenting atrophy. Why drink a cup of coffee when caffeine can be injected into the jugular vein, more rapidly taking effect in the brain?

Micrococcus shows the protagonist equipment for measuring ventricular and arterial blood pressure, interstitial microphones that capture sounds and waves, neurometers for regulating neural current, systems for detecting deviations in cell genesis, and devices enabling variations of cellular osmosis. A diagnostic machine performs a large part of physicians’ work, using data and mathematical calculation to generate a diagnosis and treatment based on logarithmic tables.²⁹

Cajal shows some degree of skill in predicting scientific progress; for example, he foresaw telemedicine, whose development began in 1967 with a pioneering programme at Massachusetts General Hospital. However, years previously and shortly after the invention of the telephone, Cajal described an assistant sending telephone tapes displaying imagery of a case of valvular endocarditis, with the physician noting down figures on a diagnostic machine.^{3,29}

The author links the 19th century with a far more technologically advanced future world in which sentiment, moral values, and enjoyment of art have been stripped from humankind due to their consideration as being a waste of time. We may ask whether such an evolved race has the capacity to be happy, or whether it is simply a collective of purely productive beings.

Conclusions

In addition to his scientific research, Santiago Ramón y Cajal also produced fiction. Some of these works were intended merely as entertainment or a means of expressing his thoughts and sentiments, but they also show a desire to teach and to critique, and his aim of dispelling false beliefs and popular superstitions. Some of his early texts were lost during his time as a military physician, and are only referenced in autobiographical writings and articles mentioning these early stories.

The book of Cajal's unpublished writings includes essays, poems, and the story *Life in the year 6000*, probably one of the texts he ultimately chose not to include in *Vacation stories*. Of the 12 stories he wrote, he published only five, focusing on science, the scientific method, laboratory work, and the use of microscopes and hypnosis; the stories are educational, aiming to dispel superstitious beliefs in favours of scientific explanation. He presents methods of social control through the use of chemicals, vaccines, and hypnosis, and anticipates new technologies, genetic modification, cloning, remote learning, and telemedicine.

The limited dissemination of these stories is explained by the short runs of publication and the fact that they were not translated into English until many years later.

In conclusion, we should once more underscore education and social criticism as Cajal's intentions in writing these stories, as well as the importance of

analysing them to better understand the humanistic side of this Spanish scientist.

Conflicts of interest

The authors have no conflicts of interest to declare. No funding was received for this study.

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