The Inspiration of Astronomical Phenomena VI
ASP Conference Series, Vol. 441
Enrico Maria Corsini, ed.

Galileo as a Patient

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Abstract. The clinical history of Galileo, as it turns out from hundred letters he wrote and received, is so informative as to make it possible to delineate the natural history of his body. It is well known that he suffered from recurrent episodes of fever (*terzana*) since 1606, when he was in Florence as guest of Cristina Lorena for education of the future granduke Cosimo II. By reading signs and symptoms he reported several times, it is clear that he had various diseases (rheumatism, haemorroids, kidney stones, arrhythmias). When in December 1632, at the age of 68, Galileo delayed his journey to Rome claiming sickness, Pope Urban VIII committed 3 physicians to examine him. They reported that Galileo was affected by "pulsus intermittens" (most probably atrial fibrillation), large hernia at risk of rupture, dizziness, diffuse pain, hypochondriacal melancholy as a consequence of the "declining age". It was in February 1637 that he started to have eye disease with lacrimation and progressive loss of sight, which in 10 months led to loose at first the right eye and then also the left one. According to the consultation, asked at distance to Giovanni Trullio on February 1538 in Rome, the diagnosis of blindness due to bilateral uveitis came out. Keeping with the current medicine, the illnes might have been explained in the setting of an immune rheumatic disease (Reiter's syndrome). The cause of Galileo's death, which occurred on 8 January 1642 at the age of 78, is not known since it was not submitted to autopsy. We can speculate cardiac death due to pneumonia complicating congestive heart failure.

The case we will herein present and discuss refers to an Academician of the Lincei, affected by chronic arthritis, who died at the age of 78 years after having become blind when he was 73. It was possible to reconstruct his clinical history from the hundreds of letters he sent and received during his life and collected by Antonio Favaro[1].

His familial history was negative. As far as the physiological history, he was born in Pisa on 15 February 1564, at term, through a dystocyc delivery complicated with neonatal asphyxia[2].

His life-style was a bit libertine, since he was a great eater and drinker. Until middle age, he was said to be of cheerful and pleasant countenance, square of frame, well proportioned and above middle height (Figure 1). His complexion was fair and sanguine, his eyes blue and sparkling and his hair and beard (of which he had in abun-

[1] A. Favaro, *Galileo Galilei e lo studio di Padova*, Padova, Antenore, 1966; V. Viviani, *Racconto istorico*, 1654, in A. Favaro (ed.), *Edizione Nazionale delle Opere di Galileo Galilei*, Firenze, Barbéra Editore, XIX, 1968, pp. 609-610; C. Basso-G. Thiene, *Galileo Galilei, i suoi mali e le origini della medicina moderna*, "Cuore & Salute", 7-9, 1994, pp. 387-397.

[2] Viviani, *Racconto istorico* (cit. note 1).

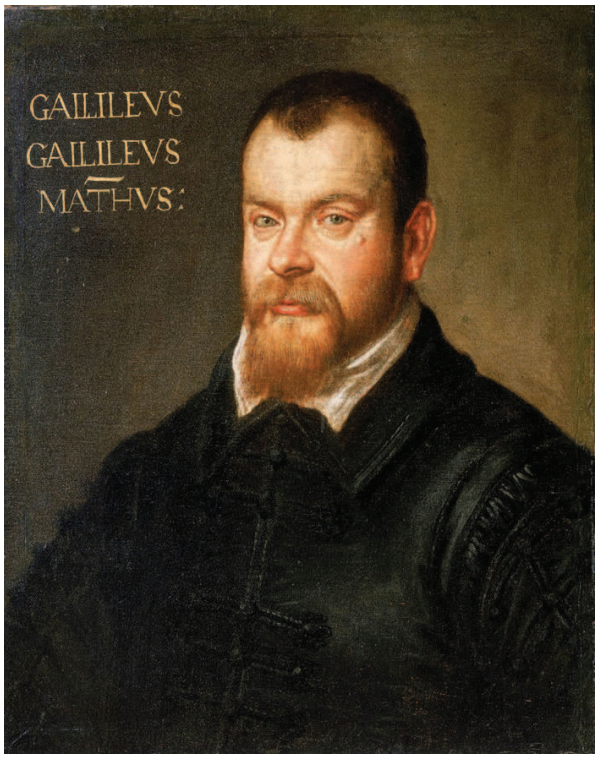

Figure 1. Francesco Apollodoro, *Portrait of Galileo at the Age of 40 Years*, c. 1602-1607, oil on canvas, National Maritime Museum, Greenwich. (Credit: National Maritime Museum, Greenwich)

dance) of a reddish hue[3].

As far as remote pathological history, at the age of 11, in 1575, when he was in the Monastery of Vallombrosa near Florence, he suffered from an episode of ophthalmia, probably a stye, a good reason for the father to take the child home and keep him far from a monastic career[4].

A very severe illness, which most probably is linked to the subsequent morbid manifestations, occurred in the early summer 1593, at the age of 29, the year after he moved from Pisa to Padua to take over the chair of Maths (Figure 2). Galileo was spending a very hot summer day with friends in a villa near Vicenza, that belonged to the Count Camillo Trento. One room of the villa had the unique feature of being cooled by air circulated through large ventiducts from the nearby caves of Costozza, where the temperature remained even at 11°C (52°F) throughout the year. After luncheon, they

[3]G. Thiene-C. Basso, *I mali di Galileo*, "Atti e Memorie dell'Accademia Galileiana di Scienze Lettere ed Arti in Padova", CXXI, II, 2009, pp. 25-36; V. Viviani, in Favaro, *Galileo e lo studio di Padova* (cit. note 1).

[4]Viviani, *Racconto istorico* (cit. note 1).

Figure 2. The chair of Galileo in Sala dei Quaranta ("The Room of the Fourties") at the University of Padua. (Credit: F. Danesin)

had a rest in this room wearing few or no clothes and, according to Viviani's account, while they were asleep, a servant opened the window[5]. Whatever the exact story, it is sure that, when they awoke a few hours later, they were extremely ill, with high fever, cramps, chills, haemorrhages, intense headaches, and lethargy. All then suffered from permanent or temporary deafness. One died after three days; another one three weeks later, still deaf. Galileo, who survived, was deaf in one ear.

On December 1606, when back to Florence at the Medicean Villa in Pratolino for the education of the adolescent young Cosimo II de' Medici, Galileo suffered from an episode of tertian fever, which was successfully cured by Professors Menadoi and Acquapendente in Padua (those, by the way, that had been part of the Committee for the graduation of William Harvey at the University of Padua on 25 April 1602).

In the time interval 1609-1610 Galileo had recurrent fevers, which in a letter to Belisario, dated 19 March 1610, he attributed to having "spent most of the night time in the winter more in the open space than in the bedroom or at the fireplace"[6] with the

[5]*Ibid.*; Viviani, in Favaro, *Galileo e lo studio di Padova* (cit. note 1).

[6]Favaro, *Galileo Galilei* (cit. note 1).

Figure 3. The objective of the original telescope of Galileo, which looks like an eye with iris and pupil. From F. Bertola, *Da Galileo alle Stelle*, Cittadella, Biblos, 2008. (Credit: F. Bertola)

telescope (Figure 3). Indeed, on December 1611, fever kept him to bed again, with pain and stitches to the joints. On January 1612 he complained hemorrhoids with bleeding, and on May 1612 sleeplessness and inappetence. On January 1613 he suffered of a renal colic by sandy stones[7].

His friends started worrying for his clinical conditions. The colleague Antonio Magini, Professor of Maths in Bologna, on 1 January 1614 wrote to him "your Lordship should refrain from motion, particularly coaches, and above of all from excess of wine and sexual intercourses…"[8].

Benedetto Castelli, his successor as lecturer in Pisa, on 5 March 1615, warned Galileo "I heard about your deteriorating illness. My goodness, Mister Galileo, let go all the stars to ruin and preserve your health…"[9].

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[7] *Ibid.*

[8] *Ibid.*

[9] *Ibid.*

Figure 4. Ottavio Leoni, *Portrait of Galileo*, 1624, engraving, Istituto Nazionale per la Grafica, Rome. Note the right sovraorbital swelling and wrinkling, in keeping with mucocele. (Credit: Istituto Nazionale per la Grafica, Roma)

The first episode of sight injury occurred in 1616 when he reported a corneal halo[10]. In 1617 he complained the "return of my usual pains" because of arthritis, increasing inguinal hernia and piles. On November 1618, he informed the friends to be confined to bed "due to longstanding and dangerous illness"[11].

In 1624 he presented with a fluxion to the right eye. By checking his portrait by Ottavio Leoni, painted exactly in 1624, you can easily see right sovraorbital swelling and wrinkling in keeping with sinus mucocele[12] (Figure 4).

In 1629 he claimed to have suffered from a transient loss of hearing, so severe to be "unable to hear an artillery"[13].

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[10]Viviani, in Favaro, *Galileo e lo studio di Padova* (cit. note 1); P. G. Watson, *The Enigma of Galileo's Eyesight: Some Novel Observations on Galileo Galilei's Vision and His Progression to Blindness*, "Survey of Ophtalmology", 54, 2009, pp. 630-640.

[11]Favaro, *Galileo Galilei* (cit. note 1).

[12]Watson, *The Enigma of Galileo's Eyesight* (cit. note 10).

[13]Favaro, *Galileo Galilei* (cit. note 1).

Figure 5. The blind Linceo ("Linceo cieco"), as it appears in the portrait on the ceiling of the Aula Magna of the University of Padua, which in 1992 was named Aula Magna "Galileo Galilei". (Credit: M. Danesin)

On 17 December 1631 he was struck by an episode of fluxion ("sciesa") on both eyes, which hindered him to read and write for two months[14].

In 1632, following his reluctance, due to alleged poor healthy conditions, to obey the Pope Urbano VIII to move to Rome and be inquired by the Holy Office for the *Dialogue* affair, he underwent to a "medical" verification of his health by three eminent

[14]R. Di Fernando, *Fiaccole spente alla festa delle capanne* in *Il Linceo Cieco*, Pesaro, Nobili, 1994, pp. 127-150; G. M. Germani, *Malattia reumatoide e cecità di Galileo Galilei*, "Ospedale Maggiore", 59, 1964, pp. 193-196; F. Grondona, *In tema di eziogenesi della cecità di Galileo*, in *Atti del simposio internazionale di storia, metodologia, logica e filosofia della scienza "Galileo nella storia e nella filosofia della scienza" (Firenze-Pisa, 14-16 settembre 1964)*, Firenze, Barbèra Editore, 1967, pp. 141-154; C. Mancini, *Le malattie di Galilei*, in *Atti del XX congresso nazionale di storia della medicina (Roma, 10-11 ottobre 1964)*, Roma, Società italiana di storia della medicina, 1964, pp. 284-294; P. A. Secchi, *Sull'epoca vera e la durata della cecità del Galileo*, in *Le Recenti Scoperte Astronomiche*, Lettura fatta alla Pontificia Accademia Tiberina nella Tornata del 27 Gennaio 1868, "Giornale Arcadico", LIV, Roma, Tipografia delle Belle Arti, 1868, pp. 1-52.

physicians (Vettorio De Rossi, Giovanni Ronconi, and Pietro Cervieri), committed by the same Urbano VIII[15]. They recorded:

> His pulse intermits every three or four beats, from which we conclude that his vital powers are affected, and at his great age much weakened. To the above are to be ascribed frequent attacks of giddiness, hypochondriacal melancholy, sleeplessness and flying pains about the body to which others can testify... We have also observed a serious hernia with rupture into the peritoneum. All these symptoms are worthy of notice, as under the least aggravation they might become harmful to life[16].

Clearly he had atrial fibrillation or incomplete av block. It is interesting to note that in the medical report there is no mention of ocular problems at that time.

Galileo on 15 January 1633 made his will "sanu Gratia Dei mente, visu et intellectu", which means that his mind, sight and intellectual activity were perfectly healthy[17].

Despite such a serious alarm, Galileo was forced to travel to Rome by coach, a journey which took one month.

The trial on June 1633, which resulted in the deny of his theories and in the sentence to home arrest in Arcetri.

On 27 April 1634 he stated "My health condition is on trouble. The hernia increases more than ever, the pulse is intermittent with palpitations, I feel odious to myself with immense sadness and extreme inappetence"[18].

Concerning recent morbid history, a new episode of fluxion occurred on February 1637, which evolved into complete sight loss at the right eye itself. On 5 November of the same year, also the left eye was struck with fluxion and Galileo wrote that "it is also under the way of darkness". The ocular conditions were deteriorating so that on Christmas 1637 he was not seeing anymore. He said "apertis oculis, quam occlusis"[19], which means that whether the eyes were open or closed it was the same (Figure 5).

On 2 January 1638 he wrote the famous letter to his friend Elia Diodati, who at that time was in Paris:

> All light is extinguished [...] The blindness is the consequence of a very dense cloud which formed itself in the space of seven months, first in the right eye and then in the left eye [...] that sky, that world, that universe which I, through my astonishing observations and clear demonstrations, had expanded hundred and thousand times beyond anything ever seen before by scientists, has now shrunk and narrowed as to reach no further than my own body[20].

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[15] Secchi, *Cecità di Galileo* (cit. note 14).

[16] Favaro, *Galileo Galilei* (cit. note 1); Viviani, *Racconto istorico* (cit. note 1).

[17] Favaro, *Galileo Galilei* (cit. note 1).

[18] *Ibid.*

[19] *Ibid.*

[20] *Ibid.*; Viviani, *Racconto istorico* (cit. note 1).

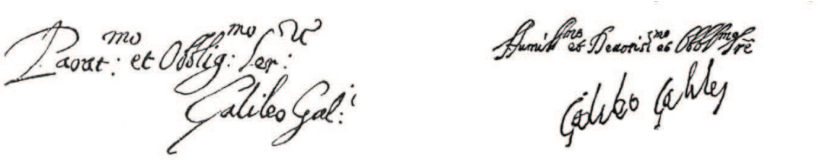

Figure 6. The handwriting and signature of Galileo before (4 April 1637, left panel) and after (13 March 1640, right panel) complete blindness.

His writing and signature started becoming unclear, as it appears in a letter to Leopoldo de' Medici on 13 March 1640, when compared to a previous letter dated 4 April 1637 (Figure 6).

Since then, the letters were dictated to his pupils Viviani and Torricelli, who assisted him during the last years of home arrest.

Alarmed by his terminal sight conditions, his friend Pier Battista Borghi decided to ask an opinion at distance to the roman surgeon Giovanni Trullio, known as "the French" since he had trained for years in Lyon[21]. A detailed report of the signs and symptoms, written by Galileo himself and unfortunately lost, was sent to Dr. Trullio, who expressed the following opinion:

> I infer that his blindness is due to a suffusion which obstructs the pupil and which is incorrectly defined as a cataract. I was able to observe that the formation of this mucosity is caused by a slight solidification of the aqueous humour. Thus little by little a skin would have formed in front of the lens and eventually led to blindness.

The final diagnosis of the consultation was uveitis with pannus formation ("skin") occluding both the pupils. He excluded senile cataract and advised, as therapy, laudanum pills, eye drops with aloe, lead, malmsey wine, rose-water. Due to the suspicion of ocular hypertension (glaucoma), he suggested a needle decompression, if necessary. It is nice to quote the original sentence, written in Latin:

> [...] caecitatem enasci ex suffusione, pupillam obstruente, quae improprie cataratta dicitur [...] quia morbi sedes non in superficie est oculorum, sed intra corneam et uveam tunicam, cuius basis est humor aqueus [...] quod intra oculos factum est, tempore densius et durius factum, acu, Deo auxiliante, deprimi potest[22].

Several hypotheses have been put forward in differential diagnosis: neonatal asphyxia? actinic damage due to observation of sunspots through the telescope? infective uveitis due to brucellosis got in Pratolino? a sequela of the episode of ophthalmia during the novitiate in Vallombrosa? rheumatic immune uveitis? ankylosing spondylitis? psoriasic arthritis? By interpreting the overall signs and symptoms, on the light of modern medicine, and trying to put together the arthritis, of which Galileo has been suffering since years, with the recurrent bilateral conjunctivitis ("fluxion" from the eyes),

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[21] Secchi, *Cecità di Galileo* (cit. note 14).

[22] D. Furfaro, *Consulto medico di Giovanni Trullio sulla cecità di Galileo*, in *Atti del XX congresso nazionale di storia della medicina (Roma, 10-11 ottobre 1964)*, Roma, Società italiana di storia della medicina, 1964, pp. 387-393.

Figure 7. The Mausoleum of Galileo in Santa Croce Church, Florence where his remains were definitively buried in 1737.

it is highly probable that Galileo was affected by the so-called Reiter's syndrome, an immune disease triggered by infections and characterized classically by a triad: 1) polyarthritis, 2) uretris and 3) anterior uveitis[23]. There is no mention of an urethral infection in the clinical history of Galileo, however may be that he skipped this information in his letters for shame. Considering his libertine life, it would be not surprising he had had an episode of gonorrheal disease, which triggered the immunological syndrome. The same Cristoforo Colombo, who died on 20 May 1506 in Valladolid at the age of 54, had ocular problems and arthritis in keeping with Reiter's syndrome[24].

By continuing to live at home arrest, on 21 August 1638 he undersigned a new will, this time with a postscriptum "I am fully blind"[25].

His health conditions progressively deteriorated. Following an episode of fever, Galileo died on 8 January 1642, the day of anniversary of first observation of the moons

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[23]I. B. Wu-R. A. Schwartz, *Reiter's Syndrome: the Classic Triad and More*, "Journal of the American Academy of Dermatology", 59, 2008, pp. 113-121.

[24]G. Thiene, *Buscando el levante por el poniente*, "Cuore & Salute", 7-9, 2008, pp. 246-252.

[25]Favaro, *Galileo Galilei* (cit. note 1); G. Thiene-C. Basso, *Il paziente Galileo*, "Padova e il suo territorio", 142, 2009, pp. 55-59.

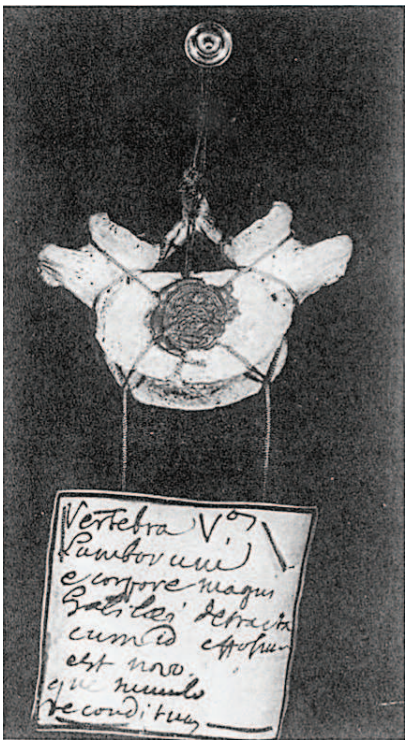

Figure 8. The fifth lumbar vertebra, preserved at the University of Padua and donated by Countess Isabella Thiene in 1823, thanks to intercession of Dr. Domenico Thiene, consultant of Internal Medicine at the San Bortolo Hospital in Vicenza. (Credit: Università di Padova)

of Jupiter made on 1610 in Padua with the telescope (Figure 3). He was buried in the Church of Santa Croce, Florence, without honors, in a neglected corner being considered heretic[26]. Autopsy was not performed. The cause of death was most probably congestive heart failure and pneumonia. *The final diagnosis is: Reiter's syndrome(?), blindness, congestive heart failure, pneumonia.*

On 12 March 1737, before being eventually buried in the Mausoleum in Santa Croce (Figure 7), exhumation was carried out by Anton Francesco Gori, Professor of Ancient History, and Antonio Cocchi, Professor of Natural Philosophy[27]. Professor Gori removed the middle finger of the right hand (which is now at the Museum of Science History in Florence) and Professor Cocchi the fifth lumbar vertebra (which is now at the University of Padua, Figure 8). Surprisingly, they do not exhibit changes which might be associated with a seronegative arthropathy (Figure 9).

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[26]G. Ongaro, *Galileo Galilei e la medicina*, "Padova e il suo territorio", 40, 1992, pp. 78-81.

[27]G. Gamba-A. Sperotti Giacometti, *Un ritratto inedito di Antonio Cocchi, che "involò" la vertebra di Galileo*, "Padova e il suo territorio", 40, 1992, pp. 82-83.

Figure 9. The middle finger of the right hand (left panel) and the fifth lumbar vertebra (right panel), removed on the occasion of Galileo's body exhumation on 12 March 1737. There is no evidence of arthropathy. (Credit: Università di Padova)

In 1823 the Galileo's vertebra was donated to the University of Padua by Countess Isabella Thiene from Vicenza, who got it from Count Querini from Venice, thanks to the advice and pushing of Dr. Domenico Thiene, Consultant of Internal Medicine at the San Bortolo Hospital in Vicenza[28]. Thus, Galileo was back to Padua, where he had spent "the best 18 years of my life"[29].

[28] A. Gamba-A. Natali, *Per la storia della quinta vertebra lombare di Galileo Galilei conservata all'Università di Padova*, "Atti dell'Istituto Veneto di Scienze, Lettere ed Arti, Classe di Scienze Fisiche, Matematiche e Naturali", 152, 1993-1994, pp. 63-85.

[29] Ongaro, *Galileo Galilei e la medicina* (cit. note 26).