If Clinical Chemistry Had Existed Then . . .

Paul L. Wolf

Many myths, theories, and speculations exist as to the exact etiology of the diseases that affected famous artistic painters, composers of classical music, and political leaders. Illness can profoundly affect the productivity and creativity of those who are ill (1). Clinical chemistry, had it existed during the lifetimes of various well-known individuals, might have unraveled the mysteries of their afflictions. The various diseases thought to affect these individuals are listed in Table 1, as are the laboratory tests that might have clarified their ailments.

Classical Painters and Sculptors

Fascinating speculations exist regarding the diseases and the therapies that have influenced the creativity of famous painters and sculptors. Two of these affected artists are discussed here.

Vincent van Gogh

Vincent van Gogh (1853–1890), the Dutch postimpressionist painter, was an uncommon man whose life was characterized by manic depression, psychosis, epilepsy, and rejection. Psychiatric illness also afflicted his sister Wilhelmine and his brothers Cornelis and Theodor. In a manic phase, van Gogh attacked his friend, Paul Gauguin, and then, in remorse, cut off a part of his own left ear and presented it to a prostitute. His last painting, Wheat Fields, shows possible manic components in tempestuous, whirling brush strokes and possible depression in the flock of black birds in the painting. Of it, he wrote, "I am painting immense expanses of wheat beneath troubled skies, and I have not hesitated to express sadness, extreme solitude." Van Gogh committed suicide shortly thereafter (2).

Before van Gogh's death, physicians in France considered diverse diagnoses as to the cause of his illness. Up to 1888, he had acute mania with delirium. Feydon and Rey of St. Remy believed he had epilepsy. Paul-Ferdinand Gachet of Auvers-Sur-Oise made a diagnosis of turpentine poisoning and exposure to intense sunlight (3). After van Gogh's death, the various diagnoses included epilepsy, psychosis, syphilis, cerebral tumor, and sunstroke (4). The coronas in van Gogh's later paintings and the anisocoria in his self-portrait led Maire to suggest that van Gogh had glaucoma (5).

Overmedication with digitalis. Van Gogh was fascinated by the color yellow in the last years of his life. His house was entirely yellow. He wrote, "How beautiful yellow is," and all of his paintings in these years were dominated by yellow. Van Gogh's last physician, Paul-Ferdinand Gachet, was the subject of three portraits by van Gogh; in one, Gachet is holding the flower purple foxglove, or digitalis purpurea (Fig. 1). In 1785, W. Whithering had observed that objects appeared yellow or green when foxglove was given therapeutically in large and repeated doses (6). Since 1925, various physicians, including Jackson, Zerfas, Sprague, and White, quoting Cushny, professor of pharmacology at the University of Edinburgh, have noted that patients overmedicated with digitalis develop yellow vision (7–9). According to Cushny, "All colors may be shaded with yellow or rings of light may be present."

It has been established that van Gogh suffered from epilepsy, for which he was treated with digitalis, as was often the case in the late 19th century. Barton and Castle stated that Parkinson recommended the use of digitalis in epileptic (10). Other physicians, including Bartholow, Phillips, Gelineau, and Gowers, also suggested the utilization of digitalis in epilepsy (11–14).

Was van Gogh's fascination with the color yellow due to the toxic effects of digitalis? Van Gogh became extremely melancholic, and his depression accelerated during the years 1874–86. Prior to this time, his palette was predominately black, brown, and umber. However, his palette lightened markedly with the increasing prominence of yellow as his depression, psychosis, and epilepsy worsened. During this period, digitalis may have been utilized to relieve his suffering.

In 1925, Sprague et al. (8), in addition to describing the dominance of yellow and green visual disturbance in digitalis poisoning, also noted that overmedicated patients complained of spots of various colors surrounded by a corona; dilation and constriction of pupils also occurred, leading to anisocoria. A century earlier, the famous physician Jan Evangelista Purkinje had noticed, 2 days after ingesting an aqueous extract of digitalis, "a soft flicker before my left eye. In the center of the field of vision, there was a rounded spot of dim lights which disappeared and around the spots were concentric light and dark waves" (15). The anisocoria of van Gogh in a later self-portrait strongly suggests that he was being overmedicated with digitalis.

The observations of Sprague et al. and Purkinje also lend credence to the suggestion that overmedication...
with digitalis resulted in the yellow coronas and halos surrounding the stars in van Gogh’s The Starry Night, which he painted in 1889, 1 year before his death (Fig. 2). However, it is possible that van Gogh simply liked the color yellow and halos; perhaps the anisocoria of his pupils in his self-portrait was simply poetic license by this brilliant artist. Nonetheless, several studies indicate that he was being overmedicated with digitalis (3, 8, 9).

Meniere disease. In another recent report, Arenberg et al. (16) speculate that van Gogh suffered from Meniere disease, not epilepsy. They theorize that he had severe vertigo, which was misdiagnosed as epilepsy. If this theory is true, van Gogh may have cut off his left ear to relieve tinnitus and auditory hallucinations; however, this speculation has been challenged by various physicians (17–19).

Excessive ingestion of absinthe. Van Gogh’s taste for absinthe (a liqueur) may have also influenced his style of painting (20). The drink’s effect comes from the chemical thujone (21). Distilled from plants such as wormwood, thujone poisons the nervous system. Van Gogh had a pica, or hunger, for unnatural “foods,” craving the entire class of fragrant but dangerous chemicals called terpenes, including thujone. As van Gogh recovered from cutting off his ear, he wrote to his brother: “I fight this insomnia with a very, very strong dose of camphor in my pillow and mattress, and if ever you can’t sleep, I recommend this to you.” Camphor is a terpene known to cause convulsions in animals when inhaled. Van Gogh had at least four such fits in his last 18 months.

Van Gogh’s friend and fellow artist Paul Signac described an evening in 1889 when he had to restrain the painter from drinking turpentine. The solvent contains a terpene distilled from the sap of pines and firs. And van Gogh tried more than once to eat his paints, which contained terpenes as well. Signac also wrote that van Gogh, returning after spending the whole day in the torrid heat, would take his seat on the terrace of a cafe.

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### Table 1. Illness in Selected Artists, Composers, and Political Leaders

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<td>Benjamin Franklin</td>
<td>Gout</td>
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ALP, alkaline phosphatase; AST, aspartate aminotransferase; ALT, alanine aminotransferase.

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Fig. 1. Digitalis purpurea (purple foxglove): (left) held by Paul-Ferdinand Gachet in Vincent van Gogh’s 1889 portrait of him and (right) standing alone. Reproduced with permission of J Am Med Assoc, Thomas C. Lee (3), and the Metropolitan Museum of Art, New York.

Fig. 2. Vincent Van Gogh’s The Starry Night (1889). The yellow coronas surrounding the stars are characteristic of overmedication with digitalis. Reproduced with permission of J Am Med Assoc, Thomas C. Lee (3); photograph © the Museum of Modern Art, New York.
with the absinthe and brandies following each other in quick succession (22).

Absinthe drinkers, such as the one painted by Manet in his painting of the same name, would experience exultation, auditory and visual hallucinations, excitation, and, with excessive abuse, unpleasant hallucinations, convulsions, paranoia, acute mania, headache, and hyperesthesia.

Santonin toxicity. Arnold et al. (23) investigated another possibility to account for the yellow vision of van Gogh: overdose with santonin. Santonin, a sequiterpene lactone found in several artemisias species and commercially exploited from artemisia maritima, is useful as an anthelmintic. However, after an exhaustive chemical investigation, Arnold et al. concluded that van Gogh and other absinthe drinkers did not develop yellow vision from ingesting santonin in drinking absinthe. Their chemical analyses showed that 1 L of absinthe contained the alcohol-extractables from 50 g (wt wt.) of artemisia pontica, or at most 1.1 mg of santonin. To develop yellow vision from the amount of santonin in absinthe, an individual would have to consume 182 L of absinthe to get a dose of 0.2 g.

Friends planted an ornamental tree over van Gogh's grave; when the coffin was relocated in 1905, the tree's roots were found to be wrapped around it. The tree was a cedar, particularly loved by van Gogh, and a classic source of the poisonous thujone.

If clinical chemistry had existed during van Gogh's lifetime, perhaps the mystery of van Gogh's yellow vision, anisocoria, and coronas could have been resolved. Was it excessive digitalis? An immunoassay to determine serum concentrations of digitalis might have clarified this issue. Was it camphor, santonin, turpentine, paint terpenes, thujones? A toxicological screen could have resolved these speculations. Van Gogh's medical signs and symptoms appear to be most consistent with excessive digitalis (3, 8, 9).

Benvenuto Cellini

The famous Italian Renaissance sculptor Benvenuto Cellini (1500–1571) contracted syphilis from one of his models at age 29. He subsequently progressed to the tertiary stage and developed general paresis. Several businessmen attempted to kill Cellini with mercury to inherit a farm he co-owned. Fortunately for Cellini, the dose wasn't large enough to kill him but was enough to cure his syphilis, and he went on to live many more years. Cellini toasted his would-be assassins as healers, and in commemoration of the cause and cure of his disease, placed the multibreasted goddess of venereal disease opposite the god Mercury on the pedestal of his statue of Perseus with the Medusa's head (26) (Fig. 3). Cellini developed a dark silver grey discoloration of his skin, which may have been caused by the mercury and is consistent with mercury toxicity (27). The modern chemistry laboratory could have verified this possibility by examination of Cellini's urine. Penicillin has now replaced mercury for treating syphilis.

Composers
Niccolo Paganini

Various diseases affected the creativity and productivity of famous composers of classical music. A dark silver grey discoloration of the skin afflicted Niccolo Paganini (1782–1840), again allegedly because of the therapeutic utilization of mercury to treat syphilis. He also suffered from pulmonary tuberculosis, causing an emaciated, cachectic appearance. Ehlers-Danlos syndrome contributed to Paganini's strange appearance, which so fascinated his musical admirers (Fig. 4).

Paganini was born with Ehlers-Danlos syndrome, a connective tissue disease causing a diffuse looseness of the connective tissue. The Ehlers-Danlos 4 phenotype, related to mutations in collagen type III on chromosome 2, results in a flexibility of all of one's joints. This was a great asset to Paganini, contributing to his virtuosity as a violinist. His loose wrists and fingers enabled him to increase his reach on the violin fingerboard (28). Known as the "demon of violinists," Paganini could play the scales with great rapidity (29, 30).

As was the case with Cellini, if clinical chemistry had existed during Paganini's lifetime, the darkened, silver grey appearance of his skin, allegedly caused by mercury

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1 Arnold now believes that van Gogh's illness was acute intermittent porphyria, as he concludes in his recent book (24). In a review of this book, however, Sandblom (25) notes that Waldenstrom, an expert on porphyrias, is somewhat skeptical about this diagnosis because red coloration of the urine, typical of this condition, was never mentioned in van Gogh's correspondence.
ingestion, could have been definitely identified by examination of his urine for the presence of mercury (31).

Ludwig van Beethoven

The deafness of Ludwig van Beethoven (1770–1827) was most likely due to the compression of the eighth cranial nerve. Both Paget disease of bone and otosclerosis have been suspected as the cause of the compression (32). The osteoblastic proliferation of the bones with compression of the eighth cranial nerve is a well-known complication of Paget disease. Beethoven’s head became very large with a prominent forehead; his jaw enlarged, and his chin protruded. The enlarged bones caused his hat and shoes not to fit (Fig. 5). The belief that Beethoven was deaf due to otosclerosis was discounted at autopsy (see below).

Beethoven’s depression. Beethoven began to lose his hearing early in life and was completely deaf in his last years (33). His deafness brought on depression. Hearing was the one sense he wanted more than any other. His love for music was a powerful force that prevented him from committing suicide. He decided to endure his miserable life in order to compose more music. His Sonata Appassionata displays his despair (34).

Possible relationship of paramyxovirus and Paget disease of bone. In the Pastoral Symphony, Beethoven produced the sounds of nature entirely from memory (35).

His love of dogs has been suggested as a remote possibility for the development of his bone disease. Epidemiologically, a higher incidence of Paget disease of bone has been demonstrated in owners of dogs. Recently, a paramyxovirus similar to dog distemper virus has been identified in the osteoclasts by electron microscopy of histologic sections of bone from patients with Paget disease (36). Practically all of these patients have these inclusions, which are not found in hyperparathyroidism, osteomalacia, multiple myeloma, or fibrous dysplasia. The inclusions resemble the inclusions in the brain cells of subacute sclerosing panencephalitis, which suggests that a slow virus may be involved (37). Immunofluorescent staining of the inclusions with antisera to measles virus and respiratory-syncytial virus have been reported (38).

Beethoven’s autopsy. Palferman disputes the diagnosis of Paget disease of bone and speculates that Beethoven had a rheumatic disease (39). An autopsy was performed on Beethoven in Vienna on March 27, 1827, supervised by Professor Wagner and accompanied by Rokitansky, who was to become the father of modern morbid anatomy. This was the first of the 59 786 autopsies with which Rokitansky is credited (39).

The autopsy on Beethoven identified a uniformly dense skull vault 0.5-in. (~1-cm) thick and shriveled auditory nerves, demonstrating that he had Paget disease of bone, which causes deafness (39). In addition, the liver was atrophic, nodular, and cirrhotic. A nephropathy was present, which Davies (40) believes was renal papillary necrosis secondary to diabetes mellitus complicating pancreatitis. The autopsy also demonstrated an enlarged indurated pancreas with a dilated duct.

If clinical chemistry had existed during Beethoven’s lifetime, the laboratory could have determined if his serum bone alkaline phosphatase was elevated, either
from Paget disease of bone or from renal osteodystrophy attributable to his renal failure. The serum amylase and lipase might also have been above normal, due to pancreatitis or to decreased clearance because of renal failure. The serum concentrations of bilirubin, aspartate and alanine aminotransferases, $\gamma$-glutamyltransferase, and liver alkaline phosphatase may have been elevated due to hepatic disease. The serum glucose could have been high due to diabetes mellitus, and the serum creatinine could have been increased due to renal failure. In conclusion, Beethoven's deafness was probably due to Paget disease; the autopsy demonstrated the presence of this bone disease in addition to renal, pancreatic, and liver disease. These issues could have been investigated by the modern laboratory.

Wolfgang Amadeus Mozart

Another fascinating set of speculations exists relevant to the death of the genius, Wolfgang Amadeus Mozart (1756–1791). Playwrites from Pushkin to Peter Shaffer, doctors, amateur sleuths, and just plain cranks have kept the bandwagon rolling with speculations. When Mozart was dying of possible renal failure, he became extremely despondent. The change in his mental status may have resulted from uremia. He may also have suffered from Henoch–Schönlein purpura (41).

Mozart developed renal failure and anasarca as a result of glomerulonephritis after a respiratory streptococcal infection during his fatal illness. He developed the infection on November 18, 1791, during a streptococcal epidemic in Vienna. This triggered the glomerulonephritis and renal failure. Subsequently, he became hypertensive and sustained a cerebral hemorrhage and a hemiplegia (42). A mysterious stranger visited Mozart and requested that he compose a Requiem Mass. Mozart's Requiem Mass became a requiem for the repose of his own soul: He died before he could complete it. Mozart almost certainly knew that the Requiem, which he had worked on up to the night of his death, had been commissioned by Count Franz von Walsegg-Stuppach, who wanted to pass it off as his own.

Speculations that Mozart was poisoned. While the modern version of the poisoning legend was propagated in the play and later the film "Amadeus," the earliest confusion came just weeks after Mozart's death, in a newspaper report that suggested he might have been poisoned. Constanze, Mozart's wife, and the Romantics of the 19th century also embellished the story of Mozart's death.

Ian James, a physician and pharmacoologist at London's Royal Free Hospital, believes Mozart was poisoned by antimony and possibly mercury, which were used as medicines in 18th century Vienna (43). Perhaps, James suggests, Mozart was poisoned by his jealous rival, Antonio Salieri. Using an 18th-century pharmacopeia, a book of symptoms and treatments, James discovered that the standard treatment for Mozart's vague symptoms of fever, fatigue, and depression was antimony and perhaps mercury—two toxic metals no longer used medically. James said that the side effects of antimony poisoning match the symptoms that Mozart suffered in his last days. James said his theory would be supported by a test of Mozart's manuscripts. Traces of the metal may have rubbed off Mozart's skin onto the pages of the Requiem, now kept by the National Library in Vienna.

Peter Davies' book speculates on the cause of Mozart's death (44). In a chapter confidently entitled "Mozart was not poisoned," he delivers the coup de grace to theories that Mozart was poisoned by Salieri, the Masons, Susmayr, his wife Constanze, or Hofdemel, with any of a variety of noxious substances such as mercury, arsenic, lead, and antimony (the last three in a mixture called Aqua Tofana). If Mozart had been the victim of poisoning, the symptoms, such as tremors (a sign of mercury poisoning), would surely have been recognized by a consultant in his case, a doctor named Matthias von Sallaba, who was a pioneer in toxicology. Instead, Davies puts forward the idea that Mozart's recurrent ill health was due to Henoch–Schönlein purpura; he proposes that death was due to renal failure with a terminal cerebral hemorrhage, though he concedes that it was probably precipitated by an infection.

Possible discovery of Mozart's skull. In 1902 a skull that was said to be Mozart's was bequeathed to the International Mozarteum Foundation, a Salzburg-based research institution that holds the world's most important collection of Mozart memorabilia. Since then, anthropologists, paleontologists, forensic specialists, and geologists have examined the skull to determine whether it is authentic (45). "Our official opinion is that it very possibly is Mozart's skull, but the absolute proof is not to be had with the scientific technology now available," said Hans Peter Kaserer, a doctor associated with the Mozarteum, who directs research into the skull. "Whether the skull can ever be identified as Mozart's probably depends on four snippets of hair—said to be from Mozart's head—that are also in the possession of the Mozarteum. Research has shown that three of the four snippets definitely come from the same head, but there is still no way to test whether these hairs come from this skull," Kaserer said.

Especially important are signs of a healed fracture on the left side of the head (46). Such an injury, according to Davies, could account for Mozart's fainting spells and severe headaches in the year before his death. "Was it caused by a blow to the head? Did Mozart fall while he was stumbling home drunk from a party? We can do no more than guess what might have caused the fracture," Davies writes (47).

If clinical chemistry had existed during Mozart's lifetime, the multitest chemistry panel could have indicated possible renal failure with elevated serum urea nitrogen and creatinine. Toxicological analysis of Mozart's blood and urine by atomic absorption spectroscopy could have been performed to demonstrate the presence or absence of antimony, mercury, arsenic, or lead. If a healing skull fracture was present, the serum concentration of bone alkaline phosphatase might have been increased. Mozart's medical history of frequent streptococcal respiratory infections and his signs and
symptoms of anasarca, vomiting, purpura, dyspnea, and pallor are most consistent with renal failure being the most probable cause of his demise. The modern treatment of the poststreptococcal renal failure would have included adrenal corticosteroids, renal dialysis, and renal transplantation. The belief that Mozart was poisoned is discounted by the studies indicating that he died of renal failure (48).

Frederic Chopin

Tuberculosis and other diseases caused much pain and suffering in many of the great painters, composers, and authors. At the time of Frederic Chopin’s (1810–1849) death, no one questioned the theory that he died of tuberculosis until the autopsy. Chopin’s nocturnes and his funeral sonata are melancholic, composed when he was very febrile and toxic. He had a relentless decline in his health and had marked hemoptysis.

Possible cystic fibrosis. Chopin’s weight was only ~100 pounds (~45 kg) throughout his adult life. He was noticeably cachectic (Fig. 6). He had very poor exercise tolerance and had recurrent respiratory infections. His chronic cough was especially prominent in the morning, suggesting bronchiectasis. He had hemoptysis for ~20 years. He developed signs of chronic obstructive emphysema and pulmonary hypertension. He developed intractable diarrhea consistent with a malabsorption syndrome. He complained of excessive sweating with prostration after exercise and during hot weather (49). Jean Cruveilhier, Chopin’s physician in Paris, also performed Chopin’s autopsy. The autopsy demonstrated that cor pulmonale was present with cardiomegaly. The typical gross abnormalities of tuberculosis were not present. Chopin’s pulmonary disease at autopsy was one that had not been encountered previously by science. Before the autopsy findings, it had been widely believed that Chopin acquired his tuberculous infection from his sister, who also was considered to have pulmonary tuberculosis. However, Chopin’s sister, Emily, died at age 14 years of an illness that resembled cystic fibrosis. Her illness, which lasted for more than 1 year, was characterized by severe weight loss, recurrent hemoptysis, and terminal pneumonia. Emily also had a long history of frequent respiratory infections.

Thus, Chopin may have died of respiratory failure caused by cystic fibrosis, which also was associated with pancreatic insufficiency. If clinical chemistry had existed during Chopin’s lifetime, a sweat chloride test and a determination of serum immunoreactive trypsin could have been extremely useful in diagnosing the possibility of cystic fibrosis and not tuberculosis as the cause of Chopin’s pulmonary disease. The expression of cystic fibrosis has now been identified with a genetic defect on chromosome 7, which causes a chloride channel defect, resulting in an increased sweat chloride. Serum immunoreactive trypsin is increased in neonatal cystic fibrosis patients and decreased in adult patients.

The most likely cause for Chopin’s respiratory failure was cystic fibrosis. He had signs and symptoms of pancreatic insufficiency and chronic bronchiectasis. The autopsy did not identify tuberculosis but did show bronchiectasis and cor pulmonale, which occurs in cystic fibrosis (49). The modern treatment of cystic fibrosis is the use of pancreatic enzyme replacement, antibiotics for the pulmonary infection, DNase to liquefy the mucoid pulmonary secretions, and bilateral lung transplants. The belief that Chopin died of pulmonary tuberculosis is thus discounted by the autopsy findings (49).

Political and Military Leaders

It has been speculated that various diseases had a profound affect on political and military leaders and on the productivity and decline of various cultures.

King George III of Great Britain and William Pitt the Elder

King George III (1738–1820) was King of Great Britain from 1760 to 1820, during the time when the American colonies revolted and declared their independence. He may have been afflicted with the congenital metabolic illness acute intermittent porphyria or by porphyria variagata (50). These conditions cause agonizing abdominal pain, manic overactivity, skin rash, red urine, paralysis, delirium, and psychosis. He was not able to make important decisions regarding the American colonies. A British historian, Sir Charles Petrie, once wrote, "King George III shook hands with a branch of an oak tree with the mistaken impression that it was the King of Prussia." He eventually became violently insane and died in a mental institution. His medical history is most consistent with acute intermittent porphyria (51).

King George III had various advisors, including the
elder William Pitt (1708–1778) (Fig. 7), the great English statesman, who may have suffered from gout. The King’s advisers told him to send troops to maintain control of the colonies; however, Pitt denounced the harsh British measures against the American colonies. Because of his illness and severe arthritic pain, Pitt was forced to cease his opposition to King George’s harsh decisions. Pitt’s arthritic signs and symptoms are consistent with a diagnosis of gout (52).

The incidence of gout in England was extremely high. Alfred Baring Garrod recognized the high incidence of lead poisoning causing gout in Great Britain (52). After the treaty of Methuen in 1703, the cheaper Portuguese wines were allowed into England. The lead content of port during this period was 10 times higher than in our port today. The fruit acids of wine were excellent solvents of the lead in the crocks containing the Portuguese port. The lead could cause kidney damage, high blood uric acid, and gout. In the US, lead poisoning gout is called saturnine gout (gout due to lead poisoning) and is most often related to the habitual consumption of moonshine alcohol with a large lead content, having been produced in lead-containing vats such as discarded lead batteries (53).

If clinical chemistry had existed in the late 18th century, the diagnosis of acute intermittent porphyria could have been rapidly established in King George III by performing a porphobilinogen test on his urine during an acute attack. The possible lead-induced gout in William Pitt the Elder could have been easily assessed by quantifying blood lead and serum uric acid. The modern treatment of porphyria consists of having the patient avoid barbiturates and anticonvulsants and alcoholic beverages and use glucose and hematin. The modern treatment of gout is to decrease serum uric acid by the use of allopurinol to inhibit the oxidation of xanthine to uric acid by xanthine oxidase.

Benjamin Franklin

About the same time, famous American politicians may have also suffered from the affliction of gout. The most notable was Benjamin Franklin (1706–1790), the American printer, publisher, congressional delegate, author, and inventor. He probably suffered from gout and had great pain in the joints of his large first toes. He performed his legislative duties sitting at the conventions without shoes or stockings because both shoes and stockings touching the toes caused great pain. Here again, the gout was probably caused by the dietary consumption of port and meat, as was the case in England. Moreover, Franklin was a printer and thus was also exposed to lead in his profession. Thus, Benjamin Franklin probably developed gout from lead poisoning (54, 55). He could have been assessed by modern clinical chemistry as was suggested above for Pitt.

Illness has affected artistic achievement of musical composers, painters, creative writers, and statesmen. Illness affected their physical and mental status. Their inspiration may have been shaped by their human condition. The associations between illness and art may be close and many—because of both the actual physical limitations of the artists and their mental adaptation to disease. Even though they were ill, many continued to be productive. If clinical chemistry had existed then, the cause of their diseases likely would have been established. The afflictions these people endured probably could have been ascertained and perhaps treated.

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