

Summary

**VINCENT VAN GOGH AND THE TOXIC COLOURS OF
SATURN**

Autobiographical narrative of a case of lead poisoning

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Questioned by some, or even demoted to the category of an emotional state, Van Gogh's illness is still a hotly debated subject more than 150 years after the Dutch artist's birth. However, a thorough study of Vincent Van Gogh's pathography, based on his autobiographical letters and on the diagnoses of the physicians who treated him,^{1,2,3} confirms the fact that he suffered from recurring physical and psychopathological ailments, which coincided in time with the last stages of his career as a painter.

May the key to this coincidence be found in Van Gogh's own painting?

In order to answer this question, we embarked years ago on a documentary research^{4,5}, still ongoing, whose most relevant results are summarized and compared with other diagnoses in the present work.

EXPOSURE TO LEAD IN VAN GOGH'S PICTORIAL TECHNIQUE

Because of his *impasto* technique, based on thick layers of paint, Van Gogh resorted to colors with a high content of lead^{6,7}, such as *white lead* (lead carbonate) or *chrome yellow* (lead chromate), in the mixtures he prepared. These pigments are highly toxic in oil painting, and their use entails the risk of saturnism^{8,9}.

During his Dutch period, *white lead* ("flake white" or "*blanc d'argent*") formed part of Van Gogh's palette (222)¹⁰, featuring in his requests for supplies *in double quantity and in thick tubes* (475)¹¹. The use of this pigment afforded him vigorous brushstrokes of a creamy texture⁸, and darkened the mixtures⁸, which accounts for the tenebrism that characterizes that phase of his career. Although at Arles he obtained a more luminous palette by using zinc white in the mixtures (504)¹², he continued to use white lead to prime the canvas, or as impasting (596)¹³, in order to give more firmness to the foreground^{8,14}.

By means of chrome yellows, the Dutch painter expressed his enthusiasm for the sun-drenched landscape at Arles in the French Midi region (522)¹⁵, which he compared to Japan^{16,17,18}. This type of yellow never ceased to appear in his requests for supplies, right until the end of his artistic career^{11,19,20,21,22,23,24,25,26}. Even though chrome yellows had been discarded by the French impressionists⁶, Van Gogh would use them in a pure form, preserving all the freshness and texture of the warm color range (from light lemon yellow to dark orange)⁸. Thus, in his paintings of sun flowers, lemon trees, quince trees, peach trees, wheat fields, sun rings, hemp hedges, sun drenched landscapes, bundles of barley straw, thatched straw roofs, etc,^{6,14,27} he transmitted his experience of light²⁸ with all the power of expression such colors can conjure.

In a time dominated by French Impressionism, Van Gogh employed a very risky painting technique. X-Ray analyses carried out at the *National Gallery* and the *Courtauld Institute* in London have confirmed the use of toxic metal, and the priming of some canvases with white lead²⁹.

Lead acts as a *cumulative* poison in the organism; minute quantities penetrating through the digestive, inhalatory or cutaneous route on a daily basis suffice to cause toxic symptoms in a few months^{9, 30, 31}.

SATURNINE SYMPTOMATOLOGY AS EVIDENCED IN THE AUTOBIOGRAPHICAL LETTERS

Clinical diagnosis must be based on the identification of the key symptoms of saturnism, in a historical period when (present day treatments being still unknown then) intoxication evolved into the chronic stage.

Early symptoms

The earliest symptoms of saturnism are fairly unspecific: *weakness, prostration, dejection* ..., often blamed upon insufficient food or “neurosis” (toxophrenia)^{31,32}. One year after having tried oil painting, Van Gogh begins to complain of such *unspecific symptoms* (304)³³, (305)³⁴, (306)³⁵, (308)³⁶, (309)³⁷, which continued at Antwerp (452)³⁸, and which he blamed on *insufficient food*^{35,36,38}, *overwork*³³, or “*overwrought nerves*” (306)³⁵, (310)³⁹. Unsubstantial food and the abuse of tobacco, as reflected in the painting “*Skull with a lit cigarette*” (dec. 1885), were factors favoring the penetration of lead in the artist’s body and its absorption in the digestive tract^{40, 41, 42, 43}.

After this insidious phase, there appeared the main symptoms of *manifest saturnism*, located in the digestive tube (gingivitis, abdominal pain), in the blood (anemia), and in the nervous system (encephalopathy, peripheral neuropathy)^{9, 30, 31, 44}.

Gingivitis

Lead accreting in the mouth may cause swelling of the gums (gingivitis). In case of sustained exposure, or *overinfection* of the affected areas, the periodontal membrane gets damaged, and consequently the teeth fall off^{45, 46}. At Antwerp, Van Gogh suffered an extensive periodontal process, with *teeth progressively falling off and pain all over the mouth*, which made it difficult for him to *swallow food* (449)⁴⁷. Upon seeing a dentist, he mentioned his gums’ *poor condition* (448)⁴⁸, (450)⁴⁹.

Food degradation, combined with the lead deposited in the mouth, produces *lead sulphur*, a compound of a dark *gray color* with a great tincturing power^{50, 51}. The uncanny grayish phlegm that Van Gogh expectorated during a coughing fit at Antwerp (448)⁴⁸ - so different from smokers’ muco-purulent (greenish-yellow) phlegm⁵¹, and with no respiratory repercussions- probably contained lead sulphur.

Abdominal pain.

Sharp abdominal pain (saturnine colic) is typical in cases of acute lead intoxication, but in the chronic forms of this illness, the pain is usually diffuse and recidivant, rather like that caused by a stomach ulcer or a mere gastritis^{44, 52, 53}. The pain seems to be caused by the direct contractile effect of lead upon the gastrointestinal smooth muscle.^{44, 54} At Antwerp, at the time of the gingival process and the *grayish phlegm*, the painter

complained of his *stomach's weak condition* (448)⁴⁸. Even though he believed his *digestion* would improve after visiting the dentist (450)⁴⁹, the problem continued...

Shortly after arriving at Arles, the artist blamed his abdominal troubles on the unseasonable *Winter* (474)⁵⁵; a “*matter of patience*”(478)⁵⁶. After the cold Winter months were over, he then blamed the problem on the *bad wine* he had drunk more than three months before in Paris (480)⁵⁷. He hardly ever drunk, however, and he could not find a reasonable explanation for the abdominal ailments that recidived with no apparent cause. During August 1888, the upset began to subside, which enabled him to *eat more regularly* (520)⁵⁸. It so happened that, weeks before, he had stopped using lead white and turned to zinc, in order to obtain more luminous tones.¹²

From that moment on, although he was cautious about it, his digestive troubles began to *improve* (530)⁵⁹, (536)⁶⁰. At St Rémy he stated that his stomach was *much better than a year before* (592)⁶¹ and that he was no longer *so sensitive to the cold* (607)⁶². However, later, at Auvers, his digestion was not *strong enough* to withstand the homemade family meals at Dr. Gachet's (638)⁶³.

Anemia

In contradistinction with malnutrition states, anemia in saturnism is a very early symptom. From the letters written at Arles we know that in Paris the artist felt so tired he *could not have stood it much longer* (464)⁶⁴. This he blamed on his lack of “*good blood*” (467)⁶⁵, which he thought might be “*purified*” by the *iodide of potassium* supplied by Dr. Gruby (489)⁶⁶. Anemia caused by lead intoxication makes the subject's complexion turn remarkably pale right from the start^{9,31,52}, as can be detected in Van Gogh's self-portraits from the Paris series, one of which Bruce Bernard described as “*deathly paleness*”⁶⁷.

Weakness, paleness and irritability (such as the artist showed vis-à-vis his brother Theo in Paris) are part of the onset of an anemia syndrome⁶⁸. However, when anemia becomes chronic, there exist cardio-circulatory compensation mechanisms that maintain a regular supply of oxygen to the tissues and divert the blood (partly coming from the skin) to vital organs. The subject's condition “improves”, although their complexion remains pale^{68,69}.

Upon arriving at Arles, Van Gogh felt that his blood was *beginning to think of circulating* (464)⁶⁴. Although he longed for *good blood* (467)⁶⁵, and could not resort to “*stimulants*” (474)⁵⁵, he soon began to experience the improvement induced by the compensation mechanisms: “*my blood is getting healthier*” (480)⁵⁷, “*bit by bit my blood quickens ...*” (489)⁶⁶. And simultaneously he began to recover his physical strength. al (530)⁵⁹. But the most remarkable semiological datum in lead-caused anemia is the grayish-pale skin color (“*leaden color*”).^{31,52,70} And upon referring to the self-portrait that he dedicated to Gauguin at Arles, Van Gogh provides us with that particular bit of information: “*it is a portrait of myself, almost colorless, in ashen tones*” (537)⁷¹. He even complained about the difficulty involved in matching the precise *ashen grey* tone of his face in the portrait. (540)⁷²

On the evening of the 23 December, 1888, Van Gogh cut off his left ear lobe and consequently suffered a severe hemorrhage.^{73,74} In healthy subjects, the bone marrow

responds immediately by increasing the production of red blood cells in order to recover from post-hemorrhagic anemia in a few days^{68,69}. In saturnism, however, lead inhibits the synthesis of one of the components of hemoglobin (“hem”)⁶⁸, and in case of hemorrhage, that causes the compensatory response and the subsequent recuperation of the (previously anemic) subject to be delayed. More than three weeks after the loss of blood, the time for blood regeneration having elapsed, Van Gogh still felt *weak*, and was diagnosed with *anemia* by Dr. Rey: “*I feel weak [...] Rey told me that I was really only anemic ...*” (571)⁷⁵.

Paleness caused by anemia is limited by skin pigmentation⁶⁹. In Van Gogh’s self-portraits paleness is more intense during the periods when his face was not directly exposed to sunlight. At the St. Rémy asylum, after two months spent indoors, he painted two colorless, ashen self-portraits; in one of them he wore a dark blue blouse and was “*thin and deathly pale*” (604)⁷⁶.

Saturnine encephalopathy

Due to its toxic effect on the brain, lead is responsible for so-called “saturnine encephalopathy”, which is the most serious complication of lead intoxication^{9,31}, and is not limited to children^{44, 77}. It may appear in the form of epileptic fits- convulsive or focal^{31,78, 79, 80} - and/or states of *delirium*^{32, 78, 79, 81}, being accompanied as well by other central symptoms (vertigo, insomnia, sexual dysfunctions, affective disorder, etc).^{31,32,52, 82}

These symptoms were manifested in Van Gogh’s neuropsychiatric syndrome, which erupted at Arles and underwent acute periods of crisis that rendered him absolutely inactive and unfit for artistic creation.^{83,84}

Psychomotor crises

After the famous, legendary ear-mutilation episode, Van Gogh was interned in the Arles hospital, where he was diagnosed with “*epileptic*” (Dr. Rey) or “*epileptoid fits with hallucinations and delirium*” (Dr. Urpar).^{2, 85} These diagnoses were later supported by Dr Peyron at St. Rémy: “*fits of epilepsy with visual and aural hallucinations*”.^{3, 85}

Epilepsy is characterized by paroxystic neuronal crises that manifest themselves in the form of seizures (convulsions), or *changes in the subject’s consciousness*, with emotional, behavioral, senso-perception and memory alterations, as is the case in *psychomotor epilepsy*^{86, 87}. This is the most frequent type of epilepsy in adults^{87, 88}, and is connected with damages to the temporal lobe (traumatism, ischemia, tumors, lead intoxication, etc).^{52, 86, 89}; from all the complex clinical symptoms it manifests itself with, many can be found in Van Gogh’s psycho-pathology.

In such patients, states of obfuscation (“twilight states”)^{90, 91} may cause aggressive behavior, frequently unleashed by the effects of small amounts of alcohol.^{92, 93} Those states may also be part of an *organic personality disorder* as an intercritical phenomenon^{94, 95}, or part of a *crisis state*. In such cases, patients usually experience *dismnesia* [partial memory loss] about unpremeditated actions, accompanied by vague remorse (although this is difficult to establish without electroencephalography)^{96, 97}.

Van Gogh defined his heated arguments with Gauguin as "*terribly electric*" or "*an electric battery after it has run down*" (564)⁹⁸. In addition, Gauguin reports how, on one occasion, after having had some light absinthe, Van Gogh *suddenly* threw the glass at him, and the next day he was *vaguely worried* that he might have offended him.⁷³

But the most violent episode of obfuscation happened at Arles on the evening of the 23 December, 1888, when Van Gogh, after chasing Gauguin with a razor blade, cut off his own left ear lobe^{73, 99}. After the event, Van Gogh felt uneasy for having "*terrified*" Gauguin (567)¹⁰⁰, and could not remember what had happened very well (576)¹⁰¹. Later, at Auvers, there were more fits of rage: "he wanted to kill everybody because some youngsters had poured salt in his coffee"¹⁰²; he even threatened Dr. Gachet with incomprehensible violence for not having enframed a painting by Guillaumin⁸³.

Lesions and dysfunctions in the brain structures in charge of emotional control (the limbic system and the areas adjacent to the frontal and temporal lobes) have been detected in subjects suffering saturnine encephalopathy, which might explain socially aggressive or choleric behavior in individuals intoxicated with lead^{103, 104, 105}.

On other occasions, Van Gogh referred to twilight states, with changes in behavior in the form of *flights* or *wanderings*^{89,106}, which he described as times when you take leave of your senses (576)¹⁰¹, or as "*abominable crises*" when he felt "*absolutely wandering*" (601)¹⁰⁷. At St. Rémy, he was authorized to travel to Arles (February 1890), and when he failed to return, the employee sent to look for him found him *wandering in a wretched state*⁶⁷. Van Gogh could not remember where he had spent the night nor what he had done with a painting he was carrying, and he complained that his head was "*without pain it is true, but altogether stupefied*" (628)¹⁰⁸.

Memory disturbances in temporary epilepsy may be manifested as old childhood memories returning with extreme clarity¹⁰⁶: during his first interment in the hospital at Arles, there came to Van Gogh's mind sharp memories of *every corner of the house at Zundert* (where he was born) and the surrounding area (573)¹⁰⁹. On other occasions, dismnnesia manifested itself as vague recollections of recent events: "*When I came out of hospital with good old Roulin, I fancied there'd been nothing wrong with me, it was only afterwards I felt I'd been ill*" (576)¹⁰¹.

Moods can also be affected and shift from phases of melancholy to sudden exultation¹⁰⁶.¹¹⁰ Thus, while he writes in one of his letters that he "*display[s] great presence of mind [...], and speak[s] like the Arlésiennes*" (576)¹⁰¹, in another letter written shortly afterwards he says he feels "*a certain undercurrent of vague sadness difficult to define*" (583)¹¹¹. According to one of the painters he met at Auvers (René), "*Van Gogh was cheerful one day and gloomy the next, talkative if he he'd had a few drinks, or otherwise silent for hours*"¹⁰².

Brief reveries or "*dreamy states*" are typical of this kind of epilepsy^{89,106}. The artist referred to them when he spoke of "*state[s] of overexcitement on account of fresh mental emotion*", "*unexpected agitations*", "*passing and momentary mental disturbance[s]*" (579)¹¹² (580)¹¹³, when, sometimes, he would "*let himself go*" and a picture "*came*" to him as if in a *dream* (543)¹¹⁴. Nature would provide him with these emotionally-charged moments- watching a snowy landscape, for instance (620)¹¹⁵ - that could even make him "*lose consciousness, and the result is a fortnight during which I*

cannot do any work” (626a)¹¹⁶. Sensoperceptive alterations may also appear, in the form of false interpretations of reality or sensory illusions^{89,106,117}, such as the *distortions* or *macropsias* that can be detected in the haloes or the stars featuring in Van Gogh’s nocturnal paintings, which were not figments of his imagination. The artist complained about being *led astray into reaching for stars that are too big* when watching the firmament (593)¹¹⁸, (B21)¹¹⁹.

Crises of the temporal lobe may become generalized and cause loss of consciousness and postictal amnesia.⁹⁶ In a letter to his sister Wilhelmina, Van Gogh mentions having had “*four great crises*” during which he *didn’t know what he had said or done*, as well as “*three fainting fits without any plausible reason, and without retaining the slightest remembrance of what I felt*” (W11)¹²⁰. These fits are similar to the syncopes described in the cases of subjects suffering lead-caused encephalopathy⁴⁴.

Delirium

Delirium is an acute, transitory and fluctuating state of confusion secondary to a diffuse brain alteration (organic mental syndrome)^{94,121}. It may appear in cases of saturnine encephalopathy (50%)⁷⁸, after a focal epileptic crisis⁷⁸, or in the exacerbations of saturnism.³²

The subject is restless, incoherent, in a state of inattention; experiences waking dreams, and remains agitated or ecstatic about the contents of the dream^{32,94,121}. In October 1888, Van Gogh was concerned about states of excitement that led him to the “*contemplation of eternity, and eternal life*”, and reminded him of Hugo van der Goes’ madness (556)¹²². When visiting him during his first internment in hospital, Theo finds him unexpectedly *absorbed by incomprehensible philosophical and theological concerns; he wants to weep but can’t*^{123, 124}. Sometimes Van Gogh would feel “*twisted with enthusiasm or madness or prophecy, like a Greek oracle on his tripod*” (576)¹⁰¹; such states he himself would describe as *delirium beyond reality*, on account of which he would be willing to submit himself to the *alienists in Aix*¹⁰¹. This type of pathological mystical experience is described in cases of toxic impregnation of the brain³².

In *delirium*, the delirious dream interpretation is usually brief and unsystematic, often arising as a response to vague sensoperceptive experiences of the environment^{94,95}. It is not difficult to understand how the artist considered the “*perverted and frightful ideas about religion*” that came to his head as *attacks*, outside conscious thought (607)⁶², influenced by his sensitivity to his “*surroundings, the already prolonged stay in the sour old cloisters, the Arles hospital and the house at St. Rémy*”⁶². In states of inattention, however, transitory delusions of persecution may appear in up to 40% of cases¹²¹. During his second internment, Van Gogh believed *he was being poisoned, and there were people being poisoned everywhere*¹²⁵.

Hallucinations or false sensory (visual or aural) perceptions are frequent in *delirium*⁹⁴. The artist referred to them when he observed other patients at St. Rémy: “*I’ve noticed that others, too, hear sounds and strange voices during their attacks, as I did, and that things seemed to change before their very eyes. And that lessened the horror with which I remembered my first attack. [...] There is someone here who [...] thinks he hears*

voices and words in the echoes of the corridors [...] and in my case it was both sight and hearing at the same time...” (592)⁶¹. Van Gogh’s medical certificates mention visual and aural hallucinations^{23, 85}, which in *delirium* may be mixed with nightmares of a most realistic appearance⁹⁴. After his first internment, the artist believed “the unbearable hallucinations [had] ceased, and are now getting reduced to a simple nightmare, in consequence of my taking bromide of potassium” (574)¹²⁶.

Besides this, fear and shouting may be the result of threatening hallucinations or of delusional beliefs about reality, which constitute manifestations of the subject’s anomalous emotional state in cases of *delirium*⁹⁴. During his crises, Van Gogh *thought that everything he imagined was real* (585)¹²⁷; he complained about how much he cried during the attacks (588)¹²⁸, so much so that he couldn’t swallow any food for several days^{83, 129}.

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Other major symptoms

Due to its toxic effects at the cerebellous and vestibular levels, lead may cause *vertigo or loss of postural balance*^{31,104,130}. During his stay in Paris, Van Gogh avoided stairs because he had *fits of dizziness* regularly (W-4)¹³¹. And he had an “*unutterable horror of precipitous cliffs verging on the sea*”, since he suffered from *vertigo* (B18)¹³².

Besides this, lead may alter the brain areas of the limbic system¹³³, causing an “*organic affective disturbance*”¹³⁴, regardless of other factors leading the artist to depression or suicide.

Insomnia is frequent in subjects suffering from delirium⁹⁴. Van Gogh *feared* it so much during his first internment in hospital, that he tried to combat it by means of a “*very strong dose of camphor*” in his pillow. (570)¹³⁵. Ultimately it led to his second internment⁸³. Another related sleep disorder is *nightmares*, which in Van Gogh’s case were deeply *unsettling, severe, abominable and recurrent* (574)¹²⁶, (613)¹³⁶, much to Dr. Peyron’s concern^{137, 138}.

In present times studies have been carried out on the effect of lead intoxication on reproductive capabilities and *sexual functions*^{139,140}: erections may be impeded at their early stage, or libido may be reduced. When Van Gogh was 35 he seemed to disclose to Theo that he suffered from some sort of sexual disturbance, or at least a lack of interest in sex, when he compared himself with *Maupassant* (506)¹⁴¹. He even considered that health-motivated sex deprivation would help to make his painting more “*spermatic*” (B14)¹⁴².

Motor disorder of the hand

In saturnism, peripheral neuropathy mainly affects the motor contingent of the radial nerve^{143, 144}. It is often manifested as a certain weakness in forearm, wrist, and thumb extension, flexion of the other fingers being also altered^{82, 145}. This is intensified by the positions adopted when writing or painting¹⁴⁶.

In the last stages of his artistic career, Van Gogh stated that “*the brush is almost falling from my fingers*” (649)¹⁴⁷, which might in principle be attributed to despair. But Theo, replying to a another letter written later, was worried because Vincent said he *wrote with difficulty* and *didn't talk about his work* (T41a)¹⁴⁸. At least ten days had passed since Van Gogh painted the most demanding parts of *Daubigny's Garden* and the *Wheat Fields under Clouded Sky* (642)¹⁴⁹, (649)¹⁴⁷. From that moment on, the artist's letters became brief and scarce. In the last missive he sent to Theo, where the additional effort of a few sketches is added to that of handwriting, the last lines- unusually fragmented- betray the muscular fatigue in the dominant hand (651)¹⁵⁰.

Furthermore, in late paintings such as *Wheat Fields near Auvers* and *Landscape at Auvers in the Rain* the technique is remarkably simplified; the brushstrokes are dragged unidirectionally and the perspective is distorted. The rendering of “*Wheat Fields with Auvers in the Background*” is surprisingly confusing. It was none other than Karl Jaspers, an authority of worldly renown in the field of psychiatry, who attributed “*the growing insecurity of the artist's hand*” to a probable *motor disorder* rather than to his emotional state¹⁵¹.

POSSIBLE ROUTES OF PENETRATION OF LEAD AND FAVOURING FACTORS

Painters often get intoxicated with lead through the digestive tract⁴⁰. Owing to bioaccumulation, minute quantities of the metal (between 0.6 and 3.5 mg per day) absorbed on a daily basis suffice for the toxic symptoms to appear in a few months^{9, 30, 31}.

Van Gogh handled lead salt pigments, which can be easily absorbed¹⁵², rather carelessly, and he may have ingested the toxic agent via the hands and contaminated utensils. At the Cormon Studio in Paris (1886), “*he would horrify the classicists by lumping paint in huge chunks of paste that would overflow from his brush and end up in his fingers*”¹⁵³. Or in his mouth if he held the brush with it (as has been suggested).¹⁵⁴ At the “yellow house”, he would leave remains of paint in kitchenware and was not used to closing the tubes⁷³.

Cases of lead intoxication with a suicidal intent have also been described¹⁵⁵. During his stay at St. Rémy, Van Gogh had outbursts of impulsive behavior and he ingested paint, which made it necessary to administer him a *counterpoison*¹⁵⁶. Such outbursts may have occurred previously in several occasions. At Arles he had already attempted to swallow some solvent¹⁵⁷.

Lead pigment penetrates through the inhalatory route more frequently when artists mix their own oil colors¹⁴⁶. Although Van Gogh used them ready-made in tubes, white lead priming and the subsequent sanding of surfaces⁸ may have entailed inhalatory hazard. In any case, inhaling lead is difficult owing to its density, and therefore the poison is generally thought to penetrate mainly through the mouth when the subjects drink, eat or smoke, since it can easily stick to the hands, the hair, the beard, and the clothes⁴⁰. Van Gogh wore a beard and would usually smoke a pipe while painting, as witnessed by some of his self-portraits, and admitted by the artist himself when he referred to a

caricature by Gauguin representing him¹³². Another possibility is the penetration of the toxic through damaged skin⁹.

Besides all this, in Van Gogh's case other factors were present that are known to increase a subject's individual susceptibility to saturnism, favoring the penetration and intestinal absorption of lead: alcoholism, tobacco, deficient nutrition^{9,40,41,42,43,144,158,159}. Moreover, absorption may be increased by prolonged exposure to sunlight¹⁶⁰, and Van Gogh would usually spend long sessions painting right under the sun (501)¹⁶¹.

DISCUSSION

Principle of causality

There is no evidence that Van Gogh was diagnosed with any physical or mental illness of any type prior to his encounter with painting. At the time when he was making progress in his drawing technique (before he knew the laws of color), he stated that *"nothing, except illness, can take from me the force which is now beginning to develop"* (letter 185)¹⁶². A few months after using lead pigments he suffered an unspecific intoxication syndrome. And it is in the last five years of his rich artistic career when the *symptoms of manifest saturnism* appear.

Previous personality

Prior to his illness, Van Gogh's personality showed the features of *impulsive or borderline emotional instability*^{94,134,163}: instability of affects and interpersonal relationships, impulsiveness, irritability, feelings of being abandoned or low spirits. In Vincent's case, constitutional, sociocultural as well as adaptation factors would have played a role in the formation of this type of pre-morbid personality (not to be mistaken for epilepsy or a mental illness). On that basis there established itself later (coinciding in time with the last stages of the painter's career) an *organic personality disorder* of an "explosive type", related to lesions in the temporal lobe^{94,95}.

Hereditary factors

Van Gogh's father died suddenly at the age of 63, probably from a heart attack or a cerebrovascular infarct^{129,164} or accident.¹⁶⁵ The mother died of old age when she was 87. There is no evidence that they suffered from any mental illness.

His sister "Will" attempted suicide and was interned in the Ermelo Sanatorium at Veldwijk¹⁶⁴. His younger brother "Cor" went to Africa with the Boers and there, as certified by the Red Cross, he apparently committed suicide¹⁶⁴. In any case, depression and suicidal inclinations are rather contingent upon family inheritance¹⁶⁶. As regards Theo, we know from his death certificate that he died from a "chronic renal illness", complicated with *hemiplegia*¹⁶⁷.

Besides this, Van Gogh told Dr. Peyron that *"one of her aunts was epileptic and there were other cases in the family"*^{3,168}. Susceptibility to epilepsy, even when the latter is secondary to brain damage, seems to be based on a certain hereditary predisposition deriving from the genetically determined threshold of neural excitability^{96,169,170}.

Alcoholism

Although Van Gogh ingested alcohol, he did so only occasionally, and conditioned by psychosocial factors (friendships in Paris, living with Gauguin, social rejection at Arles...), and he showed a strong determination to recover (specially at the St. Rémy asylum), which probably enabled him to avoid physical dependence.

Never in his life was the artist diagnosed with an *alcoholic illness*. Well known psychiatric case studies rule out the possibility that he suffered from an “*alcohol-related Organic Mental Disorder*”⁹⁴: alcoholic hallucinosis, Korsakoff syndrome, ethylic dementia, etc. However, when there is a previous brain damage, or an *underlying* saturnine encephalopathy, the consumption of alcohol (even in moderate quantity) may unleash -as opposed to the cases of drinkers without encephalopathy-aggressive and violent behavior, *delirium* (though not *tremens*) or focal (not generalized) epileptic crises^{106,171,172,173}. All of this is consistent with the neuropsychiatric syndrome that Van Gogh showed at Arles under the effects of alcohol.

Depression and suicide

Inheritance, male gender, alcoholism, lack of social support and *despair*: all these factors, relevant in Van Gogh’s case, determine the risk of suicide^{133, 174}. Besides, a concurring disease such as saturnism may cause an “*organic affective disorder*”¹³⁴.

Van Gogh’s sadness and dejection, and his fear of new crises are evident in the letters he wrote at the end of his stay at St. Rémy. His thoughts about death and suicide-mentioned by Dr. Peyron¹³⁸-, and his self-damaging behavior (ingestion of paint) were all signs foretelling his fateful ending. In his last visit to Theo’s house a bitter family quarrel erupted, and days later he fell into a state of deep melancholy that shows in his paintings of wheat fields (649)¹⁴⁷. Little is known, however, about the last two weeks in the artist’s life, or about the circumstances surrounding his suicide at Auvers. In his last letter to Theo, he did not seem to have desired to provide too many explanations any way: “*I would like to try, perhaps, to write to you about a lot of things, but the inclination has passed...*” (651)¹⁵⁰.

Other diagnoses

The diagnosis of *schizophrenia* established by Karl Jaspers (1922)¹⁷⁵, under Eugen Bleuler’s influence, is considered obsolete today⁸⁴. The German psychiatrist openly admitted to his lack of knowledge about art, and several high quality stylistic studies of Van Gogh’s paintings agree upon the fact that *his art is not that of an schizophrenic*⁸⁴: “*nothing like the typical poverty, rigidity or immobility [of schizophrenic art] is present in it: on the contrary, his painting is all movement and sense of rhythm*”¹⁷⁶. In June 1882, Van Gogh was diagnosed with “*gonorrhoea*” (206)¹⁷⁷. But even supposing that he had contracted *syphilis*, Jaspers and other eminent psychiatrist rule out the possibility that it could have developed far enough to account for the artist’s neuropsychiatric disorder. Syphilis shows a very late development as regards neuropsychiatric disorders: 10 to 20 years after contagion, it manifests itself as progressive generalized paralysis, demetation, or delirious megalomania¹⁷⁸.

The interpretation of Van Gogh's clinical symptoms as a case of *Ménière Syndrome*¹⁷⁹, on the basis that vertigo was the allegedly dominant factor, and that the hallucinations were mere "tinnitus" is hardly tenable. Besides, the artist's digestive symptoms were not accompanied by fits of vertigo. And there is no evidence that hearing loss may be associated with this process¹⁸⁰.

Vincent's illness has often been compared with Theo's on the basis of an alleged "inheritance". Theo suffered from *chronic nephropathy*¹⁶⁷, probably with *stones in the kidneys*^{181, 182}, which would explain the abdominal pain and the symptoms of uremia (irritability, anemia, motor disorders...), similar to those that Vincent showed. But the fact that their symptoms were coincidental does not entail that they suffered from the same disease. It cannot be proved that both brothers suffered from *hereditary acute intermittent porphyria* (AIP)¹⁸³, since the presence of this rare disease- more frequently seen in women¹⁸⁴- has not been confirmed in either Theo's progenitors or his descendants. Lead may, however, alter porphyrine metabolism (plumboporphyria), and generate symptoms similar to those of AIP (laboratory tests are required to discriminate one from the other)^{185,186}. The colic abdominal pain that accompanies the worsening of AIP¹⁸⁶ was not prevalent in Vincent's illness, nor is there any evidence of the conspicuous Port wine-colored urine that may be excreted by patients during a AIP attack^{184, 186}.

It has been suggested that Van Gogh's mental disorder may have been caused by the abuse of *absinthe*¹⁸⁷, owing to the effect of *thujone*, which has neurotoxic and convulsive effects in high doses¹⁸⁸. Such effects, however, have only been established in clinical tests carried out on animals^{189, 190} (essence of absinthe being employed). The toxic dose that is required to damage a human brain remains unknown.^{188, 191} Besides, the neurotoxicity of absinthe as liquor derives from its high content of ethylic alcohol, thought to be even more dangerous than thujone.¹⁹¹ Furthermore, in Van Gogh's time the liquor may have been adulterated with antimony trichloride or cupric acetate (to give it its green color)^{191,192}, or stored in barrels made of lead. It is surprising, moreover, that the physicians of that period, who were quite familiar with the symptoms caused by absinthe abuse^{193, 194}, did not see any connection with Van Gogh's ailments; they never spoke of him as an *absintheur* (the term used to designate absinthe addicts¹⁹⁴). Besides, the artist's disease often relapsed in periods when he was using absinth at all.

It has recently been suggested that Van Gogh suffered from *manic depression*¹⁹⁵. Even though the artist showed mood fluctuations, there were no *manic* or *hypomanic* episodes meeting our present day criteria⁹⁴: a subject that is in an unusually elevated, optimistic, expansive mood for days or months, with an increased, sometimes delirious self-esteem. Such episodes, moreover, occur more frequently before the age of 20 or after the age of 50⁹⁴. Besides, such a diagnosis or the proposed one by Leonhard K. of "*cycloid psychosis*" (anxiety-elation),¹⁹⁶ cannot be firmly established unless the agency of external agents (organic affective disorder)⁹⁴ has been previously ruled out, nor these diagnoses can explain the artist's loss of consciousness, or his physical symptoms, which were independent from his moods.

Historical context

At the end of the 19th century, the study of psychomotor epilepsy caused by temporal lobe dysfunction was not sufficiently advanced. The most important pioneer in that

field, Gastaut, would later interpret Van Gogh's malady as a manifestation of that type of epilepsy¹⁹⁷. This conclusion was supported by extremely thorough neuropsychiatric studies of the artist's case^{84,198,199}, and still stands in our days^{200,201}.

Electroencephalograms were not available to the physicians who treated Van Gogh (Berger 1929), but they knew H Jackson's basic epileptology (1873) and could establish sound clinical diagnosis criteria⁸⁴. It is only natural that they were not familiar with saturnism, since it was only after the Industrial Revolution when it came under the attention of occupational medicine as one of the more frequent causes of symptomatic epilepsy in adults^{202,203}. However, Peyron had already suggested that exposure to the *poison in colours* entailed a certain risk for Van Gogh - which Theo thought was going "a little too far" (T24)²⁰⁴.

It is difficult in our days for saturnism to develop, as it did in the past, into a chronic encephalopathy syndrome with comitial crises and states of delirium in its exacerbations³². Consulting old treatises on the subject was therefore required for the preparation of this work.

CONCLUSIONS

It has been established as a fact that Van Gogh was exposed to lead through the careless handling of toxic pigments, and that his malady was analogous to saturnism, and met the criteria for "*organic mental disorder*" and "*organic personality disorder*", in a causal relationship with the toxic antecedent (these diagnoses are made following current mental disorders classifications criteria)^{94,134}. Lead may have penetrated the artist's organism through the digestive tract, ingested by accident or voluntarily, there being circumstances that favored its penetration and its intestinal absorption. Small daily doses suffice to cause poisoning through *bioaccumulation* in a few months.

Documentary research allows us to correlate the artist's malady with the accumulated knowledge about saturnism available today. We do not have, however, the necessary laboratory test results that would have confirmed the clinical diagnosis (blood levels of lead and free erythrocyte *protoporphyrin*)^{9,44,79}. Toxicological analysis of bone samples would be doubtful, since lead accumulates in bone epiphysis in a very labile fashion^{9,82}. In any case, excreted poison may be detected in the permanent skin structures (hair, nails, etc.)^{9,40}.

Besides all this, we agree with other researchers that *Van Gogh's illness did not structure or empower his artistic creation; his pattern of creativity was prior to the disease and was interrupted during the crises*^{84,176,198,205}. We believe that only by judging Van Gogh's case from the perspective of the "diseased man" and the "lucid painter" can we do justice to this avant-garde artist, whose single, excruciating passion was to feel the colors of nature in their purest form.

Few painters might conceive today such a disinterested passion for art. Van Gogh lived for art, and in the end he died for it. In the last lines of the letter found on him after his death, he wrote about his profession: "*I risk my life on it, and my reason has half-foundered*" (652)²⁰⁶. But he wanted to take no further risks, and so he tragically decided to end a life full of color and torment.

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