

# Could nitroglycerine poisoning be the cause of Alfred Nobel's anginal pains and premature death?

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**Abstract** — The life of 19th century Swedish chemist cum inventor Alfred Nobel can be conveniently divided into two equal phases: pre-nitroglycerine phase (1833–1863) and nitroglycerine phase (1864–1896). According to the records of Ragnar Sohlman, his assistant during his last year of life, Nobel's physical condition began to decline towards the end of the 1870s, and for the last 16 years he suffered from deep depression and anginal pains. Based on Nobel's descriptions of his condition, on his prolonged experimentation with explosives, his strenuous work habit and some recent knowledge about nitroglycerine poisoning, I hypothesize that nitroglycerine poisoning was an aggravating factor which contributed to Nobel's deteriorating health and premature death at the age of 63.

## Introduction

The year 1996 marked the centenary of the death of Alfred Bernhard Nobel (1833–1896), the Swedish chemist, inventor, entrepreneur and benefactor of sciences. He died at the age of 63. Ragnar Sohlman (1870–1948), the personal assistant of Nobel during the last 3 years of his life, had observed that Nobel suffered from bouts of deep depression during the period 1880 to 1896 (1). Sohlman had attributed this depression to Nobel's poor health, his disillusionment with fraudulent business colleagues and his troubling relationship with his mistress Sofie Hess (1858–1912), a Viennese flower sales girl he first met in 1876. However, Sohlman (a chemical engineer like Nobel himself) may have overlooked the toxicological component which could have significantly contributed to Nobel's declining health.

In this paper, I propose that nitroglycerine poisoning was an aggravating factor which contributed to Nobel's deteriorating health and premature death. My hypothesis is based on (a) the existing personal records such as Nobel's letters and Sohlman's observations, (b) analysis of Nobel's professional career and (c) recent knowledge about nitroglycerine poisoning.

## Development of the hypothesis

### *Lifespan of Nobel family members*

The lifespans of Nobel family members, noted from biographies and reference sources (2–4), are shown in Table 1. Nobel's father and mother lived for 71 and 84 years, respectively. Among the Nobel siblings, the youngest (Emil Nobel) was killed at the age of 20 in

**Table 1** Lifespan of Nobel family members

Nobel family	Relationship to Alfred Nobel	Lifespan	Age at death
Immanuel Nobel	father	1801–1872	71
Andriette Nobel	mother	1805–1889	84
Robert Nobel	brother	1829–1896	67
Ludwig Nobel	brother	1831–1888	57
Alfred Nobel		1833–1896	63
Emil Nobel <sup>a</sup>	brother	1844–1864	20

<sup>a</sup> Died in a laboratory explosion while experimenting with nitroglycerine at Heleneborg, near Stockholm, which also killed four fellow workers.

a tragic laboratory explosion which occurred in 1864. While the eldest of the siblings, Robert Nobel, lived for 67 years, Ludwig Nobel died at the age of 57 as a result of a heart attack. Alfred Nobel lived for only 63 years. Thus none of the siblings lived as long as their parents.

#### *Prolonged experimentation with nitroglycerine*

Table 2 provides a synopsis of Nobel's career (2,5). It can be conveniently divided into two equal phases. The first half (1833–1863) was the pre-nitroglycerine phase. The second half (1864–1896) can be termed as the nitroglycerine phase. This division is based on Nobel's own description that, 'the real age of nitroglycerine began in 1864, when an explosion with pure glycerine took place for the first time with the help of a very small charge of gun powder' (2).

During the 33 year period, Nobel experimented with nitroglycerine in his laboratories, which were established first in Sweden, then in France and finally in Italy. His work habit can be characterized by the following features. First, as typical of that era, Nobel was mostly a solitary worker without much laboratory help. Secondly, in the initial phase of his 'nitroglycerine age', he 'worked feverishly in the small half-timber laboratory. Eighteen-hour work days were common place during certain periods, and he constantly overextended himself. His already-frail health was exposed to constant strain' (2). Thirdly, Nobel believed that even seemingly insignificant changes in the chemical proportions could give remarkably large variations in consistency. Thus, he performed hundreds of experiments to finalize his formulation to optimal efficiency. Fourthly, his record of receiving 355 patents in different countries also attests to the fact that Nobel was a productive researcher and entrepreneur. Taken together, the evidence suggests that Nobel allowed himself to be exposed to nitroglycerine for a prolonged period, with adverse consequences to his health.

**Table 2** Alfred Nobel's life events

Year	Life event
1833	Born in Stockholm, Sweden
1841–42	Attended Jakob Parish Higher Apologist School in Stockholm
1843–49	Tutored privately in St Petersburg
1850	Study trip to Paris to work in the laboratory of T. J. Pelouze and to New York, to apprentice under inventor John Ericsson
1853–56	Crimean War; worked in St Petersburg in his father's firm
1863	Returned to Sweden. Patented a detonator that introduced the principle of detonation by shock, using small charge of nitroglycerine in a metal cap with detonating or fulminating mercury
1864	Younger brother Emil killed in an explosion in Nobel's lab; Nobel received minor injuries
1865	Establishment of Nitroglycerine Ltd in Stockholm, for production of nitroglycerine (world's first nitroglycerine factory)
1867	Patented dynamite (a safe, solid and pliable form of nitroglycerine mixed with kieselguhr)
1875	Invented blasting gelatin (a colloidal solution of nitrocellulose in nitroglycerine)
1879	Experimentation on less smoky, military explosive charges for artillery missiles, torpedoes and ammunition
1880–96	Suffered from deep depression, leading to angina
1887	Received a French patent for nearly smokeless blasting powder (Ballistite; a mixture of nitroglycerine and nitrocellulose plus 10% camphor)
1893	Received an honorary doctor's degree from the Uppsala University, Sweden
1895	Drafted his now famous will and testament
1896	Received Swedish patent for progressive smokeless powder (a refinement Ballistite); Died in San Remo, Italy

#### *Health profile*

Sohlman's memoirs, published posthumously in 1950, are of value in seeking to understand Nobel's life, because they constitute the only biography by someone who knew the Swedish inventor personally. Thus I extensively quote the relevant passages from Sohlman's book, which describe Nobel's health problems. Sohlman wrote,

'Towards the end of the seventies [1870s], his [Nobel's] physical condition started to decline. Since he caught cold very easily he was sensitive to any change in the weather... In his private correspondence at this time he frequently complained of other forms of illness, and symptoms of ageing. In the autumn of 1878 he said that he was suffering from scurvy, and wrote that the cure prescribed—horseradish and grape juice—was doing him no good. A few years later he consulted a French doctor who diagnosed advanced scurvy and ordered more of

the same diet, combed with strong salt baths, to be taken in Austria. Nobel's letters also mention severe migraine, which made it impossible for him to work and could keep him in bed for days on end.' (1)

With time, Nobel's health complications became intensified. Sohlman had written, 'As time passed, other more serious symptoms appeared, among them indications of heart disease . . . Nobel begins to speak of angina; these attacks became increasingly frequent and worried him greatly, especially on his travels' (1). Sohlman also reproduced excerpts from a letter written by Nobel in October 1887, which states, 'I have been ill for nine days and obliged to stay indoors. I feel I am much more seriously ill than Boute [his doctor] believes—the pain is insistent and does not let up. My heart is as heavy as lead . . .' (1).

Then in a letter written in July 1888, 3 months after the death of his elder brother Ludvig, Nobel had mentioned: 'One night at about 2 a.m. I suddenly felt so ill that I did not even have the strength to ring my bell or unbolt the door. So I had to spend some hours entirely alone, wondering if they were to be my last. No doubt an attack of angina, a complaint I had once studied, though not in the laboratory . . .' (1).

This letter was written when Nobel was only 54, and had eight more years to live. But the descriptions of his health problems are revealing. Repetitive mention of severe migraine and anginal pains suggests that Nobel was suffering from nitroglycerine poisoning.

### *Nitroglycerine poisoning*

Nitroglycerine [ $C_3H_5(O.NO_2)_3$ ; formula wt. 227.1] was first produced in the laboratory by Ascanio Sobrero (1812–1888), who qualified as a physician and surgeon and then studied chemistry (2,4). In 1847, to a mixture of nitric and sulfuric acids, Sobrero slowly added glycerine and discovered the lethal nitroglycerine. The explosion caused injury to him and his colleagues in the lab and Sobrero became horrified by his discovery to the extent that he refused to exploit it, which led to Nobel's experimentation on nitroglycerine.

The toxicological nature of nitroglycerine became understood only during the last few decades. In its undiluted form, nitroglycerine is a white to pale yellow, flammable liquid. It explodes when heated to 215°C. Continuous exposure to nitroglycerine and other organic nitrates can lead to malfunctioning of the cardiovascular system in humans. Nitroglycerine causes vasospasm of the coronary artery and can thus lead to ischemic heart disease, even in the absence of atherosclerosis (6). Intake of nitroglycerine by any route (ingestion, intraperitoneal, subcutaneous

and intravenous) leads to poisoning. It is also a skin irritant. Notable acute symptoms of nitroglycerine poisoning are headaches, nausea, vomiting, abdominal cramps, convulsions, methemoglobinemia, circulatory collapse, reduced blood pressure, vertigo and cyanosis (7,8).

When one links the toxicological characteristics of nitroglycerine to Nobel's description of his 'pains', the nature of his malady becomes clear. In one of his outbursts against the physicians who treated him, Nobel wrote, 'two specialists, both idiots, ascribe my pains—one to rheumatic gout and the other to goutish rheumatism; this is nothing but jargon which does not explain to me why my heart beats like a horse' (9). However, nitroglycerine also has been used in the management of angina pectoris, myocardial infarction and heart failure, even during Nobel's time.

Sohlman had observed that Nobel, in his final 3 years, continued to spend 'several hours each day in the laboratory, where he followed the work in hand and gave instruction for its completion' (1). These included research projects on explosives involving nitroglycerine, such as

1. 'Progressive powder, i.e. a smokeless powder in which the separate powder grains or powder pipes consisted of layers having differing and gradually increasing combustion speeds';
2. 'Ballistite (or Nobel powder) with lower combustion temperatures and reduced corrosion';
3. 'Firing trials with Nobel powder to determine the pressure generated at varying charge densities'.

Even 8 months before he died, Nobel was actively working with explosives. In a letter dated April 6, 1896, he wrote to Sohlman: 'My health is unfortunately giving me a lot of trouble this year, and much of what should be done has been neglected . . . They concern gun forging, artificial rubber and much else'. When Sohlman replied that his 'work in hand would not prevent me from going away for a week or two', Nobel sent a telegram: 'Come. It will be refreshing and useful, but no explosives are to be manufactured in your absence' (1).

Nobel's health continued to worsen by the day. Sohlman noted, 'He [Nobel] began to suffer from attacks of migraine, when he had to sit and write with his head swathed in wet towels. When the pain and his nervous depression became too acute, he would stop working on immediate problems and, by way of a change, take up his own literary efforts' (1). In his last letter to Sohlman, dated October 25, 1896, Nobel had complained about the internal use of nitroglycerine prescribed to him, as follows: 'My heart trouble will keep me here in Paris for another few

days at least, until my doctors are in complete agreement about my immediate treatment. Isn't it the irony of fate that I have been prescribed N/G1, to be taken internally! They call it Trinitrin, so as not to scare the chemist and the public' (1). Finally, Nobel succumbed on December 10, 1896.

### Conclusion

Nobel's prolonged contact with nitroglycerine in the laboratory and firing trials, lasting for over three decades, would have subjected him to long-term exposure to nitroglycerine. From his descriptions in letters to Sohlman about his 'pains', his solitary work habit and the toxic nature of nitroglycerine which came to be understood long after Nobel's death, I conclude that nitroglycerine poisoning would have been a contributing factor to his illness and premature death.

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