BENJAMIN THOMPSON, COUNT RUMFORD

1753-1814

Benjamin Thompson's progress from poor Massachusetts farmboy to Imperial Count of the Holy Roman Empire and husband of the wealthy and socially prominent widow of the great chemist Lavoisier seems more like the plot of a comic opera than history. Thompson, like Gibbs, was an American-born contributor to the theory of heat. But the similarity ends there. Whereas Gibbs was content to contemplate the nature of matter and energy and to participate quietly in academic life, Thompson was driven by ruthless ambition towards the centers of power, prestige, and wealth. His scientific and technological discoveries, although undeniably important, were often intertwined with his political intrigues and frequently were stimulated by a practical military or administrative problem that he faced. Thompson's qualities of energy, ambition, and arrogance propelled him to discovery and power, but they were also limitations. In the end they turned men against him and diminished his scientific and political impact.

Thompson was born to a poor farming family in Woburn, Massachusetts, and starting at the age of 13 he was successively apprenticed to two dry goods merchants and a doctor. He failed to please his employers because he was less interested in learning a trade than in studying science and carrying out experiments. Consequently, in 1772, at the age of 19, he took a job as schoolmaster in Concord, New Hampshire (originally called Rumford, New Hampshire). Within four months he made the move that started his career on its incredible path: he married the wealthiest and most prominent widow of the colony, a woman eleven years his senior. The schoolmaster instantly became gentleman farmer, and soon received from the British Royal Governor the commission of major in the New Hampshire militia.

This was, of course, the time during which the American Revolution was brewing. Local patriots had no illusions about which camp Thompson's sympathies would lie in, and when he heard a rumor of approaching tar and feathers, he fled back to Woburn, abandoning his wife and infant daughter. Thompson first worked for the British as a spy, and then joined them openly in Boston. When the city fell in 1776, he sailed for London where he acted as an expert on the colonial war. By exaggerating his own importance and by the persuasive power he seemed to exert over men, he soon became private secretary to Lord Germain, who was Secretary of State for Colonies and the man in charge of pursuing the war against the revolutionaries. By 1780 he had secured for himself a position of independent power as Undersecretary of State for the Northern Department, which entailed the responsibility of recruiting, equipping, and transporting British forces to America.

In 1780 Thompson also carried out a series of experiments on the forces produced by exploding gunpowders of various compositions. He designed

an improved ballistic pendulum for this purpose. The experiments were judged important enough scientifically that he was elected Fellow of the Royal Society in the following year, and the results were thought to be of sufficient practical importance that he was invited on maneuvers with the British fleet. It was typical of Thompson to turn to fundamental science to solve a practical problem which he encountered in his work. It was also typical that his results led to a strengthening of his political position or prestige.

Thompson was forced from his position with the British government when it was rumored that he was a spy for the French. At the close of the American Revolution he was a soldier of fortune, seeking a new arena for his talents and ambitions. His talents in science and administration gained for him a post as adviser to the Elector of Bavaria, in charge of reorganizing the country's inefficient army. He secretly maintained his contacts with the British Foreign Office, however, and sent back reports on the Bavarian army.

Thompson noted that clothing and feeding the soldiers were the principal items of the army budget. To find ways to trim these costs, he turned again to basic science. He devised a simple instrument to measure the thermal conductivity of materials, and set out to discover which fabrics were the best insulators for uniforms. He discovered that an insulating cloth is one in which air is prevented from moving. When local manufacturers were reluctant to produce cloth by the weave of his design, he opened "workhouses," in which beggars and other poor people did weaving in return for food and clothing. To educate children in the workhouses (and also the adults who desired it) he initiated what was one of the earliest free schools in Europe. Scientific advisers and innovators in government are not a development of the twentieth century.

In order to provide maximum nutrition at minimum cost for the army and for his workhouses, Thompson began to experiment with foods. He found that a "Rumford soup" of peas, barley, and potatoes was both nutritious and inexpensive. He set up gardens, including Munich's famous English garden, as experimental agricultural centers, and also to produce foods for his establishments. Thompson's interest in efficient preparation of food led him to devise the kitchen range to replace the open hearth, and then to invent the baking oven, the double boiler, the pressure cooker, a portable field kitchen for the army, and the drip coffee pot. To study the efficiency of heating fuels he designed the combustion calorimeter, and to improve lighting in his workhouses he invented a photometer and used it to study the luminosity of various candles and lamps. Other Thompson inventions include central heating and the modern efficient fireplace with smoke-shelf and damper.

It was during this period that, as superintendent of the Munich arsenal, Thompson performed his famous cannon boring experiments. He discovered that the intense heat produced during the boring of a cannon was proportional to the mechanical work of boring. This made it unlikely that heat was a substance (then called "caloric") squeezed from the metal as boring took place, because the caloric in any substance would be exhausted after extended boring. Thompson's idea that work and heat are energetically equivalent foreshadowed the first law of thermodynamics.

Thompson's genius for administration and innovation was soon apparent to the Elector, who promoted him from adviser and army colonel to Minister of War, Minister of Police, Major General, Chamberlain of the Court, and State

Councillor, and then to Count of the Holy Roman Empire. Thompson never again referred to himself by his family name, but only by his title, Count Rumford.

Holding all of these positions simultaneously was a drain on his health, and created numerous enemies. He decided that it was time to return to England, and the Elector cooperated by naming him Bavaria's Minister Plenipotentiary to the Court of St. James. This proposal angered King George's government, first because Thompson had supposedly been acting as a spy for Britain but had obviously held back information, and second because Rumford was a subject of the King, and hardly could act as ambassador from another country.

This setback was a disappointment to Rumford, who then began to cast about for a new position. It took a person of his incomparable arrogance to devise the next plan: he proposed to the new United States government that he return to America to set up a military academy. Fortunately his role during the Revolution was discovered before the appointment was arranged.

Rumford then busied himself with the foundation of the Royal Institution of Great Britain. It was started as a showcase for his inventions and discoveries, but when he brought in a young and talented chemist, Humphrey Davy, as professor, the future of the institution as a great research laboratory was established. Rumford also founded two prizes in his name, to be awarded periodically by the Royal Society of London and the American Academy of Arts and Sciences for research on heat and light. These were the first international awards for science, predating the Nobel awards by a century. Gibbs was a later recipient of the Rumford Medal.

Rumford returned to the Continent, where he courted and eventually married Madame Lavoisier. The marriage was not a happy one, and before long Rumford moved into his own villa to pursue his experiments. He died in 1814, leaving his estate to Harvard College. In a final act of intrigue, to insure that his benefaction would be accepted in a quarter that might have reason to reject it, Rumford arranged to have the signing of his will witnessed by Lafayette, the French hero of the American Revolution.