

Dr. Ward

Advanced Biology Packet

Day 1-5

These Advanced Biology assignments are geared toward discovery and the scientific method. Please do the best that you can and feel free to use any resources at your disposal. These activities may reference a textbook, but the book is not needed.

These activities are meant to keep your mind engaged while you are away, but do try to have fun with them.

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AMI Work for Advanced Biology

1. Read the following article.
2. Write a brief summary.
3. Write a 1 paragraph discussion of the importance of this scientist's work today.

JOSEPH-BIENAIMÉ CAVENTOU (1795-1877) AND PIERRE-JOSEPH PELLETIER (1788-1842)

In the early nineteenth century, French pharmacists Joseph-Bienaimé Caventou and Pierre-Joseph Pelletier isolated a number of active principles from plant materials used in drugs—that is, particular chemical compounds producing physiological effects in patients. These drugs, often of exotic origin and relatively recently introduced into European medical practice, were originally administered as brews made from ground flowers, leaves, roots, and bark of trees and other plants. Then—as now—isolating active principles was undertaken to achieve higher potency, fewer side effects, and more consistency than would be available directly from unrefined natural materials.

Caventou and Pelletier shared a common heritage as the sons of pharmacists and graduates of the rigorous Parisian system of educating members of their profession. The required curriculum at the *École de Pharmacie* included a strong component of chemistry, based on Antoine Lavoisier's reform of the subject. At the time of their discoveries Pelletier was already on the teaching staff of the *École* and operating a pharmacy in Paris, and Caventou would soon be similarly employed. Pelletier owned a chemical plant in nearby Clichy as well.

Pelletier's first collaborator was François Magendie, a physician now revered as a pioneer experimental physiologist. As a physician Magendie was interested in finding new and improved medicines for his patients. As a physiologist he used the newly discovered substances as probes to investigate how the nervous system and other systems of living organisms function.

Working in Pelletier's laboratory, Pelletier and Magendie conducted chemical investigations of a wide variety of natural materials used in medicines of the day, including the root of the ipecacuanha (or ipecac) plant, the basis for a purge of the same name that was commonly prescribed. The two were joined in their search for ipecac's active principle by Caventou, who was then a twenty-two-year-old pharmacy intern. Using himself as a test subject, Caventou swallowed six grains

of a vile-smelling fatty constituent of ipecac; when this noxious stuff did not induce vomiting, it was thus ruled out as the active ingredient in the medicine. Another substance that they isolated worked as expected on Magendie, Pelletier, and some students; they named it "emetine" from the Greek word for vomiting.

Emetine is one of the alkaloids, a group of basic organic substances (those that form salts with acids) with complex molecular structures that are among the most physiologically active substances known to mankind. The first alkaloid to be identified was morphine, extracted by Friedrich Wilhelm Sertürner in 1805 (research published in 1817) from opium derived from the opium poppy; up until that time all vegetable matter was thought to be acidic.

In an amazing five years, from 1817 to 1821, Caventou and Pelletier not only studied and named the green pigment in leaves "chlorophyll," but they also isolated and characterized a number of alkaloids. Among these were the poison strychnine, a derivative of St. Ignatius's beans (*Strychnos ignatii*) and the seeds of nux vomica (*S. nux vomica*), known to the English as "Quaker buttons"; quinine from the bark of the cinchona tree—an effective treatment for malaria, for which they received a prize from the *Académie des Sciences* (see also Robert Burns Woodward, p. 114); and caffeine—the popular stimulant present in coffee, tea, and today's cola drinks.

With the purest samples of these and other new substances that they had obtained through chemical manipulations, Caventou and Pelletier attempted to use combustion analysis to determine empirical chemical formulas. In all of the substances they found varying proportions of carbon, hydrogen, and oxygen. But it was not until 1823, when Pelletier and Jean-Baptiste Dumas repeated such analyses for nine alkaloids, that it was recognized that the alkaloids also contain nitrogen. Determining the molecular structure of and synthesizing most alkaloids awaited the twentieth century.