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| |  | | --- | |  | | **Top of Form**    **Bottom of Form**  **Alkaloids**  **Alkaloids are natural, organic substances that are predominantly found in plants and normally contain at least one nitrogen atom in their chemical structure. Their basic (alkaline) nature has led to the term *alkaloids.* Since the identification of the first alkaloid, morphine, from the opium poppy (*Papaver somniferum*) in 1806, more than ten thousand alkaloids have been isolated from plants. Alkaloids are the active components of numerous medicinal plants or plant-derived drugs and poisons, and their structural diversityand different physiological activities are unmatched by any other group of natural products.**  **Structures of some alkaloids, with the names of the plants that produce them.Structures of some alkaloids, with the names of the plants that produce them.**    **Although alkaloids have been detected in some animals (e.g., in the toxic secretions of fire ants, ladybugs, and toads), their major occurrence is in the flowering plants. Alkaloids are relatively stable compounds that accumulate as end products of different biosynthetic pathways, mostly starting from common amino acids such as lysine, ornithine, tyrosine, tryptophan, and others. Their classification is usually based on the formed heterocyclic ring system (e.g., piperidine in coniine, pyridine in nicotine, and quinoline in quinine). Some structures are relatively simple, whereas others are quite complex.**  **Alkaloids can occur in all parts of the plant but frequently, depending on the plant species, they accumulate only in particular organs (e.g., in barks, roots, leaves, and fruits), whereas at the same time other organs are alkaloid-free. In potato plants, the edible tubers are devoid of alkaloids,whereas the green parts contain the poisonous solanine. The organ in which alkaloids accumulate is not always the site of their synthesis. In tobacco, nicotine is produced in the roots and translocated to the leaves where it accumulates.**  **The functions of alkaloids in plants are mostly unknown, and their importance in plant metabolism has been much debated. A single plant species may contain over one hundred different alkaloids, and the concentration can vary from a small fraction to as much as 10 percent of the dry weight. Breeding for plants devoid of alkaloids has also demonstrated that alkaloids are apparently not vital. Why does a plant invest so much nitrogen and energy in synthesizing such a large number and quantity of compounds? Most alkaloids are very toxic and, therefore, have the potential to function in the chemical defense arsenal of plants against attack by herbivores and micro-organisms. For example, the nicotine present in tobacco leaves inhibits the growth of tobacco hornworm larvae; the purified compound is also applied as an effective insecticide in greenhouses. In addition, alkaloids have been suggested to serve as a storage form of nitrogen or as protectants against damage by ultraviolet light.**  **Alkaloids have traditionally been of great interest to humans because of their pronounced physiological and medicinal properties. From the beginning of civilization, alkaloid-containing plant extracts have been used in all cultures as potions, medicines, and poisons. Greek philosopher Socrates died in 399 B.C.E. by consumption of coniine-containing hemlock (*Conium maculatum*), and Egyptian queen Cleopatra (69-30 B.C.E.) used atropine-containing plant extracts (such as belladonna) to dilate her pupils. In modern times, the stimulants caffeine in coffee, tea, and cacao and nicotine in cigarettes are consumed worldwide. Alkaloids with hallucinogenic, narcotic, or analgesic properties have found medical application as pure compounds (e.g., morphine, atropine, and quinine) or served as model compounds for modern synthetic drugs, while several are abused as illegal drugs (e.g., cocaine). Other alkaloids are too toxic for any therapeutic use (e.g., coniine and strychnine), but plant constituents are still screened for new, biologically active compounds. An example is the discovery of taxol, which has cytostatic properties and is applied as an anticancer dr.** |

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