

# THE OXFORD SYMPOSIUM ON CARNIVOROUS PLANTS

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A symposium on carnivorous plants was held as a part of the Society for Experimental Biology meetings in Oxford, England on December 18, 1981. The symposium was organized by Dr. B. E. Juniper of the Botany School, Oxford University. Topics covered were: the structure and function of carnivorous plant glands, the kinetics of amino acid uptake by *Dionaea*, the physiology of the movements of the *Droseraceae* and the culture and propagation of carnivorous plants. In addition, the excellent collection of carnivorous plants at the Oxford Botanical Garden was viewed and a film on CPs called "The Tender Trap" was presented. The approximately 75 people attending included John Watkins, the secretary and founder of the British Carnivorous Plant Society, and Paul Simons, the British Society President. The morning session was chaired by Dr. Juniper of Oxford University and the afternoon session was chaired by Dr. Robins of East Anglia University.

Since much of the information presented is covered in recently published papers, references to "Review of Recent Literature" in CPN are given in place of more lengthy description of each talk.

**Glands and Their Secretory Activity** was the topic addressed by the majority of the speakers. J. Heslop-Harrison of Aberwyth, Wales, R. J. Robins and B. E. Juniper of Oxford and East Anglia, England, U. Lutge of Darmstadt, Germany and D. Joel and B. E. Juniper of Hebrew University, Israel and Oxford, England all presented papers on this topic. These papers covered a wide range of CPs but it became clear that they have much in common with CPs and

flower nectaries. All have an endodermis (a layer of cells with impermeable lateral walls) that forces water and dissolved substances to pass through the protoplasts of the endodermal layer and thus creates a semipermeable barrier. All have secretory cells external to the endodermis that produce the various substances that are secreted and a set of basal reservoir cells (the stalked glands of *Drosophyllum* and *Drosera* tentacles which lack reservoir cells were not covered in this meeting). In all cases, similar mechanisms that cause the secretion of chloride ion seem to control fluid secretion.

However, the mechanisms that control secretion seemed to differ in the two major groups of plants which were discussed. Work from Dr. Juniper's laboratory indicates that in the *Droseraceae* (*Dionaea* and *Drosophyllum* sessile glands) there is a digestive cycle with secretion and absorption phase. Digestive enzyme production in this group occurs de novo in the secretory cells after stimulation. By contrast, the work of the Heslop-Harrisons in the *Byblidaceae* (*Byblis*) and *Lentibulariaceae* (*Pinguicula*, *Utricularia* and *Gentlisea*) indicates that digestive enzymes are produced as a normal part of secretory cell development and are released upon stimulation in a single destructive secretory event. The *Droseraceae* are capable of going through several cycles of secretion and absorption while the other two families seem to rely on a one shot mechanism.

**Amino acid uptake by *Dionaea*** was the topic of a talk by P. Rea, a student of Dr. Juniper. Mr. Rea presented a kinetic analysis of amino acid uptake

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by discs cut out of *Dionaea* leaves. His work indicates a co-transport mechanism that uses secreted hydrogen ions and that compounds that increase the rate of secretion increase the rate of uptake of amino acids.

**Movements in the Droseraceae** was a topic addressed by two speakers. S. E. Williams of Lebanon Valley College, U.S.A. presented a broad review of the entire topic and covered some more recent work which indicates that both cell wall plasticity (growth) processes and a turgor mechanism are likely to be involved in the rapid movements of *Dionaea* leaf blades. Inga Weilbrenner, a student at Heidelberg University, Germany presented a paper on the control mechanisms of the slow movements of *Drosera* leaf blades. Miss Weilbrenner's work indicates auxin is likely to be involved in these movements which she demonstrated to be caused by differential growth.

**Horticulture of Carnivorous Plants** was covered by J. K. Burras, who is in charge of the Oxford Botanic Center. Judging from the impressive display of healthy plants which is reputed to be the most diverse in Great Britain, he is a man well-qualified to speak on the subject. The exceptionally large number of *Heliamphora* in prime condition was the most outstanding feature of the collection. A discussion among the audience revealed that the preponderance of evidence now indicates that *Heliamphora* is not carnivorous and that pitchers serve primarily to collect water. Dr. Burras stated that when he put water in the leaves it was quickly absorbed and that no fluid was secreted by his plants. A list of suggestions for the culture of carnivorous plants follows.

#### Culture Methods

**Water.** Use soft water (except for one or two species of *Utricularia*). Dilute sulfuric acid-treated water brought to pH

6.8 works well but rainwater is best. Avoid domestic softeners because the large amounts of sodium they introduce is a problem. Use overhead watering for *Nepenthes* and *Heliamphora*.

**Light.** Avoid shade. This must be particularly important in England with its short, gloomy winter days. Artificial light is a help. Growlux lighting is recommended at 400 foot-candles.

**Substrate.** The following is a list of raw materials: sphagnum peat (avoid sedge peats), two year-old leaf mold from oak leaves, chipped bark from coniferous trees (coarse grades for most plants but finer grades for *Drosera* and *Sarracenia* species), sphagnum moss, *Typha* (cattails), sand (sharp sand 1/8 inch (2 mm) and down — avoid builder's or beach sand), perlite, vermiculite (avoid for *Drosera*, *Drosophyllum* and *Byblis*), clay pots for *Darlingtonia*, plastic pots for other species to avoid water loss.

Use sand, peat and leaf mold for most plants. Some tips are:

- Drosophyllum*. Plant one per pot and then do not disturb the roots.
- Dionaea*. Use peat, sand and perlite. Three-fourths inch of the base of a leaf will root.
- Heliamphora*. Use leaf mold and sphagnum moss. Never grow the plants at temperatures higher than 25° C (78° F) and divide them only in springtime.
- Sarracenia*. Peat, sand and a little leaf mold for the soil. However, *S. psittacina* should be grown underwater in winter.
- Darlingtonia*. Can be grown out of doors in England. A coldhouse plant. Keep roots cool and give overhead watering in the summer.
- Cephalotus*. Divide only in the spring since the plant normally dies back in winter.
- Aldrovanda* and *Utricularia*. Boil dry *Typha* leaves and peat in soft water and let stand for a few days. Take out the remains of the *Typha* leaves. Try to keep ahead of the algae.