Like most higher living organisms, dicot plants have a localized centromere in the chromosomes, except for the members of the dicot *Drosera* that have a diffused centromere. *Drosera* chromosomes also have diffused properties of the telomeric repeat sequences $(TTTAGGG)_n$ of *Arabidopsis thaliana*, which have already been proved to hybridize with the chromosome DNA of human, *Leucanthemella linearis*, *Scorzonera austriaca*, *Zea mays* and so on. This phenomenon was found by southern and dot hybridizations. Those diffused telomeres may be required as a functional structure to make the diffused-centromeric chromosomes divide safely into the poles at late metaphase to anaphase. However, they have the rDNA region localized at the nucleolar organizing region like usual higher plants, as detected by the pTa71 probe. The pTa71 contains a 9-kb Eco-RI fragment of rDNA isolated from wheat (*Triticum aestivum*) and recloned into pUC19. Thus, each species of *Drosera* has a specific number of rDNA signals or nucleolar organizing regions. A meiotic chromosome configuration in *Drosera* called "Drosera type pairing" is mainly found in Australian pygmy *Drosera*, while those *Drosera* species distributed in the Northern Hemisphere show exactly the same chromosome pairing configuration as organisms with localized-centromeric chromosomes.

If *Drosera* is exposed to radiation at relatively high doses, its diffused-centromeric chromosomes break to produce multifragments. The best performance was obtained by gamma (γ) irradiation at 50 Gy. Each fragment was still active and continued usual cell division. Thus, many plants exposed to γ-rays show mixoploidy with different chromosome numbers in the cells of the same individual. The natural *D. roseana* has mixoplidy with 2n=5, 6, 7, 8, and 9 perhaps caused by natural radioactive substances. Chromosome aberrations exhibited are the same as those observed in localized-centromeric chromosomes, such as breaks, fusions, gaps, multipolarity, non-disjunction, pulvilization, rings and sister chromatid exchanges. These phenomena artificially produced genetic mutations, such as albino and yellow-colored plants, jelly-like plants, densely-leaved, very flat rosulate-formed plants, and plants with leaves that produced another leaf at the center of lamina. The albino plants were mixoploid.

The chromosomes of 47 species of *Drosera* studied up to the present display a diversified aneuploid series which is well progressed and is still under process especially in the pygmy *Drosera* in Australia, although those of the species in the Northern Hemisphere display always a stable polyploid series with X=10.

Many more new species of *Drosera* may be taxonomically described in Australia and many more new cultivars may be synthesized in the near future.

Structure and Function of Digestive Glands

Daniel M. Joel; Newe-Ya'ar Research Center, P.O. Box 1021, Ramat-Yishay 30095, Israel

By definition, carnivorous plants possess glandular structures that absorb digestion products. In most cases these glands also secrete digestive fluids.

The digestive glands of all genera are composed of two main components, glandular and endodermoid. Depending on the species, both components are composed of either single cells or groups of cells. The cells that are directly involved in the synthesis and release of enzymes, as well as in digest uptake, are the glandular cells. These cells possess a typical glandular cytoplasm with a large nucleus and active organelles, and have a thin outer cell wall with a thin cuticle which is commonly porous, providing the gland with an external boundary of low diffusive resistance.

The endodermoid cells mediate between the glandular unit and the leaf tissues. Their radial walls are typically impregnated with cutin, where their plasma membrane is tightly attached to the cell wall. This unique structure blocks all extracellular transport across the endodermoid layer from the glandular cells and to them, allowing water and solute movement that is controlled by the endodermoid cytoplasm. The

glandular unit can therefore be regarded as the digestive pump, and the endodermoid unit - as its main valve.

In addition, digestive glands are often provided with auxiliary elements such as reservoir cells, stalks, and conductive cells.

Carnivorous glands operate under different digestive strategies . In some species digestive cycles take place only when prey is available to the trap, in other species the glands show a continuous digestive activity. The former strategy is employed by the snap-traps of *Dionaea* and *Aldrovanda*, where digestive fluid is secreted by all trap glands when prey is available and the trap shuts, or by the adhesive traps of *Drosera* and *Pinguicula*, where digestive fluid is secreted only by glands that are stimulated by entrapped prey. The latter strategy is employed by pitcher plants and by *Utricularia*, where the main volume of the digestive fluid is spontaneously secreted during the maturation of the trap. In this latter case the entrapment of prey often operates additional secretion of enzymes and leads to a decrease in the pH of the digestive fluid. We therefore see that digestive gland activity is usually stimulated by the presence of prey even if the trap is passive.

The pitcher epithelium of *Sarracenia* is composed of a glandular epidermis that continuously occupies the inner surface of the bottom zone of the pitcher, with an endodermoid sub-epidermis that constitutes a physical barrier of extracellular leakage of water and solutes. This unique surface-gland serves not only as a digestive gland but also plays a key role in helping associated fauna to coexist in the pitcher. The epithelium was shown to control the levels of oxygen, carbon dioxide and various other solutes in the digestive pool. The role played by associated organisms in prey breakdown and digestion is significant mainly in pitcher plants.

The structure of the cuticle covering the outer surface of digestive glands corresponds to the trapping strategy. When the fluid is secreted spontaneously, as in the pitcher plants, the cuticle also opens spontaneously during gland maturation. When the fluid is secreted only in response to trapping, the cuticle also opens only when stimulated by prey. Cuticular opening seems to develop as a result of wall stretching, that in turn is caused by an increase in the ionic content of the outer glandular cells. In *Dionaea* it was shown that a wave of chloride transport precedes cuticular opening, and this ion was shown to accumulate in turn in the various layers of the glands: first in the basal cells, then in the endodermoid cells and later in the glandular cells. Chloride ions were followed under the electron microscope and were seen to move from one cell to another both via plasmodesmata, that serve as plasmatic connections between cells that bridge across cell walls, and via the tangential cell walls that are located between endodermoid cells and the basal cells or glandular cells. In the basal cells chloride is accumulated in special organelles.

The uptake of digestion products from the gland surface is an active, energy consuming process, in which ATPase is involved. Some products are immediately consumed or metabolized in the gland itself, whereas others are transferred to other plant organs.

The digestive glands of carnivorous plants are interesting not only because of the special nature of the plants that carry them, but also because these structures secrete enzymes to the plant surface as the result of simple external chemical signals, in contrast to most other cases in the plant kingdom where stimulated secretion of enzymes is restricted to internal structure only. This quality of the digestive glands makes them an ideal model for research of glandular mechanisms in plants.

In vitro Cultivation and Experiments with Carnivorous Plants

Heiko Rischer, Matthias Wenzel, Jan Schlauer, Gerhard Bringmann*; Institute of Organic Chemistry, University of Würzburg, Am Hubland, 97074 Würzburg, Germany, <rischer@chemie.uni-wuerzburg.de>, <wenzel@chemie.uni-wuerzburg.de>, <schlauer@chemie.uni-wuerzburg.de>, <bringman@chemie.uni-wuerzburg.de>
L. Aké Assi, Centre National de Floristique, 08 B. P. 172, Abidjan 08, Ivory Coast

Porter (1940) reported germination and growth of sterile sown *Nepenthes maxima*. This work marks the very starting point of growing carnivorous plants *in vitro*, published only a few years after the final