

Analyzing the Digestive Process of Carnivorous Plants



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Introduction

- Carnivorous plants are plants that are capable of trapping and consuming prey in order to get the nutrients they need
- Each species of carnivorous plant digests insects in different ways
- The digestive enzymes of *Nepenthes* are similar to that of a human, meaning this plant can be used in human medicines

Background

- Scientists have studied how carnivorous plants get their food for decades, however, it wasn't until recently that they began studying the digestive enzymes
- Plants have mechanisms to protect themselves from predators. It is believed that carnivorous plants evolved to do the opposite; To become the predator instead of the prey (ncbi.nlm.nih.gov)
- Scientists have learned that some carnivorous plants produce their own enzymes, while others rely on bacteria to produce enzymes for them(carnivorousplants.org)

Question

What factors play a role in the digestive process of carnivorous plants?

Trapping Methods

The purpose of these methods is to trap prey in order to later get nutrients

- Sealed Traps
 - Dionaea, Aldrovanda*
- Water Pools
 - Nepenthes, Cephalotus, Heliamphora*
- Partner Organisms
 - Byblis, Darlingtonia, Roridula*
- Leaf Surfaces
 - Drosera, Drosophyllum, Triphyophyllum, Byblis*
- Pits
 - Genlisea*

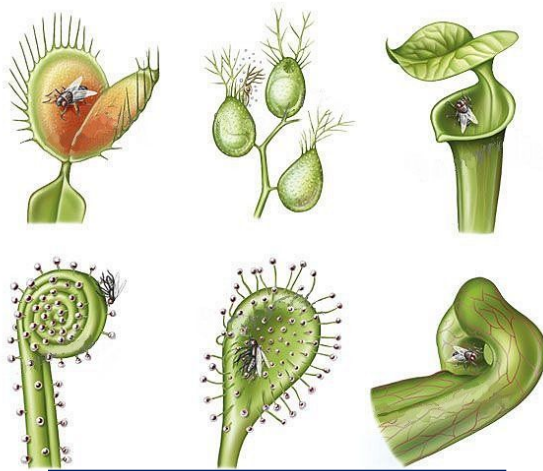


Figure 1 shows several of the trapping methods (Paginski, 2021)

Enzymes

- The digestive enzymes are secreted from glands and dissolve proteins so the plant can absorb the nutrients

- Phosphatase
- Protease
- Chitinase
- Glucanase
- Esterase
- Peroxidase
- Nucleases
- Glucosaminidase
- Glucosidase
- Amylase
- Lipase
- Ribonuclease
- Phosphoamidase
- Xylosidase
- Urease

Did you know?

- Digestive enzymes were first observed on *Nepenthes*
- There are over 700 species of carnivorous plants

Figure 2 shows the digestive enzymes of 5 carnivorous plant families

Family	Species	Enzyme category														
		Phosphatase	Protease	Chitinase	Glucanase	Esterase	Peroxidase	Nuclease	Glucosaminidase	Glucosidase	Amylase	Lipase	Ribonuclease	Phosphoamidase	Xylosidase	Urease
Cephalotaceae	<i>C. follicularis</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Droseraceae	<i>D. muscipula</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>D. capensis</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>D. rotundifolia</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>D. villosa</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>D. peltata</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Lentibulariaceae	<i>Utricularia</i> spp.	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>G. aurea</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>U. multifida</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>U. foliosa</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>U. australis</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Sarraceniaceae	<i>S. purpurea</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>Sarracenia</i> spp.	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>D. californica</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>H. tatei</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>S. psittacina</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Nepenthaceae	<i>N. alata</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>N. bicalcarata</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>N. ×ventrata</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>N. albomarginata</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	<i>N. gracilis</i>	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Take Home Message

Carnivorous plants have developed in ways that ensure their own survival. With further studies, carnivorous plants can be beneficial in furthering human medicine.

References

Carnivorous plant digestion and NUTRIENT ASSIMILATION. (n.d.). Retrieved April 16, 2021, from <https://www.carnivorousplants.org/cp/carnivory/digestion>
 Renner, T., & Specht, C. (2013, August). Inside the trap: GLAND Morphologies, digestive enzymes, and the evolution of plant carnivory in The caryophyllales. Retrieved April 16, 2021, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3820484/>