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Why are some plants poisonous ?

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Herbivory

Why are some plants poisonous ?

A. Herbivory

B. How do plants protect themselves against herbivory?

1. Physical Protection

(spines, thorns, leaf hairs)

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   (spines, thorns, leaf hairs)

2. <u>Chemical</u> protection that affects taste, smell or other physiological damage.

Poison – any substance, particularly chemical, that causes injury, illness or death.

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"*All substances are poisonous; there is none which is not a poison. The right dose differentiates a poison and a remedy*"

Paracelsus (1493 – 1541)

Poison – any substance, particularly chemical, that causes injury, illness or death.

"*All substances are poisonous; there is none which is not a poison. The right dose differentiates a poison and a remedy*"

Paracelsus (1493 – 1541)

Toxicant

Xenobiotic

Natural toxin

Phytotoxin

Mycotoxin

“All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy”

Paracelsus (1493 – 1541)

*"All **substances** are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy"*

Paracelsus (1493 – 1541)

1. What ?

*“All substances are poisons; there is none which is not a poison. The right **dose** differentiates a poison and a remedy”*

Paracelsus (1493 – 1541)

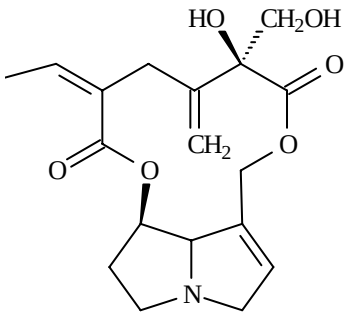
1. What ?

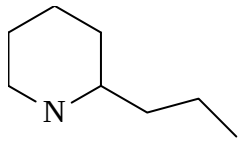
2. How Much ?

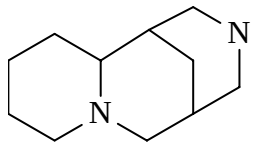
Classes of Toxins

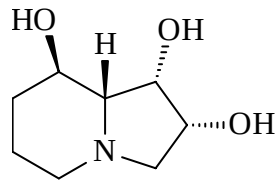
Classes of Toxins

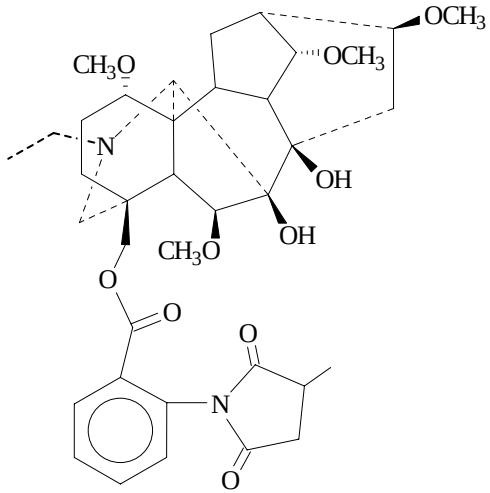
Alkaloids

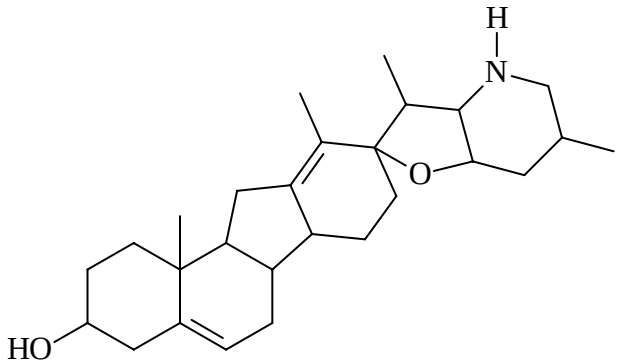






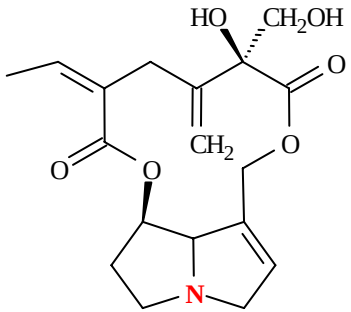


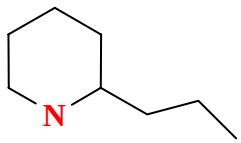


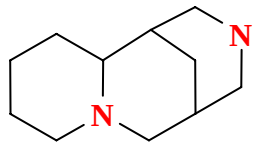


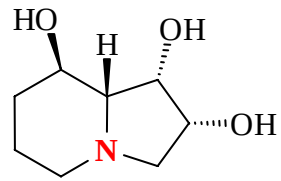
Classes of Toxins

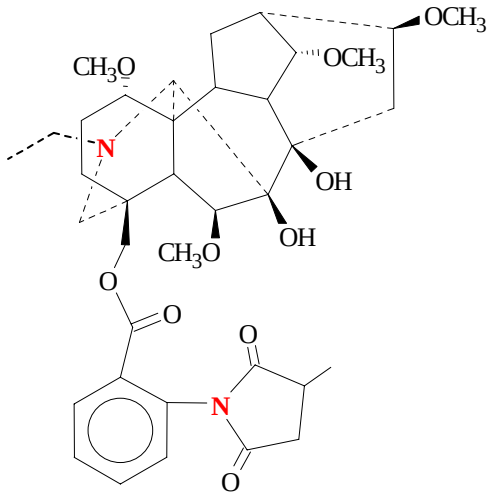
Alkaloids

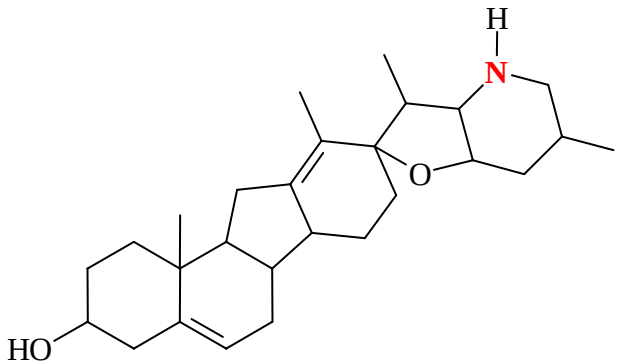






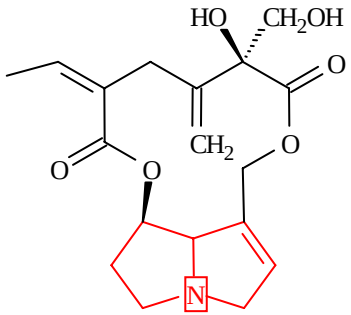


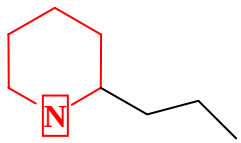


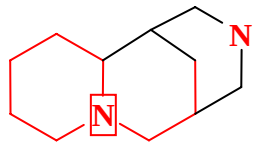


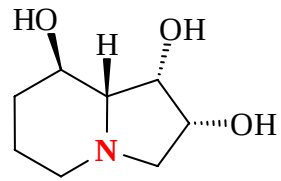
Classes of Toxins

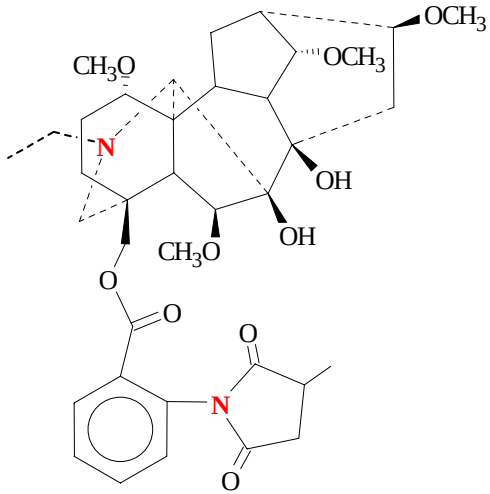
Alkaloids

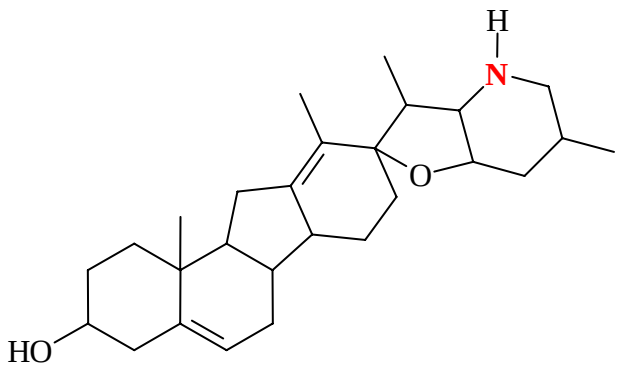




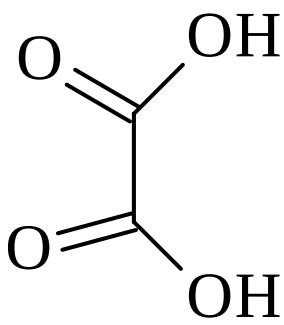






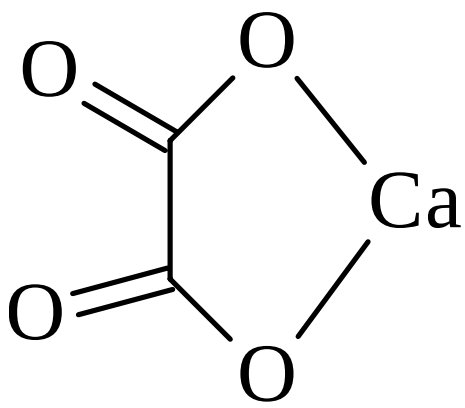


Metal-binding Compounds

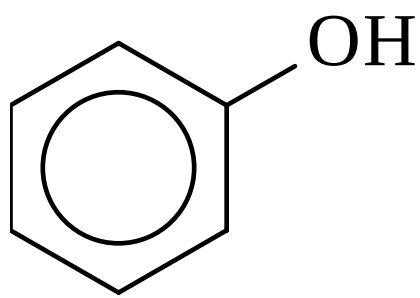


Ca^{2+}

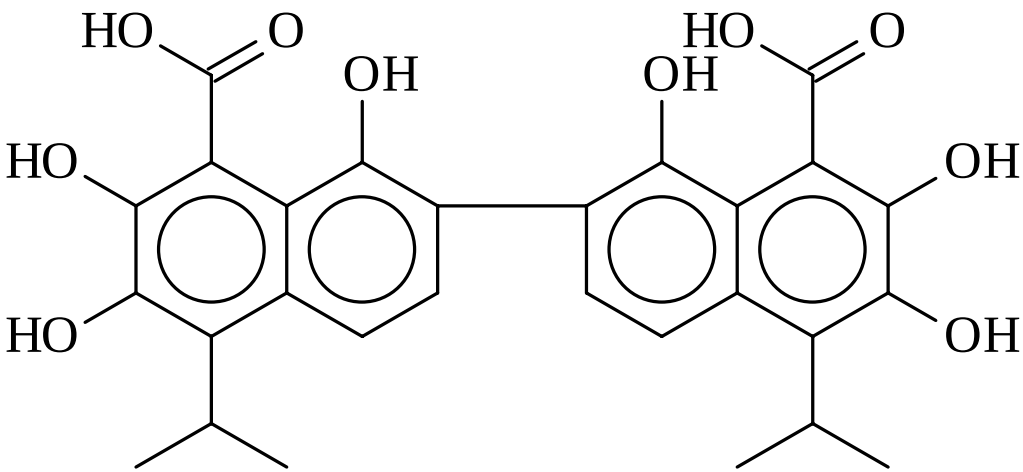
Metal-binding Compounds



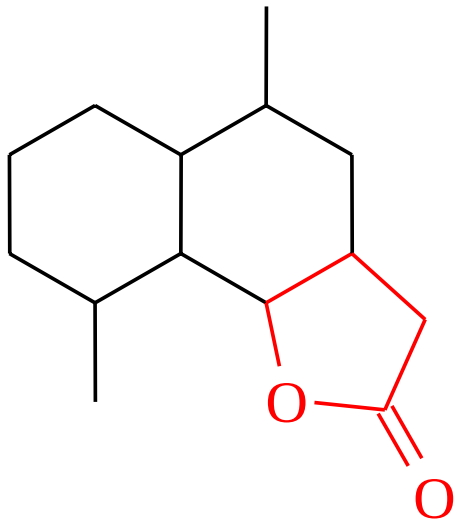
Phenolic compounds



Phenolic compounds



Sesquiterpene Lactones



B. Physiological Effects

hepatotoxins

neurotoxins

myotoxins

Identification of Plant Toxins

Identification of Plant Toxins

A. Need an appropriate biological assay for testing toxicity.

Identification of Plant Toxins

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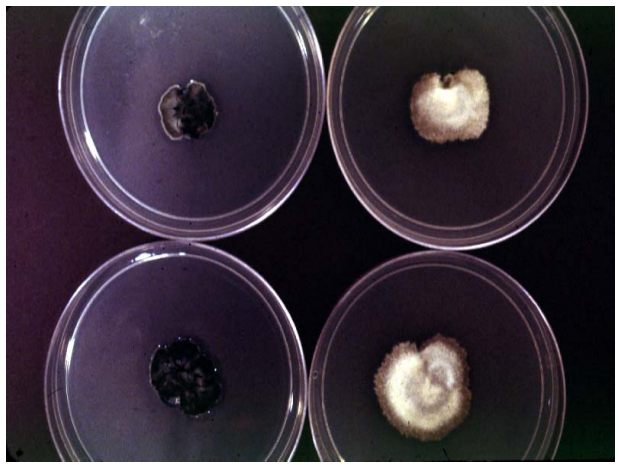
    1. Cell, enzyme, chemical based assay.



Identification of Plant Toxins

A. Need an appropriate biological assay for testing toxicity.

   1. Cell, enzyme, chemical based assay.

   2. Small Animal Assay (mouse, rat).

Identi Toxin

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2. say (

3. Large Animal Assay (sheep, cow).

B. Bioassay guided chemical fractionation.

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1. Chemical Extraction of Plant material.

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2. Test extracts or residue with appropriate bioassay.

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6. Assay of individual components.

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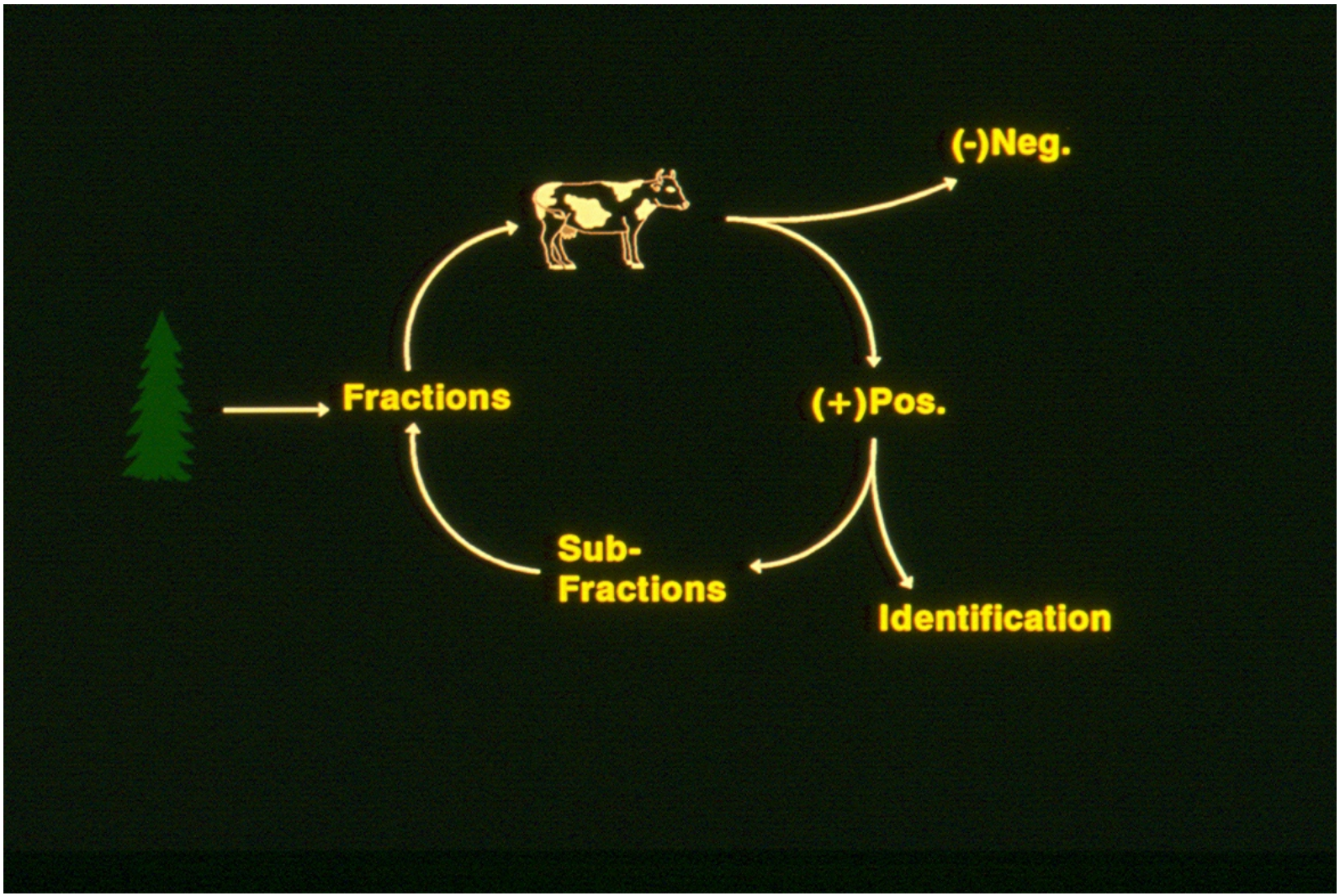
1. Chemical Extraction of Plant material.
2. Test extracts or residue with appropriate bioassay.
3. Continue fractionation of positive materials.
4. Assay new fractions.
5. Identification of chemical components in active fractions.
6. Assay of individual components.
7. Confirmation of toxic compound in large animal.

B. Bioassay guided chemical fractionation.



Analysis of Plant Toxins

Analysis of Plant Toxins

A. Plant Toxicity

Analysis of Plant Toxins

A. Plant Toxicity
   1. Concentration of toxin in the plant can be measured.

      % dry weight, mg/g, ppm, ppb

Analysis of Plant Toxins

A. Plant Toxicity and Toxic Dose.

1. Concentration of toxin in the plant can be measured.

2. Dose = Amount of plant material consumed

Analysis of Plant Toxins

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Analysis of Plant Toxins

A. Plant Toxicity and Toxic Dose.

1. Concentration of toxin in the plant can be measured.

2. Dose = Amount of plant material consumed

3. Toxic Dose = mg/kg of toxin required to induce the clinical signs of toxicity.

4. Plant poisonings occur when 1 +2 $\geq$ 3

B. Metabolic Fate of Toxins in Animal

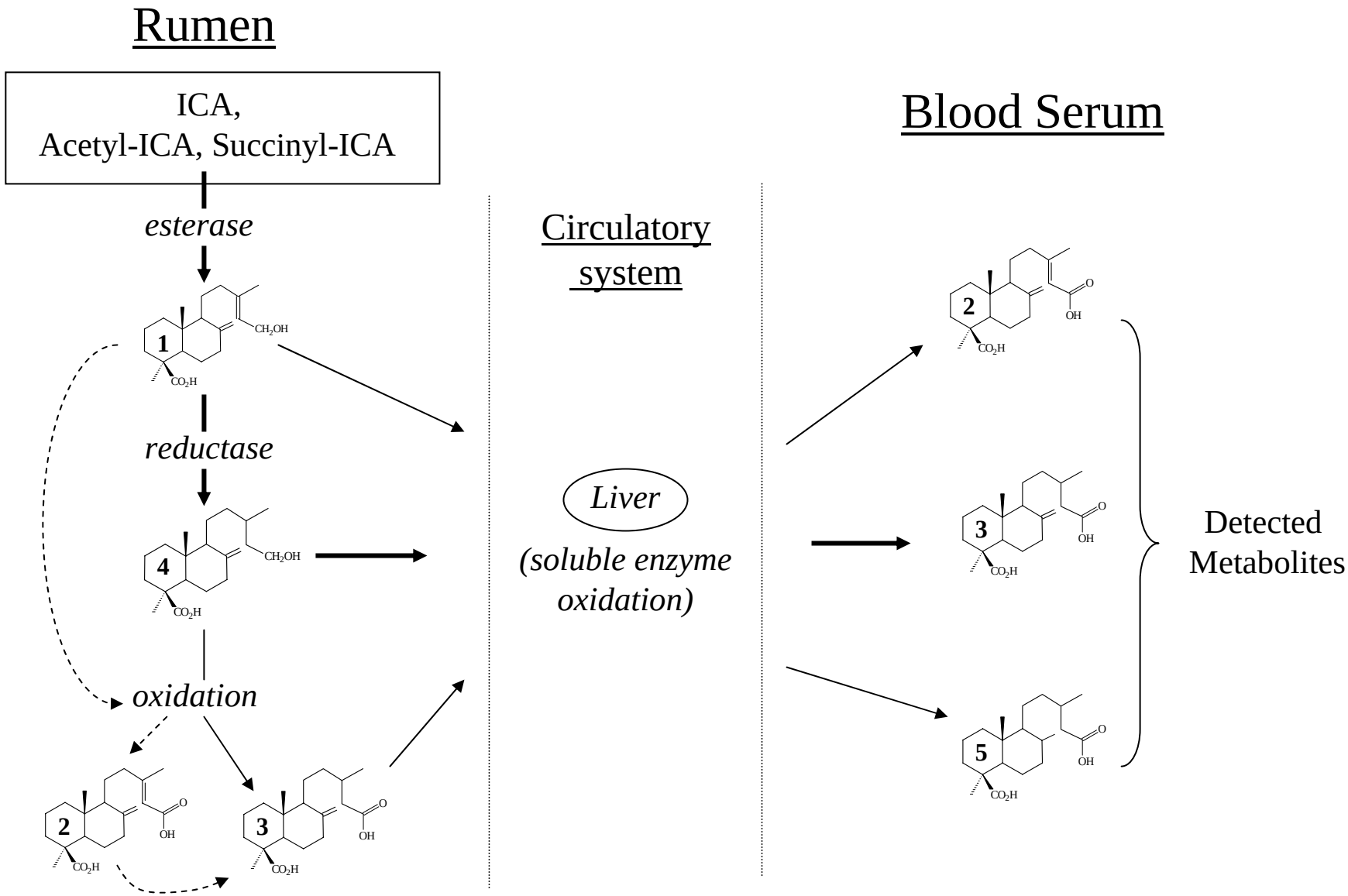
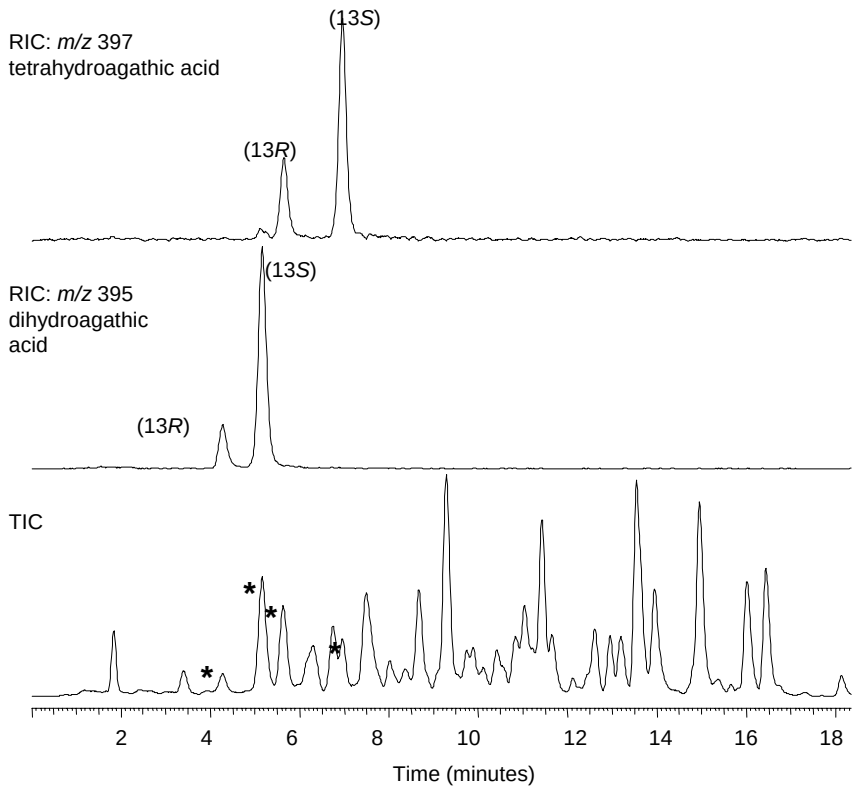


Figure 9. Summary of proposed metabolism of isocupressic acid after ingestion by cattle. ICA (**1**) isocupressic acid; (**2**) agathic acid; (**3**) dihydroagathic acid; (**4**) imbricatoloic acid; (**5**) tetrahydroagathic acid. Bold arrows indicate proposed major pathway. Dashed arrows indicate pathway as proposed by Lin et al. (1998) with ICA oxidized to **2** and then reduced to **3**.

B. Metabolic Fate of Toxins in Animal

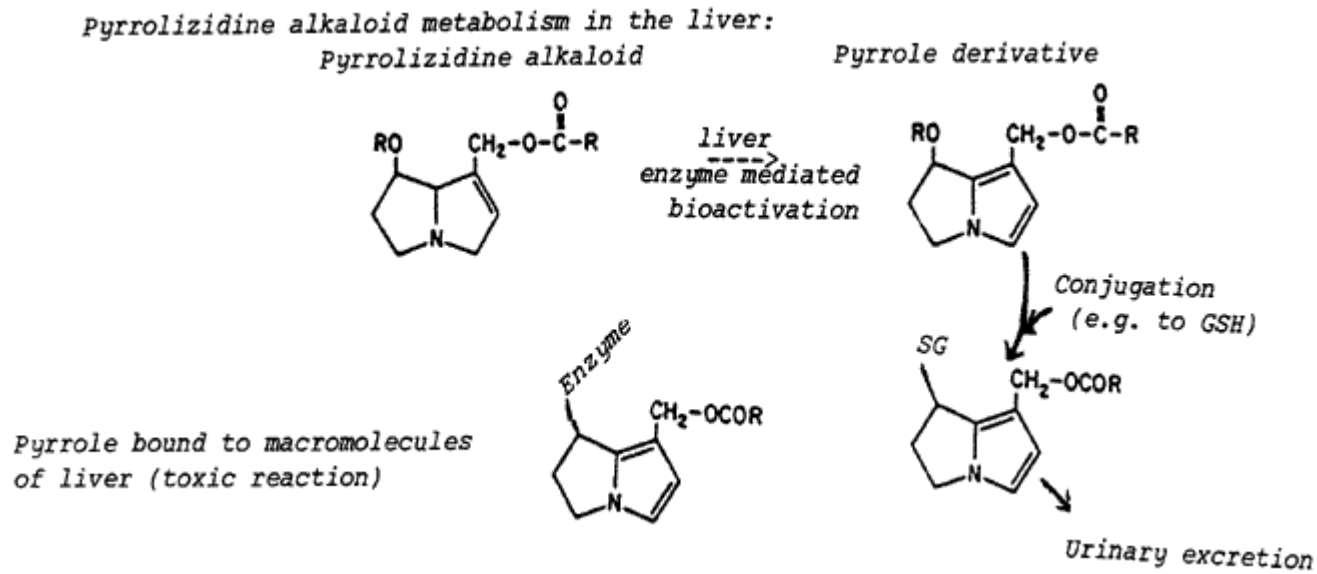
1. Target compounds for diagnostics.



B. Metabolic Fate of Toxins in Animal

1. Target compounds for diagnostics.

2. Mechanism of toxicity.



C. Diagnosis of Poisonous Plant Intoxications.

University of Idaho
Analytical Laboratory
Holm Center
Moscow, ID 83843
208-885-7081
FAX 208-885-8937

Dr. Dale Gardner
USDA-ARS Poisonous Plant Research Laboratory
1150 East 1400 North
Logan, UT 84321
Phone: 801.752.2941

Dr. Gardner: I am enclosing a blood sample and two samples of frozen rumen contents from a dead cow from the Rigby, ID area. Seven dead cows out of a group of 210 were found dead in a high mountain pasture, with heavy evidence of grazing death camas. Dr. Richard Old is identifying the species of death camas. I had emailed Bryan about the possibility of testing for zygacine in the rumen contents. This would make a nice teaching case for our students. So if you can, I would appreciate it, and please do not hesitate to send a bill (within my budget☺) to defray the cost. You can email or FAX the results; whatever is easier.

Thank you so much. I can try and provide you with any more information you think you might like, and I can always query the client again.

Very truly yours,

Patricia Talcott, MS,DVM,PhD,DABVT
Veterinary Toxicologist, Associate Professor
Phone: 208.885.6109
FAX: 208.885.8937
ptalcott@uidaho.edu

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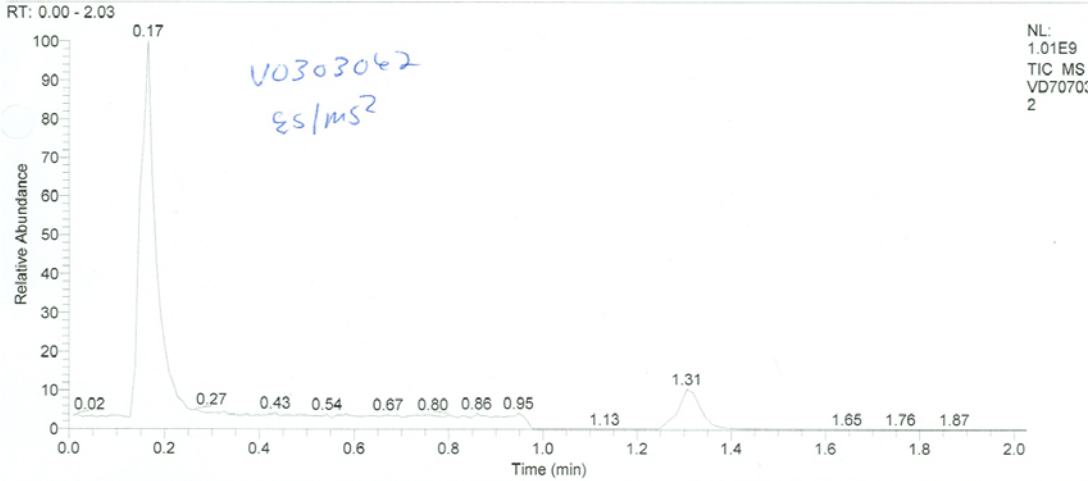

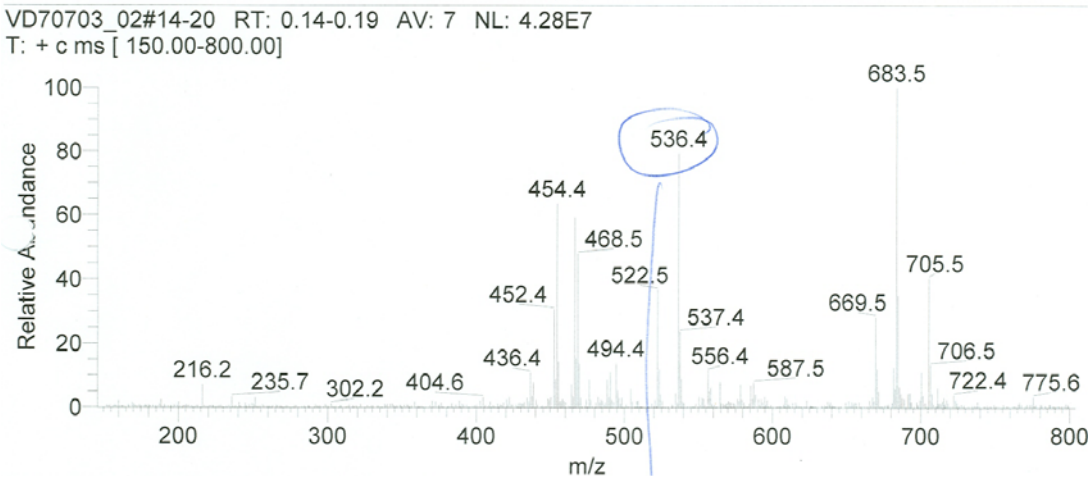

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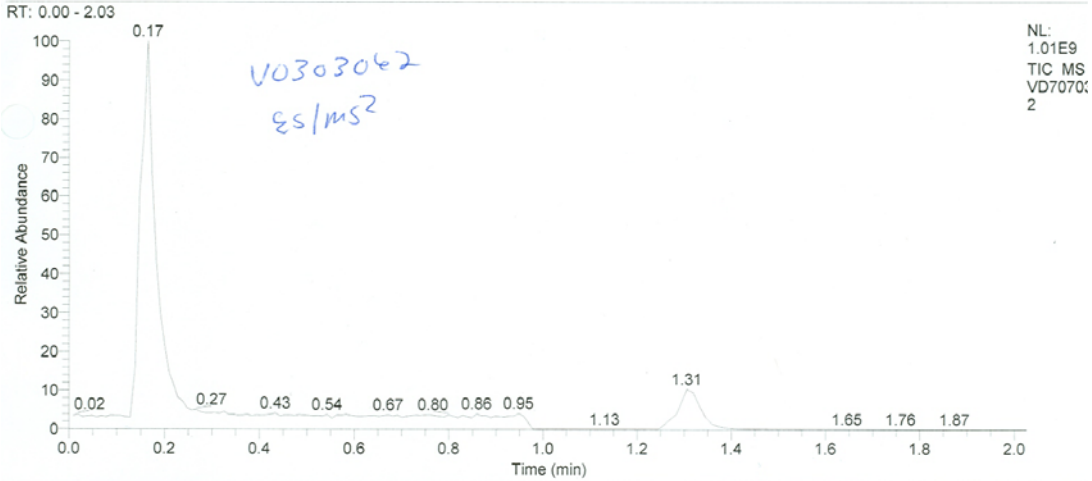
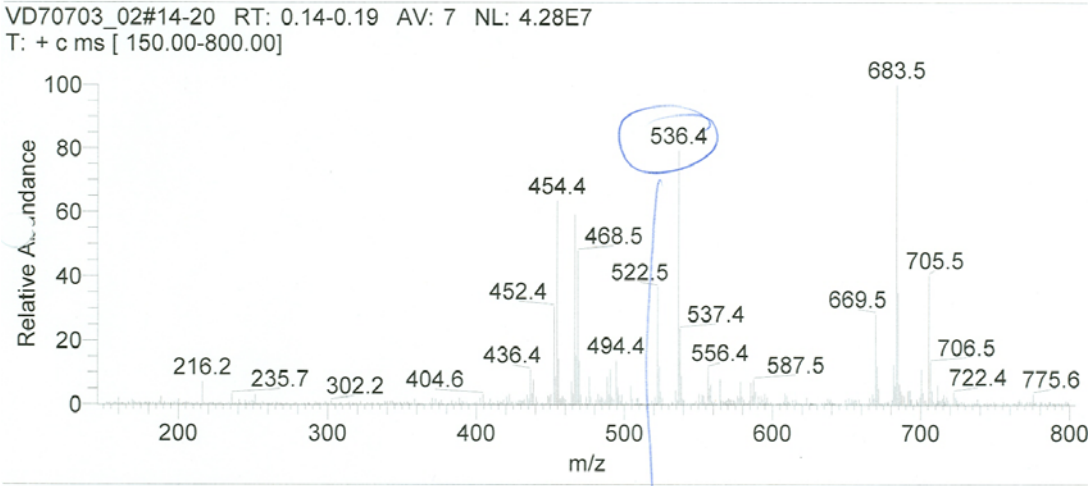
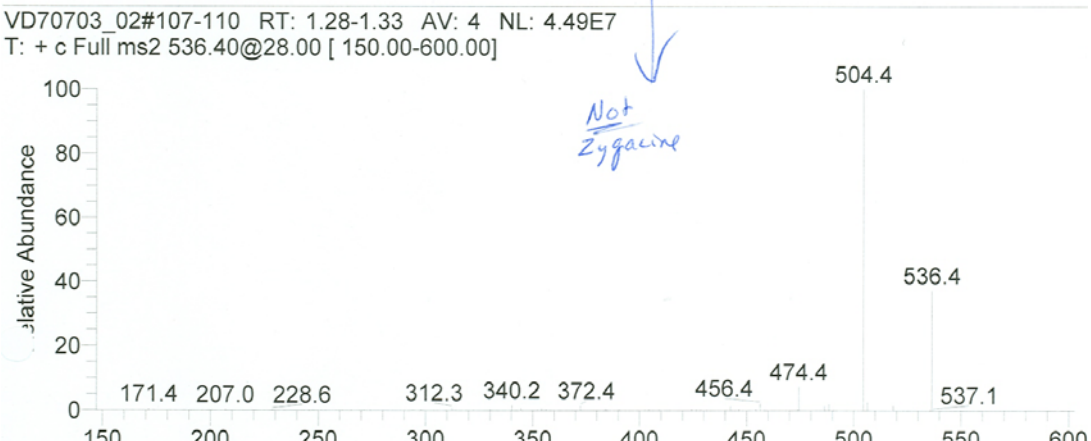
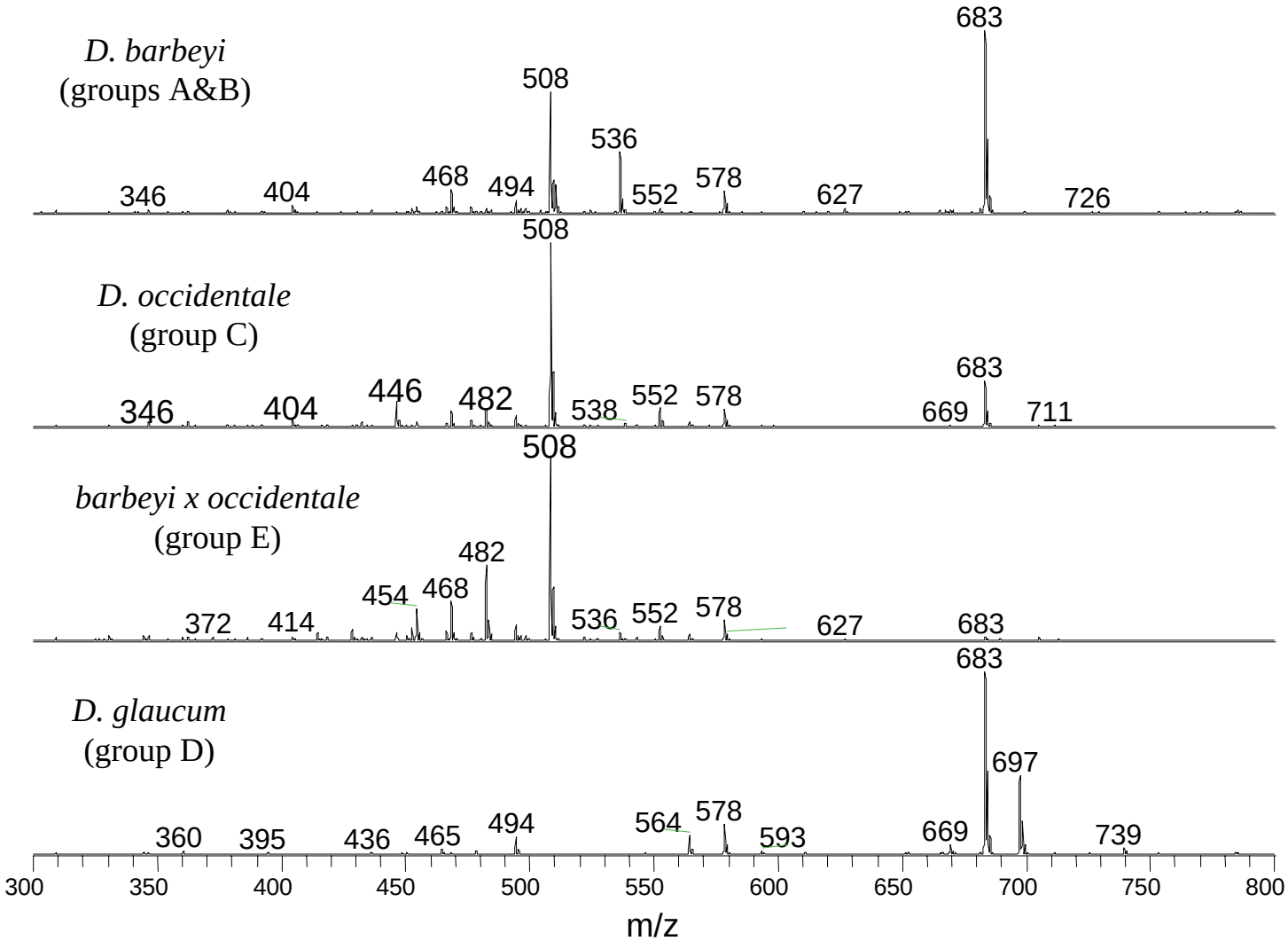






D. Plant Taxonomy = Chemotaxonomy.



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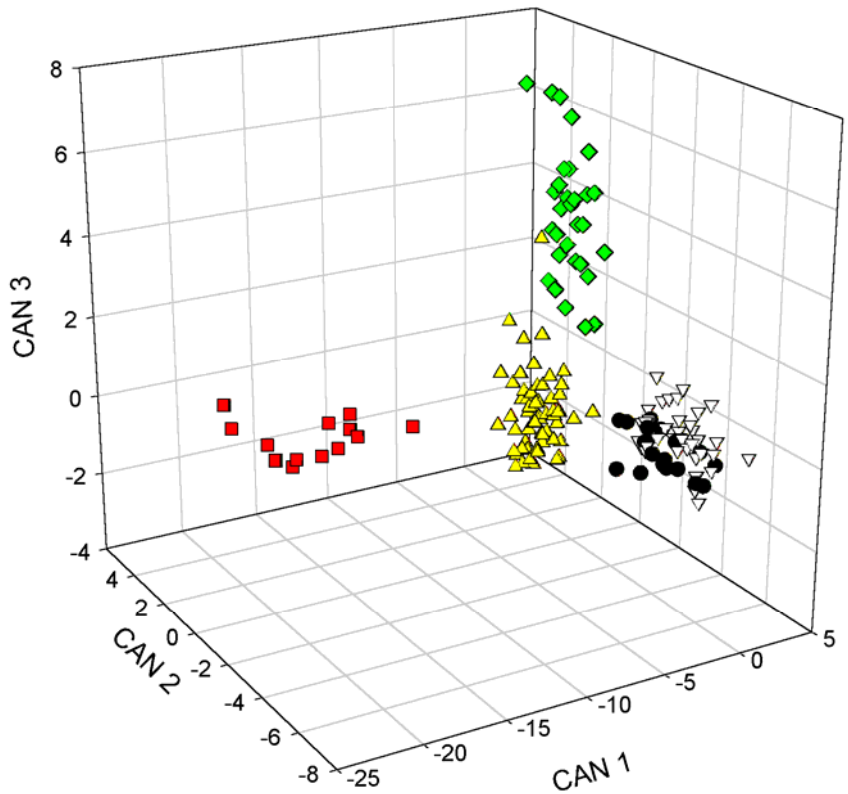
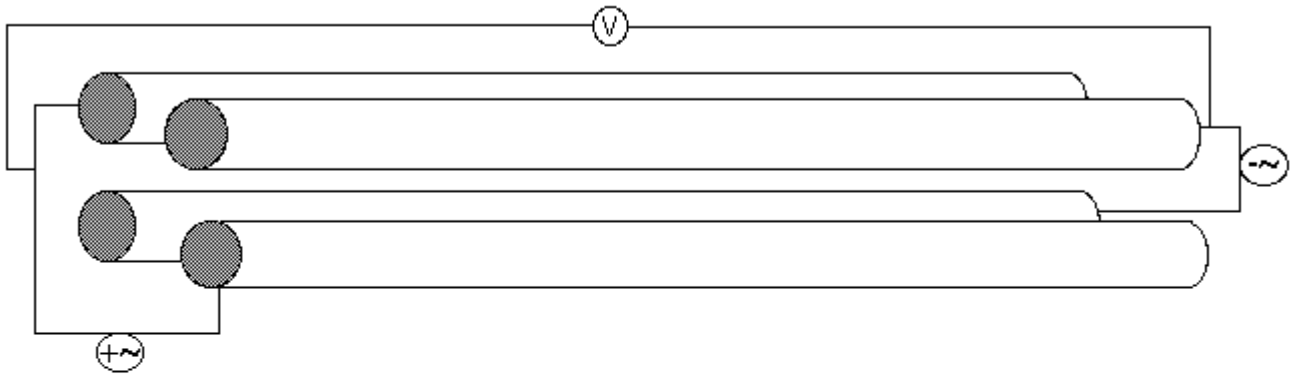


The Whys and Wherefores of Quadrupole Ion Trap Mass Spectrometry

The Whys and Wherefores of Quadrupole Mass Spectrometry

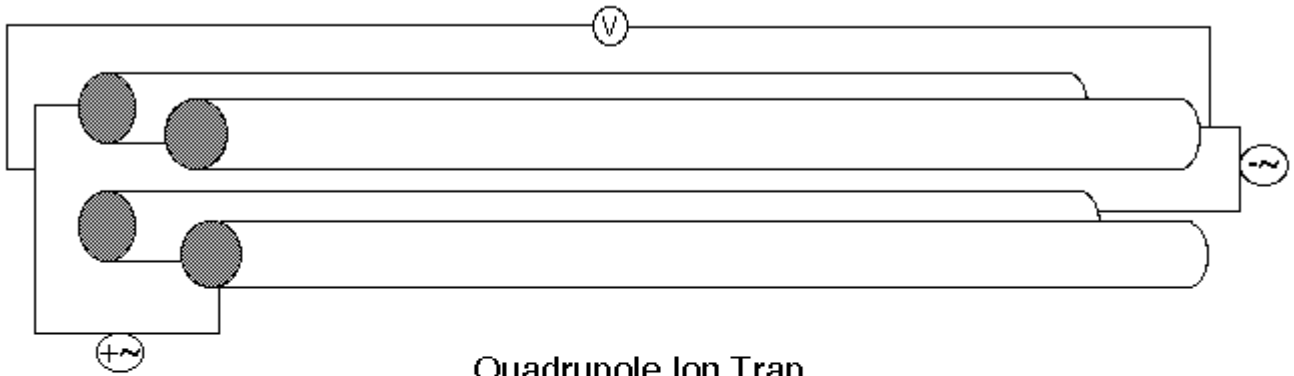
Quadrupole Mass Filter



ION SOURCE

DETECTOR

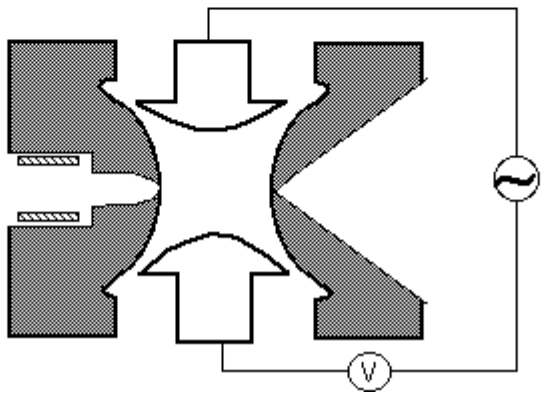
Quadrupole Mass Filter



ION SOURCE

DETECTOR

Quadrupole Ion Trap



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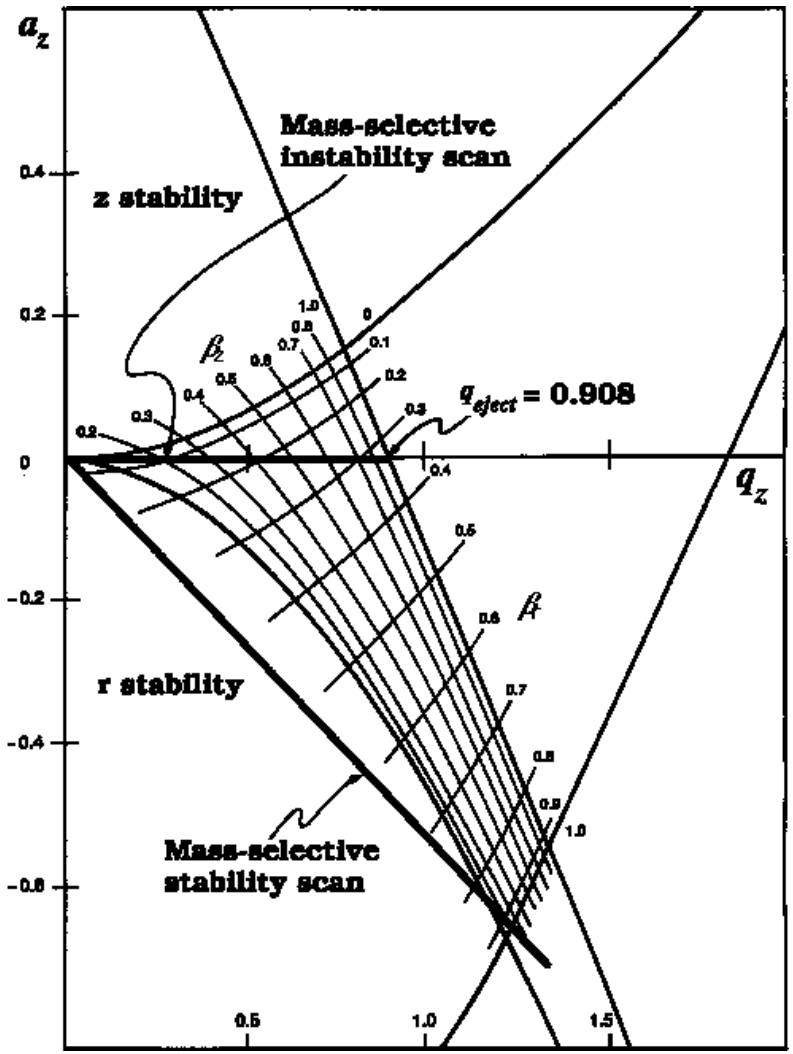
a_z
Mass-selective
instability scan
z stability
β_z
q_{eject} = 0.908
q_z
β_r
r stability
Mass-selective
stability scan
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0
-0.2
-0.4
-0.6
0.5
1.0
1.5