



IN VIVO

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**KENNETH WESSON AND EVAN BALABAN
TO PRESENT KEYNOTE ADDRESSES
AT 39TH ANNUAL MACUB CONFERENCE
HOSTED BY
KINGSBOROUGH COMMUNITY COLLEGE
SATURDAY, OCTOBER 28, 2006**



Kenneth Wesson “What Recent Brain Research Tells Us About Learning”

Dr. Ken Wesson, believes we should be sufficiently versed in the fundamentals of brain science. Applying contemporary neuroscientific research data, in many ways, will shape both the future of education and the future of humankind. Educators will determine the direction of the trajectory on which our species will travel a path towards cognitive and developmental advancement or a detour leading to extinction.

Dr. Evan Balaban “Brain Transplant for the Study of Species Behavioral Differences”



Dr. Balaban is an Associate Professor of Neuroscience at McGill University. His areas of research interest are behavioral neuroscience and cognition-language-perception. Dr. Balaban incubated fertilized quail and chicken eggs and cut tiny windows in their shells. Cells in the chicken embryo were removed and substituted with corresponding quail brain cells. After much trial and error he discovered that certain cells in the quail midbrain changed the animal's sound patterns, and other cells in the quail brain stem changed head movement during singing. His research was cited by *Discover Magazine* in 1998 in their coverage of Most Important Scientific Discoveries of the Year.

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Articles can be submitted electronically to invivo@mec.cuny.edu or mailed as a printed copy (preferably with a diskette that contains the file) to the Editorial Board at Medgar Evers College. All submissions should be formatted double spaced with 1 inch margins. The title of the article, the full names of each author, their academic affiliations and addresses, and the name of the person to whom correspondence should be sent must be given. As a rule, full length articles should include a brief abstract and be divided into the following sections: introduction, materials and methods, results, discussion, acknowledgments and references. Reviews and short communications can be arranged differently. References should be identified in the text by using numerical superscripts in consecutive order. In the reference section, references should be arranged in the order that they appeared in the text using the following format: last name, initials., year of publication. title of article, journal volume number: page numbers. (eg. - ¹Hassan, M. and V. Herbert, 2000. Colon Cancer. *In Vivo* **32**: 3 - 8). For books the order should be last name, initial, year of publication, title of book in italics, publisher and city, and page number referred to. (eg. - Prosser, C.L., 1973. *Comparative Animal Physiology*, Saunders Co., Philadelphia, p 59.). Abbreviations and technical jargon should be avoided. Tables and figures should be submitted on separate pages with the desired locations in the text indicated in the margins.

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The Vascular Flora of Voyageurs National Park, Minnesota

by

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ABSTRACT

The vascular flora of Voyageurs National Park, Minnesota consisted of 749 species within 317 genera and 107 families. The major families were the Cyperaceae, Poaceae and Asteraceae with 77, 72 and 61 species respectively. The largest genus was *Carex* (52 species). Eighteen species were new to Minnesota. Sixty-two non-native species, 8.3% of the flora, were a minor component of the natural vegetation. *Lythrum salicaria* was the most problematic non-native species.

Key words: flora, distribution, biodiversity, Voyageurs National Park, Minnesota.

INTRODUCTION

Voyageurs National Park, 48° 34' N Latitude, 93° 23' W Longitude, is located in north-central Minnesota bordering Canada. The park, encompassing 218,054 acres (88,442 hectares) was established April 8, 1975. One hundred thirty four thousand two hundred sixty-five acres (54,336 ha) are terrestrial and 83,789 acres (33,909 ha) are lacustrine. A portion of Rainy Lake, covering 35,142 acres (14,222 ha), is the largest lake in the park.

Voyageurs National Park has a continental climate. Winters are cold and long; below zero (F) temperatures have been recorded from November to April. Mean temperature for January, the coldest month, is 1.0° F (-17.2°C). July, the warmest month, has a mean temperature of 66.7° F (19.3 °C). Annual average precipitation is 24.36 inches (618mm). Most of the precipitation occurs during the short growing season. June is the wettest month with 3.93 inches (99.8mm) of rain while February is the driest month averaging 0.63 inches (16.0 mm). Detailed climatological data for the nearest city, International Falls, Minnesota, can be found in Anonymous¹.

Four major bedrock formations are present: Ely greenstone, biotite schist belt, gneiss contact zone and the vermilion batholith². Rocks of the Canadian Shield are mixed with glacial drift, lacustrine deposits and closed, poorly drained bog

areas. Glacial ice advances during the Pleistocene and interactions between the four major bedrock formations have resulted in the present topography. After the retreat of the Wisconsin glacier, portions of the park were submerged under glacial Lake Agassiz. The present lakes, Rainy Lake and several smaller lakes, are remnants of Lake Agassiz³.

Soils in the area are immature podzol soils approximately 10,000 years old. Canadian Shield rocks mix with glacial drift and lacustrine deposits. Immature soils are found in poorly drained bog areas. Fenneman⁴ describes three major soil types: silt to clay lacustrine deposits from the west, calcareous glacial till from the south, and noncalcareous glacial till from the east. Generally, rocky shallow soils occupy upland sites while deep, organic lowland soils occupy lowland sites. Small changes in relief result in profound changes in soils, with a concomitant change in vegetation.

The setting for the vegetation at Voyageurs National Park is a product of glaciation³. Maycock and Curtis⁵ classify the vegetation as conifer-hardwood forests dominated by trembling aspen, *Populus tremuloides*, paper birch, *Betula papyrifera*, and jack pine, *Pinus banksiana*. White pine, *Pinus strobus*, red pine, *Pinus resinosa* are also common along with spruce-fir, *Picea spp.* and *Abies balsamea*, or mixtures of the aforementioned vegetation.

Braun⁶ classifies the vegetation at Voyageurs as part of the Minnesota Section of the Hemlock-White Pine-Northern Hardwoods Region. Gleason and Cronquist⁷ place the vegetation in the Northern Conifer Province while Kuchler⁸ classifies the vegetation in the Great Lakes as Spruce-Fir and Pine Forests. The Society of American Foresters classifies the vegetation as the Northern Conifer Province. For additional information see Merriam *et al.*², Maycock and Curtis⁵ and Marschner⁹.

The first of several floristic inventories of Voyageurs National Park was conducted by Kurmis *et al.*¹⁰ who prepared vouchered lists of the park's vascular plants for the National Park Service. The Kurmis *et al.*¹⁰ vouchers are housed at the Department of Biology and Olga Lakela Herbarium, University of Minnesota, Duluth. Kurmis *et al.*¹¹ described the plant communities of the park and summarized the floristic information in the earlier 1978 publication. Monson^{12,13} collected plants at the park in the 1980's and identified 302 species. Monson's study was the most complete voucher-documented vascular flora of Voyageurs National Park. These plants are housed at the Voyageurs National Park Herbarium and duplicates are at the Department of Biology and Olga Lakela Herbarium, University of Minnesota, Duluth. Meeker and Wilcox¹⁴ compared aquatic communities in regulated and non-regulated lakes, Voyageurs National Park and Boundary Waters Canoe Area, Minnesota. Plants collected in this study are at the Olga Lakela Herbarium. Lammie¹⁵ prepared a list of the vascular flora of Voyageurs National Park based on the work of Dr. James Quinn, University of California, and Davis. The species list generated by Lammie¹⁵ was part of a larger study initiated by Davis to develop databases at many National Parks Units (Schaberl, 1998 pers. comm.). Jakala¹⁶ identified vascular plants in quadrats in a study of the effects of fire on vegetation at selected plots at Voyageurs National Park, though no voucher specimens were prepared. Bennett¹⁷ developed a checklist of 778 vascular plants from Voyageurs National Park based on vouchered and unvouchered plant lists of the previous investigators. Bennett¹⁷ did not address the problem of synonymous names; accordingly the total number of plants on the Bennett list is greater than the actual number of vascular plants that occur in the park. Michael Smith and Deborah Pomroy-Petry, The Nature Conservancy (TNC), collected plants during the 1997 growing season for the NPS/BRD Vegetation Mapping Program for

Voyageurs. Their list contains 185 vascular plants including eight new species for Voyageurs.

Plant sampling in the present study was concentrated at disturbed sites and habitats with the potential to harbor non-native plants. Species within the Caryophyllaceae, Chenopodiaceae, Cyperaceae, Orchidaceae, Poaceae, Polygonaceae and Polypodiophyta were collected and sent to experts for identification.

The nomenclature of many plants collected by previous investigators in the park is confused. To correct the problem of synonymous names Kartesz¹⁸ was used as the primary reference for plant nomenclature.

The primary objective of this study is an inventory to the vascular flora of Voyageurs National Park following the most recent nomenclature of Kartesz¹⁸. Pertinent synonyms for park plants collected by previous investigators are given for all taxa.

Methods

Four collecting trips were made to the study area in August 1994, June 1995, August 1995 and May 1996. Objectives for each trip included the collection of voucher specimens and accumulation of information on abundance and apparent habitat preference for each species. More than 500 specimens collected by the senior author and plant lists generated by the aforementioned investigators form the basis for this study. Taxonomically problematic specimens were sent to various experts for annotation; experts consulted include Ihsan Al-Shehbaz (Brassicaceae), Robert Meyer (Poaceae), Richard Mitchell (Polygonaceae), Jim Montgomery (Polypodiophyta), Richard Rabeler (Caryophyceae), Charles Sheviak (Orchidaceae) and Gordon Tucker (Cyperaceae). Voucher specimens collected in the present study are deposited at the herbarium at Voyageurs Park, International Falls, Minnesota, and partial duplicate sets have been deposited in the herbaria of Brooklyn Botanic Garden (BKL), University of Michigan (MICH), Missouri Botanical Garden (MO), New York State Museum (NYS), and Jim Montgomery's private herbarium (MONT). Accession numbers will be assigned by the National Park Service to the primary set of specimens at the herbarium in International Falls and will be available upon request from the National Park Service.

The annotated checklist contains an inventory of the vascular plants that reproduce

spontaneously and persist for more than one year without cultivation, including native taxa, naturalized and adventive weeds, and escapes from cultivation. In the checklist plants are arranged first by division, and then alphabetically by family, genus and species. Each taxon collected by us includes the following information sequence: scientific name; pertinent synonym, enclosed in brackets; habitat; frequency relative to the habitat, using the categories: rare (scarce, fewer than 5 populations), infrequent (uncommon, occasional, 5 to 20 populations), frequent (common, more than 20 populations). Estimates of species frequency are based upon our personal observations. Published reports by earlier investigators of the species not collected by us have been included in the checklist; in these cases we have not examined the original voucher specimens. Indication of species rarity across all of Minnesota is based upon the Minnesota Natural Heritage Program (indicated in the checklist as MNHP) list of rare plant species¹⁹.

Nomenclature primarily follows Kartesz¹⁸. Synonyms are generally plant names in Gleason and Cronquist²⁰ which follow the names given by Kartesz¹⁸ enclosed in brackets. Native and non-native status of species was determined according to Gleason and Cronquist. Non-native species in the appendix are preceded by an asterisk.

Results and Discussion

The vascular flora of Voyageurs National Park consisted of 749 species within 317 genera and 107 families. Sixty-two species or 8.3 percent of the flora were not native to the region (Table 1). Ten monocots, 3.9 percent of the 254 monocot species were not native while 52 dicots, 11.8 percent of the 439 dicots, were of extra-regional origin.

The major families of the flora were the Cyperaceae (77 species), Poaceae (72 species) and Asteraceae (61 species). Twenty eight percent of the flora were contained in these three

families. Other large families were the Rosaceae (47 species), Ranunculaceae (24 species), Polygonaceae (23 species) and Juncaceae (16 species). The largest genus was *Carex* (52 species) followed by *Polygonum* and *Potamogeton* (each with 16 species). Other genera with a large number of species were *Juncus* and *Salix* (each with 13 species), *Rubus* (12 species) and *Ranunculus* (11 species), *Poa* and *Scirpus* (each with 9 species), and *Dichanthelium* and *Ribes* (each with 8 species).

Non-native species were insignificant in the flora (Table 1,2). They occurred principally along the edges of roads and trails and lawns. Families with five or more non-native species were the Polygonaceae, Caryophyllaceae, Fabaceae, Asteraceae, and Poaceae. All five *Trifolium* species were non-native. The introduction of seventeen non-native species of grasses (Poaceae) is noteworthy in the flora. *Lythrum salicaria* was the most aggressive non-native species. The Resource Management Staff at Voyageurs has initiated an eradication program to remove this species from the park.

Eighteen species at Voyageurs may be new to Minnesota²¹. New state records include five ferns: *Gymnocarpium disjunctum*, *Dryopteris phegopteris*, *Thelypteris palustris* var. *pubescens*, *Phegopteris connectalis*, *Thelypteris palustris*; nine dicots: *Crataegus dodgei*, *Rosa palustris*, *Toxicodendron radicans*, *Betula lutea*, *Arabis nuttallii*, *Cardamine oligosperma*, *Triadenum virginicum*, *Pyrola americana*, *Ranunculus septentrionalis*; and four monocots: *Juncus alpinus*, *Luzula campestris*, *Setaria pumila* and *Zizania aquatica*. It is quite possible that some of these taxa have been misidentified. Old field records list *Toxicodendron radicans* from the park; the only *Toxicodendron* listed for the state is *T. rydbergii*.

Ten species were on the state threatened or special concern list. Dicot species were: *Arenaria laterifolia*, *Crassula aquatica*, *Littorella uniflora*, *Ranunculus lapponicus*, and *Subularia aquatica*. Monocots included: *Agrostis geminata*,

Table 1. A summary of the vascular flora of Voyageur's National Park, Minnesota.

	Fern Allies	Ferns	Gymnosperms	Dicots	Monocots	Total
Families	4	6	3	75	19	107
Genera	5	14	7	205	86	317
Species	21	24	11	439	254	749
Native Species	21	24	11	387	244	687
Introduced Species	0	0	0	52	10	62

* Native and introduced taxa that reproduce spontaneously.

Table 2. Selected features of soil landscape units within the Tower-Ely Glacial Drift and Bedrock Complex geomorphic area Erickson *et al.*²². Approximate fertility in the rooting zone and representative soil series can be found in pages 18 and 19 of the Erickson *et al.*²² reference.

Most common texture and thickness (feet)		Moisture relationships			Approximate fertility in rooting zone		
Soil Landscape Unit	Landscape Position	Rooting Zone	Substratum	Inches of available water to 5 feet	Drainage class	pH	Representative Soil Series
RWL	Shallow drift over bedrock, rolling to steep	Gravelly sandy loam, cobbly sandy loam, and gravelly loamy sand (0-2)	Bedrock, cobbly sandy loam and gravelly sandy loam (2+)	<8	Well to excessively drained	5.0-6.0	Mesaba Conic, Barto Insula Quetico Newfound
NP	Low lying depressions	Peat (1-3)	Peat (3+)	>12	Very poorly drained	5.5-7.0	Mooselake Unnamed
R	Bedrock and very shallow drift over bedrock, steep	Gravelly sandy loam, gravelly loamy sand and bedrock	Bedrock and gravelly sandy loam (2+)	<4	Well to excessively drained	5.0-6.0	Quetico Insular Barto
AP	Low lying depressions	Peat (1-3)	Peat (3+)	>12	Very poorly drained	<5.5	Greenwood Unnamed
CCWL	Gently sloping to rolling upland valleys	Silty clay (3)	Clay (3-20+)	8-12	Moderately well drained	5.2-6.2	Taylor Indus
CCPL	Nearly level upland valleys	Silty clay (3)	Clay (3-20+)	8-12	Poorly drained	5.2-6.2	Indus
P	Low lying depressions	Peat (1-3)	Peat (3+)	>12	Very poorly drained	<7.0	Mooselake Greenwood Beseman

Allium cernuum, *Deschampsia cespitosa*, *Poa paludigena*, and *Pucinellia palida*.

Two questionable species are included in the Voyageur flora. The first, *Anenome americana*, Accession Number 462968, University of Minnesota Herbarium, may be an invalid species as it is not listed in Gleason and Cronquist⁷ or Kartesz¹⁸. A second species, *Toxicodendron radicans* is most likely *T. rydbergii*; no specimen of *T. radicans* at Voyageurs National Park is listed in the University of Minnesota Herbarium.

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Annotated Checklist of Species Voyageurs National Park, Minnesota

The vascular plant taxa have been arranged according to the following categories: vascular cryptograms, gymnosperms, dicots and monocots. Within each category, families and lower taxa are arranged alphabetically. Nomenclature primarily follows Kartesz (1994). Synonyms usually follow Gleason and Cronquist (1991). An asterisk precedes non-native plants.

LYCOPODIOPHYTA

LYCOPODIACEAE

- Huperzia lucidula* (Michx.) Trevisan [*Lycopodium lucidulum* Michx.]
Huperzia selago (L.) Bernh. ex Mart. & Schrank
Lycopodiella inundata (L.) Holub [*Lycopodium inundatum* L.]
Lycopodium annotinum L. woods; infr.
Lycopodium clavatum L. woods; infr.
Lycopodium complanatum L. woods; freq.
Lycopodium dendroideum Michx.
Lycopodium obscurum L. moist woods; freq.

SELAGINELLACEAE

- Selaginella rupestris* L. Spring rocky dry soil; infr.

ISOETACEAE

- Isoetes echinospora* Durieu. shallow bays in Rainy Lake; freq.
Isoetes lacustris L.
Isoetes macrospora Durieu. ponds, shallow lake margins; freq.

EQUISETACEAE

- Equisetum arvense* L. woods; freq.
Equisetum fluviatile L. wet meadows and roadside; freq.
Equisetum hyemale L.
Equisetum x machailii (Newm.) Brichan
Equisetum palustre L.
Equisetum pratense Ehrh.
Equisetum scirpoides Michx
Equisetum sylvaticum L. moist woods; freq.
Equisetum variegatum Schleich. ex F. Weber & D. M. H. Mohr

POLYPODIOPHYTA

OPHIOGLOSSACEAE

- Botrychium dissectum* Spreng. moist woods; infr.
Botrychium multifidum (Gmel.) Trev.
Botrychium virginianum (L.) Sw. moist woods; infr.

DRYOPTERIDACEAE

- Athyrium americanum* (Butters) Maxon.
Athyrium felix-femina (L.) Roth ssp. *angustum* (Vill.) H. P. Fuchs [*Athyrium angustum* (Willd.) K. Presl.] moist woods; freq.
Cystopteris fragilis (L.) Bernh.
Dryopteris cristata (L.) Gray.
Dryopteris carthusiana (Vill.) H. P. Fuchs [*Dryopteris spinulosa* (O. F. Muell.) Watt.]
Dryopteris fragrans (L.) Schott
Gymnocarpium disjunctum (Rupr.) Ching [*Dryopteris disjuncta* (Rupr.) Morton]
Gymnocarpium dryopteris (L.) Newman woods; infr.

- Gymnocarpium jessoense* (Koidzumi) Koidzumi
Phegopteris connectilis (Michx.) Watt [*Dryopteris phegopteris* (L.) Chistens.;

- Thelypteris phegopteris* (L.) Slosson] moist rock faces, islands Rainy Lake; infr.
Thelypteris palustris Schott. roadside ditches; open wet woods; infr.
Thelypteris palustris var. *pubescens* (Lawson) Fern. [*Dryopteris thelypteris* auct. non (L.) SW.]
Woodsia x abbeae Butters
Woodsia ilvensis (L.) R. Br. moist woods; infr.
Woodsia obtusa (Spreng.) Torr. moist rock faces; infr.
Woodsia oregana D. C. Eat.

DENNSTAEDTIACEAE

- Pteridium aquilinum* (L.) Kuhn. dry open woods; infr.

OSMUNDACEAE

- Osmunda cinnamomea* L. moist woods; freq.
Osmunda claytoniana (L.) moist woods; freq.

ONOCLEACEAE

- Matteuccia struthiopteris* (L.) Todaro moist woods; freq.
Onoclea sensibilis L. moist woods; freq.

POLYPODIACEAE

- Polypodium virginianum* L. on rocks in woods; freq.

PINOPHYTA

CUPRESSACEAE

- Juniperis communis* L. var. *depressa* Pursh, dry woods, and on islands; freq.
Juniperis horizontalis Moench
Thuja occidentalis L. bogs and moist woods; freq.

PINACEAE

- Abies balsamea* (L.) P. Mill. successional moist woods; freq.
Larix laricina (Du Roi) K. Koch. bogs, wet woods; freq.
Picea glauca (Moench) Voss.
Picea mariana (P. Mill) B. S. P. bogs, wet woods; freq.
Pinus banksiana Lamb. dry woods; freq.
Pinus resinosa Soland. dry woods; freq.
Pinus strobus L. dry or rich woods; freq.

TAXACEAE

- Taxus canadensis* Marsh. moist woods; freq.

MAGNOLIOPHYTA

MAGNOLIOPSIDA (DICOTS)

ACERACEAE

- Acer negundo* L.

Acer rubrum L. wet woods; freq.
Acer saccharinum L. rich woods; infr.
Acer spicatum Lam. moist woods; freq.

AMARANTHACEAE

Amaranthus retroflexus L.

ANACARDIACEAE

Rhus glabra L. fields and roadsides; freq.
Rhus hirta (L.) Sadworth [*Rhus typhina* (L.) TNC]
Toxicodendron radicans (L.) Kuntze [*Rhus radicans* L.] woods,
fields; freq.
Toxicodendron rydbergii (Small ex Rydb.) Erskine

APIACEAE

Cicuta bulbifera L. wet roadsides, lake margins; freq.
Cicuta maculata L.
Heracleum maximum Bartr. [*Heracleum lanatum* Michx.]
Osmorhiza claytonii (Michx.) C. B. Clarke. moist woods;
infr.
Osmorhiza longistylis (Torr.) DC.
Sanicula marilandica L. rich woods; freq.
Sium suave Walter wet roadsides and lake margins; infr.
Zizia aptera (Gray) Fern.
Zizia aurea (L.) W. D. J. Koch

APOCYNACEAE

Apocynum androsaemifolium L. roadsides and fields; freq.
Apocynum cannabinum L. [*Apocynum sibiricum* Jacq.]

AQUIFOLIACEAE

Ilex verticillata (L.) Gray

ARALIACEAE

Aralia hispida Vent. dry woods; freq.
Aralia nudicaulis L. rich woods; freq.
Aralia racemosa L.

ARISTOLOCACEAE

Asarum canadense L.

ASCLEPIADACEAE

Asclepias incarnata L.
Asclepias syriaca L.

ASTERACEAE

Achillea millefolium L. fields and roadsides; freq.
Achillea millefolium var. *occidentalis* DC. [*Achillea lanulosa*
Nutt.]
Ambrosia artemisiifolia L.
Ambrosia psilostachya DC. [*Ambrosia cumanensis* auct.
non Kunth]
Anaphalis margaritacea (L.) Benth. & Hook f.
Antennaria howellii ssp. *canadensis* (Greene) Bayer.
[*Antennaria canadensis* Greene]
Antennaria neglecta Greene open woods, roadsides; infr.
Antennaria plantaginifolia (L.) Richards *Articum minus*
Bernh.
Aster borealis (Torr. & Gray) Prov. [*Aster junciformis* Rydb.]
Aster ciliolatus Lindl. woods and clearings; infr.
Aster ericoides L.
Aster lanceolatus Willd.
Aster lanceolatus ssp. *hesperius* (Gray) Semple &
Chmielewski [*Aster hesperius* Gray]
Aster lanceolatus Willd. var. *lanceolatus* [*Aster simplex*
Willd.] moist woods, lake margins; freq.
Aster lateriflorus (L.) Britt. dry open woods; islands; freq. *Aster*
macrophyllus L. woodlands; freq.
Aster puniceus L. wet roadsides, moist woods; freq.

Aster umbellatus P. Mill
Aster umbellatus P. Mill var. *pubens* Gray [*Aster pubenitior*
Cronq.] moist woods; infr.

Aster undulatus L.

Bidens cernua L. moist lake shores; infr.

Bidens connota Muhl. ex Willd.

Bidens frondosa L. moist lake shores and wet roadsides; freq.

Bidens tripartita L. moist lake shores and wet roadsides;
freq.

**Cirsium arvense* (L.) Scop. Fields; freq.

Cirsium muticum Michx.

**Cirsium vulgare* (Savi) Ten.

Conyza canadensis (L.) Cronq. roadsides, disturbed sites; infr.

**Leucanthemum vulgare* Lam. [*Chrysanthemum*
leucanthemum L.]

Erigeron glabellus Nutt.

Erigeron philadelphicus L. disturbed sites; infr.

Erigeron strigosus Muhl. disturbed sites; infr.

Eupatorium maculatum L.

Eupatorium perfoliatum L. moist roadsides; freq. *Eupatorium*
purpureum L.

Euthamia graminifolia (L.) Nutt. [*Solidago graminifolia* (L.)
Nutt.] fields and roadsides; freq.

**Gainsoga quadriradiata* Ruiz & Pavon [*Galinsoga ciliata* (Raf.)
Blake]

Hieracium scabrum Michx. fields, lawns, roadsides; freq.

Helianthus giganteus L.

Helianthus kalmii L.

Helianthus grosseserratus Martens

Hieracium canadense Michx. fields, lawns, roadsides; freq.

Hieracium umbellatum L.

Lactuca biennis (Moench) Fern. disturbed sites; infr. *Lactuca*
canadensis L.

Lactuca ludoviciana (Nutt.) Riddell

Matricaria discoidea DC. [*Chamomilla suaveolens* (Pursh)
Rydb.]

**Matricaria matricarioides* (Less.) Porter roadsides; rare.

Megalodonta beckii (Torr. ex Spreng.) Green [*Bidens beckii*
Torr.] moist lake shores; infr.

Petasites frigidus (L.) Fries [*Petasites palmatus* (Alt.) Gray]
moist woods; freq.

Petasites sagittatus (Banks ex Pursh) Gray moist woods, wet
roadsides; freq.

Prenanthes alba L. woods and roadsides; infr.

Rudbeckia hirta L.

Senecio aureus L. moist woods; infr.

Senecio pauperculus Michx. moist woods, fields and
roadsides; freq.

Solidago canadensis L.

Solidago gigantea Ait. fields and roadsides; freq.

Solidago hispida Muhl. ex Willd. fields and open woods;
freq.

Solidago missouriensis Nutt.

Solidago nemoralis Alt. dry roadsides and fields; freq.

Solidago uliginosa Nutt.

**Sonchus arvensis* L. disturbed sites; infr.

**Tanacetum vulgare* L.

**Taraxacum officinale* G. H. Weber ex Wiggers lawns,
roadsides; freq.

BALSAMINACEAE

Impatiens capensis Meerb. [*Impatiens biflora* Walt.] moist
lakesides and roadsides; freq.

BERBERIDACEAE

Podophyllum peltatum L.

BETULACEAE

Alnus incana ssp. *rugosa* (Du Roi) Clausen [*Alnus rugosa* (Du

Roi) Spreng.] bogs, lake shores, wet roadsides; freq.

Alnus viridis ssp. *crispa* (Ait.) Turrill [*Alnus crispa* (Ait.) Pursh] bogs, wet roadsides; freq.

Betula alleghaniensis Britt.

Betula lutea L.

Betula pumila L.

Betula pumila var. *glandulifera* Regel. [*Betula glandulifera* (Regel) Butler]

Betula papyrifera Marshall var. *cordifolia* (Regel) Fern. successional woods; freq.

Betula papyrifera Marsh. successional woods; rare.

Corylus americana Walt.

Corylus cornuta Marsh. fields and moist woodland borders; freq. *Ostrya virginiana* (P. Mill.) K. Koch.

BORAGINACEAE

**Cynoglossum virginiana* L. var. *boreale* (Fem.) Cooperrider

Hackelia deflexa (Wahlenb.) Opiz

Mertensia paniculata (Ait.) G. Don. woodland borders and rich woods; freq.

**Myosotis scorpioides* L.

BRASSICACEAE

Arabis divaricata A. Nels. gardens and disturbed sites; rare.

Arabis hirsuta (L.) Scop.

Arabis nuttallii B.L. Robbins

**Barbarea vulgaris* R. Br.

**Capsella bursa-pastoris* (L.) Medik.

Cardamine oligosperma Nutt.

Cardamine parviflora L. var. *arenicola* (Britt.) O.E. Schulz

Cardamine pensylvanica Muhl. ex Willd.

**Erysimum cheiranthoides* L. wet roadsides; infr.

Lepidium densiflorum Schrad.

Rorippa islandica (Oeder) Borbas

Rorippa palustris (L.) Bess. ssp. *fernaldiana* (Butters & Abbe) Jonsell

Subularia aquatica (L.) lake shores; freq.

CABOMBACEAE

Brasenia schreberi J. F. Gmel.; TNC

CALLITRICHACEAE

Callitriche palustris L. [*Callitriche verna* L.] lake and pond margins; freq.

CAMPANULACEAE

Campanula aparinoides Pursh [*Campanula uliginosa* Rydb.] wet fields and meadows; infr.

Campanula rotundifolia L.

Lobelia dortmanna L. lake shores; freq.

Lobelia inflata L.

Lobelia spicata Lam.

CAPRIFOLIACEAE

Diervilla lonicera P. Mill. dry woods and islands; freq. *Linnaea borealis* L. rich woods, bogs; freq.

Lonicera caerulea L.

Lonicera canadensis Bartr. ex Marsh. dry and moist woods; freq.

Lonicera dioica L. moist woods; freq.

Lonicera hirsuta Eat. rich woods; infr.

Lonicera oblongifolia (Goldie) Hook.

Lonicera villosa (Michx.) J.A. Schultes

Sambucus racemosa var. *pubens* (Michx.) Koehne [*Sambucus pubens* Michx.]

Symphoricarpos albus (L.) Blake dry woods and islands; infr

Viburnum lentago L. rich woods; freq.

Viburnum opulus L. var. *opulus* rich woods; freq.

Viburnum opulus var. *americanum* Ait. [*Viburnum trilobum* Marsh.]

Viburnum rafinesquianum J. A. Schultes moist or dry rocky woods; freq.

CARYOPHYLLACEAE

Arenaria laterifolia L. woods; freq.

Cerastium arvense L.

**Cerastium fontanum* Baumg. spp. *vulgare* (Hartman) Greuter & Burdet. [*Cerastium vulgatum* L. 1762, non 1755] lawns; infr.

Cerastium fontanum Baumg. spp. *vulgare* (Hartman) lawns and disturbed sites; freq.

Cerastium nutans Raf. Lawns; infr.

**Cerastium vulgatum* L. [*Cerastium holosteoides* Fries var. *vulgare* (Hartman) Hyl.] lawns and disturbed sites; freq.

**Lychnis chalcedonica* L.

**Myosoton aquaticum* (L.) Moench [*Stellaria aquatica* (L.) Scop.] wet roadsides; infr.

Silene antirrhina L.

**Silene latifolia* Poir. [*Silene alba* (P. Mill) Krause; *Lychnis alba* P. Mill] roadsides; infr.

Stellaria longifolia Muhl. moist woods; infr.

**Stellaria media* (L.) Vill. lawns, disturbed sites; infr.

CELASTRACEAE

Celastrus scandens L.

CERATOPHYLLACEAE

Ceratophyllum demersum L. shallow bays; freq. *Ceratophyllum echinatum* Gray. shallow bays; infr.

CHENOPODIACEAE

**Chenopodium album* L. roadsides and disturbed sites; infr.

**Chenopodium leptophyllum* (Moq.) Nutt. ex S. Wats. roadsides and disturbed sites; infr.

Chenopodium simplex (Torr.) Raf. [*Chenopodium hybridum* auct. non L.]

CISTACEAE

Lechea intermedia Leggett ex Britt.

Lechea stricta Leggett ex Britt.

CONVOLVULACEAE

Calystegia spithamea (L.) Pursh [*Convolvulus spithameus* L.]

**Convolvulus arvensis* L.

CORNACEAE

Cornus alternifolia L. f. moist roadsides; freq.

Cornus canadensis L. moist roadsides and woods; freq.

Cornus racemosa Lam.

Cornus rugosa Lam. roadsides and woods; freq.

Cornus sericea L. [*Cornus stolonifera* Michx.] fields and woods borders; infr.

CLUSIACEAE

Hypericum majus (Gray) Britt.

Triadenum fraseri (Spach) Gleason; bogs, lake margins; infr.

Tridenum virginicum (L.) Raf. [*Hypericum virginicum* L.]

CRASSULACEAE

Crassula aquatica (L.) Schoenl. [*Tillaea aquatica* L.] moist lake shores; infr.

CUCURBITACEAE

Echinocystis lobata (Michx.) Torr. & Gray

CUSCUTACEAE

Cuscuta cephalanthi Engelm. fields and disturbed sites; rare.

Cuscuta gronovii Willd. ex J. A. Schultes

Cuscuta megalocarpa Rydb.

DROSERACEAE

Drosera rotundifolia L. bogs, lake margins; freq.

ELAEAGNACEAE

Shepherdia canadensis (L.) Nutt.

ELATINACEAE

Elatine minima (Nutt.) Fisch & C. A. Mey.

Elatine triandra Schkuhr. lake shores; infr.

ERICACEAE

Andromeda polyfolia L. var. *glaucophylla* (Link) DC.
[*Andromeda glaucophylla* Link]

Arctostaphylos uva-ursi (L.) Spreng. dry soil, open sites; freq.

Chamaedaphne calyculata (L.) Moench. bogs and lakesides; freq.

Gaultheria hispidula (L.) Muhl. ex Bigelow dry woods; freq.

Gaultheria procumbens L. dry open woods; freq.

Gaylussacia baccata (Wangenh.) K. Koch

Kalmia polifolia Wangenh. bogs; freq.

Ledum groenlandicum Oeder bogs and moist sites and lake shores; freq.

Vaccinium angustifolium Alt. dry or moist woods; freq.

Vaccinium cespitosum Michx.

Vaccinium myrtilloides Michx. dry or moist woods; freq.

Vaccinium oxycoccus L. dry woods; freq.

Vaccinium vistic-idaea L. bogs and on rocks; freq.

EUPHORBIACEAE

Chamaesyce glyptosperma (Engelm.) Small [*Euphorbia glyptosperma* Engelm.]

FABACEAE

Amphicarpaea bracteata (L.) Fern. moist woods; freq.

Astragalus canadensis L. moist open woods; infr. Glycyrrhiza lepid

Lathyrus ochroleucus Hook. dry open woods sites; infr.

Lathyrus palustris L.

Lathyrus venosus Muhl. ex Willd.

**Medicago sativa* L.

**Melilotus alba* Medik. roadsides and disturbed sites; infr.

**Melilotus officinalis* (L.) Lam. roadsides and disturbed sites; infr.

**Trifolium arvense* L. roadsides and disturbed sites; freq.

**Trifolium campestre* Schreb. [*Trifolium procumbens* L.] roadsides; infr.

**Trifolium hybridum* L. lawns; freq.

**Trifolium pratense* L. roadsides; freq.

**Trifolium repens* L. lawns and roadsides; freq.

Vicia americana Muhl. roadsides, woods borders; freq. ota Pursh wet fields; infr.

FAGACEAE

Quercus ellipsoidalis E. J. Hill

Quercus macrocarpa Michx. dry woods; infr.

Quercus rubra L.

FUMARIACEAE

Corydalis aurea Willd.

Corydalis sempervirens (L.) Pers.

GENTIANACEAE

Gentiana andrewsii Griseb.

Gentianopsis crinita (Froel.) Ma [*Gentiana crinita* Froel.]

Halenia deflexa (Sm.) Griseb. disturbed places; infr.

GERANIACEAE

Geranium bicknellii Britt. rich woods; freq.

GROSSULARIACEAE

Ribes americanum P. Mill. moist woods; freq.

Ribes cynosbati L. moist woods; freq.

Ribes glandulosum Brauer wet woods; freq.

Ribes hirtellum Michx. rocky wet woods; freq.

Ribes hudsonianum Richards. wet woods; infr.

Ribes lacustre (Pers.) Poir.

Ribes oxycanthoides L. moist woods; freq.

Ribes triste Pallas wet woods; freq.

HALORAGACEAE

Myriophyllum alterniflorum DC.

Myriophyllum farwellii Morong

Myriophyllum sibiricum Komarov.; TNC

**Myriophyllum spicatum* L.

Myriophyllum tenellum Bigelow shallow bays; freq.

Myriophyllum verticillatum L. shallow bays; infr.

LAMIACEAE

Agastache foeniculum (Pursh) Kuntze

Dracocephalum parviflorum Nutt.

**Glechoma hederacea* L.

Lycopus americanus Muhl. moist lake shores and wet roadsides; freq.

Lycopus uniflorus Michx. moist lake shores and wet roadsides; freq.

Mentha arvensis L. moist roadsides; infr.

Monarda fistulosa L. woods and roadsides; infr.

Physostegia parviflora Nutt. ex Gray

Physostegia virginiana (K.) Benth. lake shores; freq.

**Prunella vulgaris* L. rich woods and roadsides; infr.

Satureja vulgaris (L.) Fritsch. dry woods; infr.

Scutellaria galericulata L. [*Scutellaria epilobiifolia* A. Hamilton] rich wet woods and wet roadsides; infr.

Scutellaria lateriflora L. rich woods; rare

Stachys palustris L. rich wet woods and wet roadsides; infr.

Stachys tenuifolia Willd. var. *tenuifolia* [*Stachys hispida* Pursh] wet roadsides; infr.

LENTIBULARIACEAE

Utricularia intermedia Hayne shallow bays; infr.

Utricularia macrorhiza Le Conte [*Utricularia vulgaris* L. p.p.]

Utricularia minor L.

Utricularia vulgaris L. Rainy Lake bays; infr.

LYTHRACEAE

**Lythrum salicaria* L. margins of Rainy Lake; freq.

MENYANTHACEAE

Menyanthes trifoliata L.

MOLLUGINACEAE

**Mollugo verticillata* L.

MONOTROPACEAE

Monotropa hypopithys L. rich woods; infr.

Monotropa uniflora L. rich woods; infr.

MYRICACEAE

Comptonia peregrina (L.) Coult. dry woods; infr.

Myrica gale L. bogs, lake shores; freq.

OLEACEAE

Fraxinus nigra Marsh. wet or moist woods; freq.

Fraxinus pennsylvanica Marsh. moist and wet woods; infr.

ONAGRACEAE

Circaea alpina L.

Circaea lutetiana ssp. *canadensis* (L.) Aschers. & Magnus
[*Circaea quadrisculata* L.]

Epilobium angustifolium L. roadsides and fields; freq.

Epilobium ciliatum ssp. *glandulosum* (Lehm.) Hoch & Raven
[*Epilobium glandulosum* Lehm.]

Epilobium coloratum Biehler

Epilobium leptophyllum Raf.

Epilobium strictum Muhl. ex Spreng.

Oenothera biennis L.

Oenothera parviflora L.

Oenothera perennis L.

OXALIDACEAE

Oxalis stricta L. [*Oxalis fontana* Bunge] disturbed sites and roadsides; freq.

PAPAVERACEAE

Sanguinaria canadensis L.

PLANTAGINACEAE

Littorella uniflora (L.) Aschers. [*Littorella americana* Fern.] lake margins; infr.

**Plantago lanceolata* L.

**Plantago major* L. disturbed sites; freq.

POLYGONACEAE

**Fagopyrum esculentum* (Moench) [*Fagopyrum sagittatum* Gilib.]

Polygonum achoreum Blake. roadsides and disturbed sites; infr.

Polygonum amphibium L. var. *emersum* Michx. [*Polygonum coccineum* Muhl. ex Willd.] Rainy Lake Visitors Center; rare]

Polygonum amphibium L. var. *stipulaceum* Coleman
[*Polygonum natans* Eaton] lake margins; infr.

Polygonum arifolium L. [*Polygonum arifolium* L. var. *pubescens* (Keller) Fern.]

**Polygonum aviculare* L. disturbed sites and roadsides; freq.

Polygonum bellardii All. [*Polygonum neglectum* Bess.]

Polygonum cilinode Michx. dry pine woods; freq.

**Polygonum convolvulus* L. fields, roadsides and woods edge; freq.

Polygonum douglasii Greene

**Polygonum hydropiper* L. wet roadsides; freq.

Polygonum hydropiperoides Michx.

Polygonum lapathifolium L. moist roadsides; infr.

**Polygonum persicaria* L. disturbed sites; infr.

Polygonum punctatum Ell. marshes and wet meadows; freq.

Polygonum ramosissimum Michx.

Polygonum sagittatum L. marshes and wet meadows; freq.

Polygonum scandens L. moist woods and roadsides

**Rumex acetosella* L. disturbed sites and roadsides; infr.

**Rumex crispus* L.

Rumex maritimus L.

Rumex orbiculatus Gray

**Rumex patientia* L.

Rumex salicifolius Weinm. [*Rumex mexicanus* Meisn.]

disturbed sites; rare.

PORTULACACEAE

**Portulaca oleracea* L.

PRIMULACEAE

Lysimachia ciliata L. moist woods and roadsides; infr.

Lysimachia terrestris (L.) B. S. P. wet roadsides and wet woods; infr.

Lysimachia thyrsoflora L.

Trientalis borealis Raf. rich moist woods; freq.

PYROLACEAE

Chimaphila umbellata (L.) Pursh rich woods; freq.

Moneses uniflora (L.) A. Gray wet woods and bogs; infr.

Orthilia secunda (L.) House [*Pyrola secunda* L.]

Pyrola americana Sweet [*Pyrola rotundifolia* auct. p. p. on L.]

Pyrola asarifolia Michx.

Pyrola chlorantha Sw. [*Pyrola virens* Schreb.]

Pyrola elliptica Nutt.

RANUNCULACEAE

Actaea rubra (Alt.) Willd. rich woods; infr.

Anemone americana

Anemone canadensis L. rich woods; freq. *Anemone cylindrica* Gray

Anemone quinquefolia L.

Anemone virginiana L.

Aquilegia canadensis L. wet open woods; freq.

Caltha palustris L. roadsides wet open sites; freq.

Coptis trifoliata (L.) Salisb. bogs and moist woods; freq.

[*Copotis trifoliata* var. *groenlandica* (Oeder) Fassett.;

Coptis trifoliata spp. *groenlandica* (Oeder) Hulten.]

Hepatica nobilis var. *obtusa* (Pursh) Steyermark [*Hepatica americana* (DC.) Ker-Gawl.]

Ranunculus abortivus L. roadsides, wet sites; freq.

**Ranunculus acris* L. moist roadsides; infr.

Ranunculus aquatilis L.

Ranunculus flammula L. var. *filiformis* (Michx.) Hook.
[*Ranunculus reptans* L.] Wet soil, roadsides; infr.

Ranunculus gmelinii DC. lake shores; infr.

Ranunculus hispidus var. *nitidus* (Chapman) T. Duncan
[*Ranunculus septentrionalis* Pior.]

Ranunculus lapponicus L. wet soil, roadsides; infr.

Ranunculus longirostris Godr. [*Ranunculus circinatus* auct. non Sibthorp]

Ranunculus pensylvanicus L. f. wet meadows and marshes; rare

Ranunculus subrigidus W. Drew [*Ranunculus circinatus* Sibth. var. *subrigidus* (W. Drew) L. Benson] pond and lake margins; rare.

Thalictrum dasycarpum Fisch. and Ave-Lall. wet fields lake shores; infr.

Thalictrum dioicum L.

Thalictrum venulosum Trel. [*Thalictrum confine* Fern.] rich woods and lake shores; infr.

RHAMNACEAE

Rhamnus alnifolia L'. Her.

ROSACEAE

Agrimonia gryposepala Wallr.

Agrimonia striata Michx. rich woods; infr.

Amelanchier bartramiana (Tausch) M. Roemer

Amelanchier interior Nielson [*Amelanchier x weigandii* Nielson]

Amelanchier laevis Wieg.

Amelanchier sanguinea (Pursh) DC. roadsides and open woods; freq.

Amelanchier spicata (Lam.) K. Koch. dry open woods; infr.
Amelanchier stolonifera Wieg. [*Amelanchier spicata* auct. p. p. non (Lam.) K. Koch] [*Aronia melanocarpa* (Michx.) Willd. [*Pyrus melanocarpa* (Michx.) Willd.]
Comarum palustre L. [*Potentilla palustris* (L.) Scop.] lake margins, wet sites; freq.
Crataegus chysocarpa Ashe [*Crataegus rotundifolia* Moench p. p. non Lamb.]
Crataegus dodgei Ashe
Crataegus succulenta Schrad. ex Link
Fragaria vesca L.

Fragaria virginiana Duchesne. fields, roadsides; infr.
Geum aleppicum Jacq. wet meadows, wet roadsides; freq.

Geum macrophyllum Willd.

Geum rivale L.

**Potentilla argentea* L.

Potentilla arguta Pursh fields, roadsides, dry woods; freq.

Potentilla norvegica L. fields, roadsides; freq.

Potentilla simplex Michx. lawns, roadsides; freq.

Prunus americana Marsh.

Prunus nigra Ait.

Prunus pennsylvanica L. f. dry open woods; freq.

Prunus pumila L. var. *besseyi* (Bailey) Gleason dry open sites, islands; infr.

Prunus pumila var. *susquehanae* (Hort. ex Willd.) Jaeger

Prunus serotina Ehrh.

Prunus virginiana L. open woods, woods edges; freq.

Rosa acicularis Lindl.

Rosa blanda Alt. roadsides, fields; freq.

Rosa palustris Marsh.

Rubus allegheniensis Porter fields, roadsides; freq.

Rubus canadensis L.

Rubus flagellaris Willd. rich woods; freq.

Rubus hispidus L.

Rubus idaeus L. [*Rubus strigosus* Michx.] roadsides, fields; freq.

Rubus kennedyanus Fern. [*Rubus acridens* Bailey]

Rubus occidentalis L.

Rubus parviflorus Nutt.

Rubus pensilvanicus Poir.

Rubus pubescens Raf.

Rubus recurvicaulis Blanch.

Rubus setosus Bigelow

Sibbaldiopsis tridentata (Alt.) Rybd. [*Potentilla tridentata* Ait.]

Sorbus americana Marsh. [*Pyrus americana* (Marsh.) DC.]

Sorbus decora (Sarg.) Schneid.

Spiraea alba Du Roi wet meadows, lake margins; freq.

RUBIACEAE

Galium asprellum Michx. rich woods; freq.

Galium boreale L. roadsides, dry woods; freq.

Galium labradoricum (Wieg.) Wieg.

Galium obtusum Bigelow *Galium tinctorium* (L.) Scop.

Galium trifidum L. rich woods; infr.

Galium triflorum Michx. rich woods; infr.

Houstonia longifolia Gaertn. [*Hedyotis longifolia* (Gaertn.) Hook] *Mitchella repens* L.

SALICACEAE

Populus balsamifera L.

Populus grandidentata Michx. successional woodlands; freq.

Populus tremuloides Michx. successional woodlands; freq.

Salix amygdaloides Anderss. moist open woods, roadsides; infr.

Salix bebbiana Sarg. moist fields, roadsides; infr.

Salix candida Fluegge ex Willd.

Salix discolor Muhl. moist fields, roadsides; freq.

Salix eriocephala Michx.

Salix exigua Nutt. [*Salix interior* Rowlee]

Salix humilis Marsh. fields, roadsides; infr.

Salix lucida Muhl.

Salix pedicellaris Pursh swamp and bogs; infr.

Salix petiolaris Sm. [*Salix gracillis* Anderss.] moist fields, roadsides, lake margins; infr.

Salix planifolia Pursh

Salix pyrifolia Anderss.

Salix serrissima (Bailey) Fern. bogs, roadsides; infr.

SANTALACEAE

Comandra umbellata (L.) Nutt. [*Comandra richardsiana* Fern.] dry open woods; infr.

SARRACENIACEAE

Sarracenia purpurea L. bogs; freq.

SAXIFRAGACEAE

Heuchera richardsonii R. Br. dry open woods; freq.

Mitella nuda L. sphagnaceous woods; infr.

Parnassia palustris L. wet meadows; infr.

Saxifraga virginiana Michx.

SCROPHULARIACEAE

Agalinis tenuifolia (Vahl) Raf. [*Gerardia tenuifolia* Vahl]

Gratiola neglecta Torr. moist roadsides; freq.

**Linaria vulgaris* P. Mill.

Melampyrum lineare Desr. bogs and wet roadsides; infr.

Mimulus ringens L. wet woods, marshes; freq.

Pedicularis canadensis L. dry woods; freq.

Penstemon gracilis Nutt.

**Verbascum thapsus* L. roadsides and disturbed sites; infr.

Veronica anagallis-aquatica L. [*Veronica catenata* Pennell]

Veronica peregrina L.

Veronica scutellata L.

TILIACEAE

Tilia americana L.

ULMACEAE

Ulmus americana L.

URTICACEAE

Laportea canadensis (L.) Wedd.

Urtica dioica L. moist woods; freq.

VERBENACEAE

Verbena hastata L.

VIOLACEAE

Viola adunca Small

Viola blanda var. *palustriformis* Gray [*Viola incognita* Brainerd]

Viola canadensis var. *rugulosa* (Greene) C. L. Hitchc. [*Viola rugulosa* Greene]

Viola conspersa Reichenb.

Viola cucullata Ait.

Viola cucullata x *sororia*

Viola macloskeyi ssp. *pallens* (Banks ex DC.) M. S. Baker [*Viola pallens* (Banks ex DC.) Brainerd]

Viola novae-angliae House

Viola pubescens Ait. var. *pubescens* [*Viola eriocarpon* (Nutt.) Schwein]

Viola renifolia Gray

Viola selkirkii Pursh ex Goldie

Viola sororia Willd.

VISCACEAE

Arceuthobium pusillum Peck.

VITACEAE

Parthenocissus quinquefolia Planch. (L.) [*Parthenocissus inserta* (Kerner) Fritsch]

Parthenocissus vitacea (Knerr) A. S. Hitchc.

Vitis riparia Michx.

MONOCOTS

ACORACEAE

Acorus calamus L. bogs, lake margins; freq.

ALISMATACEAE

Alisma subcordatum Raf.

Alisma triviale Pursh

Sagittaria cuneata Sheldon bogs, beaver ponds and lake margins; freq.

Sagittaria graminea Michx.

Sagittaria latifolia Willd.

Sagittaria rigida Pursh

ARACEAE

Arisaema triphyllum (L.) Schott [*Arisaema atrorubens* (Ait.) Blume] rich woods; freq.

Calla palustris L. swamps, lake margins; freq.

CYPERACEAE

Carex adusta Boott

Carex aenea Fern.

Carex arcata Boott wet meadows; infr.

Carex atherodes Spreng. lake margins; infr.

Carex aurea Nutt.

Carex brevior (Dewey) Mackenzie ex Lunell

Carex brunnescens (Pers.) Poir. moist woods; freq. *Carex canescens* L. bogs and wet woods; freq.

Carex castanea Wahlenb.

Carex chondorrhiza Ehrh. ex L. f.

Carex crawfordii Fern. wet roadsides and wet meadows; infr.

Carex crinita Lam. wet woods; freq.

Carex cristatella Britt.

Carex cryptolepis MacKenzie wet roadsides, lake margins; infr.

Carex deflexa Hornem.

Carex deweyana Schwein.

Carex disperma Dewey

Carex gracillima Schwein. moist woods; freq.

Carex haydenii Dewey

Carex hirta L.

Carex houghtoniana Torr. ex Dewey

Carex intumescens Rudge. Moist woods; freq.

Carex lacustris Willd.

Carex lasiocarpa Ehrh. bogs, lake margins; freq.

Carex lenticularis Michx.

Carex leptalea Wahlenb.

Carex leptonevia (Fern.) Fern.

Carex limosa L.

Carex muricata L.

Carex nigromarginata Schwein.

Carex oligosperma Michx. bogs, wet roadsides; infr.

Carex pauciflora Lightf.

Carex paupercula Michx. sphagnaceous bogs; freq.

Carex pedunculata Muhl. ex Willd.

Carex projecta Mackenzie

Carex radiata (Wahlenb.) Small

Carex retrorsa Schwein. wet meadows; infr.

Carex rosea Schkuhr ex Willd. lake margins, wet roadsides; freq.

Carex rostrata Stokes wet woods and wet roadsides; freq.

Carex scoparia Schkuhr ex Willd. wet meadows, lake shores; freq.

Carex stipata Muhl. ex Willd.

Carex stricta Lam.

Carex sychnocephala Carey wet meadows, lake margins; freq.

Carex tenera Dewey wet roadsides and wet meadows; freq.

Carex tonsa (Fern.) Bickn.

Carex trisperma Dewey bogs; infr.

Carex tuckermanii Dewey

Carex umbellata Schkuhr ex Willd.

Carex utriculata Boott [Schkuhr ex Willd.]

Carex rostrata var. *utriculata* (Boott) Bailey; TNC

Carex vesicaria L. bogs, wet roadsides; freq.

Carex viridula Michx.

Carex vulpinoidea Michx. wet roadsides, lake margins; freq.

Cyperus squarrosus L. [*Cyperus aristatus* (Rottb.)]

Cyperus strigosus L. roadsides; freq.

Dulichium arundinaceum (L.) Britt. marshes; freq.

Eleocharis acicularis (L.) R. & S.

Eleocharis obtusa (Willd.) R. & S.

Eleocharis ovata (Roth) R. & S. marshes; freq.

Eleocharis palustris (L.) R. & S. marshes and wet roadsides; freq.

Eleocharis smallii Britt.

Eriocaulon aquaticum (Hill) Druce [*Eriocaulon septangulare* Withering] lake margins, bogs; freq.

Eriophorum angustifolium Honckeny

Eriophorum chamissonis C. A. Mey.

Eriophorum vaginatum L. var. *spissum* (Fern.) Boivin [*Eriophorum spissum* Fern.] bogs; freq.

Eriophorum virginicum L.

Eriophorum viridi-carinatum (Engelm.) Fern.

Fimbristylis autumnalis (L.) R. & S.

Lipocarpa micrantha (Vahl) G. Tucker [*Hemicarpha micrantha* (Vahl) Pax]

Scirpus acutus Muhl. ex Bigelow

Scirpus cyperinus (L.) Kunth. [*Scirpus rubrotinctus* Fern.] marshes; freq.

Scirpus fluviatilis (Torr.) Gray marshes and lake margins; freq.

Scirpus heterochaetus Chase

Scirpus microcarpus J. & K. Presl

Scirpus pedicellatus Fern.

Scirpus subterminalis Torr.

Scirpus tabernaemontani K. C. Gmel.

Scirpus validus Vahl shallow bays, Rainy Lake, freq.

HYDROCHARITACEAE

Elodea canadensis Michx.

Vallisneria americana Michx. shallow bays, Rainy Lake; freq.

IRIDACEAE

Iris versicolor L. roadsides, marshes, lake margins; freq.

Sisyrinchium montanum Greene meadows, open dry islands; infr.

JUNCACEAE

Juncus alpinus auct. non Vill.

Juncus alpinoarticulatus ssp. *fuscescens* (Fern.) Hämet-Ahti

Juncus articus Willd.

Juncus balticus Willd.

Juncus brevicaudatus (Engelm.) Fern. marshes, lake margins; freq.

Juncus bufonius L. moist sands and roadsides and waste

places; freq.
Juncus dudleyi Wieg.
Juncus effusus L.
Juncus filiformis L.
Juncus greenei Oakes & Tuckerman
Juncus nodosus L.
Juncus pelocarpus E. Mey.
Juncus tenuis Willd. paths, dry or moist soil; freq.
Luzula acuminata Raf. moist woods; freq.
Luzula campestris (L.) DC. roadsides; rare
Luzula multiflora (Ehrh.) Lej.

JUNCAGINACEAE

Triglochin maritimum L.

LEMNACEAE

Lemna minor L.
Lemna trisulca L. beaver ponds, Rainy Lake bays; freq.
Spirodela polyrrhiza (L.) Schleid. ponds and shallow bays; freq.

LILIACEAE

Allium cernuum Roth
Allium stellatum Nutt. ex Ker-Gawl. islands; infr.
Clintonia borealis (Ait.) Raf. rich woods; freq.
Lilium philadelphicum L. fields, lake shore borders; infr.
Maianthemum canadense Desf. rich woods; freq.
Maianthemum racemosum (L.) Link ssp. *Racemosum* [*Smilacena racemosa* (L.) Desf.]
Maianthemum stellatum (L.) Link [*Smilacina stellata* (L.) Desf.]
Maianthemum trifolium (L.) Sloboda [*Smilacina trifolia* (L.) Desf.] bogs and wet woods; freq.
Polygonatum biflorum (Walter) Elliott moist woods; freq.
Polygonatum pubescens (Willd.) Pursh moist woods; freq.
Streptopus roseus Michx. rich woods; freq.
Trillium cernuum L. rich woods; infr.
Uvularia grandiflora Sm. rich woods; infr.
Uvularia sessilifolia L. rich woods; infr.

NAJADACEAE

Najas flexilis (Willd.) Rostk. & Schmidt Rainy Lake; freq.

NYMPHAEACEAE

Nuphar lutea ssp. *pumila* (Timm) E. O. Beal [*Nuphar microphylla* (Pers.) Fern.; *Nuphar rubrodiscalis* Morong]
Nuphar variegata (Dur.) E. O. Beal beaver ponds and shallow bays; freq. *Nymphaea odorata* Ait. [*Nymphaea tuberosa* Paine] shallow bays; freq.

ORCHIDACEAE

Amerorchis rotundifolia (Banks ex Pursh) Hulten [*Orchis rotundifolia* Banks ex Pursh]
Calypso bulbosa (L.) Oakes
Corallorhiza maculata (Raf.) Raf.
Corallorhiza striata Lindl.
Corallorhiza trifida Chatelain
Cypripedium acaule Ait. woodlands; freq.
Cypripedium calceolus L. roadsides and woodlands; freq.
Cypripedium parviflorum Salisb.
Cypripedium reginae Walt.
Goodyera repens (L.) R. Br. ex Ait. f. moist coniferous forest; rare
Goodyera tessellata Lodd. rich woods; rare.
Liparis loeselii (L.) L. Rich.
Listera cordata (L.) R. Br. ex Ait. f. wet woods; rare
Malaxis brachypoda (Gray) Fern. [*Malaxis monophyllos* ssp. *brachypoda* (Gray) A. & D. Löve]
Malaxis unifolia Michx.

Plantanthera dilatata (Pursh) Lindl. ex Beck [*Habenaria dilatata* (Pursh) Hook.]
Plantanthera hookeri (Torr. ex Gray) Lindl. [*Habenaria hookeri* Torr. ex Gray] rich moist woods; infr.
Plantanthera hyperborea (L.) Lindl. [*Habenaria hyperborea* (L.) R. Br. ex Alt. f.]
Plantanthera lacera (Michx.) D. Don [*Habenaria lacera* (Michx.) R. Br.]
Plantanthera obtusata (Banks ex Pursh) Lindl. [*Habenaria obtusata* (Banks ex Pursh) Richards.]
Plantanthera orbiculata (Pursh) Lindl. [*Habenaria orbiculata* (Pursh) Torr.] moist woods; infr.

Plantanthera psychodes (L.) Lindl. [*Habenaria psychodes* (L.) Spreng.] moist fields; infr.
Spiranthes lacera (Raf.) Raf. [*Spiranthes gracilis* (Bigelow) Beck] open coniferous forest; infr.

POACEAE

Agrostis geminata Trin.
 **Agrostis gigantea* Roth
Agrostis hyemalis (Walt.) B. S. P. fields, roadsides; freq.
Agrostis perennans (Walt.) Tuckerm. dry woods and islands; freq.
Agrostis scabra Willd.; TNC
Agrostis stolonifera L. roadsides and wet sites; freq.
Alopecurus aequalis Sobol.
Beckmannia syzigachne (Steud.) Fern. marshes; infr.
Brachyelytrum erectum (Schreb. ex Spreng.) Beauv.
Bromus ciliatus L. moist roadsides, wet open woods; freq.
 **Bromus inermis* Leyss. disturbed roadsides; infr.
Bromus kalmii Gray
Calamagrostis canadensis (Michx.) Beauv. wet roadsides and lake margins; freq.
Calamagrostis stricta ssp. *inexpansa* (Gray) C. W. Greene
Cinna latifolia (Trev. ex Goepp.) Griseb.
Danthonia spicata (L.) Beauv. ex Roemer & J. A. Schultes fields, dry woods, islands; freq.
Deschampsia cespitosa (L.) Beauv.
Dichanthelium acuminatum (Sw.) Gould & C. A. Clark
Dichanthelium boreale (Nash) Freckmann
Dichanthelium depauperatum (Muhl.) Gould [*Panicum depauperatum* Muhl.]
Dichanthelium linearifolium (Scribn. ex Nash) Gould [*Panicum linearifolium* Scribn. ex Nash *Panicum perlongum* Nash]
Dichanthelium oligosanthes var. *oligosanthes* [*Panicum oligosanthes* J. A. Schultes]
Dichanthelium sabulorum var. *patulum* (Scribn. & Merr.) Gould & C. A. Clark [*Panicum lancearium* Trin.]
Dichanthelium scabriusculum (Ell.) Gould & C. A. Clark [*Panicum lanuginosum* Bosc ex Spreng.]
Dichanthelium xanthophysum (Gray) Freckmann [*Panicum xanthophysum* Gray]
 **Echinochloa crusgalli* (L.) Beauv. roadsides; infr.
Echinochloa muricata (Beauv.) Fern.
Elyhordeum x mouconii (Vasey) Barkworth & Dewey [*Elymus x macounii* Vasey]
Elymus trachycaulus (Link) Gould ex Shinnars (*Agropyron trachycaulum* (Link) Malte ex H. F. Lewis); infr.
Elymus virginicus L. roadsides, marsh borders; infr.
Elytrigia repens (L.) Desv. ex B. D. Jackson [*Agropyron repens* (L.) Beauv.] ; moist roadsides and fields; freq.
Eragrostis pectinacea (Michx.) Nees ex Steud.
Festuca brachyphylla J.A. Schultes ex J.A. & J.H. Schultes
 **Festuca elatior* L. [*Festuca arundinacea* Schreb.] roadsides and disturbed sites; freq.
 **Festuca ovina* L.

Glyceria borealis (Nash) Batchelder lake margins; freq.
Glyceria canadensis (Michx.) Trin. bogs, swamps and wet woods; freq.
Glyceria grandis S. Wats.
Glyceria striata (Lam.) A. S. Hitchc. moist roadsides; infr.
Hierochloa odorata (L.) Beauv. moist meadows and roadsides; freq.
Hordeum jubatum L. roadsides; freq.
Leersia oryzoides (L.) Sw. marshes and lake margins; freq.
**Lolium perenne* L. disturbed roadsides; rare.
Muhlenbergia frondosa (Poir.) Fern.
Muhlenbergia glomerata (Willd.) Trin.
Muhlenbergia mexicana (L.) Trin. moist woods, islands and roadsides; freq.
Muhlenbergia racemosa (Michx.) B. S. P. rocky island sites and dry woods; freq.
Muhlenbergia sylvatica (Torr. ex Gray) Spreng.
Oryzopsis asperifolia Michx.
Oryzopsis pungens (Torr. ex Spreng) A.S. Hitchc. *Panicum capillare* L. fields and roadsides; freq.
Phalaris arundinacea L.
**Phleum pratense* L. lawns and fields; infr.
Phragmites australis (Cav.) Trin. ex Steud. moist disturbed sites; infr.
Poa alsodes Gray
**Poa annua* L. lawns; freq.
Poa arida Vasey
**Poa compressa* L.
Poa glauca Vahl
Poa interior Rydb.
Poa paludigena Fern. & Weig. bogs and wet woods; rare
Poa palustris L. wet meadows and fields; freq.
Poa pratensis L. lawns and fields; freq.
Puccinellia distans (Jacq.) Parl. lake margins; freq.
Schizachne purpurascens (Torr.) Swallen. dry woods; freq.
**Setaria glauca* (L.) Beauv.
Setaria pumila (Poir.) Roemer & J. A. Schultes
Setaria viridis (L.) Beauv.
Spartina pectinata Link. marshes, wet open sites; infr.
Sphenophyllis intermedia (Rydb.) Rydb. [*Sphenophyllis*

obtusata var. *major* (Torr.) K. S. Erdman]
Sphenophyllis obtusata (Michx.) Scribn.
Torreyochloa pallida Torr. Church [*Puccinellia pallida* (Torr.) Clausen]
Zizania aquatica L. shores of Rainy Lake; freq.
Zizania palustris L.

PONTEDERIACEAE

Pontederia cordata L.

POTAMOGETONACEAE

Potamogeton amplifolius Tuckerm. shallow bays of Rainy Lake; infr.
Potamogeton epihydrus Raf. shallow bays of Rainy Lake; infr.
Potamogeton filiformis Pers.
Potamogeton foliosus Raf. *Potamogeton friesii* Rupr.
Potamogeton gramineus L. shallow bays of Rainy Lake; infr.
Potamogeton illinoensis Morong
Potamogeton natans L. lake margins; infr.
Potamogeton pectinatus L.
Potamogeton pusillus L. lake margins and shallow bays; infr.
Potamogeton richardsonii (Benn.) Rydb. lake margins and shallow bays; infr.
Potamogeton robbinsii Oakes lake margins and shallow bays; infr.
Potamogeton spirillus Tuckerm. lake margins and shallow bays; infr.
Potamogeton strictifolius Benn.
Potamogeton vaseyi J. W. Robbins, shallow bays of Rainy Lake; infr.
Potamogeton zosteriformis Fern. shallow bays of Rainy Lake; infr.

SMILACACEAE

Smilax herbacea L. moist woods and roadsides; infr.

SPARGANIACEAE

Sparganium americanum Nutt.

Responses of Hemoglobin and Serum to *Hirudin*

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ABSTRACT

Changes in localized (wound sites) hemoglobin and serum patterns to *Hirudin* of a human subject as a result of leech bites were observed using agarose gel electrophoresis. Hemoglobin patterns show the appearance of hirudin as early as ½ hour after the bite. The presence of hirudin disappears after five hours. Serum protein patterns show a spike in the gamma region. This peak was not observed two hours after bites. No proteins were detected in leech exudate.

Introduction

Hirudin is an anticoagulant that occurs in the salivary glands of *Hirudo medicinalis* (medicinal leech) and in *H. manillensis* (buffalo leech). Hirudin inhibits thrombin¹ which interferes with the blood coagulation cascade. This allows the leech, after attachment to a victim, a constant blood flow until the leech is sated. A study of the hemoglobin and serum response of a human subject (a 72 year-old male Caucasian) was made after successful attachment of medicinal leeches (Fig. 1) on four separate occasions.

Materials and Methods

Medicinal leeches were obtained from Carolina Biological Supply Company. They were maintained in the laboratory without feeding until used for attachment to the left forearm.

Blood was collected from the subject just prior to leech attachment, by finger stick, and from 20 minutes to 28 hours by blood collection from the wounds and by finger stick (Fig. 2). Blood was collected in Non-heparinized tubes, centrifuged, and the red blood cells and serum separated and frozen until analyzed. Analyses were made with agarose gel electrophoresis using prepared gel plates (Helena Titan High Resolution Gel) for hemoglobin obtained from the frozen lysed and thawed red blood cells and serum. Hemoglobins and serums were electrophoresed for 24 minutes at 250 volts and 3-10 amps, stained with coomassie blue, then destained and oven dried. Density traces (Bio-Rad Quantity One, 4.3) were obtained from the stained proteins and the percent proteins determined. On one of the four occasions for leech attachment, blood was drawn at a hospital by venous puncture one half hour prior to the bite, then, using the same method, two hours

after leech removal. The hospital analyses included serum protein electrophoresis (Sebia, Georgia), serum protein immunofixation electrophoresis, and hemoglobin electrophoresis. Leeches, during attachment, secrete a clear fluid. Samples of this fluid were collected and analyzed electrophoretically.

Results

Leeches fed from seven to 40 minutes. Blood flowed from the wounds for as long as 10 hours.

Hemoglobin

Prior to the leech bites three Hemoglobin (Hb) peaks appear (Fig 3a). The main peak, HbA represents 80 percent of the proteins, followed by HbF, 13 percent, then by the peak closest to the point of application, HbA₂, seven percent.

In blood collected from the wounds one half hour after removal of the leeches a hirudin peak appears in advance of HbA, representing one plus percent of the proteins. This increases to as much as three percent after five hours (Fig. 3 b). The next pattern, observed after 28 hours, shows no hirudin peak (Fig. 3c). Blood collected by finger stick does not show a hirudin peak.

Hospital hemoglobin electrophoresis, performed two hours after leech removal, yielded 95.3 percent HbA, less than one percent HbF, and 3.1 percent HbA₂.

Serum

Serum protein patterns include six peaks (Helena analysis) prior to leech bite (Fig. 4a). Blood collected from the wounds 20 minutes after leech bite and removal shows an additional peak close to the origin point (Fig. 4b). This peak is distinct from the main gamma peak. This



Figure 1. Medicinal leeches attached to left forearm.



Figure 2. Leeches removed after successful leech bites.

additional peak does not appear after five hours from wound samples (Fig. 4c), nor does this appear two hours after leech bite and removal with the hospital analysis (Fig. 5). An additional peak also does not appear from the analysis of any serum from finger sticks. In the hospital analysis a pre-albumin peak does not appear. The serum peak patterns shown in Figures 4 and 5 are gamma (I), beta (II), alpha 2 (III), alpha 1 (IV), albumin (V), and pre-albumin (VI).

Exudate

Analysis of the leech exudate obtained

during their feedings yielded no protein patterns.

Discussion

The leeches fed from seven to 40 minutes and fell off when sated or were removed. Each leech can take in 15 to 30 mls of blood, and the wounds can ooze for 10 or more hours². There was localized inflammation and itching for up to four days after the bites. No attempt was made to staunch the bleeding after the bites. Retention and the appearance of hirudin systemically may occur by applying pressure, with fingers moistened with adrenaline, to the wound area³. The free flow of blood allowed in this study may have diluted any hirudin that entered the circulatory system to levels that could not be observed by electrophoresis. Hirudin reached its peak about five hours after bite and was not evident in hemoglobin sampled at 21 hours.

The spike in the serum patterns from wound blood, observed up to 30 minutes after bite, is an immunoglobulin immune response (IgM). This immunoglobulin has a molecular weight of 900,000 and migrates only a short distance from the origin, or point of serum application⁴.

The large number of components in the salivary complex of leeches^{5,6} enables them to maximize protein removal other than hemoglobin and to produce a clear exudate free of detectable proteins.

Acknowledgements

Thanks are extended to the Monmouth University Institutional Review Board for the approval of this study. The study was supported by the University Biology Department. Keith Chapman and Wayne Elliott assisted with the density scans.

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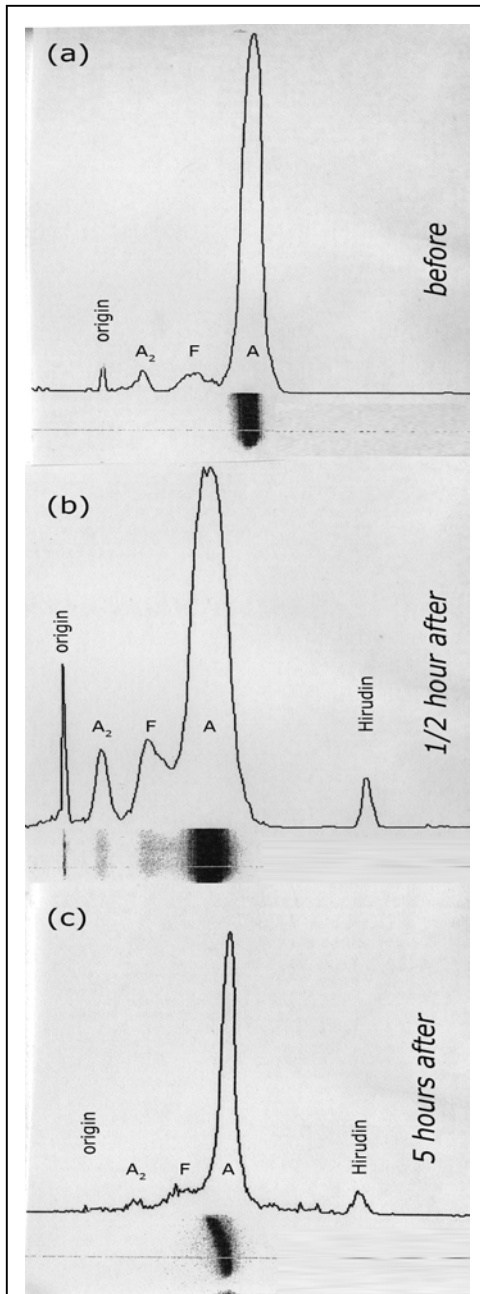


Figure 3. Hemoglobin patterns (a) before leech bite, (b) from wound blood one-half hour after bite and (c) from wound blood five hours after. The hirudin peak is shown in (b) and (c).

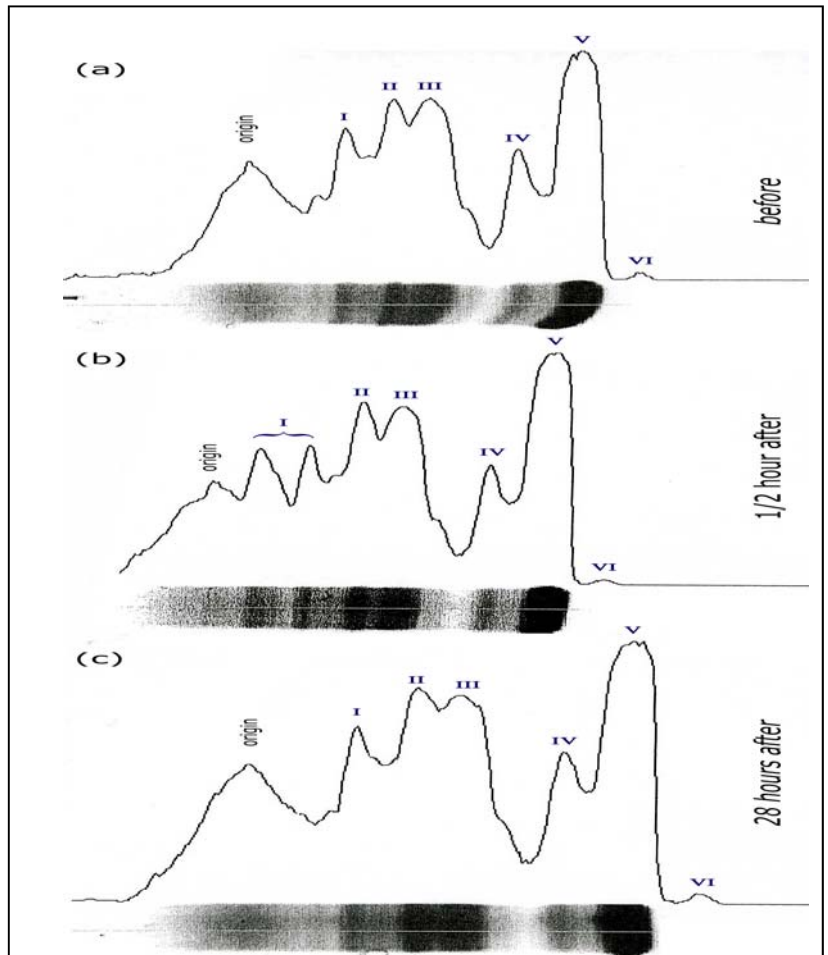


Figure 4. Serum electrophoresis pattern analyses from blood (a) prior to leech bite, (b) from the wound one-half hour after bite and, (c) 28 hours after. In (b) an additional peak appears in the gamma region.

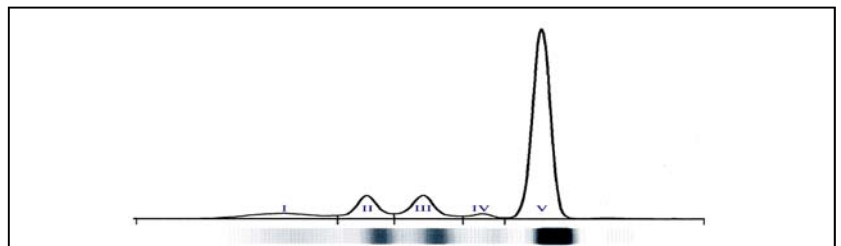


Figure 5. Serum electrophoresis pattern and density trace from hospital analysis of blood from venous puncture performed two hours after leech bite. The pattern is normal (a pre-albumin peak does not appear).

CALL FOR NOMINATIONS

The terms of office for the following positions will be up for re-election to serve on the Year 2007 Executive Board:

President
Corresponding Secretary
Members-at-Large - 2 positions

The duties of these officers will involve attending all Executive Board meetings in addition to specific duties as described below:

It shall be the duty of the President to preside over the annual business meeting of the Association. The President will serve as the chairperson of the Executive Board, will appoint and charge, with the approval of the Executive Board, the chairperson and members of all committees, and will carry out other activities usually pertaining to the office.

The Corresponding Secretary of the Association shall receive and validate applications for membership, respond to all inquiries, assemble and update the directory, and any other duties that usually pertain to this office.

The Members-at Large shall chair committees (Articulation, Exhibition, etc.) and handle other assignments as directed by the Executive Board.

Normally, each candidate for President, and Corresponding Secretary should have been a Member-at-Large for at least one term and each candidate for Member-at-Large should have attended at least one Annual Conference.

DEADLINE FOR NOMINATIONS is September 30, 2006.

If you are interested in running for office (or wish to nominate anyone else), please send a letter of nomination to:

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Student Membership

We encourage your students to become Associate Members in MACUB. Many of them will go on to graduate and professional schools. Their membership, participation and attendance at conferences such as these can enhance the experiences they include on their applications and discuss during interviews.

**2006 MACUB Conference Registration Form
39th Annual MACUB Conference at kingsborough Community College
Saturday, October 28, 2006**

Registrations should be returned no later than October 16, 2006. Registration on the day of the conference will be \$50. A separate form must be completed by each person attending the conference. Please photo copy this form for each additional registrant.

- | | | |
|--------------------------------|---|--|
| <input type="checkbox"/> Dr. | <input type="checkbox"/> Regular Member | <input type="checkbox"/> Student Member ¹ |
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* Name: _____	* School Phone: _____
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*The above information may appear in a Directory of Members unless you indicate otherwise.

Home Address: _____ I prefer MACUB mailings to be sent to my:

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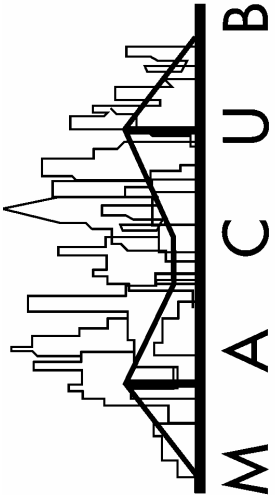
Student and adjunct mailings will normally be sent to your home address.

	Early Bird <u>by 9/15</u>	In Advance <u>by 10/16</u>	On-Site <u>10/28</u>	
<input type="checkbox"/> Regular Member	\$40	\$45	\$50	Includes 2007 Membership dues, conference registration, continental breakfast and luncheon.
<input type="checkbox"/> Student Associate Membership	\$30	\$30	\$35	
<input type="checkbox"/> Member's Spouse/Guest	\$30	\$30	\$35	Includes 2007 Associate Membership dues, conference registration,

- I will not be attending the Conference but enclosed is my 2007 membership dues.
- Regular Member \$15 Student Member \$5

Return this registration form by October 16, 2006
Please make checks payable to: MACUB
Send registration form and check to:
Dr. Paul Russo
Division of Natural Sciences & Mathematics
Bloomfield College
467 Franklin Street
Bloomfield, NJ. 07003

Registration fees are refundable upon written notification by October 16, 2006. The membership fee (\$15 for regular members and \$5 for student members) will be deducted. *No refunds will be given postmarked after October 16, 2006.*



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