Curriculum Vitae:

Name:

Graeme Pierce Berlyn
E.H. Harriman Professor of Anatomy and Physiology of Trees and Forest Management,
Founding and Senior Editor, Journal of Sustainable Forestry
Fellow of the International Academy of Wood Science
Yale University School of Forestry and Environmental Studies

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Education:

1952-1956	Iowa State University, Ames, Iowa, B.S. 1956 (Forestry)
1956-1960	Iowa State University, Ames, Iowa, Ph.D. 1960 (Botany-Forestry)
1969	Northeastern University, Boston, Massachusetts
	Certificate in biological electron microscopy
1978	Yale University, New Haven, Connecticut, M.A. (Hon.)

RESEARCH FOCI:

Our main goal is to deepen knowledge of the ways in which plants respond to the environment in terms of different traits (genetic, physiological, anatomical, and morphological). We examine these traits at different levels of biological organization: molecular, cellular, organ, and organismal. We look at different modes of response such as phenotypic plasticity, the capacity of an organism to change in morphology and physiology in response to environmental signals, and genetic mechanisms as revealed in common garden experiments and DNA analysis. The techniques we have used are cellular (cytophotometry, DNA microsatellites & microarrays, and image analysis of cellular and tissue level changes), light and carbon processing (photosynthesis, reflectivity analyses, fluorescence monitoring, stable isotopes, etc), water relations, and growth analysis. One of the ways we investigate these responses is to use natural gradients of environmental stress such as along elevational gradients in mountains. High elevation sites are indicator ecosystems. Because of their high stress loads they provide indications of stressors impacting landscapes such as acid rain, heavy metals, overgrazing

by domestic animals and wildlife, and impact of recreation and development. Another system is to look at changes along microtopographic transects such as ridge tops, midslope and bottomland sites. Even these finer environmental differences are recorded in the structure and function of leaves, enabling determination which species are optimally adapted to each of these types of habitats. Within the crowns of trees and in cross sections of the forest canopy there are environmental gradients which are reflected in the way these aggregate structures process light. In turn structural and changes mirror these gradients and can be studied using invasive and non-invasive techniques. We, along with colleagues and students, have conducted studies in New England, Canada, Sri Lanka, Panama, Peru, Mexico, Costa Rica, Puerto Rico, Africa, and India. In addition to the field components we also conduct controlled experiments in the Greenhouse and controlled growth rooms in order to more precisely isolate effects of environmental factors such as light quantity and quality, nutrition, competition, and water relations.

A second, more applied goal, is to develop plant growth enhancers. These natural organic substances can reduce fertilizer augmentation by up to 50% and increase insect and water stress resistance while maintaining optimal plant growth. Although plants are deemed to be the ultimate autotrophs they do not grow optimally in many stressful environments. For example if you wish to grow roots in culture it is necessary to supply B vitamins to the culture medium. In the intact plant B vitamins are largely synthesized in the leaves and transported to the roots. Under stress the leaves may not be able to provide the roots with sufficient amounts of vitamins and root growth suffers. Thus one of the components of our plant growth enhancers is vitamins and antioxidants. Some of our plant growth enhancers contain beneficial microorganisms like mycorrhizae that enhance nutrient and water uptake by plants.

Recent Doctoral Dissertations from the Berlyn Laboratory

Marshall, Philip. 2011. Ecophysiological and historical aspects of eastern white pine in New England in relation to human societies (in collaboration with Paul Draghi and Gordon Whitney)

Goodale, Uromi. 2009**.** Forest restoration using native species in Sinharaja Forest Reserve in Sri Lanka (in collaboration with Mark Ashton Tim Gregoire).

Liptak, David. 2007. Evaluating physiological, anatomical and molecular changes in leaves in response to differences in light quantity and quality using DNA microarrays to determine environmentally induced changes in gene action (in collaboration with Xing Wang Deng).

Richardson, Andrew. 2003. Responses of balsam fir and red spruce to elevation and the canopy light gradient (in collaboration with Xuhui Lee).

Rodriguez, Helga. 2000. New tools for the conservation of forest genetic resources: genetic diversity of tree species in forest fragments by DNA microsatellites.

Sivaramakrishnan, Saroj. 2000. Feeding effects of the hemlock woolly adelgid on eastern hemlock anatomy, morphology and physiology: Bio-remediation through the use of Organic biostimulants.

Thadani , Rajesh. 1999. Disturbance, microclimate, and the competitive dynamics of tree seedlings in banj oak (*Quercus leucotrichophora*) forests of the central Himalaya India. (in collaboration with Mark Ashton).

Professional Experience:

1960-62 Instructor and Curator, Samuel James Record Collection of Tropical Woods, Yale University.

1962-67 Assistant Professor and Curator, Samuel James Record Collection of Tropical Woods, Yale University

1963-1965 Research Collaborator and Visiting Scientist (summers) Department of Biology, Brookhaven National Laboratory, Upton, Long Island, New York. Autoradiography,tissue culture, microspectrophotometry, electron microscopy, interference and fluorescence microscopy.

1966 Summer Visiting Scientist. Northern Institute of Forest Genetics, U.S. Forest Service, Rhinelander, Wisconsin. Autoradiography, root regeneration, anatomy of germination, radiosensitivity studies on pines.

1967-1978 Associate Professor, Yale University

1969 Summer Visiting Professor. University of Kentucky, Lexington, Kentucky. Ultrastructural studies of plant cell wall formation.

1971 Visiting Scientist. Cornell University, Ithaca, New York. Electron microscopy of yeast chromosomes.

1978- Professor of Anatomy and Physiology of Trees, Yale University

1980-1988 Director of Doctoral Studies, School of Forestry and Environmental Studies, Yale University and Director of Graduate Studies of the Yale University Graduate School.

2000- The E. H. Harriman Professor of Forest Management, Yale University

2000-2001 Co-Director of Doctoral Studies, op. cit.

Professional Activities:

1966-68 Tree Physiology Committee of the Society of American Foresters.

1967-79 Thesis Abstract Committee of the Society of Wood Science and Technology

1968-73 Chairman, Physiological Section, Botanical Society of America

1976 Co-Chairman, Xylem Physiology Group. IUFRO

1978 Elected Fellow, The International Academy of Wood Science

1979-80 Member of a Committee organizing an international workshop on the "Control of shoot growth in trees" held in July, 1980 in Fredericton, N.B. Canada sponsored by IUFRO

1979-80 Co-Chairman of an international symposium on "Age and growth rate determination in tropical trees: New directions for research" held March 30 - April 14 in Petersham, Mass. USA. Sponsored by the U.S. National Research Council, U.S.D.A. Forest Service, FAO (ROME), the Instituto Nacional de Investigaciones sobre Recursos Bioticos (MEXICO), and Harvard and Yale Universities

1986- Biological Stain Commission - representative of
Botanical Society of America

1986-1988 Board of Directors, Organization of Tropical Studies,
Costa Rica

1986-1989 Member, Editorial Review Board, Tree Physiology

1989-2009 Member, Editorial Board, Biotechnic and Histochemistry
1990- Editor, Journal of Sustainable Forestry

1992-2008 Elected Trustee, Biological Stain Commission

2000 Elected Vice President, Biological Stain Commission

2004-2007 Elected President, Biological Stain Commission
2007-2008 Elected Vice-President, Biological Stain Commission

Honors:

Fellow, The International Academy of Wood Science
Phi Kappa Phi (highest scholastic award of ISU)
Gamma Sigma Delta (Scholastic Honor Society of Agriculture)
Dean's list of outstanding students (ISU)
Sigma Xi, Distinguished military graduate (ISU)
Trustee, Biological Stain Commission (1992)
Vice President, Biological Stain Commission

Current Teaching

F&ES 654a	Anatomy of Trees & Forests
F&ES 658b	Research Methods in Anatomy and Physiology of woody plants
F&ES 656a	Physiology of Trees and Forests
F&ES 6llb	Advanced topics in tree physiology and Ecosystem Ecology
F&ES 612b	Seminar in Alpine, Arctic and Boreal Ecosystems

PATENTS:

Co-holder of two patents for organic biostimulants that increase plant growth while decreasing fertilizer requirements by up to 50% and increase drought resistance.

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BIBLIOGRAPHY OF GRAEME PIERCE BERLYN, 5/17/13

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Berlyn, G.P. l961. Factors affecting the incidence of reaction tissue in *Populus deltoides* Bartr. Iowa State Jour. Sci., 35: 367-424.

Berlyn, G.P. l962. Developmental patterns in pine polyembryony. Amer. Jour. Bot., 79:327-333.

Berlyn, G.P. l962. Some size and shape relationships between tree stems and crowns. Iowa State Jour. Sci., 37:7-15.

Berlyn, G.P. 1963. Methacrylate as an embedding medium for woody tissues. Stain Tech. 38: 23-28.

Berlyn, G.P. 1964. Recent advances in wood anatomy: The cell walls in secondary xylem. For. Prod. Jour. XIV: 467-476.

Greenwood, M.S. and G.P. Berlyn. 1965. Regeneration of active root meristems in vitro by hypocotyl sections from dormant *Pinus lambertiana* embryos. Can. Jour. Bot. 43: 173-174.

Berlyn, G.P. and P.E. Passof. 1965. Cytoplasmic fibrils in proembryo formation in *Pinus*. Can. Jour. Bot. 43: 175-176.

Berlyn, G.P. and R.E. Mark. 1965. Lignin distribution in wood cell walls. Forest Products Jour. 15: 140-141.

Berlyn, G.P. and J.P. Miksche. 1965. Growth of excised pine embryos and the role of the cotyledons during germination in vitro. Amer. Jour. Bot., 52: 730-736.

Berlyn, G.P. 1967. The structure of germination in *Pinus lambertiana* Dougl. Bulletin No. 71. Yale University School of Forestry, New Haven, Conn.

Berlyn, G.P. 1967. A hypothesis for cell wall density. 1968. For. Prod. Jour. 18: 334-336.

Berlyn, G.P. 1968. Biophysical investigations of free space in tracheid cell walls. Amer. Jour. Bot. 55: 728.

Greenwood, M.S. and G.P. Berlyn. 1968. Feulgen cytophotometry of pine nuclei: Effects of fixation, role of formalin. 1968. Stain Tech. 43: 111-117.

Berlyn, G.P. 1969. Microspectrophotometric investigations of free-space in plant cell walls. Amer. Jour. Bot. 56: 498-506.

Berlyn, G.P. 1970. Ultrastructural and molecular concepts of cell wall formation. Wood & Fiber 2: 196-227.

Berlyn, G.P. 1972. Germination and morphogenesis. In T. Koslowski (ed.), Seed biology. Academic Press, New York. pp. 223-311.

Berlyn, G. P. 1972. John E. Sass. Botancial Gazette 133:85-86l.

Greenwood, M.S. and G.P. Berlyn. 1973. Sucrose-indole-3-acetic acid interactions on root regeneration by *Pinus lambertiana* embryo cuttings. Amer. Jour. Bot. 60: 42-47.

Cataldo, D.A. and G.P. Berlyn. 1974. An evaluation of selected physical characteristics and metabolism of enzymatically separated mesophyll cell and minor veins of tobacco. Amer. Jour. Bot. 61: 957-963.

Berlyn, G.P. and R.A. Cecich. 1976. Optical techniques for measuring DNA quantity. In J.P. Miksche (ed.) Modern Methods in Forest Genetics. Springer Verlag, New York. pp. 1-18.

Berlyn, G.P. and J.P. Miksche. 1976. Botanical microtechnique and cytochemistry. Iowa State University Press. Ames, Iowa.

Dhillon, S.S., G.P. Berlyn, and J.P. Miksche. 1977. Requirement of an internal standard for microspectrophotometric measurements of DNA. Amer. J. Bot., 64: 117-121.

Dhillon, S.S., G.P. Berlyn, and J.P. Miksche. 1978. Nuclear DNA content in populations of *Pinus rigida*. Amer. J. Bot. 65: 192-196.

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Bormann, F.H. and Berlyn, G.P. (eds.). 1981. Determination of age and growth rate in tropical trees: New directions for research. Yale Univ. Sch.Forestry Environ. Stud. Bull. 94.

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Berlyn, G. P. and S. Sivaramakrishnan. 1996. The use of organic biostimulants to reduce fertilizer use, increase stress resistance, and promote growth, p 106-112 in T. D. Landis and D. B. South (eds). National Proceedings, Forest and Conservation Nursery Associations. Gen. Tech. Rep. PNW - GTR-389, Portland, OR: Department of Agriculture, Forest Service, Pacific Northwest Research Station.

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