The Consortium for Plant Biotechnology Research, Inc.

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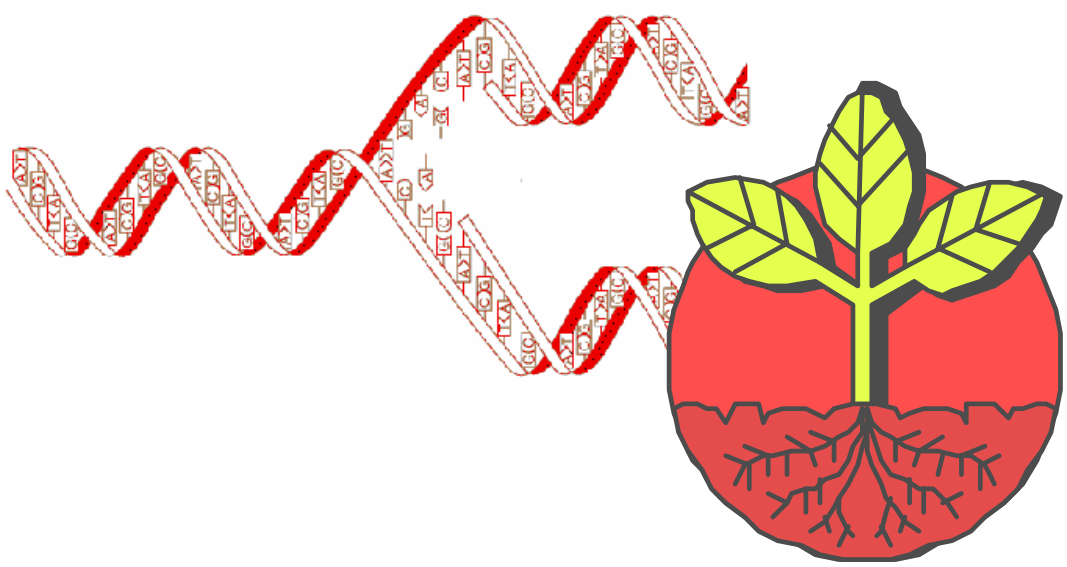
2009 Competitions

Bioenergy and Environment



Request for Preproposals

Preproposal Deadline: December 14, 2007

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Request for Preproposals
Submission Deadline: December 14, 2007

About CPBR
The Consortium for Plant Biotechnology Research, Inc. (“CPBR”) is a non-profit organization that funds peer-reviewed research and technology transfer. CPBR facilitates research interactions among academic, industry and government scientists. Member organizations include universities, companies, and trade associations. Industry sectors represented include the seed, agrochemical, forestry, energy, electric power, health, and other food and non-food agricultural products industries.

Research Areas
Preproposals are requested for research that (1) is related to plant biotechnology and (2) addresses industrial problems and opportunities related to bioenergy and/or the environment. Funding for CPBR research for 2009 may come from the U.S. Department of Energy ("DOE"),and/or the U.S. Environmental Protection Agency ("EPA"). Preproposal writers should review the information provided in Appendix 1 (page 13) concerning the missions and goals of DOE and EPA. Indicate on a preproposal's cover sheet whether the preproposal would fall under DOE missions (i.e., bioenergy), EPA missions (the environment), or any combination of these. Preproposals should also address one or more of the industrial research needs listed on pages 8-12 or one or more of the "breaking news" industrial needs submitted by member companies in October, 2007, found on pages 6-7.

Competition Schedule
Preproposals and Workshop registrations due	December 14, 2007
Industrial review of preproposals	January-February
Workshop: "Writing a Competitive Proposal for CPBR"…… ..... ……	February 11
CPBR Symposium: Preproposals presented in person	February 11-13
Companies’ Registrations of Interest in preproposals	March
Invitations for full proposals issued	mid April
PIs/Universities invite competitive bids for matching funds	May-June
Full proposals due	June 20
Final matching funds confirmations due	September 19
Project selection	November (or later)
Projects start	January 1, 2009 (or later)

Eligibility
Investigators from CPBR member universities are eligible to submit preproposals. Investigators from any other U.S. university may participate through collaboration with a principal investigator (“PI”) at a CPBR member university. There is no limit on the number of preproposals submitted per eligible PI.

Project Duration and Size
One- or two-year projects are requested. Second year funding is subject to scientific progress, feedback from matching companies, and availability of CPBR and matching funds. CPBR awards have ranged from $20,000 to $165,000/year, and have been matched with equal or larger amounts from industry and universities.

MATCHING REQUIREMENTS

CPBR funds requested must be matched at least 1:1 with non-federal funds. PIs are responsible for securing matching funds commitments for their full proposals, which will be due June 20, 2008. The match may come from industry, state or local government, foundations, universities, etc.

Some portion of the match must be from a for-profit company. Industrial cash matching is essential as it represents an independent, objective evaluation of the potential economic value of the proposed research. The company(ies) committing to match must be, or must agree to become, a CPBR member or pay an administrative fee of 25 percent of the total project cost. The deadline for industrial matching funds commitments is September 19, 2008. Matching funds commitments are not required at the preproposal stage.

In-kind (non-cash) support from a company will not be counted as industrial match. However, if a company plans to provide significant technical assistance essential to the completion of the project, a description of such assistance would strengthen the proposal.

The identity of companies committing matching funds is kept confidential by CPBR. They may be listed as a group for purposes such as federal and state reporting, but their names are not associated with specific projects. The Project Recommendation Committee is not given the names of the matching companies, just the amounts of match committed to each proposal.

A match described as "up to" a certain dollar amount will not be accepted as a commitment to match. The dollar amount committed must be specified and must be a firm commitment.

Because most companies require several months to make matching funding decisions, PIs should contact potential industrial sources of matching funds early. PIs are advised to approach companies as potential collaborators and to explain the leveraging that CPBR funds can provide for company R&D funds.If you would like a free copy of CPBR President Dorin Schumacher's book *Get Funded! A Practical Guide for Scholars Seeking Research Support From Business* please email or write us.

REVIEW PROCESS

CPBR uses a two-stage review process.

- Preproposals are reviewed for industrial relevance and practical application(s) by CPBR's member companies. Member companies may register interest in a preproposal in accordance with CPBR's policy on competitive bidding (see page 19). PIs whose preproposals are deemed relevant will be invited to submit full proposals.
- Full proposals are peer reviewed for scientific merit.

Final selection of full proposals will be based primarily on peer reviews. Also considered will be relevance to the needs of industry and CPBR sponsoring agencies, industrial matching funds commitments, and availability of CPBR funds.

INDUSTRIAL REVIEW FOR RELEVANCE

CPBR will send preproposals in PDF format to member company representatives, and the company evaluations will be returned to CPBR after the 2008 Symposium at which company representatives have had an opportunity to talk one-on-one with PIs.

With regard to preproposal content, company representatives prefer to have clear statements of (1) objectives and (2) expected outcomes and not information about details of research methodology. Because of the diverse expertise of company representatives, and because preproposals may be circulated for review within a company, the language of a preproposal should be clear and understandable to non-scientists and should not include sensitive or proprietary information.

CPBR 2008 SYMPOSIUM

PIs participating in the 2009 competition must present their preproposals as posters at CPBR's Symposium to be held February 11 – 13, 2008 at The Morris & Gwendolyn Cafritz Foundation Conference Center, George Washington University, 800 21st Street, N.W., Suite 204, Washington, DC 20009. It is important that PIs make hotel reservations early. Washington D.C. will be extremely busy during the time of the symposium. Reservations can always be cancelled later.

The Symposium will provide an opportunity to meet industry scientists and attract matching fund commitments. A workshop, "Writing a Competitive Proposal for CPBR" will precede the Symposium. (See below.) Travel assistance of up to $400 is available to investigators who present a preproposal poster and do not have current CPBR funding. Reimbursement guidelines will be emailed to registrants who are eligible for assistance and will also be available at the Symposium registration desk. Further information will be provided with the Symposium announcements.

PRE-SYMPOSIUM WORKSHOP: "WRITING A COMPETITIVE PROPOSAL FOR CPBR," FEBRUARY 11, 2008

Winning proposals are developed through planning and experience. This workshop will describe how to develop a winning proposal from planning to writing. It will provide tips from successful researchers on how to be competitive in CPBR competitions. A proposal that was funded by CPBR will be studied. Each section of the proposal will be discussed and common mistakes will be addressed. Participants will be given the opportunity to act as reviewers in a hands-on exercise. Leaders of the review groups will be scientists who have been successful in CPBR competitions. Strategies for getting industrial matching will also be presented.

WORKSHOP/SYMPOSIUM REGISTRATION

For CPBR's planning, we need to know who will be attending the Symposium and what their poster topics are. Please complete one registration form and return it with your preproposal(s).

COMPANY REVIEWS: REGISTRATION OF INTEREST IN PREPROPOSALS AND BIDDING FOR RIGHTS TO INTELLECTUAL PROPERTY

A member company may register interest in a preproposal on the *Industrial Preproposal Evaluation Form* and return it to CPBR. See the CPBR policy *Registration, Notice and Bidding for Exclusive Rights to Intellectual Property Developed Through CPBR Funding* (Appendix 2) for the definition of "Registration of Interest." CPBR will inform each PI of the identity and contact information for all companies that register interest in the PI's preproposal.

When two or more qualified companies register interest in the same preproposal, the PI and his/her university must follow CPBR's policy to insure a process of orderly and fair bidding for exclusivity. The policy requires the PI or other university official to notify (in writing) each qualified company that desires exclusivity that another qualified company has submitted a Registration of Interest. All interested qualified companies must be so notified and must be given an equal opportunity to bid and negotiate for desired intellectual property rights and/or options.

MINORITY COLLABORATIONS

PIs are strongly encouraged to establish research and educational collaborations with scientific colleagues at minority institutions such as Historically Black Universities, Hispanic, and Native American institutions. For information and assistance in establishing such collaborations, contact CPBR.

PREPROPOSAL SUBMISSION

Each preproposal package should contain the following items:

- CPBR Preproposal Cover Sheet (Appendix 3, also available as a Word file)
- Project Summary
- Workshop/Symposium Registration Form (Appendix 4)
- Draft poster (see Appendix 5)
- Photos of PI and each CoPI

The project summary should include in two or three single-spaced pages:

- Preproposal title
- Objectives
- Anticipated outcomes
- Discussion of the perceived value or potential commercial applications
- Discussion of containment if GM plants are used

CPBR requests electronic submission of preproposals as Word or PDF documents. These may be sent as email attachments to <info@cpbr.org> or sent on diskette or CD to the address below. If electronic submission is not possible, preproposals should be printed in Arial (the ideal typeface for scanning).

All preproposals, regardless of format, must be **received** at CPBR by **5:00 p.m., December 14, 2007.** The print copies and diskettes or CDs should be sent to:

Dr. David Loehle, Research Grants Coordinator
The Consortium for Plant Biotechnology Research, Inc.
P.O. Box 20634
(For express delivery, address to: 100 Sylvan Drive, Suite 210)
St. Simons Island, GA 31522

Phone: 912-638-4900 Fax: 912-638-7788
Email: dloehle@cpbr.org URL: www.cpbr.org

CPBR will acknowledge receipt of preproposals by email.

CPBR MEMBER UNIVERSITIES AND REPRESENTATIVES AND MEMBER COMPANIES

UNIVERSITIES	REPRESENTATIVE
Arkansas State University	Elizabeth Hood
Clemson University	Tom Schwedler
Dartmouth College	Lee Lynd
Donald Danforth Plant Science Center	Sam Fiorello
Florida State University	Hank Bass
Georgia Institute of Technology	Gerald Pullman
Indiana University	Mark Estelle
Iowa State University	Walter Fehr
Kansas State University	Forrest Chumley
Louisiana State University	Harold Silverman
Michigan State University	J. Ian Gray
Michigan Technological University	Chung-Jui Tsai
Montana State University	Thomas McCoy
New Mexico State University	Abbas Ghassemi
North Carolina State University	Steven Lommel
North Dakota State University	W. David Dai
Northwestern University	Michael Green
The Ohio State University	F. Robert Tabita
Oregon State University	John Cassady
The Pennsylvania State University	Bruce McPheron
Purdue University	Sonny Ramaswamy
South Dakota State University	Gary Lemme
Southern Illinois University	David Lightfoot
Syracuse University	John Russell
Texas Agricultural Experiment Station	Mark Hussey
University of Chicago	Gayle Lamppa
University of Colorado	Fred Pampel
University of Connecticut	Yi Li
University of Florida	James Preston
University of Georgia	David Lee
University of Hawaii	Michael Antal, Jr
University of Illinois	Maryann Lila
University of Iowa	TBD
University of Kentucky	William F. Schweri
University of Massachusetts	Steve Goodwin
University of Michigan	John C. Thomas
University of Minnesota	Michael Sadowsky
University of Missouri	Mark Linit
University of Nebraska	Donald Weeks
University of Tennessee	Max Cheng
University of Toledo	Alan Goodridge
University of Washington	Mary Lidstrom
University of Wisconsin	Petra Schroeder

COMPANIES
Agrivida, Inc.
AgroFresh, Inc.
ArborGen, LLC
Archer Daniels Midland Company
Ashland Specialty Chemical Company
Aventine Renewable Energy, Inc.
Bayer CropScience
BioDimensions
Biotechnology Research & Development Corporation
ButylFuel, LLC
Carbon Diversion, Inc.
Cargill, Inc.
Ceres, Inc.
Dow AgroSciences, LLC
Edenspace Systems Corporation
Expansyn Technologies, Inc.
Hawaii Agricultural Research Center
HybriGene, Inc.
iDiverse, Inc.
Iowa Soybean Association
Key Ingredients, Inc. / ViaLactia Biosciences
Landscape Plant Development Center
Metabolix, Inc.
Monsanto Company
New York Chapter American Chestnut Fdn., Inc.
NewFields Companies, LLC
Phenotype Screening Corporation
The Peanut Foundation
The Procter & Gamble Company
Renessen. LLC
Renewable Fuels Association
Syngenta
TreeFree Technologies, Inc.
UniSouth Genetics, Inc.
United States Golf Association
Venganza, Inc.
Weyerhaeuser Company
WorldWide BioEnergy, LLC
XL TechGroup, Inc.

"BREAKING NEWS" SOME INDUSTRIAL RESEARCH NEEDS – AS OF FALL 2007

CPBR invited member companies to submit a short summary of current research needs. These are presented below with company identification removed.

Company 30
Our company continues to have broad interest in agronomic trait improvements, but is increasingly focusing on quality trait outputs. Areas of need for agronomic traits include: mechanisms of crop pathogen resistance, molecular basis for crop yield and environmental stress response, and insight into advanced breeding concepts (apomixes, hybrid vigor, compatibility). The quality traits interests are broad, but include basic information relating to oil and protein composition, nutritional value, biofuels (ethanol and biodiesel) and novel product opportunities for use of materials from major crops. Enabling technologies include refined analytical methods, remote sensing and imaging, novel transformation and gene stacking capabilities, targeted integration, and insight into many aspects of gene expression and regulation including protein expression systems in plants and promoters

Company 42
Our company is committed to developing new sources of critical materials in order to assure sustainability of supply and control of costs. To achieve this, flexibility to use a variety of feedstocks, including petroleum, coal, gas and renewable, to make specific materials is advantageous. CPBR helps us to monitor technology and fund projects that specifically address the renewables portion. Note that, short term, we are looking for new ways to produce old materials, but long term can help develop cheaper alternatives.

INDUSTRIAL RESEARCH NEEDS -- 2009 COMPETITIONS - BIOENERGY, ENVIRONMENT, HEALTH

The following research needs and issues have been identified by CPBR member companies and sponsoring agency representatives.

AGROCHEMICALS

1. Fate of agrochemicals, including biological/ microbial pesticides, with emphasis on environmental impact:
   - ♦ factors that influence detoxification in soil or water
   - ♦ pathways of agrochemical metabolism in target organisms
   - ♦ fate of microbial pesticides in the environment
   - ♦ fate of agrochemicals in the environment
2. Identification of vulnerable target sites:
   - • molecular targets of herbicide/pesticide/ biopesticide action
   - ♦ gene products which influence agronomically important traits
   - ♦ new genes to confer pest and disease resistance, including those native to the target species
   - ♦ pesticidal metabolites from fermentation
3. Mechanisms of resistance to agrochemicals and biological pesticides:
   - ♦ detoxification systems in insects
   - ♦ herbicide tolerance in crops
   - ♦ mechanisms of cross resistance to different agrochemicals and biopesticides
   - ♦ strategies to delay development of resistance
4. Microbes affecting crop production:
   - ♦ plant pathogens for mycoherbicides
   - ♦ microbes for control of insect and nematode pests and for plant pathogens
   - ♦ survival and spread of microbes
   - ♦ mechanisms determining the host range of entomopathogens
5. Biopesticides and bioherbicides from vegetable oils:
   - ♦ lipid biosynthesis
   - ♦ transformation
6. Alternatives to agrochemicals to manage loss of biomass crops due to pests and disease:
   - ♦ genetic modification of crops to increase resistance to pests and diseases
   - ♦ new genes to confer pest and disease resistance, including those native to the target species
7. Mechanisms of plant growth regulation/plant hormones.
8. Development of feedstock chemicals from plants.
9. Novel plant derived chemicals.
10. Isolation of plant enzymes to make chemical products.

BIOMASS CONVERSION

1. Improve biomass conversion to biofuels:
   - ♦ improve processing economics
   - ♦ improve industrial fermentation organisms (optimize growth rate, ethanol and other product/byproduct tolerance, thermo tolerance, robustness, tolerance to shear and other physical stress)
   - ♦ use thermophilic bacteria as sources of thermally stable enzymes for biomass conversion
   - ♦ improve physical properties and catalytic efficiency of conversion enzymes through protein engineering
   - ♦ convert methanogenic organisms to production of other fuel gases (e.g. propane, butane)
   - ♦ improve fractionation/purification of fermentation products
   - ♦ improve physical and enzymatic pretreatment of cellulosic materials to improve conversion efficiency
   - ♦ improve rates of enzymatic hydrolysis of cellulose
   - ♦ better, more efficient conversion of 5-carbon sugars and better understanding of pathways
   - ♦ genetically modify biomass crops to express enzymes required for conversion to biofuels
   - ♦ analyses of enzymology, biochemistry and genetics of degradation of starch, cellulose, lignin and other plant polysaccharides and determine metabolism of sugars released
   - ♦ genetic modification of plant properties which will tailor them to improve processing
   - ♦ hydrogen production via gasification
2. Identify and develop uses of biomass to conserve petroleum fuels:
   - ♦ improve plant components for use as substitutes for petroleum products
   - ♦ develop biodegradable polymers for plastics
   - ♦ biodiesel, utilization of byproducts
   - ♦ ethanol, utilization of byproducts
   - ♦ production of biocarbon/charcoal
   - ♦ catalytic conversion of syngas to ethanol

The following research needs and issues have been identified by CPBR member companies and sponsoring agency representatives.

BIOMASS CONVERSION (cont.)

3. Develop processes to produce and purify industrially important materials from crops:
   - ♦ produce and utilize alternative end products from fermentation
   - ♦ industrial uses of vegetable oil methyl esters
   - ♦ basic biochemistry of non-food products
   - ♦ improve separation technology for production of chemicals by fermentation
4. Improve utilization of all components of feedstocks:
   - ♦ improve plant components for use as substitutes for petroleum products (detergent additives, biodiesel fuels, lubricants)
   - ♦ combination of fermentation and thermochemical technology
   - ♦ minimize residues, and/or generate coproducts from residues
   - ♦ identify, quantify, and ameliorate residues—gaseous, liquid and solid phase—generated by the processing of biomass
   - ♦ energy production from stillage
5. Biomass for electricity production:
   - ♦ conversion of biomass in sufficient quantities and at a price competitive with conventional fuels used in electricity generation
   - ♦ conversion options for specific feedstocks: gasification, co-firing; combined cycle, fuel flexibility
   - ♦ waste products and byproducts: ash disposal, nitrogen and sulfur oxides, carbon dioxide, scrubber sludge uses
   - ♦ develop other marketable products from waste material
   - ♦ compare compositional information and suitability of crops for conversion

ENERGY CROP PRODUCTION

1. Identification and development of novel plant materials suitable to serve as biomass feedstock:
   - ♦ alternative renewable energy crops to serve as cellulosic feedstocks
   - ♦ harvestable fruits or transported saps/latexes from long term perennial crops as alternative feedstocks
2. Improve productivity of current biomass crops:
   - ♦ genetic modification of biomass crops to increase yield
   - ♦ determine microbial interaction with plants
   - ♦ genetic modification of microorganisms associated with biomass crops
   - ♦ develop pest control biotechnologies
   - ♦ environmental and biological stress systems
   - ♦ genetically engineer herbicide resistant crops
3. Genetically modify biomass crops to increase suitability as a feedstock:
   - ♦ increase understanding of the structure, composition and conversion of cell wall components
   - ♦ determine mechanisms regulating size and composition of carbohydrate pools in plants
   - ♦ modify carbohydrate composition of biomass crops to be consistent with conversion process (higher starch level in corn, less lignin in cellulosic feedstocks, shorter chain length in starch, etc.)
   - ♦ modify oil content to produce more optimal balance for specific industrial applications of environmentally favorable plant oils (biodiesel, lubricants)
   - ♦ increase solids content (lower water content) of biomass feedstocks
   - ♦ characterize mechanisms to control the composition of secondary metabolites in biomass crops
4. Improve sustainability of biomass production:
   - ♦ increase efficiency of Ca^{+2} and Mg^{+2} use by plants to minimize demineralization of soil
   - ♦ develop methods to produce and harvest biomass crops that minimize soil erosion and promote soil conservation
   - ♦ determine limitations to achieving truly sustainable biomass production
   - ♦ monoculture problem
5. Develop somatic embryogenesis for woody crops.

The following research needs and issues have been identified by CPBR member companies and sponsoring agency representatives.

ENERGY CROP PRODUCTION (cont.)

6. Biomass for electricity production:
   - ♦ perennials and trees applicable for biomass power utilization
   - ♦ plants with a potential for a high-value co-product that results in relatively large amount of residues available for biomass power
   - ♦ increase yield through genetic or cultural manipulation (biotechnology or bioengineering)
   - ♦ produce biomass in sufficient quantities and at a price competitive with conventional fuels used in electricity production
   - ♦ optimize feedstock growth characteristics: growth rate, energy content/density, biomass density per acre, fertilizer and pesticide requirements, water requirement
   - ♦ optimize feedstock chemical composition: lignin, water, ash, slagging, tradeoff with growth rate and yield, byproduct or coproduct possibilities, relationship between composition and suitability for conversion
   - ♦ optimize other feedstock properties: harvesting, transport, drying, storage, combustion, problem wastes
   - ♦ optimize feedstock availability: seasonality, amount, sustainability

ENABLING BIOTECHNOLOGIES

1. Improve genetics methods:
   - ♦ genetic purity and fingerprinting for plant variety and patenting
   - ♦ genetic tools to enhance traditional breeding of biomass crops
   - ♦ develop genetic maps, especially for biomass crops
2. Improve systems for transformation of agronomic plants:
   - ♦ develop transformation systems, especially in monocots
   - ♦ develop vectors and selectable markers
   - ♦ optimize methods for stable genetic transformation
   - ♦ determine mechanisms regulating gene expression
   - ♦ develop Agrobacterium techniques
   - ♦ develop non-Agrobacterium techniques
   - ♦ gene tagging
   - ♦ improve double haploid production techniques
   - ♦ develop capabilities to transfer multi-gene pathways and clone them into commodity crops
3. Plant propagation and regeneration systems
4. Improved processes for plant cell and tissue culture:
   - ♦ expression of secondary plant metabolites in differentiated tissue culture
   - ♦ induce differentiated callus cultures to produce differentiated secondary tissues
   - ♦ develop immobilized plant cell systems for production of plant products
   - ♦ address scale-up problems of natural products
   - ♦ develop high secretion systems in plant cell culture
5. Characterize molecular mechanisms underlying and controlling agronomically important traits:
   - ♦ develop inducible genetic regulatory systems for syntheses of specialized products in plants that will work in the field as well as in tissue culture
   - ♦ reproductive biology
   - ♦ new genes for stress tolerance
6. Characterize metabolic pathways for synthesis of important plant products and coproducts:
   - ♦ genetic modification of rate-limiting reaction steps
   - ♦ modification of reaction steps to force accumulation of valuable intermediates
   - ♦ modification of enzyme reactions in pathways to produce modified products
7. Gene regulation:
   - ♦ tissue specific and inducible promoters
   - ♦ novel methods of regulating gene expression
   - ♦ sterility and control of sexual reproduction
   - ♦ development of regulatory genes that respond to environmental, chemical, and physical stimuli
8. Determine the metabolism, biochemistry and genetics in plants and animals of plant-synthesized toxins and other undesirable components.
9. Examine chemistry, biochemistry, and physical properties of plant carbohydrates, proteins, lipids, and metabolites and relate this knowledge to physiology and genetics.
10. Develop stereospecific and regiospecific systems for biotransformation of existing compounds which are synthetically difficult for the production of novel and more efficacious products.
11. Genomics topics.

INDUSTRIAL RESEARCH NEEDS -- 2009 COMPETITIONS - BIOENERGY, ENVIRONMENT, HEALTH

The following research needs and issues have been identified by CPBR member companies and sponsoring agency representatives.

ENVIRONMENTAL ISSUES

1. Bioremediation/phytoremediation:
   - ♦ bioremediation of marginal lands by biomass crops
   - ♦ use of fungi
   - ♦ evaluation techniques
   - ♦ identify nutrients to improve bioremediation processes
   - ♦ treatment of plant effluent
   - ♦ addition of nutrients to soil-ecology; how to stimulate desirable microorganisms and eliminate undesirable pathogens
   - ♦ phytoremediation of aromatic pollutants and development of elite clone lines
2. Reduction of greenhouse gas emissions:
   - ♦ methods to fix or use carbon dioxide from fermentation
   - ♦ develop fermentations yielding products other than ethanol (e.g., acetone) which may produce less carbon dioxide production as a byproduct
   - ♦ direct conversion of biomass to carbon/charcoal
3. "Fertigation" with wood mill effluent:
   - ♦ use marginal/non productive lands
   - ♦ salt and heavy metal buildup problem
   - ♦ ground water contamination
4. Identify ecological consequences of intensive biomass cropping.
5. Determine environmental impact of deliberate release of genetically modified biomass crops and microorganisms:
   - ♦ assess effects of pollen drift on wild plant relatives;
   - ♦ assess effects of pollen drift on non-target pests;
   - ♦ assess development of resistance in target pests, microbes, and viruses;
   - ♦ assess possible toxicity or immunogenicity of new gene products in food crops;
   - ♦ . assess possible toxicity of new gene products in soil and water.
6. Develop methods to prevent escape of introduced genes from engineered crops.
7. Determine cost-differential for conventional breeding "release" versus laboratory genetic modification release.
8. Determine environmental impact of using vegetable oil and animal fats to replace petrochemicals in industrial uses.

FOREST PRODUCTS

1. Pulp and paper:
   - ♦ identify components of post-harvest wood degradation and modify resistance, i.e. extend the "shelf life" of stored wood (to reduce bleaching costs)
   - ♦ reduce energy in pulping process by fiber structure modification--longer, thin-walled fibers
   - ♦ reduced lignin content
   - ♦ extraction of higher-valued chemicals from pulp
   - ♦ methods to approach zero water usage in pulp and paper mill
   - ♦ design a pulp and paper mill with no aqueous, air or solids pollution
   - ♦ methods to automatically sort and handle incoming wastepaper for recycled paper applications
   - ♦ requirements to achieve a low energy, high strength, high brightness, high yield mechanical pulp fiber
   - ♦ zero chlorine bleaching
2. Solid wood products:
   - ♦ increased strength properties
   - ♦ stain resistance
3. Forest crop production:
   - ♦ herbicide tolerance - new genes
   - ♦ insect and disease tolerance - new genes to inhibit insect damage
   - ♦ increased specific gravity
   - ♦ develop more prolific and/or aggressive predators for spruce bud worm on spruce, aspen defoliators (e.g. tent caterpillars)
   - ♦ better propagation: clone (cell/tissue culture) outstanding conifer or deciduous species
   - ♦ discover the role of the major physiological factors in the growth of trees
   - ♦ design efficient clonal forestry system
   - ♦ locate/specify key genetic markers related to tree growth
   - ♦ discover the components for a system of intensive cultivation of trees so that optimal growth rates can be achieved

The following research needs and issues have been identified by CPBR member companies and sponsoring agency representatives.

FOREST PRODUCTS (cont.)

4. Biomass/cogeneration production for short rotation species including hybrid aspen for limiting nutrients (e.g. Ca^{+2} on forest soils):
   - ♦ extract higher valued products (e.g. alcohols, starches) prior to burning
5. Integration of ecosystems and timber management.
6. Controls on transgenic material introduced into the environment (e.g. male sterility, female sterility, etc.).
7. How to balance genetic gain against propagation efficiency in hard-to-propagate but valuable clones.

PROCESS APPLICATIONS

- Examination of chemistry, biochemistry, and physical properties of plant carbohydrates, proteins, lipids, and metabolites, and relate this knowledge to physiology, and genetics.
- Analyses of the enzymology, biochemistry, and genetics of degradation by microorganisms of starch, cellulose, lignin, and other plant polysaccharides, and determine metabolism of sugars released by such degradation.
- Development of new processes for the production and purification of industrially important materials from crops.
- Examination of new processes for the modification and conversion of plant materials.
- Determination of the metabolism, biochemistry, and genetics in plants and animals of plant-synthesized toxins and other undesirable components.
- Exploration of genetic engineering of plants to improve processing economics.
- Development of improved processes for plant cell and tissue culture.
- Fermentation technology.
- Better separation technology for production of chemicals by fermentation.
- Reduce energy expenditures in processing.

SEEDS

1. Microbial interaction with seeds:
   - ♦ pathogens
   - ♦ symbionts
   - ♦ stimulants
   - ♦ vigor-enhancing factors from natural products
2. Improved product quality:
   - ♦ germination
   - ♦ manipulation of seed components
   - ♦ long-term seed viability
   - ♦ altered grain composition
   - ♦ improved seed vigor and disease resistance
   - ♦ increased seed yields
   - ♦ new genes to confer pest and disease resistance, including those native to the target species
3. Novel hybrid seed production techniques with or without transformation of cytoplasmic elements.
4. Food-related seed industry interests.
5. Develop artificial seeds via somatic embryogenesis.
6. Expression of enzymes in seeds.

APPENDIX 1: EPA AND DOE MISSIONS AND GOALS

EPA Research Authorities

According to the Catalog of Federal Domestic Assistance, the EPA Office of Research and Development and the National Center for Environmental Research receive research authorization from the following statutes:

1. Clean Air Act (42 U.S.C. 7401)

One of the stated purposes of the Clean Air Act ("CAA") is "to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution." The CAA authorizes a variety of research activities to, for example:

- prevent and control air pollution resulting from the combustion of fuels
- improve, cost-effective techniques for-(A) control of combustion byproducts of fuels, (B) removal of potential air pollutants from fuels prior to combustion, (C) control of emissions from the evaporation of fuels, (D) improving the efficiency of fuels combustion so as to decrease atmospheric emissions, and (E) producing synthetic or new fuels which, when used, result in decreased atmospheric emissions
- prevent or controlling discharges into the air of various types of pollutants
- develop low emission alternatives to the present internal combustion engine

2. Clean Water Act (33 U.S.C. 1251)

The Clean Water Act ("CWA") is a 1977 amendment to the Federal Water Pollution Control Act of 1972. The CWA sets the basic structure for regulating discharges of pollutants to waters of the United States. The CWA authorizes EPA to make grants to study methods to reduce water pollution.

3. Resource Conservation and Recovery Act (42 U.S.C. 6901)

The Resource Conservation and Recovery Act ("RCRA") gives EPA the authority to control the generation, transportation, treatment, storage, and disposal of hazardous. RCRA authorizes EPA to fund research activities to improve the disposal of solid waste by, for example:

- the production of usable forms of recovered resources, including fuel, from solid waste;
- the reduction of the amount of such waste and unsalvageable waste materials;
- the development and application of new and improved methods of collecting and disposing of solid waste and processing and recovering materials and energy from solid wastes;
- the identification of solid waste components and potential materials and energy recoverable from such waste components.

4. Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136)

One of the primary goals of Federal Insecticide, Fungicide, and Rodenticide Act ("FIFRA") is to provide federal control of pesticide distribution, sale, and use. EPA was given authority to study the consequences of pesticide usage and to assist in the development of alternatives to chemicals to develop and improve the safe use and effectiveness of chemical, biological, and alternative methods to combat and control pests that reduce the quality and economical production and distribution of agricultural products to domestic and foreign consumers.

5. Toxic Substances Control Act (15 U.S.C. 2601)

The Toxic Substances Control Act ("TSCA") gives EPA the ability to track industrial chemicals currently produced or imported into the United States. EPA has the authority to screen these chemicals and can require reporting or testing of those that may pose a hazard.

6. Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601)

The Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA or “Superfund”) was enacted to allow EPA to clean uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. CERCLA includes authorization for EPA to conduct research for several purposes. Research, evaluation, testing, development, and demonstration of alternative or innovative treatment technologies may be utilized in response actions to achieve more permanent protection of human health and welfare and the environment.

DOE Bioenergy Topics

Bioenergy technologies use renewable biomass resources to produce an array of energy related products including electricity, liquid, solid, and gaseous fuels, heat, chemicals, and other materials. Bioenergy ranks second (to hydropower) in renewable U.S. primary energy production and accounts for three percent of the primary energy production in the United States.

Technologies

Biomass Resources
The term "biomass" means any plant derived organic matter available on a renewable basis, including dedicated energy crops and trees, agricultural food and feed crops, agricultural crop wastes and residues, wood wastes and residues, aquatic plants, animal wastes, municipal wastes, and other waste materials. Handling technologies, collection logistics and infrastructure are important aspects of the biomass resource supply chain.

Biopower
Biopower technologies are proven electricity generation options in the United States, with 10 gigawatts of installed capacity. All of today's capacity is based on mature direct-combustion technology. Future efficiency improvements will include co-firing of biomass in existing coal fired boilers and the introduction of high-efficiency gasification combined-cycle systems, fuel cell systems, and modular systems.

Biofuels
A variety of fuels can be made from biomass resources, including the liquid fuels ethanol, methanol, biodiesel, Fischer-Tropsch diesel, and gaseous fuels such as hydrogen and methane. Biofuels research and development is composed of three main areas: producing the fuels, finding applications and uses of the fuels, and creating a distribution infrastructure.

Biobased Chemicals and Materials
Biobased chemicals and materials are commercial or industrial products, other than food and feed, derived from biomass feedstocks. Biobased products include green chemicals, renewable plastics, natural fibers, and natural structural materials. Many of these products can replace products and materials traditionally derived from petrochemicals, but new and improved processing technologies will be required.

Integrated Bioenergy Systems and Assessments
The economic, social, environmental, and ecological consequences in growing and using biomass are important to understand and consider when addressing technological, market, and policy issues associated with bioenergy systems.

* Source: http://www.eere.energy.gov/RE/biomass.html

APPENDIX 2: GUIDELINES FOR COMPETITIVE BIDDING

REGISTRATION, NOTICE, AND BIDDING FOR EXCLUSIVE RIGHTS TO INTELLECTUAL PROPERTY DEVELOPED THROUGH CPBR FUNDING

The Consortium for Plant Biotechnology Research, Inc. ("CPBR") is a partnership between universities and companies. In order to insure fairness to all members in the matter of exclusivity of rights to intellectual property developed through CPBR-funded research projects, these rules have been adopted by the CPBR Board of Directors, effective April 21, 1998. All members and other participants in CPBR competitions, by participating in a competition, agree to abide by these rules.

CPBR requires that any request for CPBR funds be matched 100 percent by non-federal funds, a portion of which must come from industry. CPBR provides its corporate members with the opportunity to provide matching funds in the following way. In the CPBR competition process, preproposals submitted to CPBR are provided to member companies for review. Each qualified company is asked to review each preproposal for such factors as 1) the degree of the company's interest in the research, 2) the company's assessment of the potential for industrial applications and potential for application by the company, 3) scientific merit, and 4) the desire for further discussions with the principal investigator ("PI"). Thus, the companies register their interest in a proposed project by their responses.

In many cases, more than one qualified company may register interest in a proposed project. "Registration of Interest" is defined as a "yes" response by a qualified company to the Industrial Preproposal Evaluation Ballot question, "Do you want the PI to contact you to discuss this project?"

Three levels of company interest are possible: 1) a qualified company may wish to provide matching funds for a project but have no interest in exclusive intellectual property rights in projects funded by CPBR ("exclusivity"); 2) two or more qualified companies may wish to provide matching funds for a project, but one company may want exclusivity in one area of a project and the other company may want exclusivity in another, unrelated area of the project–the companies are not in competition for exclusive rights to the same area; and 3) two or more qualified companies may wish to provide matching funds for a project and all the companies may want exclusivity in the same area. In this case, all the companies are in competition for exclusivity.

In the case of 1) and 2) above, the university may proceed to negotiate with the interested qualified company or companies in its discretion. In the case of 3) above, the university shall proceed in accordance with these rules.

Only member companies may submit a Registration of Interest on a preproposal, except that any non-member company which submits a Registration of Interest to CPBR with a check for annual dues for one year and a completed application for membership shall be considered to have a timely qualified Registration of Interest on file, even if the Board of Directors has not yet acted on its request for membership. Such companies, together with member companies, shall be considered "qualified" companies. The Board of Directors will act promptly on all such requests for membership. In the event the Board of Directors approves the application, it shall be effective from the date of receipt of the check, and if denied, the check will be returned and the application denied.

The companies' Registrations of Interest are kept confidential by the CPBR. CPBR will inform, on a strictly confidential basis, each principal investigator of the identity of all companies that have registered interest in his/her proposed project, and where appropriate or necessary, the areas of the projects that are of interest. The principal investigator will not disclose to any other company the identity of any qualified company that has a Registration of Interest on file for the proposed project. Breach of this confidentiality may lead to automatic rejection of the proposed project and/or constitute a bar to future funding for the investigator and/or university member, in the sole discretion of the CPBR Board of Directors.

In order to insure a process for orderly and fair bidding for exclusivity when two or more qualified companies are in competition for rights to the same area of a project, CPBR requires that, where applicable, each qualified company desiring exclusivity be notified by the principal investigator or other university official, without identifying the other company or companies, that one or more Registrations of Interest are on file for the proposed project. Each interested qualified company desiring exclusivity must be given an equal opportunity to make its highest and best offer for providing matching funds and for obtaining exclusivity, if desired.

The principal investigator or other university official must notify each qualified company that desires exclusivity (in writing) that another qualified company has a Registration of Interest, without disclosing the identity of such firm, and must give the company the opportunity to make its highest and best offer for such rights, including matching funds and any other support, its request for any exclusivity that is desired, terms of such rights and any other terms it may propose. CPBR must be copied on the letter that is sent to each company requesting its bid. The only Registration of Interest that can block the granting of exclusivity is that of a qualified company.

Exclusivity may not be granted until all interested qualified companies have been notified and have been given an equal opportunity to bid and negotiate for such rights. Universities participating in the competition are prohibited from entering into an exclusive arrangement until they have informed CPBR that they have followed these rules and have negotiated impartially with all interested qualified companies.
In evaluating such assurances, CPBR will take into account such factors as the amount of the match, the duration of the match, other resources to be provided such as equipment, potential applications by the company, the creation of jobs and other economic benefits, and statements by the companies as to the fairness of their treatment by the university. The university reserves the unilateral right to make a decision as to which matching funds and exclusivity offer it will accept. The above procedures and practices are also applicable to second year funding or subgrants to which exclusivity has not yet been assigned in accordance with these rules. In the event of second year funding in which more than one qualified company is interested in providing matching, the university shall negotiate fairly with all interested parties but shall place special emphasis on the company(ies) that supplied first year matching.

No funds will be awarded by CPBR to a university that is in violation of these rules. These rules apply equally to initial and follow-on subgrants. Any protest under these rules will be brought to CPBR for resolution at the staff level.

Companies and universities must abide by these rules as a condition of their continuing membership in CPBR. A university may not grant exclusivity to a non-qualified company unless there are no qualified companies interested in exclusivity. A university can apply to CPBR at any time for a waiver of these rules based on unique circumstances.

Letter of Notice of Bidding for Exclusivity Opportunity

(Name of Representative of Qualified Company)
(Qualified Company Name)
Address

Re: (Project name) (Principal Investigator Name)

Dear (Name of Representative),

The Consortium for Plant Biotechnology Research, Inc. (“CPBR”) has informed me/us that your company has registered interest in the referenced project.

This is to inform you that another qualified company has registered interest in the referenced project. In order to insure a fair and impartial bidding process, (university name) is hereby giving you the opportunity to make an offer of matching funds and to request whatever exclusivity of intellectual property you may wish. The other qualified company(ies) that has(have) registered interest in this project will be given the same opportunity at the same time to make a bid. (University name) will give each company making an offer and a bid the opportunity to mutually negotiate for such rights.

Your best and final matching funds offer and request for exclusivity must be received by (date). (University name), as a member of CPBR, will make a determination as to which offer is in the best interest of the principal investigator, the university and CPBR, and will provide assurances to CPBR that this has been done. Such factors as the amount of the match, the duration of the match, other resources to be provided such as equipment, potential applications by the company, the potential creation of jobs and other economic benefits, the testimony by the companies as to the fairness of their treatment by the university will be taken into account by CPBR. [A past match provided by your company, if any, on this project will be accorded more weight than other factors in this consideration.]

Please inform me in writing by (date) of the amount of matching funds you are offering, any special terms of the match and what interest you have in exclusivity. If I do not hear from you by then, I will assume you are not interested in participating in such bidding and will proceed accordingly.

Sincerely,

University Official or Principal Investigator

PROCEDURES TO BE FOLLOWED BY PRINCIPAL INVESTIGATORS FOR THE IMPLEMENTATION OF REGISTRATION, NOTICE, AND BIDDING FOR EXCLUSIVE RIGHTS TO INTELLECTUAL PROPERTY DEVELOPED THROUGH CPBR FUNDING

1) At the start of each CPBR competition, principal investigators shall indicate on their preproposals and on their preproposal posters the potential availability of exclusive intellectual property rights.

2) If such rights are still available, PI's will follow the CPBR rules for Registration, Notice, and Bidding for Exclusive Rights to Intellectual Property Developed through CPBR Funding ("Rules").

3) When the PI is notified of a qualified company's Registration of Interest, he/she will send or cause to be sent to that company the Letter of Notice of Bidding for Exclusivity Opportunity, with a copy to CPBR.

4) The bidding will be handled in accordance with the Rules.

5) The same procedures will be followed for Year Two funding applications and any subgrants where more than one qualified company registers interest.

PROCEDURES TO BE FOLLOWED BY UNIVERSITY OFFICIALS FOR THE IMPLEMENTATION OF REGISTRATION, NOTICE, AND BIDDING FOR EXCLUSIVE RIGHTS TO INTELLECTUAL PROPERTY DEVELOPED THROUGH CPBR FUNDING

1) At the start of each CPBR competition, principal investigators shall indicate on their preproposals and on their preproposal posters the potential availability of exclusive intellectual property rights.

2) If such rights are still available, the university will follow the CPBR rules for Registration, Notice, and Bidding for Exclusive Rights to Intellectual Property Developed through CPBR Funding ("Rules").

3) When the PI is notified of a qualified company's Registration of Interest, a university official will send or cause to be sent to that company the Letter of Notice of Bidding for Exclusivity Opportunity, with a copy to CPBR.

4) The bidding will be handled in accordance with the Rules.

5) The same procedures will be followed for Year Two funding applications and any subgrants where more than one qualified company registers interest.

PROCEDURES TO BE FOLLOWED BY COMPANIES FOR THE IMPLEMENTATION OF REGISTRATION, NOTICE, AND BIDDING FOR EXCLUSIVE RIGHTS TO INTELLECTUAL PROPERTY DEVELOPED THROUGH CPBR FUNDING

1) At the start of each CPBR competition, principal investigators ("PI's") shall indicate on their preproposals and on their preproposal posters the potential availability of exclusive intellectual property rights.

2) A qualified company may file a Registration of Interest by giving a "yes" response to the Industrial Preproposal Evaluation Ballot question, "Do you want PI to contact you to discuss this project?"

3) If more than one qualified company files a Registration of Interest for a particular project, each company will receive from the principal investigator or university a Letter of Notice of Bidding for Exclusivity Opportunity ("Letter").

4) When the qualified company receives the Letter, it will, if it so desires, enter into the bidding by making an offer of matching funds, other resources, and a request for any exclusivity it desires.

5) The university will give each qualified company making an offer and a bid the opportunity to mutually negotiate for such rights.

6) The same procedures will be followed for Year Two funding applications and any subgrants where more than one qualified company files a Registration of Interest for the project.

APPENDIX 3: PREPROPOSAL COVER PAGE

THE CONSORTIUM FOR PLANT BIOTECHNOLOGY RESEARCH, INC.

2009 Competition – Bioenergy and/or Environment
Preproposal Cover Sheet

Competition(s) Preference (check all that apply):

☐ Bioenergy ☐ Environment

Principal Investigator's Name: _____

Principal Investigator's University: _____

Complete Mailing Address:

Office Phone: _____ Lab Phone: _____ Department Phone: _____

Fax: Email Address:

University's Congressional District:

Preproposal Title (Make understandable to a non-technical audience. **Limit 55 letters and spaces):**

Intellectual Property Rights Availability (check one):

☐ Are Available ☐ May Be Available ☐ Are Not Available

Summary Statement of Project (Make understandable to a non-technical audience):

Economic Benefits of Proposed Project (Make understandable to a non-technical audience):

Duration of Proposed Project : months Estimated Project Cost: $

List all Co-PI names, addresses, phone and fax numbers, and email addresses. Use an additional page if necessary:

APPENDIX 4: 2008 SYMPOSIUM REGISTRATION

Please print clearly:

Name:_____ E-mail:_____

Affiliation/University:_____

Address:_____

City:_____ State: Zip:_____

Phone:_____ Fax:_____

Symposium - Feb. 11-13, 2008: (Provided: breakfasts, lunches, coffee breaks & **2/12 & 2/13 p.m. receptions**)

	Through 1/1/08	After 1/1/08	
Non-member company	$925	$1000	$_____
Member company	$800	$875	$_____
Government / Association	$300	$375	$_____
University**	$200	$250	$_____

**A PI who does not have current CPBR funding and is presenting a preproposal poster is eligible for travel assistance of up to $400. **

Special Workshop – Monday, February 11, 1-5 p.m. "Writing Competitive Proposals for CPBR"

Cost included in Symposium registration fee. I will attend the Special Workshop: **Yes**☐ **No**☐

IMPORTANT: Early registration is *required* for the Special Workshop. Registration and payment must be received by December 31, 2007. Registration for the workshop will *not* be available at the door.

HOTEL RESERVATIONS: It is important to make hotel reservations ASAP as there is no symposium hotel and this is a very busy time in DC.

Payment Options: Check (payable to **CPBR) or Credit Card**: ☐Visa ☐AMX ☐MC

Cardholder Name _____

Billing Address _____

Card # _____ **Exp Date** _____

Security # _____ (the last 3-4 digit number appearing on the back of your credit card)

Signature _____

Cancellation Policy: Cancellation notices must be made in writing via fax or email. Cancellations received on or before Monday, **January 26, 2008** are eligible for a refund less a $75 administrative fee. No shows are responsible for the full amount due. You may send a substitute in your place. Please fill out a registration form for the substitute registrant and clearly indicate the full name of the original registrant before Wednesday, January 2, 2008.

Please FAX or mail this form (see below)

(A confirmation notice will be sent once registration is processed.)

P.O. Box 20634 ▪ 100 Sylvan Drive ▪ Suite 210 ▪ St. Simons Island ▪ GA 31522
Phone: 912-638-4900 ▪ Fax: 912-638-7788 ▪ E-mail: info cpbr.org ▪ URL: www.cpbr.org

APPENDIX 5: SYMPOSIUM POSTER RULES AND GUIDELINES

The size of all Symposium preproposal posters will be 3 ft tall and 3 ft wide (3'x3'). Each poster must be one solid piece that will can attached by clips at the top corners. No pins can be used.

[A separate 2 ft tall by 2 ft wide (2'x2') poster for the Congressional Poster Session is also required. This may be a smaller version of your Symposium poster or a special one to appeal to Members from your state. Potential practical outcomes should be emphasized.]

The preproposal posters should present the preproposal through bullets and pictures rather than lengthy dissertations full of technical terms and/or details of research methods.

Brevity is key.

The purpose of the preproposal posters is different from posters presented at scientific meetings. The CPBR preproposal posters are intended to interest company representatives, not impress academic colleagues. The purpose of your poster is to attract matching funds from one or more companies. You will want to get their attention first with the potential practical applications of the project you are proposing.

Your poster should

- show the Title, PI name(s), University Name (not its logo);
- state the overall goal of the project;
- show the WHY of the research proposed -- the rationale;
- list the objectives; and
- list the expected results from a scientific and commercial point of view.
- Include photos of the PI and CoPIs so that other will recognize them to talk about their project.

Guidelines for Poster Design

The poster should communicate your proposed project with (1) a short title, (2) an introduction to your question, (3) an overview of your answer and (4) anticipated results, both from scientific and commercial perspectives.

Advice:

CPBR organizers will invariably sandwich your poster between two posters that are infinitely more entertaining, therefore your poster must be interesting and visually appealing if you hope to attract viewers.

The trick to producing a great poster is to embrace the rough draft process. Rough drafts are especially crucial in deciding whether you need to cut/add text or resize figures or fonts. You should produce a rough draft at least two weeks before it is due, and then bribe six friends, strangers, etc. to look at it when you are not present--ask them to leave their suggestions on small Post-Its that you provide for them. Ask them to comment on word count, style, idea flow, figure clarity, font size, spelling, etc. Note that you can print a miniature version of your poster on letter-sized paper to get a very rough sense of impending layout challenges.

Getting started:

A poster should be readable from a distance of six feet. Design your poster so that it has a good amount of white space, critical for a readable poster. Try to resist the inevitable temptation to use this white space to cram in more background information. A good rule is to have a minimum of 35% white space.

Try to keep your word count as low as possible to maximize the potential of viewers actually reading it. Shoot for less than 250 words. This will be painfully difficult if you are attempting to fully document everything you plan to do, but posters with too many words will cause viewers to just read your figures or, more likely, avoid your poster altogether.

What information to include:

Title: Should convey the "issue," the approach, and the system (organism); needs to be catchy in order to "reel in" passersby. [Maximum length: 1-2 lines.]

Introduction: Get your viewer interested while using the absolute minimum of background information and definitions; quickly place your issue in the context of general experimental approach, and hint at why your proposed investigation is ideal for such research; give a clear hypothesis. [Maximum length: approximately 50 words.]

Objectives: Begin presentation of specific objectives that will more specifically address the hypothesis; provide figures that can stand on their own (i.e., could convey some point to reader if viewers skipped all other sections, which they often do. [Maximum length: approximately 50 words, not counting figures.]

Conclusions: Describe expected results; why the results will be interesting; their relevance to real organisms in the real world; potential future directions. [Maximum length: approximately 100 words.]

Further information: There will be people who want to know more about your research, and you can use this section to provide your e-mail address, your web site address, and perhaps a URL where they can download a PDF version of the poster (edit so that URL is not blued and underlined). [Maximum length: approximately 20 words.] Also provide photos of yourself and other PIs so that others can find you to talk about your work.

Avoiding common mistakes:

- The number one mistake is to make your poster too long. Densely packed, high word-count posters are basically manuscripts pasted onto a wall, and attract only those viewers who are for some reason excited by manuscripts pasted onto walls. Posters with fewer than 250 words are ideal

- Format the title in "sentence case" (e.g., "Font abuse in academia"). Do not use "title case" (e.g., "Font Abuse in Academia ") or "all caps" (e.g., "FONT ABUSE IN ACADEMIA"), which undermine naming conventions that depend on font formatting (e.g., Latin binomials, genes, alleles). Another reason is that sentences formatted in these ways have been shown to require a few extra milliseconds for brains to interpret and those milliseconds can add up to be annoying.

- Use a non-serif font (e.g., Helvetica or Arial) for title and headings and a serif font (e.g., Palatino) for body text (serif-style fonts are much easier to read at smaller font sizes).

- The width of text boxes should be approximately 40 characters (on average 11 words per line).

- Avoid blocks of text longer than 10 sentences.

- Whenever possible, use lists of sentences rather than blocks of text. Bullets!

- Use italics instead of underlining.

- When using acronyms and numbers (e.g., ATP, 42) within the body of text, scale down the font size by a couple of points so that their sizes don't overpower the lowercase text, which they would do if you left them at the default size. Use of "small caps" will sometimes do the trick, but this effect varies with different fonts.

- Set line spacing of all text to be exactly 1, in case you have used super- or subscripted text.

- Because approximately 8% of males and 0.5% of females have some degree of color-vision deficiency, they see the world very differently. You can use the free tools at **http://www.vischeck.com** to test your color combinations.

- Complete the entire poster on a single platform. Choose Mac or PC and stick with it.

- Graph titles are not appropriate for laboratory write-ups and manuscripts, but they are great for posters. Having short, informative titles helps to lead the viewer more effortlessly through your poster.

- If you can add miniature illustrations to any of your graphs, do it! Visual additions help attract and inform viewers much more effectively than text alone. Tables benefit from this trick as well.

- Acronyms and other shorthands for genotypes, strains, and the like are great when talking to yourself but are not so great for communicating with others. On your graphs, use English word and then add the strain, etc. in parenthesis (e.g., "Control genotype (Col-0)").

- Y-axis labels aligned horizontally are much, much easier to read, and should be used whenever space allows. Viewers with hypertrophied, inflexible neck musculature will be especially appreciative.

- All graphs should have axis labels formatted in "Sentence case" (not in "Title Case" and not in "ALL CAPS").

- Never give your graphs colored backgrounds, grid lines, or boxes. If your graphing program gives them to you automatically, get rid of them.

- Never display two-dimensional data in 3-D. Three-dimensional graphs look adorable but obscure true differences among bar heights.

- Figures on graphs and photographs should be readable from 6 feet away.

- Never incorporate "web" graphics without extreme caution as any inherent quality and detail is lost the moment you enlarge it.

- If you include a photograph, add a thin gray or black border to make it more visually appealing. Just remember not to overpower the image with an overly thick line. Choose a line color that is subtly pleasing but barely noticeable to the viewer.

- Institutional logos are great on departmental letterhead and college athletic caps, but are somewhat inappropriate on posters. If you are unable to control yourself, minimize by hiding the logo (a small version) at the bottom of the poster.

- Acronyms and other shorthands for genotypes, strains, and the like are great when talking to yourself but are terrible for communicating with others. On your graphs, use "English" and then add the strain in parenthesis (e.g., "Control genotype (Col-0)").

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