

Renewable Bioproducts Institute (RBI) Graduate Research Fellowships Paper Science & Engineering (PSE) Academic Program of Study Request for Proposals For Academic Year 2021-2022

I. Introduction

The Renewable Bioproducts Institute at Georgia Tech benefits from a substantial endowment whose purpose is to advance the forest products industry through leadership development and graduate research that addresses current and future needs of this industry. The endowment over the years has produced more than 1,500 graduate scientists and a growing body of scientific research. The focus of endowment-sponsored research has since broadened beyond pulp and paper exclusively to include a wider scope of biomass-related research. The research mission of RBI also includes mechanical, chemical and bioindustrial technologies that produce chemicals, biofuels and new materials from forest and agricultural biomass, and recent fellowship awards have reflected this evolving portfolio.

II. Eligibility

We continue to strongly encourage interdisciplinary collaborative programs of study; accordingly, this year, each proposal is required to have at least two principal investigators with distinct expertise or disciplines, of which at least one must represent one of the four schools affiliated with the endowment (ChBE, CHEM, ME, MSE). Proposals from faculty from other schools at GT are encouraged, as long as one PI is from ChBE, CHEM, ME, or MSE. PIs can be from the same school, but their teaming must clearly provide interdisciplinary training for the student. Students are usually assigned to the fellowship in the following fall (2021) and must be enrolled in a graduate degree program of one of the four schools above. Applications that enhance diversity and inclusion of traditionally underrepresented groups in engineering and science are encouraged.

III. Requirements

Applications, emailed as a pdf document to dione.morton@rbi.gatech.edu, are **due by February 10, 2021 in the format specified in the table on page 2**. **Award announcements are expected by May 10, 2021 and student assignment to the fellowship should be completed by fall 2021**. Failure to recruit qualified students by that time jeopardizes the award.

Applications must include the **elements in the table on page 2**. Please read the section below entitled. See *Protection of Intellectual Property* and consider this in proposal preparation.

The application **must not exceed seven pages** total, inclusive of the cover page, biosketch and references. The application must be a standard letter-size (8.5-11 inches) document with 1-inch margins on all sides. The font must not be smaller than 11 points. Figures, if included must fit within the page limit.

<p>Cover page (1 page)</p>	<p>Title PI names and affiliations RBI Strategic mission alignment (select one)</p> <ol style="list-style-type: none"> 1. Paper, Packaging and Tissue <ol style="list-style-type: none"> 1a. Innovative Manufacturing Technologies and Process Improvements 1b. New, Innovative Improvements and Applications for Forest Bioproducts 2. Biorefining and Bioindustrial Technology 3. Circular Materials Economy <p>Abstract</p> <ul style="list-style-type: none"> • 350 words and one optional figure. Suitable for sharing with RBI member company representatives and potentially other prospective funding sources (See <i>Protection of Intellectual Property</i>, below).
<p>Program Alignment (2 page)</p>	<ul style="list-style-type: none"> • <i>Results from previous RBI fellowship support.</i> Include how have those results been leveraged to apply to external funding or support technology transfer activities (200 words) <ul style="list-style-type: none"> ○ If this is a continuation to a previously funded RBI fellowship, how is the proposed application innovative and a/or departure from previous work? (100 words) • <i>Industry & sustainability alignment.</i> How does the proposed research align with industry's technology research needs and/or UN sustainability goals? (200 words) RBI Member Company representatives provided information about their areas of interest at the RBI Proposers' Day event on December 8, 2020. Slide presentations and contact information were made available to participants and others. Those without access should contact Dione Morton (dione.morton@rbi.gatech.edu). • <i>RBI alignment.</i> How does the proposal align with the RBI strategic mission and the mission of the RBI Fellowship program? (100 words) • How does this award catalyze future external interdisciplinary proposals and what funding sources might be approached? (200 words) • <i>Student Advisement.</i> How will the advisement of the RBI fellow prepare them to assume leadership roles in the manufacturing industry? (100 words) • <i>Team organization.</i> How will the co-advisement of the RBI fellow be structured as this award does not include materials and supplies support? (100 words)
<p>Research Narrative (3 pages including references)</p>	<p>1. Innovation and Impact</p> <p>1.1 Overview</p> <ul style="list-style-type: none"> • Provide a general description of the project and how the proposed technology works in non-technical terms. • Describe the overall project goal. <p>1.2 Impact</p> <ul style="list-style-type: none"> • What is the problem being solved with the proposed research?

	<ul style="list-style-type: none"> • What is the project’s potential to disrupt current thinking in science or engineering? Alternatively, what is the project’s potential to disrupt current technology? <p>1.3 Innovation</p> <ul style="list-style-type: none"> • How does the project provide an innovative solution to an existing scientific or engineering challenge? • What are the technical goals and anticipated results of this project? <p>2. Proposed Work</p> <ul style="list-style-type: none"> • Provide a description of the approach to be taken. • Lay out the background theory, simulation, modeling or experimental data that supports this approach. • What are the critical technical risks of this proposal? How do will they be mitigated? • Describe the project’s key objective in appropriate detail and the tasks that need to be accomplished to achieve those goals. • Provide any alternative approaches considered.
<p>Biosketch (1 page)</p>	<ul style="list-style-type: none"> • A biosketch narrative for each PI should be provided, written in the third person, covering the two topics below. No picture should be included. • PI’s research area and how it aligns with the mission of RBI. (100 words) • PI’s expertise and facilities and equipment capabilities relevant to the proposed project. (100 words)

IV. Protection of Intellectual Property

Titles, abstracts, biosketches, program alignment, and student advisement descriptions will be shared in RBI communications with member companies for the purpose of gaining their support for funding the submitted projects. Please be mindful of this when developing these items. RBI member industry representatives are bound by GT RBI By-laws that protect our proposals; nevertheless, we recommend caution when preparing these sections. Do not include confidential/proprietary information. To preserve intellectual property protection, no aspect of the proposals will be shared beyond Georgia Tech without your express permission.

V. Strategic Alignment

RBI aligns Fellowship funding with Georgia Tech strategic areas and leverages the endowment with broader initiatives across the campus. Collaborative programs are encouraged, as are programs that an industry or a consortium of industries might co-fund. In the 2021-2022 cycle, **most of the funding will be directed towards lignocellulosic forest biomass**. Proposals to study other biomass feedstocks are welcomed, but it is recommended that you discuss these in advance with Carson Meredith, RBI Executive Director.

RBI has several strategic thrusts, discussed further below, in its research mission:

Paper, Packaging, and Tissue (including pulping and paper-forming operational excellence, new products, process intensification, enhanced paper packaging functionality, machine learning, and automation)

Biorefining and Bioindustrial Technology (including advanced pulping technologies, biocatalytic, fermentation or synthetic biology strategies to produce chemicals, fuels, and pharmaceuticals, and advanced separations and recovery strategies)

Circular Materials Economy (including synthesis of new monomers from biomass, composites with biomass-derived fibers, alternative packaging plastics, and recycling, upcycling, biodegradation, and characterization of bio-based materials, policy and economic factors)

Reference to industry priorities and alignment with the RBI strategic thrusts will be factors in the proposal review.

Paper, Packaging, and Tissue

Growing global population and the emerging markets to serve its needs will require vast amounts of materials for paper and packaging. Our objectives in investing this endowment include faculty and student engagement in developing materials and products from sustainable and renewable forest and plant biomass, to reduce energy intensity in manufacturing, to make more efficient use of energy and water, and to facilitate substitution of petrochemical-based applications with those based on renewable forest- and plant-based materials. Accordingly, this area includes pulp-, paper-, packaging- and tissue-related (a) innovative manufacturing technologies and process improvements and (b) new, innovative product applications for forest bioproducts. Concepts that have the potential to be cost-effective, scalable, and applicable to large-scale markets are of interest.

A. Innovative Manufacturing Technologies and Process Improvements

Breakthrough manufacturing and/or step-change manufacturing cost reduction. Specific interests are in innovative approaches for reducing fiber cost through higher performance, enabling effective use of lower quality fiber, and advanced fiber recycling technologies. Also in scope are novel sustainable paper manufacturing processes, including new or better separation technologies and applications and/or alternatives to the current power generation and kraft recovery processes, yielding significant reductions in fiber, energy, and water use. This category also includes applications of big data and analysis techniques, smart manufacturing, life cycle analysis, and the Internet of Things (IoT) for manufacturing. Manufacturing process intensification and modularization projects that would yield energy efficiency and manufacturing cost reduction are of interest.

B. New, Innovative Improvements and Applications for Forest Bioproducts

RBI is interested especially in modification of fibrous structures to promote novel forest-based products such as displacing petroleum products in food and beverage packaging, foodservice, and healthcare items. Other interests include novel products from 2D printing for electronics or displays and 3D printing and additive manufacturing. Development of unique recyclable or biodegradable polymers that can be coated onto paper and packaging to impart liquid- (oil and water), gas- and moisture-barrier properties are of interest.

Biorefining and Bioindustrial Technology

RBI is invested in enabling greater value and yield of fiber and biochemicals from wood and plant biomass. For purposes of the RBI Endowed Fellowship Program, biorefining is broadly defined as the chemical, biological or mechanical processing of biomass into value-added products. Bioindustrial technology broadens this to include the use of synthetic biology principles to engineer microbial-based processes to convert and valorize biomass. This category includes processes for more efficient breakdown of biomass into cellulose, hemi-cellulose, and lignin, as well as conversion of these products into valuable chemicals and fuels. We are particularly interested in research proposals that address fundamental and manufacturing challenges for future high-margin/high-volume chemical products from biomass, including renewable monomers and pharmaceutically active compounds. Proposed approaches should have a plausible path to cost-effective production at industrial volumes, and offer similar or better performance than currently available approaches.

The Circular Materials Economy

The challenges of a carbon-constrained material economy include proliferation of products in landfills and oceans at the end-of-life, reliance on limited resources, greenhouse gas emissions and loss of product value at end-of-life. Addressing the scientific challenges and developing technologies for new biomass-derived materials that can function in a circular lifecycle can be a significant value to the forest-based manufacturer's portfolio of products. We seek proposals that address fundamental questions in enabling the circular materials economy by using biomass-sourced feedstocks, by use of paper-based products, or by use of biorefining and bioindustrial technologies for manufacturing, recycling or upcycling. Areas of emphasis include but are not limited to: (i) synthesis of new monomers from biomass, (ii) functional composites with biomass-derived fibers, (iii) alternative packaging plastics, (iv) recycling, upcycling, and biodegradation, (v) characterization of bio-based materials, and (vi) economic, policy-level and life cycle analysis of circular biomass-based materials.

VI. Selection of RBI Fellowship Proposals for Funding

Applications will be reviewed and selected for funding through a three-step process that includes review by the RBI Member Council, the PSE Academic Committee, and the RBI Leadership team including the Director, Associate Director and Strategic Coordinators, described [here](#).

VII. Terms of Awards

RBI fellowships are generally awarded for a term of up to 4 years (PhD student) or 2 years (MS student), and are contingent upon satisfactory progress toward the degree objective. In the case of a student's having made progress toward his or her degree before the fellowship award, the award terms may be reduced. Advisors are responsible to obtain any funding required beyond the RBI award term.

VIII. Conditions of Support

As a prerequisite to receiving and continuing the RBI Fellowship, we must receive from faculty advisors a commitment to RBI and the PSE academic program.

- A. We require that an annual progress assessment be completed by the student and the faculty advisor to ensure that the RBI Fellow is making satisfactory progress. RBI retains the right to terminate support if project progress is unsatisfactory or the project scope is changed without

RBI approval. The report is due on May 31. The assessment reports may be shared with our member companies, and faculty must therefore be mindful of intellectual property considerations when preparing the assessment reports. The form for this report can be found [here](#).

- B. We expect RBI Fellows to participate in periodic GT-RBI industry meetings and provide posters and presentations reporting research plans and accomplishments.
- C. Students receiving support must complete the 4-course requirements of the Paper Science & Engineering program required of PSE minors described [here](#).
- D. Students must be enrolled full-time to remain eligible for an RBI Graduate Research Fellowship. Internships are encouraged and will be accommodated with the advisor's recommendation and RBI executive director approval.
- E. **Faculty and students are to acknowledge RBI support (e.g., in the acknowledgement section) in publications and presentations resulting from RBI endowment-supported work**, and are to include the **Renewable Bioproducts Institute in the affiliations at the beginning of the document or presentation**. For papers, a suggested acknowledgement may read "Student X was [partially] supported by a RBI Graduate Research Fellowship from the Renewable Bioproducts Institute at Georgia Tech."

IX. Links

- [RBI Strategic Mission & Vision](#)
- [Process for Obtaining Fellowship Funding](#)
- [Fellowship Student Annual Report Form](#)