Report to the Louisiana Board of Regents

Review of Research Proposals Submitted for Funding Consideration

in the Board of Regents Support Fund R & D Program

Proof-of-Concept/Prototyping Initiative

March 4, 2021

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LOUISIANA BOARD OF REGENTS SUPPORT FUND

PROOF-OF-CONCEPT/PROTOTYPING (PoC/P) INITIATIVE

FINAL PANEL REPORT

FY 2020-21

BACKGROUND INFORMATION

Eighteen (18) research proposals requesting a total of $705,794 were submitted for funding consideration during fiscal year (FY) 2020-21 under the Proof-of-Concept/Prototyping (PoC/P) Initiative of the Board of Regents Support Fund (BoRSF). Of the eighteen proposals submitted, one contained information of a confidential or proprietary nature. A two-phase evaluation process conducted exclusively by out-of-state experts was used to review these proposals.

REVIEW PROCESS

Phase I: In-Depth Mail Review

The eighteen proposals were reviewed by out-of-state experts for scientific and technical merit, commercialization opportunity, and potential for success. Experts included reviewers in each of the following four targeted industry sectors: Advanced Materials and Manufacturing; Life Sciences and Bioengineering; Digital Media and Enterprise Software; and Clean Technology and Energy. Each subject-area reviewer assessed and prepared an in-depth evaluation form for each assigned proposal in the subject area. No proposals were submitted in the Coastal and Water Management targeted area.

All evaluation forms submitted by out-of-state experts who participated in Phase I of the review process were available for each member of the final panel ("Panel"), along with all proposals submitted. Each member of the Panel read and studied each proposal and each evaluation prior to the Panel's meeting.

Phase II: Final Panel Review

The three out-of-state experts who served as the Panel in Phase II of the review process convened on March 4, 2021, to discuss Phase I subject-area evaluations, prioritize proposals, and develop funding recommendations. The Panel considered each of the eighteen proposals extensively and based its recommendations on the following criteria:

A. Scientific and technical merit;

B. Commercial opportunity; and

C. Potential for success.

The Panel was informed that a maximum of $304,000 would be available for new PoC/P research projects. As a result of the Panel's deliberations, seven proposals were recommended for funding (Priority One). These seven proposals are listed in **Appendix A**, immediately following the narrative section of this report. The final rankings and selections for awards were based upon individual ratings of the external reviewers (Phase I) and the Panel's consensus evaluation (Phase II).

Five other highly meritorious proposals (considered at the Panel meeting and recommended for funding only if additional monies become available Priority II) are listed in **Appendix B**.

Six proposals were considered meritorious by the subject-area reviewers and the Panel, but were insufficiently developed in one or more areas to be worthy of funding at this time (Priority III); these are listed in **Appendix C**. The Panel believes that the investigators should carefully review its comments and revise and resubmit the proposals in the future, with the prospect that improvements in proposal content could ultimately lead to an award.

The Panel recommends that the Board of Regents commit funding for each Priority One and Two proposal, as monies are available, at the level requested for a period of one year. Summary statements have been provided in **Appendix D** applicable to each of the seven Priority One proposals listed in **Appendix A** and in **Appendix E** for each of the five Priority Two proposals listed in **Appendix B**. Summary statements for the six PoC/P proposals considered meritorious but insufficiently developed in one or more areas (Priority Three) have been provided in **Appendix F.** Summaries include the following information for each proposal:

1. Proposal number and title;

2. Strengths and weaknesses of the proposal;

3. Commercial opportunity or potential for success; and

4. Recommended BoRSF funding level and funding stipulations, as applicable. (***Note:*** This information is provided only for the seven proposals recommended for funding (Appendix D) and the five proposals recommended for funding if additional funds become available (Appendix E).

<u>General Comments for Funded Projects</u>

No reduction in the scope of work plans of projects recommended for funding shall be allowed.

Cost sharing and matching commitments are binding. As a condition of funding, types and amount of institutional matching commitments as stated in the proposal shall be maintained <u>in full</u>.

The project activation date is June 1, 2021 and the termination date is no later than June 30, 2022. No-cost extensions may be requested but are generally discouraged considering the goals of the PoC/P initiative and should be limited to one (1) year.

Debriefing

Subject-area evaluations for each PoC/P proposal will be available to each applicant in July 2021.

The individuals who participated in Phases I and II of the review process are listed in **Appendix G**.

APPENDIX A
PoC/P PROPOSALS HIGHLY RECOMMENDED FOR FUNDING
(PRIORITY ONE) (7)

Rank	Proposal No.	Institution	Requested BoRSF Funds	Recommended BoRSF Funds
1	003D	LSU A&M	$ 40,000	$ 40,000
2	015D	LA-TECH	39,998	39,998
3	004D	LSU A&M	40,000	40,000
4	009D	LSU A&M	39,999	39,999
5	010D	LA-TECH	39,861	39,861
6	012D	LA-TECH	39,859	39,859
7	016D	ULL	39,990	39,990
TOTAL			**$ 279,707**	**$ 279,707**

Note: The Panel's comments on these proposals are provided in Appendix D. The subject-area review for each proposal will be provided to each applicant in July 2021.

APPENDIX B
PoC/P PROPOSALS RECOMMENDED FOR FUNDING
IF ADDITIONAL FUNDS BECOME AVAILABLE
(PRIORITY TWO) (5)

Rank	Proposal No.	Institution	Requested BoRSF Funds	Recommended BoRSF Funds
8	014D	LA-TECH	$ 29,903	$ 29,903
9	011D	LA-TECH	40,000	40,000
10	018D	UNO	40,000	40,000
11	001D	LSU A&M	40,000	40,000
12	008D	LSU A&M	40,000	40,000
TOTAL			**$ 189,903**	**$ 189,903**

Note: The Panel's comments on these proposals are provided in Appendix E. The subject-area review for each proposal will be provided to each applicant in July 2021.

APPENDIX C
MERITORIOUS PoC/P PROPOSALS
(PRIORITY THREE) (6)

002D	007D
005D	013D
006D	017D

Note: These proposals are not recommended for funding as currently submitted. The Panel's comments on these proposals are provided in Appendix F. The subject-area review for the each proposal will be provided to each applicant in July 2021.

APPENDIX D
PROPOSALS HIGHLY RECOMMENDED FOR FUNDING
(PRIORITY ONE)

Proposal No. 003D **Rank: 1**

Principal Investigator: Roger Laine, Ph.D.

Institution: Louisiana State University and A&M College

Title: Thioglycosides as Infectivity Inhibitors for SARS COV2 Viruses

Comment: The proposed research addresses a critical medical need for new COVID-19 treatment modalities. COVID-19 remains only marginally treatable with current therapeutics. Increasingly vaccine approaches to cancer are being developed with major interest from the pharmaceuticals industry, however with a one-year or longer development time. Thioglycoside decoys present a strong value proposition for COVID-19 patients because as a first, stand-alone treatment for infected patients, they may have an immediate effect in interrupting viral infection, with minimal side effects. The goals of this study are to (1) test the decoy in a spike protein induced cell fusion molecule and in a somewhat similar VSV pseudotype S19 expressing cell line; (2) test the agent for cytopathic affect in an ACE2 expressing cell line with SARS-COV2 virus; (3) measure the effect of treatment on infectivity; and (4) establish toxicity profiles for thioglycoside.

Interesting preliminary data using HSV-1 and a Vero cell plaque assay support the general concept and the agent was initially targeted as a therapeutic for ocular herpes. Although there is a significant leap from the preliminary data to an effective anti-viral agent, the concept is intriguing and novel. The PI notes that since the target is the host glycosylation system the virus cannot mutate to develop resistance. This may not be totally correct, but the point is well taken. The approach and milestones in the proposal are reasonable, as is the budget. Although the PI does not emphasize the point, use of a similar approach that has reached a Phase III trial, albeit not completely successfully, supports the potential utility of this approach. Inhibition of ACE2 activity might be detrimental; ACE2 inhibitors are agents most used to treat hypertension, so there is hope that the approach will not show systemic activity. This is an interesting, clever, and unique approach to developing an anti-viral agent targeted toward SARS-COV2. Overall, this is an excellent and timely proposal that is highly recommended for funding.

FUNDS REQUESTED: $40,000 **FUNDS RECOMMENDED: $40,000**

Appendix D (continued)

Proposal No. 015D **Rank: 2**

Principal Investigator: Shengnian Wang, Ph.D.

Institution: Louisiana Tech University

Title: Extracellular Vesicles Production with Nanoelectroporation

Comment: The primary goal of this proposal is to test a novel tunable nano-electroporation method to produce extracellular vesicles (EVs) with potentially superior efficiency relative to current chemical/physical methods as measured by yield, encapsulation dosage and integrity. EVs secreted by host cells, often referred to as endosomes, carry nucleic acids and proteins in their liquid cores and cellular communication molecules on the outside membrane. Artificially produced vesicles of similar structure and content have found use as potential therapeutics. The PI notes that current production is very labor- and time-intensive with low yield and/or concentration, limiting the potential utility of EVs in biological medicine. This is not necessarily the case, as mass adherent cell culture systems have been optimized for the production of endosomes/EV and artificial systems have been used for some applications. The proposed device is somewhat similar to those used in electroporation. The electronics of the device are not unique. The PI asserts that the proof of principle has been demonstrated. However, what is demonstrated is an increase in EV by nanosecond versus millisecond pulses. An increase in RNA concentration is only seen with nanosecond pulses. Preliminary data does support the increased production of EVs by nanopulses. The design of the pulse generator seems quite clever, although little detail is provided of the microfluidics, which is judged to be a far more complex project than a cuvette system. The work plan is very optimistic. If successful, the work will validate the physical structure and biocompatibility of generated EVs for cultured adipose-derived stem cells such as peripheral blood mononuclear cells (PBMCs). Applications lie in the fields of medical research and practice, including but not limited to *in vitro* cellular studies, early disease diagnosis and therapy. Research objectives are clearly defined, but not highly ambitious. The budget is adequately justified and appropriate. Much needs to be done to demonstrate the project's economic viability. The PI has not secured any private-sector interest, although success here could lead to publications and proposals for federal funding. The PI plans to license technology to biomedical institutions and private companies. The PI has the requisite background for the project, but the Panel has concerns about potential overlap with the reported NSF grant and publication. It is possible that major changes in pulse width and frequency would be necessary to optimize for it. Overall, it is the purpose of this program to provide funding for project initiation and the concept is potentially one of value. This is a very good proposal that is highly recommended for funding.

FUNDS REQUESTED: $39,998 **FUNDS RECOMMENDED: $39,998**

Appendix D (continued)

Proposal No. 004D **Rank: 3**

Principal Investigator: Yong-Cheol Lee, Ph.D.

Institution: Louisiana State University and A&M College

Title: Developing an Automated Disaster Resilience Evaluation System Using a Virtual Building Design

Comment: The proposed research is to develop an automated disaster resilience evaluation system using a software prototype to define rules based upon existing codes, along with a rule-checking process. The PI proposes to validate the prototype, although that may require a disaster. The outcomes are questionable. Reducing cost is not possible if requirements dictate high cost. The rule-based automated design is dictated by historical data. Previous data may be a solid indicator. The project looks at metrics such as an annual probability event and base flood level, and ways to determine the relationship between metrics and cost. The PIs have performed some preliminary work on a base system of the same type. They are using an open-source software system for the building information modeling aspect of the system. Deliverables include a software prototype, rule framework, implementation guidelines, and commercial potential analysis. The current economic analysis proposes marketing through undefined workshops and conferences, but conferences and journal publications are not a good means of disseminating information to the general public. The PI is qualified, funded, and published in the area. The Co-PI has experience with big data and, although less experienced in the tasks at hand, certainly can contribute. The budget is primarily for student support. There is a growing interest in building modeling information, so the opportunity does exist for new products to enter the market. The question is whether the team will be able to fully develop a system that distinguishes itself from a somewhat mature market. This is a very good proposal that is highly recommended for funding.

FUNDS REQUESTED: $40,000 **FUNDS RECOMMENDED: $40,000**

Appendix D (continued)

Proposal No. 009D **Rank: 4**

Principal Investigator: Ying Wang, Ph.D.

Institution: Louisiana State University and A&M College

Title: Safe and Flexible Rechargeable Aqueous Batteries Working at a Range of Temperatures

Comment: The proposed research is to develop a prototype flexible aqueous/ion battery which has a broad temperature range: a zinc-ion battery with an electrolyte made from high salt concentration and xanthan hydrogel gum to make it flexible. The targeted temperature range is -90ºC to 60ºC. The PI suggests that the flexible zinc-ion rechargeable battery is safer and lower in cost, while maintaining high energy, high power, and long cycling life. Although this is not well explained, the proposal implies that it will not harm a human if damaged. It is not clear if or how the hydrogel formed stiffens with temperature. There is a serious need to characterize the mechanical properties of the material at the targeted temperatures. The PI documents the current state of the problem associated with temperature, but the proposed experiments to address the issue are not well described. Preliminary mechanical properties versus temperature relationships would be needed. There is also need for an experimental design matrix with ZnCl2 levels to be explored, such as gum concentrations. The PI notes that she may seek interdisciplinary input from other researchers whom she has collaborated, but there are no resources for this in the project budget. The current market seems to be around $250 million per year, which is significant. The PI proposes a manufacturing cost analysis. It should be possible at least to develop an estimate comparison, based on previous work. The design appears to be simple enough that costs should be in the range of existing flexible batteries. The project plan is reasonable and likely to lead to success. It is not clear that the technology is unique enough to be easily protected by patent. There is limited private-sector support (large-scale prototype) indicated by a letter from eJoule, Inc. in California. The technology, materials and market have no particular connection to Louisiana. The economic justification for the project is primarily anecdotal but could be large, if successful. The partner in California will do testing on a large-scale prototype. Overall, this is a promising proposal recommended for funding.

FUNDS REQUESTED: $39,999 **FUNDS RECOMMENDED: $39,999**

Appendix D (continued)

Proposal No. 010D **Rank: 5**

Principal Investigator: Shaurav Alam, Ph.D.

Institution: Louisiana Tech University

Title: Development and Performance Evaluation of Clay Nanotube Embedded Thermal Insulating Paint for Use On Drywall Materials

Comment: The proposed research is to develop thermal insulating paint from clay nanotubes to give sheetrock drywall a higher R-value. This proposal was previously submitted by the PI. It appears that the entire performance issue is centered around temperature-based conductivity, while the proposal indicates it will consider overall paint quality, flame retardancy, anti-microbial and anticorrosive properties. This is an interesting project that should be fairly easy to complete. The beneficiaries of this work would likely be clay-nano tube manufacturers, as the product is intended to be mixed with ordinary paint. At a cost of $2-3 per pound, the impact on the cost of a gallon of paint ($15-$35 per gallon) should be small. It is difficult to see a significant benefit being achieved, as thickness and R values would also be small; however, even a modest improvement at low cost would be useful. Ceiling application, which includes rougher surfaces and more thickness, may be advantageous. The research team is well qualified and presents a reasonable work plan. The economic impact does not particularly focus on Louisiana as the manufacturing and blending could presumably be done anywhere. It is, however, an intriguing idea that could lead to further investigations. This is a promising project that is recommended for funding.

FUNDS REQUESTED: $39,861 **FUNDS RECOMMENDED: $39,861**

Appendix D (continued)

Proposal No. 012D **Rank: 6**

Principal Investigator: Mark DeCoster, Ph.D.

Institution: Louisiana Tech University

Title: Lateral Flow Device with Micro- and Nano-Scale Degradable Components

Comment: The proposed project is for the development of a lateral flow device (LFD) prototype for biosensing, consisting of cellulose/nitrocellulose support embedded with catalytic nano- and micro-scale degradable components such as copper high-aspect structures (CUHARS) and quantum dots (QDs). The PI states that the novelty of this platform is the dual readout – colorimetric and fluorimetric. It appears that this is an innovative approach and something that the market would need. The PI suggests that the chemistry of analyte-detection catalyzed by CUHARS and QDs makes the proposed platform potentially superior to commercially available LFDs. The baseline brightness of QDs integrated into a paper matrix in the absence of analyte under a fluorescence microscope is shown in figure 4. It is presumed that in the proposed prototype the green and red QDs will be co-integrated in the matrix, having equal baseline brightness. How the analytes enhance or dim the brightness of one at the expense of the other is not explained or shown in the preliminary data. Statements about catalytic enzymes, co-factors, substrates, and developing fluid are provided, though without specifics. The fundamental question is whether the proposed dual-readout LFD will provide a specific and more sensitive platform for detection than existing LFD devices. Another question is whether it will be versatile and price competitive. Detection sensitivity decides whether this is a better or just an alternative LFD analytical setting. The enthusiasm for the present proposal is limited by the lack of data. This is the case both in the preliminary data as well as in the proposed experiments, such as side-by side comparison with commercial LFD strip/pad[s] for a specific target. It is not clear what samples will be tested – biological or inorganic fluid, cells, or virus – or what the analytes are. However, based on past progress made by the PI, the objectives should be accomplished via the proposed approach over the provided timeline. The PI has established a partnership with Quantum Technology Group [QTG], a Massachusetts-based company, which has a non-disclosure agreement with Louisiana Tech University and will provide the QDs. The immediate benefit will be the plan by the PI to seek funding, jointly with QTG, to continue the research beyond the one year of funding provided through PoC/P. If successful, the PI plans to create a company, with the involvement of QTG, to commercialize this device. The budget primarily requests salaries and supplies, and is well justified for the proposed scope of work. Overall, this is a very good proposal that is recommended for funding.

FUNDS REQUESTED: $39,859 **FUNDS RECOMMENDED: $39,859**

Appendix D (continued)

Proposal No. 016D **Rank: 7**

Principal Investigator: Li Chen, Ph.D.

Institution: University of Louisiana at Lafayette

Title: Fast and Efficient Scheduler for Deep Learning in GPU Cluster

Comment: The goal of this project is to facilitate high-performance distributed deep learning by prototyping a fast and efficient scheduler for a GPU cluster that manages and coordinates resource allocation among deep learning jobs. The research team will design, fine-tune, and implement the strategies of job scheduling and task placement in the deep learning cluster, guided by the theoretical foundation of the scheduling algorithm. Eventually, the team will bridge the gap between theory and practice by implementation and real-world evaluation of the prototype GPU cluster with the proposed scheduler. Although the work should be successful; the real question is the marketability of the resulting product. The use of deep learning has broadened in recent years, but the need for, and use of, schedulers by corporations is not defined and very hard to ascertain. The support letter from Samsung indicates its interest in the technology. Additional letters indicating interest in the proposed work would have been beneficial. ***The project budget requests $17,840 for supplies. This request appears to include equipment, which requires a minimum 25% cash ($4,460) be provided by the institution. Prior to funding the PI must verify that the classification of the requested devices is correct. If these items must be reclassified as equipment, the requested BoRSF funding should be reduced, with the campus providing at least 25% of the cost of all equipment.** Overall, this is a promising proposal recommended for funding.

FUNDS REQUESTED: $39,990 FUNDS RECOMMENDED: $39,990

APPENDIX E

PROPOSALS RECOMMENDED FOR FUNDING IF ADDITIONAL FUNDS BECOME AVAILABLE (PRIORITY TWO)

Proposal No. 014D **Rank: 8**

Principal Investigator: David Mills, Ph.D.

Institution: Louisiana Tech University

Title: Tough Self-Decontaminating Surfaces

Comment: The PI has developed a coating technology that blocks colonizing bacteria's adhesion, preventing their growth and subsequent biofilm formation. Metalized ceramic nanotubes doped with antimicrobial agents and embedded within a polymer composite produce a surface antimicrobial effect. The PI indicates that the coating systems are antimicrobial at the surface and maintain antimicrobial effectiveness, with bacterial growth inhibition demonstrated for up to 60 days. The proposed research uses metallic ions to inhibit bacterial growth. Obviously, viruses, and in particular SARS-COV2, are major concerns, although such are not clearly shown to be significantly transmitted as fomites. Halloysite nanotubules have been proposed for many applications as they are naturally occurring. The PI suggests that the invention will inhibit biofilm production at the treated surface, suppressing bacterial adhesion. The only preliminary results presented are in a single figure, which is not well explained. In the most general sense, the specific aims are appropriate; however, there is no evidence that they can be successfully undertaken. There are issues that should be addressed, e.g., cost of fabrication; toxicity of the surface to users; wear characteristics of the treated surface; and potential for the derivatized nanotubes to spill into the environment. Funding is requested for further prototype testing and validation. In the absence of cost and toxicity data, this proposal should be funded only if additional funds are available.

FUNDS REQUESTED: $29,903 **FUNDS RECOMMENDED: $29,903**

Appendix E (continued)

Proposal No. 011D **Rank: 9**

Principal Investigator: Hamzeh Bardaweel, Ph.D.

Institution: Louisiana Tech University

Title: Enabling Technology for Green Internet of Things [IoT]: High-Power Density Eco-Friendly Vibration Energy Harvesting System for Powering Wireless Sensors

Comment: The idea of harvesting vibrational energy for use in remote locations in lieu of batteries may have some merit. However, examples of applications provided in the proposal, such as trucking, are unpersuasive. Trucks have onboard power at all times when moving. The power load of the sensors would be insignificant. Moreover, unless the vibrational source could power in real time (unlikely), a rechargeable battery would be needed. So, while reducing the need to replace batteries, a battery would still be required. It is difficult to see any significant monetary savings beyond use of onboard power. Perhaps other vibration applications, e.g., in a roadbed itself, or on a bridge structure where onboard power is not available, would be interesting. This is a good proposal that should be funded if additional funds become available.

FUNDS REQUESTED: $40,000 **FUNDS RECOMMENDED: $40,000**

Appendix E (continued)

Proposal No. 018D **Rank: 10**

Principal Investigator: Uttam Chakravarty, Ph.D.

Institution: University of New Orleans

Title: Design and Analysis of a Hybrid Energy Harvester Based on Mechanical Vibration and Solar Radiation

Comments: This is a proposal for developing a hybrid energy harvesting technology based upon mechanical vibration and solar radiation using a cantilever beam. This is essentially a resubmittal of a previous PoC/P proposal. The summary statement and proposed activities appear the same. Several new references are included, but none appear to suggest evidence of potential success. The stated goal is to make the PI competitive at a national level by increasing rates of publication and submission to SBIR or NSF. There does not appear to be any progress towards this since the previous submission. Two local partners, Advano and Unocity, provide support letters that are almost identical. The PI states that the partners will commercialize the developed system, but the letters do not support this assertion. The idea that a spin-off company will start in the near future is not realistic. There does not seem to be any significant industrial interest at this time. The budget has in-kind commitments of research and unjustified supplies from the partners. More time should be spent in budget preparation. There are no detailed outcomes for the proposed work. Overall, the proposal ranks below average in technical merit, prospects for commercialization, and the probability of success. With improvements, this could become a good proposal. The proposal is recommended for funding if additional funds become available.

FUNDS REQUESTED: $40,000 **FUNDS RECOMMENDED: $40,000**

Appendix E (continued)

Proposal No. 001D **Rank: 11**

Principal Investigator: Hunter Gilbert, Ph.D.

Institution: Louisiana State University and A&M College

Title: Omnidirectional Impact Absorption for Helmets

Comment: The objective of this proposal is to develop a helmet prototype integrating a novel conceptual design for omnidirectional shock absorption to dissipate rotational energy resulting from hard impacts. The total lifetime economic cost of traumatic brain injuries (TBI) is estimated at over $89 billion in the United States. The design concepts proposed directly address rotational impact energy, and would reduce the potential for concussions or more severe head trauma. The PI states that, based on current simulation results, the projected outcome is a reduction by up to 30% in the HARM and DAMAGE metrics. There is no reference to current levels or how a 30% decrease will make a difference; it is assumed this is a good outcome, but not quantified. Although the PI indicates that initial simulations show significant improvement over existing technology, the research plan fails to lay out any comparisons. The helmet performance score is graphed as an optimization metric, but never defined. It is not clear exactly what is being optimized in the design to drive the improvement. The literature identifies current standard practices and metrics, but emphasizes marketing. The PI is a roboticist who studies soft materials and is well positioned for success in the area. This is a good proposal recommended for funding if additional funds become available.

FUNDS REQUESTED: $40,000 **FUNDS RECOMMENDED: $40,000**

Appendix E (continued)

Proposal No. 008D **Rank: 12**

Principal Investigator: Grover Waldrop, Ph.D.

Institution: Louisiana State University and A&M College

Title: Scaling Up a Novel Clean Method for Maximizing the Concentration of Malonyl-CoA in Escherichia coli

Comment: Previous laboratory research by the PI has demonstrated a simple, low-cost method for maximizing malonyl-CoA concentration in *E. coli* while consuming CO_2. Malonyl-CoA is a highly regulated molecule in fatty acid synthesis. The PI suggests that the molecule has utility as a building block for numerous bioproducts, including polymers, bioplastics, biodiesel, and acrylic acid. The major problem with using malonyl-CoA as a feedstock is that the intracellular concentration in E. coli is low, limiting the amount of any downstream product. The investigators propose a method that yields a threefold increase in the concentration of malonyl-CoA in comparison with the best available bio-based method and at a fraction of the cost. This project seeks to scale up the volumetric productivity of the process by three orders of magnitude, from shake flasks to a small bioreactor. Given no evidence for the contention that the bulk production of malonyl-CoA has industrial value, there would appear to be limited justification for the proposal. Increasing levels of synthesis of the molecule appears to be a popular cottage industry for those interested in microbial metabolism. The proposal does a good job of summarizing such approaches. The objectives are appropriate and the last assessment of the cost per liter of the scaled-up process is critical. It would have been helpful for the PI to propose an industrial use for the project (biodiesel, for example, or a feedstock for plastic production) and estimate the relative cost of bacterial versus current production. The claimed threefold increase in level of synthesis is very unlikely to yield a favorable outcome when one considers factors such as media cost and the cost of purification/extraction. Although the PI does estimate the cost of bacterial production at $0.27/gram, this does not take into account purification and other related costs. Considering that there are about 3300 grams in a gallon of diesel, the cost can be calculated as $900 per gallon of malonyl CoA biodiesel (neglecting associated production costs), about a 300-fold premium over retail cost. There is a long way to go before bacterial malonyl-CoA will serve as an industrial-scale feedstock. Although there is no logic to the “industrial feedstock” argument, the project could be of value to those interested in a systems approach to bacterial metabolism. The investigators are very well qualified, but need to provide a more reasonable justification for the project. This is a good proposal recommended for funding if additional funds become available.

FUNDS REQUESTED: $40,000 **FUNDS RECOMMENDED: $40,000**

APPENDIX F

MERITORIOUS PoC/P PROPOSALS
(PRIORITY THREE)

Proposal No. 002D

Principal Investigator: Roger Laine, Ph.D.

Institution: Louisiana State University and A&M College

Title: Dog Phase I Safety Trial for Serratia Marsescens PS1 Tumor Hemorrhagic Polysaccharide

Comment: The general objective of this proposal is to conduct safety studies of PS1 polysaccharide on dogs using 10X the dose level that causes tumor hemorrhage in mice. The proposal includes several errors. The PI indicates that "A dog safety study for the CM101 streptococcal polysaccharide was already successfully performed in the LSU College of Veterinary Medicine by Professor Rhett Stout, DVM, PhD (letter attached);" however, such a letter stating this was not attached to the proposal. As explained in the review of a prior version of this proposal, "The work is based on studies mostly completed in the 1940s using a crude bacterial extract (Coley's toxin) to 'disrupt' tumors. Dr. Laine has purified a polysaccharide (PS1) from S. marsescens." CM101 is derived from *Streptococcus agalactica*, the strain used as a source for Coley's toxin. The proposal indicates that an already-developed mouse tumor hemorrhage model will be used as on a fee-for-service basis with the company Murigenics, with experience in cancer therapeutics if this proposal were funded. The PI suggests that this will be a cost-effective approach because of the company's experience with mouse tumor models for the study of PS1 as an antineoplastic agent.

It is unfortunate that the proposal appears to be incomplete and unclear in its definitions. Modern chemotherapeutics rely on the inhibition of molecular pathways specific to or overexpressed in the tumor or inactivation of pathways inhibiting natural tumor killing mechanisms. The production of tissue damage and subsequent necrosis might destroy a localized tumor, but in no way argues for a specific method of anti-cancer activity. In the absence of any data suggesting PS1 has specific antineoplastic rather than pro-inflammatory activity in even preliminary testing, the Panel must rely on the argument of putative analogy to a substance (CM101), which may or may not be a useful antineoplastic. It should be noted that the last pertinent reference to CM101 and HP59 dates back to 2001. Given the lack of evidence of specific antineoplastic activity, the proposal seems to be misdirected.

Appendix F (continued)

Proposal No. 005D

Principal Investigator: Adam Melvin, Ph.D.

Institution: Louisiana State University and A&M College

Title: Circulating Microfluidic Co-Culture Device for the Dynamic Analysis of Cell-to-Cell Communication

Comment: The goal of this proposal is to develop two novel microfluidic devices that will allow for the dynamic co-culture of both adherent and suspension cell lines. The operating principle of the devices is long parallel channels interconnected by short microchannels that allow for the passive diffusion of biomolecules. The proposal suffers from broad, unsubstantiated claims and hortatory statements that are not clear as to the nature of the proposed device or its claimed utility. The rather confused description of the device emphasizes the center circulating media channel, which is connected to a peristaltic pump to allow for facile sampling of extracellular media to elucidate paracrine signaling. The first device will culture two different adherent cell types while the second device will be designed to co-culture both adherent and suspension cells. The continuous ability to sample appears to be the devices' unique feature. The PI suggests that this would provide preliminary information on biomolecule production prior to upscaling into production in large-scale bioreactors, but ignores the fact that bioreactor growth conditions are completely different from those in the microfluidic device. There is no substantive discussion of commercial opportunity or existing competitive approaches and technology; rather the PI concentrates on single-use bioreactors, which are quite different in utility from the proposed device. The discussion of signaling of stem cells by breast cancer cell conditioned media, which does not involve the use of the proposed device, plays no useful role in supporting the proposal. The design details of the microfluidic co-culture device are unclear and the relationship to the proposal is not explained. Preliminary data showing how the role of molecular size and shape actually affect transport are necessary. It is not unlikely that some biomolecules will adhere in varying degrees to the plastic substrate, affecting the theoretical model. There are innumerable problems to the approach, including entrapment of molecules selectively by the hydrogel, as is likely using collagen, and size-specific effects on diffusion of molecules through the gel. The collaborating investigators are well qualified. The budget is poorly justified and includes an excessive travel request. The proposed strategies are poorly documented, with many unaddressed technical details and potential problems. Careful editing of the proposal to remove extraneous material and poorly documented claims while focusing on clarifying details is encouraged.

Appendix F (continued)

Proposal No. 006D

Principal Investigator: Hye Yeon Nam, Ph.D.

Institution: Louisiana State University and A&M College

Title: Unmasked

Comment: The PI suggests that wearing masks hinders our ability to express ourselves, as it is hard to read facial expressions and, in particular, lips behind a mask. Unmasked, an expressive interface using lip tracking, is designed to enhance communication while wearing masks. It is clear that significant populations, particularly in Asia, have worn face masks in public settings even prior to COVID-19 for disease control. The idea of using mask modifications to express feelings is not original to this proposal. Uniquely, the proposed device will track mouth (lip) movements and will attempt to display a simulacrum reflecting facial (more accurately mouth/lip) expression on a front-mounted LCD panel on the mask. The tool would be aimed at the educational market, for classroom use, and is proposed to be tested in such a setting. There are many problems with the proposed device and the design. Current technology uses physically attached sensors, presenting contamination risks and general unacceptability for school use. The investigator suggests working with consultants in industrial design to improve usability. Alternatively, a small behind-the-mask camera has been evaluated, along with a more sophisticated system using electromyography sensors, which were found to be inferior to accelerometers. In all cases considerable electronics are necessary to implement the device, which likely would require compromises to mask design and fit, impacting usability and protective function. The PI does not appear to have the necessary background to complete the project, although there is a budget request for $20,000 for consultants. In addition, the PI's CV does not give strong evidence of a background in the requisite design parameters. The PI does not demonstrate a strong need or have a feasible potential design which does not compromise the mask's primary function.

Appendix F (continued)

Proposal No. 007D

Principal Investigator: Lu Peng, Ph.D.

Institution: Louisiana State University and A&M College

Title: Accelerating Smart Contract Execution with FPGA Design

Comment: The proposed research project is to create a hardware mechanism that has an architecture capable of accelerating blockchain execution, termed a smart contact unit (SCU). The proposal is not well written. Similar to the previous submission of this work, the Panel questions why this is submitted in the digital media area, as it is clearly an engineering/computing hardware and software request. The work would take a prototype already developed and make it robust and marketable. The specified objectives are almost the same as the previous submission: (1) to develop FPGA software that can pass a test in the laboratory; (2) to find users for the system with no marketing plan; and (3) to design a business plan. It would be beneficial to accomplish these objectives before attempting the prototype phase. It is difficult to determine how this work fits into the overall cryptocurrency mining arena (e.g., do miners want to share their hardware; are the fluctuations in the currency an issue?). Success appears to be defined as gaining a license agreement. A substantial economic argument is made encompassing financial, supply chain, food, and health care markets. The true need for this work was not clearly stated. Several questions remain, e.g., what is the end result of the system? Is it a board, a chip or multiple chips? Who is making the hardware? This manufacture requires serious laboratory involvement, but no related funds are included in the budget nor is funding for the PI. It is not clear where the commitment lies.

Appendix F (continued)

Proposal No. 013D

Principal Investigator: David Mills, Ph.D.

Institution: Louisiana Tech University

Title: Large Area Projection Sintering of Metalized-Ceramic Thermoplastic Composites for Rapid Manufacture of High Performance Materials

Comment: The proposed research will use a patented method of metalizing halloysite nanotubes along with Nylon 12 for the purpose of 3-D printing. The proposal is not written well and the proof of concept or prototype suggested is difficult to understand. It appears that many research ideas and components are being thrown together into a final system that, if successful, would revolutionize 3-D printing. Specifically, the PI indicates that ceramic metal printing will move beyond a low-volume, high-market niche. To accomplish this, the PI will employ fused deposition modelling, solutional blow spinning, and stereolithography. None of these components come up again in the proposed work. The details of the proposal concentrate on two areas: large area projection sintering (LAPS); and metallizing clay nanotubes. The first is derived from a preliminary study for a master's thesis at the University of South Florida, and the second is based upon a patent filed in 2016 but not granted. Neither of these references shows potential for commercialization or sufficient promise for success to warrant funding.

Appendix F (continued)

Proposal No. 017D

Principal Investigator: Xiali Hei, Ph.D.

Institution: University of Louisiana at Lafayette

Title: Protecting Unmanned Aerial Systems [UASs] from Attacks Using Data, Mathematical Models, and Hardware

Comment: The proposed research project is to develop an approach for protecting unmanned aerial systems, such as drones, from attacks. It is a valid topic of concern and importance. This topic has received much attention in the research arena and been addressed in numerous of publications. It is not clear how the proposed approach is better than current systems. It is hard to gauge how disruptive the proposed solution will be. The proposal does not reference any other existing commercial solutions. However, the proposed approach does appear appropriate for the project. The collaborator is a company located in China, but the PI states that the goal is to create a company as a basis for securing SBIR funding. The Chinese company appears to be offering guidance to the project, evaluation of the results, and inputs from actual drone operators. The marketability of the resulting technology is not clear. This is an incomplete proposal on an important topic.

APPENDIX G

LIST OF SUBJECT-AREA AND FINAL PANEL REVIEWERS WHO PARTICIPATED IN THE REVIEW PROCESS

LIFE SCIENCES AND BIOENGINEERING

Dr. Radu Marches
Associate Research Scientist
The Jackson Laboratory for Genomic Medicine
Farmington, CT

CLEAN TECHNOLOGY AND ENERGY

Dr. Russell D. Ostermann
Associate Chair
Department of Chemical and Petroleum Engineering
University of Kansas

DIGITAL MEDIA AND ENTERPRISE SOFTWARE

Dr. John M. Usher
Professor and Head
Department of Industrial Engineering
Mississippi State University

ADVANCED MATERIALS AND MANUFACTURING

Dr. Mathew Schaefer
Associate Professor
Department of Mechanical & Industrial Engineering
Milwaukee School of Engineering

Appendix G (continued)

PoC/P FINAL PANEL

Dr. Richard C. Seagrave (Chair)
Emeritus Distinguished Professor
Chemical and Biological Engineering
Iowa State University

Dr. James A. Rice
Associate Professor
Department of Mechanical and Industrial Engineering
Marquette University

Dr. Howard Reisner
Professor
School of Medicine
Department of Pathology
University of North Carolina at Chapel Hill

APPENDIX H

SUMMARY OF PROPOSALS SUBMITTED
PROOF-OF-CONCEPT/PROTOTYPING (PoC/P) INITIATIVE
FY 2020-21

Proposals Submitted to the Research and Development Program - Proof-of-Concept/Prototyping (PoC/P) Initiative
for the FY 2020-21 Review Cycle

Proposal #	PI Name	Category	Institution	Project Title	Amount Requested
001D-21	Dr. Hunter Gilbert	Advanced Materials and Manufacturing	Louisiana State University and A & M College	Omnidirectional Impact Absorption for Helmets	$40,000.00
002D-21	Prof. Roger Laine	Life Sciences and Bioengineering	Louisiana State University and A & M College	Dog Phase I safety trial for Serratia marsescens PS1 Tumor Hemorrhagic Polysaccharide	$40,000.00
003D-21	Prof. Roger Laine	Life Sciences and Bioengineering	Louisiana State University and A & M College	Thioglycosides as infectivity inhibitors for SARS COV2 viruses	$40,000.00
004D-21	Dr. YONG-CHEOL LEE	Digital Media and Enterprise Software	Louisiana State University and A & M College	Developing An Automated Disaster Resilience Evaluation System Using A Virtual Building Design	$40,000.00
005D-21	Prof. Adam Melvin	Life Sciences and Bioengineering	Louisiana State University and A & M College	Circulating microfluidic co-culture device for the dynamic analysis of cell-to-cell communication	$40,000.00
006D-21	Prof. Hye Yeon Nam	Digital Media and Enterprise Software	Louisiana State University and A & M College	Unmasked	$40,000.00
007D-21	Prof. Lu Peng	Digital Media and Enterprise Software	Louisiana State University and A & M College	Accelerating Smart Contract Execution with FPGA Design	$40,000.00
008D-21	Prof. Grover Waldrop	Clean Technology and Energy	Louisiana State University and A & M College	Scaling Up a Novel Clean Method for Maximizing the Concentration of Malonyl-CoA in Escherichia coli	$40,000.00
009D-21	Prof. Ying Wang	Clean Technology and Energy	Louisiana State University and A & M College	Safe and flexible rechargeable aqueous batteries working at a range of temperatures	$39,999.00
010D-21	Dr. Shaurav Alam	Clean Technology and Energy	Louisiana Tech University	Development and performance evaluation of clay nanotube embedded thermal insulating paint for use on drywall materials	$39,861.00
011D-21	Dr. Hamzeh Bardaweel	Clean Technology and Energy	Louisiana Tech University	Enabling technology for green Internet of Things [IoT]: High-power density eco-friendly vibration energy harvesting system for powering wireless sensors	$40,000.00
012D-21	Dr. Mark DeCoster	Life Sciences and Bioengineering	Louisiana Tech University	Lateral Flow Device with micro- and nano-scale degradable components	$39,859.00
013D-21	Dr. David Mills	Advanced Materials and Manufacturing	Louisiana Tech University	Large Area Projection Sintering of Metalized-Ceramic Thermoplastic Composites for Rapid Manufacture of High Performance Materials	$37,403.00
014D-21	Dr. David Mills	Advanced Materials and Manufacturing	Louisiana Tech University	Tough Self-Decontaminating Surfaces	$29,903.00
015D-21	Prof. Shengnian Wang	Life Sciences and Bioengineering	Louisiana Tech University	Extracellular Vesicles Production with Nanoelectroporation	$39,998.00
016D-21	Dr. Li Chen	Digital Media and Enterprise Software	University of Louisiana at Lafayette	Fast and Efficient Scheduler for Deep Learning in GPU Cluster	$39,990.00
017D-21	Dr. Xiali Hei	Digital Media and Enterprise Software	University of Louisiana at Lafayette	Protecting Unmanned Aerial Systems [UASs] from Attacks using Data, Mathematical Models, and Hardware	$38,781.00
018D-21	Prof. Uttam Chakravarty	Advanced Materials and Manufacturing	University of New Orleans	Design and Analysis of a Hybrid Energy Harvester Based on Mechanical Vibration and Solar Radiation	$40,000.00

Total Number of Proposals submitted	18
Total Funds Requested	$705,794.00