Ongoing Metric Tracking for ND EPSCoR NSF RII Track-1: New Discoveries in the Advanced Interface of Computation, Engineering and Science (ND-ACES)

8/31/2022

	CCBSE: Materials Design at Biointerfaces Pillar	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Color Key:	**Objective 1.1a:** Design and optimize nanoclay scaffolds (**Activity 1**: Prepare nanoclay scaffolds with amino acids for cancer cell growth)	Prepare 3 different biocompatible scaffolds **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Prepared 3 nanoclay scaffolds. These scaffolds will be delivered to the Cellular Team in Y2.	Develop 2 nanoclay scaffolds incorporating the amino acids and evaluate additional one hard scaffold **Y2 Annual Report**: All three Y1 hard scaffolds were delivered to the Cellular Team in September 2021. On track to deliver Y2 scaffolds and evaluation. **Y2 ACTUAL**: Evaluation of the Y2 scaffolds is in progress.	Select one optimal scaffold (critical) **Y3 Progress**: update not available at this time	Prepare enough scaffolds for the other Pillars and for Materials Design Pillar Goal 3	Prepare enough scaffolds for the other Pillars and for Materials Design Pillar Goal 3	Lead: **K. Katti**, Co-lead: G. Du, W. Xia, (Computational Approaches Pillar liaison), New Hire at NDSU ***[Approved by NSF on 9/8/2021]***
Behind Schedule	**Objective 1.1a:** (**Activity 2:** Assist non-RU campuses involved in Activity 1 with compliance protocols) ***[Change in metric approved by NSF on 7/28/21]***	Assist with the initiation of conversations between non-RU faculty and RU campuses for the administration of necessary compliance protocols (IBC, MTAs) **Y1 Annual Report:** N/A **Y1 ACTUAL:** Change under review by NSF	Ensure that all necessary compliance protocols are in place at the non-RU campuses **Y2 Annual Report**: Per NSF policy, IBC protocols are not required of non-RU CCBSE researchers. See PROSPER P&C regarding workshops delivered to CCBSE researchers in Y2. CCBSE leads will develop a blanket NDA and MTA for CCBSE by the end of Y2. **Y2 ACTUAL**: Completed	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all campuses **Y3 Progress**: update not available at this time	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all campuses	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all campuses	Leads: **K. Katti**, **M. Hoffmann**, **S. Mallik**, **J. Zhao** ***[Responsibility change approved by NSF on 5/16/22]***
On Track / In-Progress	**Objective 1.1b:** Characterize the scaffolds and demonstrate cancer cell growth (**Activity 1:** Characterize the scaffolds and culture of breast and prostate cancer cells)	Complete characterizations on the scaffolds prepared in 1.1a. Demonstrate growth of MCF7 and PC3a cells **Y1 Annual Report:** On track to complete **Y1 ACTUAL**: Completed characterizations on the 3 nanoclay scaffolds from 1.1a; growth of MCF7 and PC3a cells was demonstrated.	Demonstrate growth of MDA-MB-231 and PC3 cells and compare with MCF7 and PC3a cells **Y2 Annual Report**: Scaffold activity with 4 types of cells completed on one hard scaffold and initiated on second hard scaffold. **Y2 ACTUAL**: Cell growth studies on the second scaffolds are in progress.	Demonstrate tumoroid formation (critical) **Y3 Progress**: update not available at this time	Time evaluation of tumor growth on optimized scaffolds	The tumors on the scaffold are genetically and morphologically similar	Lead: **K. Katti**, Co-lead: G. Du, W. Xia (Computational Approaches Pillar liaison), New Hire at NDSU ***[Approved by NSF on 9/8/2021]***
Ahead of Schedule / Complete	**Objective 1.2a**: Design and optimize soft polymeric scaffolds (**Activity 1**: Prepare soft scaffolds from Chi, Alg, and PgA, characterize the scaffolds)	Prepare 3 different biocompatible scaffolds **Y1 Annual Report:** On track to complete **Y1 ACTUAL**: Prepared 3 scaffolds. These scaffolds were delivered to the Cellular Team in Y1.	Prepare 3 different biocompatible scaffolds **Y2 Annual Report**: Y1 scaffolds were rejected by the Cellular Systems team due to low pH values. Four new soft scaffolds have been developed and delivered to the Cellular Systems team. **Y2 ACTUAL**: One soft scaffold supports cell growth for a limited time. Studies are in progress.	Select 1 optimal scaffold (critical) **Y3 Progress**: update not available at this time	Prepare enough scaffolds for the other Pillars and for Materials Design Pillar Goal 3 (nanomaterials testing)	Prepare enough scaffolds for the other Pillars and for Materials Design Pillar Goal 3	Lead: **K. Katti, K. Hossain** , Co-leads: M. Quadir, B. Voels, M. Parker, A. Allard, M. Kjelland ***[Approved by NSF on 7/8/2022]*** , W. Xia (Computational Approaches Pillar liaison)
N/A or Not yet started	**Objective 1.2a**: (**Activity 2**: Assist non-RU campuses involved in Activity 1 with compliance protocols) ***[Change in metric approved by NSF on 7/28/21]***	Assist with the initiation of conversations between non-RU faculty and RU campuses for the administration of necessary compliance protocols (IBC, MTAs) **Y1 Annual Report:** N/A **Y1 ACTUAL:** Change under review by NSF	Ensure that all necessary compliance protocols are in place at the non-RU campuses **Y2 Annual Report:** Per NSF policy, IBC protocols are not required of non-RU CCBSE researchers. See PROSPER P&C regarding workshops delivered to CCBSE researchers in Y2. CCBSE leads will develop a blanket NDA and MTA for CCBSE by the end of Y2. **Y2 ACTUAL**: Completed	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all campuses **Y3 Progress**: update not available at this time	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all campuses	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all campuses	Leads: **K. Katti**, **M. Hoffmann**, **S. Mallik**, **J. Zhao** ***[Responsibility change approved by NSF on 5/16/22]***

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Objective 1.2b: Characterize the scaffolds and demonstrate cancer cell growth (**Activity 1:** Determine mechanical properties, cell viability in the scaffolds, analyze gene expression profiles)	Complete characterizations on the scaffolds prepared in 1.2a. Demonstrate growth of MCF7 and PC3a cells. **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Completed characterizations on the 3 soft polymeric scaffolds from 1.2a; growth of MCF7 and PC3a cells was demonstrated.	Demonstrate growth of MDA-MB-231 and PC3 cells and compare with MCF7 and PCa **Y2 Annual Report**: The "first generation" scaffolds did not support cell growth. Studies are in progress with the pH-controlled scaffolds. **Y2 ACTUAL**: Studies on the growth of MCF7 and PC3 cells are in progress on one of the soft scaffolds identified in Objective 1.2a.	Demonstrate tumoroid formation (critical) **Y3 Progress**: update not available at this time	Time evaluation of tumor growth on optimized scaffolds	The tumors on the scaffold are genetically and morphologically similar	Lead: **K. Katti**, Co-lead: G. Du, M. Quadir, K. Hossain, W. Xia (Computational Approaches Pillar liaison)
Objective 1.2b: (**Activity 2:** Assist non-RU campuses involved in Activity 1 with compliance protocols) ***[Change in metric approved by NSF on 7/28/21]***	Assist with the initiation of conversations between non-RU faculty and RU campuses for the administration of necessary compliance protocols (IBC, MTAs) **Y1 Annual Report**: N/A **Y1 ACTUAL**: Change under review by NSF.	Ensure that all necessary compliance protocols are in place at the non-RU campuses **Y2 Annual Report**: Per NSF policy, IBC protocols are not required of non-RU CCBSE researchers. See PROSPER P&C regarding workshops delivered to CCBSE researchers in Y2. CCBSE leads will develop a blanket NDA and MTA for CCBSE by the end of Y2. **Y2 ACTUAL**: Completed	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all campuses **Y3 Progress**: update not available at this time	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all campuses	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all campuses	Leads: **K. Katti**, **M. Hoffmann**, **S. Mallik**, **J. Zhao** ***[Responsibility change approved by NSF on 5/16/22]***
Objective 1.3a: (**Activity 1**: Design and develop stimuli-responsive polymeric materials as nanocarriers)	Prepare 5 different PSEs and characterize nanoparticles. **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Developed 5 different PSEs and chazcterized them. Optimized one of them as the most suitable PSE.	Demonstrate drug release in the tumoroids cells in scaffolds **Y2 Annual Report**: Degradation studies of the nanoparticles are in progress in low pH values. **Y2 ACTUAL**: Degradation studies are in progress.	The nanoparticles release drugs within desirable time in scaffolds (critical) **Y3 Progress**: update not available at this time	Prepare 3 different polymers, demonstrate imaging in the tumor cells in 3D scaffolds	Released drugs kill majority of cancer cells in scaffold/models	Lead: **G. Du**, Co-leads: J. Zhao, C. Combs, B. Sui ***[Approved by NSF 7/28/21]***
Objective 1.3b: (**Activity 1**: Design and develop silicon quantum dots (QDs) and polymer-QDs hybrids for bioimaging)	QDs with stable signal in cells **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Completed	Demonstrate good biocompatibility with cancer cell lines **Y2 Annual Report**: Biocompatibility studies with cancer cells are in progress. **Y2 ACTUAL**: Studies continue to be in progress.	Identify two polymers (critical) **Y3 Progress**: update not available at this time	Make two polymer-SiQD hybrids	Demonstrate optimized imaging	Lead: **J. Zhao** , Co-leads: G. Du, C. Combs, B. Sui ***[Approved by NSF 7/28/21]***
Objective 1.3c: Design and test polymer nanoparticles for vascular surrogacy (**Activity 1:** Design, preparation, and testing of hypoxiaresponsive polymer nanoparticles)	Prepare 3 polymers with different hypoxia-responsive units, characterize nanoparticles. **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Prepared three polymer nanoparticles.	Prepare two additional polymers, demonstrate drug release in the tumoroids on hard and soft scaffolds. **Y2 Annual Report**: Studying the release of metarrestin from the nanoparticles under various oxygen levels. **Y2 ACTUAL**: Polymer synthesis and release studies without any cells are complete. However, we are waiting for the optimal hard and soft scaffolds.	The nanoparticles release drugs within 2 hours in the hard and soft scaffolds (critical). **Y3 Progress**: update not available at this time	Release drugs kill at least 80% of the breast and prostate cancer cells on the scaffolds (critical)	Released drugs kill at least 80% of the cancer cells in the patient-derived model.	Lead: **S. Mallik**, Co-leads: M. Bobylev, K. Katti, G. Du, New Hire at NDSU ***[Approved by NSF 9/8/21]***
Objective 1.3c (**Activity 2:** Design, preparation, and testing of pH-responsive polymer nanoparticles)	Prepare 3 polymers, characterize nanoparticles **Y1 Annual Report**: On track to complete. **Y1 ACTUAL**: Prepared and characterized 3 pH-responsive polymer nanoparticles.	Demonstrate drug release in the tumoroids on hard and soft scaffolds **Y2 Annual Report**: Validation ongoing in provided scaffolds. **Y2 ACTUAL**: Validation of the scaffolds and the selection process are ongoing.	The nanoparticles release drugs within 2 hours in the hard and soft scaffolds (critical) **Y3 Progress**: update not available at this time	Release drugs kill at least 80% of the breast and prostate cancer cells on the scaffolds (critical)	Released drugs kill at least 80% of the cancer cells in the patient-derived model	Lead: **M. Quadir**, Co-leads: S. Mallik, K. Katti, G. Du, New Hire at NDSU ***[Approved by NSF 9/8/21]***

Ongoing Metric Tracking for ND EPSCoR NSF RII Track-1: New Discoveries in the Advanced Interface of Computation, Engineering and Science (ND-ACES)

8/31/2022

	CCBSE: Cellular Systems at Materials Interface Pillar	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Color Key:	**Objective 2.1a:** Increase CCBSE capacity/expertise in basic and translational use of in vivo-like 3D cell cultures (**Activity 1:** Validate multiple soft and hard tissue scaffolds)	Validation SOP creation using existing materials and 2D culture **Y1 Annual Report**: Behind schedule **Y1 ACTUAL**: We have created SOPs based on commercially available materials and 2D culture; first gen soft scaffold materials failed to support growth, second gen materials not yet available for testing.	*Metric was not completed in Y1 as planned* **Y2 Annual Report**: Second gen materials are available for testing. **Y2 ACTUAL**: Second gen materials are available for testing.				Leads: **A. Dhasarathy, J. Wilkinson** Co-leads: C. Combs, G. Du, (Materials Design Pillar liaison), K. Hartman ***[Approved by NSF 7/28/21]*** , K. Katti, A. Haage, H. van Gijssel, M. Hoffmann ***[Approved by NSF 7/28/21]*** (Computational Approaches Pillar liaison)
Behind Schedule	**Objective 2.1a** (**Activity 1** - cont.)	Protocol database creation based on validation **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Database created and protocols are being uploaded by the team.	Completion of secondary validation on provided 1st generation materials **Y2 Annual Report**: Validation incomplete since first generation materials failed initial screening. **Y2 ACTUAL**: Validation incomplete since first generation materials failed initial screening.	Completion of tertiary validation, provided 1st generation materials **Y3 Progress**: update not available at this time	Completion of quaternary validation, provided 1st generation materials	Completion of quaternary validation, provided 2nd generation materials	
On Track / In-Progress	**Objective 2.1a** (**Activity 1** - cont.)	Reagent database creation based on validation **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Reagent database created and will be updated continuously.	Completion of preliminary validation on provided 2nd generation materials **Y2 Annual Report**: Validation ongoing as materials continue to arrive in labs. **Y2 ACTUAL**: Validation ongoing as materials continue to arrive in labs.	Completion of secondary validation, provided 2nd generation materials **Y3 Progress**: update not available at this time	Completion of tertiary validation, provided 2nd generation materials		
Ahead of Schedule / Complete	**Objective 2.1a** (**Activity 1** - cont.)	Completion of preliminary evaluation of provided first generation materials (baseline viability and growth, initial hypoxic response and EMT/MET signatures) e.g., 85% similar to 2D and matrigel cultures **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: First gen hard scaffold work completed. First gen soft scaffold materials did not work, second gen materials not provided during Y1.	*Metric was not completed in Y1 as planned* **Y2 Annual Report**: Second gen materials are available for testing. **Y2 ACTUAL**: Second gen materials are available for testing.	Completion of preliminary nanomaterial delivery assessments **Y3 Progress**: update not available at this time	Completion of secondary nanomaterial delivery assessments	Completion of tertiary nanomaterial delivery assessments	
N/A or Not yet started	**Objective 2.1a** (**Activity 1** - cont.)	Data exchange with Materials Design and Computational Approaches Pillars **Y1 Annual Report**: On track **Y1 ACTUAL**: Data exchange initiated and is continuing.	Continued data exchange with Materials Design and Computational Approaches Pillars **Y2 Annual Report**: Data exchange is continuous and will not be complete until year ends. **Y2 ACTUAL**: Data exchange is continuous and will not be complete until year ends.	Continued data exchange with Materials Design and Computational Approaches Pillars **Y3 Progress**: ongoing	Continued data exchange with Materials Design and Computational Approaches Pillars	Continued data exchange with Materials Design Pillar and Computational Approaches Pillar	
	Objective 2.1a (**Activity 2:** Generate heterogeneous multicellular 3D cultures with improved in vivo-like tissue)	A protocol for growth of multi-cellular cultures on provided hard and soft 1st generation materials **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Incomplete, as materials failed/ not provided respectively.	An optimized co-culture protocol for growth on provided hard and soft 1st generation materials **Y2 Annual Report**: Co-culture cannot be tested until single cell culture validation of first generation materials is completed, as noted above. **Y2 ACTUAL**: Co-culture cannot be tested until single cell culture validation of first generation materials is completed, as noted above.				Leads: **C. Combs, J. Wilkinson, A. Haage, N. Galt, G. Du**, (Materials Design Pillar liaison), K. Katti, M. Hoffmann ***[Approved by NSF 7/28/21]*** (Computational Approaches Pillar liaison)

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Objective 2.1a (**Activity 2** - cont.)		A co-culture protocol for growth on provided hard and soft 2nd generation materials **Y2 Annual Report**: Second generation materials have been received and validation is ongoing. **Y2 ACTUAL**: Second generation materials have been received and validation is ongoing.	An optimized co-culture protocol for growth on provided hard and soft 2nd generation materials **Y3 Progress**: update not available at this time			
Objective 2.1a (**Activity 2** - cont.)		Establish phenotype marker criteria (e.g., morphology and proteins) for co-cultures on provided hard and soft 1st generation materials to compare to *in vivo* tumors **Y2 Annual Report**: We have a source of PDX tumor tissue; experiments are starting on this metric. **Y2 ACTUAL**: We have a source of PDX tumor tissue; experiments are starting on this metric.	Establish phenotype marker criteria (e.g., morphology and proteins) for co-cultures on provided hard and soft 2nd generation materials to compare to in vivo tumors **Y3 Progress**: update not available at this time	Genomic and transcriptomic characterization of co-cultures on hard and soft materials	Genomic and transcriptomic characterization of nanocarrier-mediated drug delivery to co-cultures on hard and soft materials	
Objective 2.1a (**Activity 2** - cont.)			Protocol for nanocarrier design and drug delivery to 3D-cultures **Y3 Progress**: update not available at this time	Optimized protocol for nanocarrier design and drug delivery to 3D-cultures	Demonstration of nanocarrier-mediated drug delivery effects on co-culture viability and the established cellular phenotype markers	
Objective 2.1a (**Activity 2** - cont.)	Continued data exchange with Materials Design and Computational Approaches Pillars **Y1 Annual Report**: On track **Y1 ACTUAL**: Data exchange initiated and is continuing.	Continued data exchange with Materials Design and Computational Approaches Pillars **Y2 Annual Report**: Data exchange is continuous and will not be complete until year ends. **Y2 ACTUAL**: Data exchange is continuous and will not be complete until year ends.	Continued data exchange with Materials Design and Computational Approaches Pillars **Y3 Progress**: ongoing	Continued data exchange with Materials Design and Computational Approaches Pillars	Continued data exchange with Materials Design and Computational Approaches Pillars	
Objective 2.1a (**Activity 3:** Develop a high throughput system that combines materials and modeling to create an improved culture paradigm for human *in vivo* relevance)	Successful establishment of PDX colonies as source of test materials **Y1 Annual Report**: On track to compete **Y1 ACTUAL**: a breast cancer PDX colony has been established at NDSU, this is supported by a different project and not currently associated with ND-ACES. Administrative efforts are in progress to correct this problem.					
Objective 2.1a (**Activity 3** - cont.)	Establishment and maintenance of PDX explant tissues (XOs) in scaffold cultures with greater than 1-month viability **Y1 Annual Report**: Behind schedule, as noted above **Y1 ACTUAL**: Administrative efforts in progress to associate established breast cancer PDX with the ND-ACES project before explant testing can begin.	Complex Analysis of phenotypic criteria indicating XO tissues on scaffolds exhibit growth and gene expression characteristics similar to *in vivo* conditions **Y2 Annual Report**: We have arranged to get PDX tissues from the NDSU Animal Core Facility. **Y2 ACTUAL**: We have arranged to get PDX tissues from the NDSU Animal Core Facility.	Response to hypoxia/ acidification by XO/scaffolds that mimics the *in vivo* tumor environment **Y3 Progress**: update not available at this time	Successful long-term culture of PDO with TAM/TAF on scaffolds	Changes in PDO/scaffold growth behavior, genetics, and morphology upon the intervention of TAM-PDO communication	Leads: **J. Kim, J. J. Wilkinson, C. Combs, A. Haage, H. van Gijssel**

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Objective 2.1a (**Activity 3** - cont.)	Development of standard protocols for sustained growth of XO tissues on next generation material scaffolds **Y1 Annual Report**: Behind schedule **Y1 ACTUAL**: Administrative efforts in progress to associate established breast cancer PDX with the ND-ACES project before explant testing can begin.	Faster and more efficient growth of XO tissues under scaffold conditions when compared to in vivo maintenance **Y2 Annual Report**: We have arranged to get PDX tumor tissue *ex vivo* from the NDSU Animal Core Facility. **Y2 ACTUAL**: We have arranged to get PDX tumor tissue ex vivo from the NDSU Animal Core Facility.	Development of a standard protocol for successful co-culture of XO with TAM/TAF on scaffolds **Y3 Progress**: update not available at this time	Presentation of miniature tumor microenvironment by PDO/TAM/TAF on scaffolds that is similar to TME of PDX tumor	Presentation of drug resistance characteristics by explanted tumoroids that maintain similar properties to those observed *in vivo*	
Objective 2.1a (**Activity 3** - cont.)		Successful growth of PDO on the next-generation scaffolds **Y2 Annual Report**: PDO's have been established in conventional culture, assessment in scaffolds is underway. **Y2 ACTUAL**: PDO's have been established in conventional culture, assessment in scaffolds is underway.	Complex Analysis of phenotypic criteria indicating PDO tissues on scaffolds exhibit growth and gene expression characteristics similar to *in vivo* conditions **Y3 Progress**: update not available at this time			
Objective 2.1a (**Activity 3** - cont.)	Continued data exchange with Materials Design and Computational Approaches Pillars **Y1 Annual Report**: On track **Y1 ACTUAL**: In progress, this is a continous process.	Continued data exchange with Materials Design and Computational Approaches Pillars **Y2 Annual Report**: data exchange is continuous and will not be complete until year ends. **Y2 ACTUAL**: data exchange is continuous and will not be complete until year ends.	Continued data exchange with Materials Design and Computational Approaches Pillars **Y3 Progress**: ongoing	Continued data exchange with Materials Design and Computational Approaches Pillars	Continued data exchange with Materials Design and Computational Approaches Pillars	
Objective 2.1a (**Activity 4:** Assist non-RU campuses involved in Activity 1 with compliance protocols) ***[Metric change approved by NSF on 7/28/21]***	Assist with the initiation of conversations between non-RU faculty and RU campuses for the administration of necessary compliance protocols (IBC, MTAs) **Y1 Annual Report**: N/A **Y1 ACTUAL**: Change under review by NSF	Ensure that all necessary compliance protocols are in place at the non-RU campuses **Y2 Annual Report**: Per NSF policy, IBC protocols are not required of non-RU CCBSE researchers. See PROSPER P&C regarding workshops delivered to CCBSE researchers in Y2. CCBSE leads will develop a blanket NDA and MTA for CCBSE by the end of Y2. **Y2 ACTUAL**: Per NSF policy, IBC protocols are not required of non-RU CCBSE researchers. See PROSPER P&C regarding workshops delivered to CCBSE researchers in Y2. CCBSE leads will develop a blanket NDA and MTA for CCBSE by the end of Y2.	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all non-RU campuses **Y3 Progress**: ongoing	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all non-RU campuses	Ensure that all necessary compliance protocols (IBC, MTAs) are in place at all non-RU campuses	Leads: **K. Katti, C. Combs, A. Dhasarathy, J. Wilkinson**

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	CCBSE: Computation, Machine Learning, and Predictive Modeling Pillar	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Color Key:	**Objective 3.1**: Create an evolutionary in-silico platform to predict tumor growth (**Activity 1:** Machine learning to understand cellular and materials connections)	C7-ML Bone site - Classification Accuracy >=0.4 **Y1 Annual Report**: On track to meet **Y1 ACTUAL**: Databases of cancer tissue images were used to identify best performing ML algorithms. Classification Accuracy >=0.4 has been achieved.	C7 ML Bone site - Classification Accuracy >=0.5 **Y2 Annual Report**: Discussion with Cellular Systems pillar to identify experimental data necessary for ML is taking place. **Y2 ACTUAL**: Discussion with Cellular Systems pillar to identify experimental data necessary for ML is taking place.	C7 ML Bone site – Classification Accuracy >=0.6 **Y3 Progress**: update not available at this time			Leads: C7 - **L. Liu;** C8 - **J. Delhommelle**
Behind Schedule	**Objective 3.1**: (**Activity 1** - cont.)	C8-ML Primary site - Datasets generation from composite data sources for ML model training & identification of best performing ML algorithms for image recognition of the 4 types of cancer cells on bone stem cells **Y1 Annual Report**: On track to meet **Y1 ACTUAL**: Databases of cancer tissue images were used to identify best performing ML algorithms and image recognition of at least 4 was achieved.	C8 ML Primary site - 1) Datasets generation for the cellular growth-material formulation using data from experimentalists and other collaborators. Identification of high performing ML algorithms on image recognition for cell migration and clustering **Y2 Annual Report**: Discussion with Cellular pillar to identify experimental data necessary for ML is taking place. **Y2 ACTUAL**: Discussion with Cellular pillar to identify experimental data necessary for ML is taking place.	C8 ML Primary site - Determination of patterns & optimal properties via ML **Y3 Progress**: update not available at this time			Leads: C7 - **L. Liu;** C8 - **J. Delhommelle**
On Track / In-Progress	**Objective 3.1**: (**Activity 1** - cont.) ***[Metric change approved by NSF 8/27/21]***		Build Machine learning capacity at a PUI and determine Y3-5 PUI researcher activity **Y2 Annual Report**: PUI investigator with ML expertise added, will collaborate with existing ML researcher to develop PUI content. **Y2 ACTUAL**: PUI investigator with ML expertise added, will collaborate with existing ML researcher to develop PUI content.	TBD, see Y2 **Y3 Progress**: update not available at this time			Lead: **M. Fries**, D. Katti, M. Hoffmann, L. Liu, J. Delhommelle
Ahead of Schedule / Complete	**Objective 3.1**: **Activity 2:** Multiscale modeling with Materials Design Pillar)	M1-Ab-initio/DFT-Obtain binding interface information at the atomistic level **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Binding affinity of 13 aminoacids with clays completed.	M1-Ab-initio/DFT - Obtain binding interface information at the atomistic level **Y2 Annual Report**: Electrostatic description of amino acids and clays on binding obtained. **Y2 ACTUAL**: Electrostatic description of amino acids and clays on binding obtained.	M1-Ab-initio/DFT - Obtain binding interface information at the atomistic level **Y3 Progress**: update not available at this time			Leads: M1 & M2 - **M. Hoffmann** ***[Approved by NSF 7/28/21]*** M3 & M5 - **D. Katti** M4 - **W. Xia** M6 - **T. Le**
N/A or Not yet started	**Objective 3.1**: (**Activity 2** - cont.)	M2-Ab-initio/DFT -Building atomistic models to understand interfaces **Y1 Annual Report**: On track **Y1 ACTUAL**: Ab-initio/DFT modeling of clay is completed.	M2-Ab-initio/DFT - Building atomistic models to understand interfaces **Y2 Annual Report**: Integrin model is identified. Specific domains to be used for the calculations are to be finalized. **Y2 ACTUAL**: Integrin model is identified. Specific domains to be used for the calculations are to be finalized.	M2-Ab-initio/DFT - Building atomistic models to understand interfaces **Y3 Progress**: update not available at this time			

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Objective 3.1: (**Activity 2** - cont.)	M3-Molecular Dynamics - Successful model development **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: MD model for the PCN being currently used by other pillars is complete.	M3-Molecular Dynamics - Successful model development; compare mechanical properties with nanoindentation with results within an order of magnitude **Y2 Annual Report**: MD model for a new nanocomposite for hard scaffolds under development. The MD nanoclay model with a new amino acid is built. **Y2 ACTUAL**: MD model for a new nanocomposite for hard scaffolds under development. The MD nanoclay model with a new amino acid is built.	M3-Molecular Dynamics - Successful model development; compare mechanical properties with nanoindentation with results within an order of magnitude **Y3 Progress**: update not available at this time			Leads: M1 & M2 - **M. Hoffmann** ***[Approved by NSF 7/28/21]*** M3 & M5 - **D. Katti** M4 - **W. Xia** M6 - **T. Le**
Objective 3.1: (**Activity 2** - cont.)	M4-Coarse Graining - CG model of clay developed; CG model of polymer developed; CG force field validated **Y1 Annual Report**: On track **Y1 ACTUAL**: CG model of clay is developed and validated; CG modeling strategy of polymer is established and the CG polymer model is under development.	M4-Coarse Graining - CG model of clay developed; CG model of PCN developed; CG force field validated **Y2 Annual Report**: Polymer PCL CG model is under development. **Y2 ACTUAL**: Polymer PCL CG model is under development.	M4-Coarse Graining - CG model of clay developed; CG model of PCN developed; CG force field validated **Y3 Progress**: update not available at this time			
Objective 3.1: (**Activity 2** - cont.)	M5-Finite Element Modeling - Successful model development **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: FEM model for the scaffold currently used by other pillars is complete.	M5-Finite Element Modeling - Successful model development. Elastic modulus within an order of magnitude of nanoindentation/ macroscale experiments **Y2 Annual Report**: Simulations will be done in Y2. **Y2 ACTUAL**: Simulations will be done in Y2.	M5-Finite Element Modeling - Successful model development. Elastic modulus within an order of magnitude of nanoindentation/ macroscale experiments **Y3 Progress**: update not available at this time			
Objective 3.1: (**Activity 2** - cont.)	M6-Deterministic models for degrading scaffold under shear flows developed; Rate of degrading validated **Y1 Annual Report**: On track **Y1 ACTUAL**: Computational model for shear flows developed; the model for degrading is being developed.	M6-Computational Fluid Dynamics - Range of model parameters for degradable scaffold established; Models for cell interaction and migration developed **Y2 Annual Report**: CFD simulations of flow through scaffolds in progress. **Y2 ACTUAL**: CFD simulations of flow through scaffolds in progress.	M6-Computational Fluid Dynamics - Multi-resolution CFD model for scaffold developed; Local distribution of shear stresses in complex geometries validated **Y3 Progress**: update not available at this time			
Objective 3.1: (**Activity 3:** Multiscale modeling with Cellular Systems Pillar)	C1-Ab-initio/DFT Bone site - Creation of reduced models for integrin domains, nanoclays, and polymers **Y1 Annual Report**: On track **Y1 ACTUAL**: Integrin molecular model is identified. Clay model to be used for the study has been developed.	C1-Ab-initio/DFT Bone site - Validation and improvement of reduced models for nanoclays and polymers interacting with Integrin domains **Y2 Annual Report**: Modeling is in progress **Y2 ACTUAL**: DFT studies on all 11 nonantural amino acids completed	C1-Ab-initio/DFT Bone site **Y3 Progress**: update not available at this time	C1-Ab-initio/DFT Bone site	C1-Ab-initio/DFT Bone site	C1 - **S. Kilina** C2 - **D. Cakir** C3, C5 & C11 - **D. Katti** C4, C9 - **W. Xia**
Objective 3.1: (**Activity 3** - cont.)	C2-Ab-initio/DFT - Building atomistic models to model bio-interfaces **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Integrin molecular model is identified.	C2-Ab-initio/DFT - Building atomistic models to represent/model bio-interfaces **Y2 Annual Report**: Modeling is in progress **Y2 ACTUAL**: DFT studies on all 11 nonnatural amino acids interacting with clay completed	C2-Ab-initio/DFT Primary site - Building atomistic models to model bio interfaces **Y3 Progress**: update not available at this time	C2-Ab-initio/DFT Primary site	C2-Ab-initio/DFT Primary site - Building atomistic models to represent/model bio-interfaces	

CCBSE: Computation, Machine Learning, and Predictive Modeling Pillar	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Objective 3.1: (**Activity 3** - cont.)	C3-Molecular Dynamics - Successful model development of actin and integrin. Obtaining mechanical properties of actin from SMD **Y1 Annual Report**: On track to complete **Y1 ACTUAL**: Both tasks are completed- actin results are published in a Journal paper.	C3-Molecular Dynamics - Successful model development of actin and deploymerization genes; integrin on surfaces; Obtaining mechanical properties of actin and integrin from SMD **Y2 Annual Report**: The model development of actin and depolymerization genes is completed and the results will be submitted soon to a Journal. The integrin modeling is complete and simulations are ongoing. **Y2 ACTUAL**: The model development of actin and depolymerization genes is completed and the results will be submitted soon to a Journal. The integrin modeling is complete and simulations are ongoing.	C3, C9, C10-Molecular Dynamics - Determine the mechanical properties of E-Cadherin junctions; Determine the mechanical properties of the integrin molecules on PCN and polymers **Y3 Progress**: update not available at this time	C3, C9, C10-Molecular Dynamics - Determine the mechanical properties of the additional six integrin molecules on PCN and polymers	C11-Multibody dynamics simulations integrated with Finite Element Modeling - Successful development of multibody dynamics simulations model for cell migration	C1 - **S. Kilina** C2 - **D. Cakir** C3, C5 & C11 - **D. Katti** C4, C9 - **W. Xia**
Objective 3.1: (**Activity 3** - cont.)	C4-Coarse Graining - CG model of integrins developed; Integrins-PCN interfacial interactions captured by CG modeling **Y1 Annual Report**: On track **Y1 ACTUAL**: CG modeling framework of interface is established, and CG model of integrins has been developed.	C4-Coarse Graining – Continued **Y2 Annual Report**: Awaiting MD results for parameter development. **Y2 ACTUAL**: Awaiting MD results for parameter development.	C4-Coarse Graining - Mechanical properties of interphases obtained with CG modeling for six integrins and varying interfacial design parameters **Y3 Progress**: update not available at this time	C4-Coarse Graining - Mechanical properties of interphases obtained with CG modeling for additional six integrins with extended interfacial design parameters		
Objective 3.1: (**Activity 3** - cont.)	C5-Finite Element Modeling - Successful development of FEM cell model **Y1 Annual Report**: On track **Y1 ACTUAL**: FEM model of single cells is completed and nonlinear material properties are being evaluated.	C5-Finite Element Modeling –Successful development of FEM cell model on substrate; incorporation of adhesion parameters from C1 through C4; calibration with experiments **Y2 Annual Report**: Adhesion models under development. **Y2 ACTUAL**: Adhesion models under development.	C5-Finite Element Modeling - Successful development of FEM cell model on substrate and Cell-Cell adhesion model; incorporation of adhesion parameters from C1 through C4; calibration with experiments **Y3 Progress**: update not available at this time			
Objective 3.1: (**Activity 3** - cont.)	C6-Computational Fluid Dynamics - Continuum representation of actin networks in cell membrane developed; Cell adhesion model developed and validated **Y1 Annual Report**: On track **Y1 ACTUAL**: The DPD model for actin network of cellular membrane has been developed. The result has been published in a Journal article. The adhesion model is being developed.	C6-Computational Fluid Dynamics - Models for cell migration on a clay substrate developed and validated **Y2 Annual Report**: A realistic model for eukaryotic cells has been developed. The migration model is being developed. **Y2 ACTUAL**: A realistic model for eukaryotic cells has been developed. The migration model is being developed.	C6-Computational Fluid Dynamics - CFD simulations of flows around groups of cancer cells populated on a substrate **Y3 Progress**: update not available at this time	C6-Computational Fluid Dynamics - Using measures such as cell density and alignment to validate CFD models for cellular migration on the surface of scaffold	C6-Computational Fluid Dynamics - Full-scale simulation of cell migration in a bio-reactor. Resolution provides from millimeter to micrometer (three order of magnitudes). Flow distribution and shear stresses will be provided in all pores of the scaffold	C6 - T. Le C10 - **M. Hoffmann** ***[Approved by NSF 7/28/21]***
Objective 3.1: (**Activity 4:** Machine learning to develop the in-silico platform)			C12, C14, C15, C16, C18-ML Bone Site - Obtain the knowledge to construct preliminary rules of designing new scaffold materials for bone site. Classification Accuracy >=0.6 **Y3 Progress**: update not available at this time	C12, C14, C15, C16, C18-ML Bone Site - Obtain the knowledge to construct fundamental rules of designing new scaffold materials for bone site; Classification Accuracy >=0.7; Generate simulated datasets under perturbed conditions and use those datasets to build ML models for cell migration; ML predictive models derived; ML model predictions validated against modeling and experiments	C12, C14, C15, C16, C18-ML Bone Site - Accuracy >=0.8; ML predictive models derived; ML model predictions validated against modeling and experiments; obtain the knowledge to construct fundamental rules of designing new scaffold materials for bone site	C12 - **L. Liu** (lead) C13 - **J. Delhommelle** (lead) C14 - **W. Xia** C15 - **M. Hoffmann** ***[Approved by NSF 7/28/21]*** C16 - **D. Katti** C18 - **T. Le**

CCBSE: Computation, Machine Learning, and Predictive Modeling Pillar	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Objective 3.1: (**Activity 4** - cont.)				C12, C14, C15, C16, C18-ML Bone Site - ML predictive models derived; ML model predictions validated against modeling and experiments; obtain the knowledge to construct fundamental rules of designing new scaffold materials for bone site		C12 - **L. Liu** (lead) C13 - **J. Delhommelle** (lead) C14 - **W. Xia** C15 - **M. Hoffmann** ***[Approved by NSF 7/28/21]*** C16 - **D. Katti** C18 - **T. Le**
Objective 3.1: (**Activity 4** - cont.)			C13, C14, C15, C16, C18-ML Primary Site - Obtain the knowledge to construct preliminary rules of designing new scaffold materials for primary site. Statistical and reduced order models will be developed to predict where cancer cells migrate and grow **Y3 Progress**: update not available at this time	C13, C14, C15, C16, C18-ML Primary Site - ML predictive models derived; ML model predictions validated against modeling and experiments; obtain the knowledge to construct fundamental rules of designing new scaffold materials for primary site	C13, C14, C15, C16, C18-ML Primary Site - Accuracy >=0.8; ML predictive models derived; ML model predictions validated against modeling and experiments; obtain the knowledge to construct fundamental rules of designing new scaffold materials for primary site	
Objective 3.1: (**Activity 4** - cont.) ***[Metric change approved by NSF 8/27/21]***			PUI researcher activity TBD, based on Y2, activity #1 **Y3 Progress**: update not available at this time	PUI researcher activity TBD, based on Y2, activity #1	PUI researcher activity TBD, based on Y2, activity #1	Lead: **M. Fries**, D. Katti, M. Hoffmann, L. Liu, J. Delhommelle
Objective 3.1: (**Activity 5:** Design Rules)				C17, C12, C13, C14, C15, C16, C18-Parameter-structure-property relationships drawn for design of materials; optimized design parameters identified; develop design rules (geometry, material properties) for fluid flows in degradable scaffolds	C17, C12, C13, C14, C15, C16, C18-Formulation of updated design rules for materials and scaffolds - Parameter-structure-property relationships refined for design of materials; materials design parameters finalized; validate design rules and establish optimized ranges of parameters	C12 - **L. Liu** C13 - **J. Delhommelle** C14 - **W. Xia** C15 - **M. Hoffmann** ***[Approved by NSF 7/28/21]*** C16 - **D. Katti** C17 - All Pillar and science leads C18 - **T. Le**

Ongoing Metric Tracking for ND EPSCoR NSF RII Track-1: New Discoveries in the Advanced Interface of Computation, Engineering and Science (ND-ACES)

8/31/2022

Center for Cellular Biointerfaces in Science and Engineering (CCBSE) Overall	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025
Number of new hires		**Y2 Annual Report**: UND - 1 hired: Binglin Sui NDSU - Initial virtual interviews have been completed. Spring 2022 campus interviews. On track for Fall 2022 start **Y2 ACTUAL**: UND - 1 hired NDSU - hire to start work in Y3 on 8/16/22	2 hired: NDSU new materials science faculty member will be hired **Y3 Progress**: NDSU hire, Prakash Selvakumar, to start 9/26/2022	Retained	5-yr goal: 2 Total to date: 2 hired
Total number of peer-review publications	**Y1 Annual Report**: 13 **Y1 ACTUAL**: 14** ***Update*** : ***Y1 Actual revised to 11*** as 3 were later removed from the total as they did not pertain to ND-ACES ***Update*** : During Y2, notified that 3 articles had been published during Y1, ***bringing Y1 award year published articles to 14*** . ****Update*** : end Y2 into Y3, a review is being done of all publications. Will post any updates pertaining to Y1 after review is completed.	**Y2 Annual Report**: 6 **Y2 ACTUAL**: 10* 11 articles published during Y2 award year (4 after Y2 reporting) ***Update*** : *1 journal article removed as it was not a product of ND-ACES project, bringing total from 11 to 10. 2 additional articles submitted in Y2 award year are in Submitted status.	Continue toward goal **Y3 Progress**: 0	Continue toward goal	5-yr goal: 140 Total published to date: 24
Number of collaborative products/ outputs from one senior author from two or more ND-ACES institutions ***[Metric change approved by NSF 5/16/22]***	**Y1 Annual Report**: 0 **Y1 ACTUAL**: 0	**Y2 Annual Report**: 0 **Y2 ACTUAL**: request submitted to NSF to change metric language was approved. **Products*/output TTL Y1/Y2 = 33:*** Collaborations: 1 Outreach: 19 + 23 = 42 Other Products: 5 Patents: 0 Presentations: 5 Proposals: 3 (1 denied, 2 in submitted status) Publications: 0	Continue toward goal **Y3 Products**: 0 Collaborations: 0 Outreach: 0 Other Products: 0 Patents: 0 Presentations: 0 Proposals: 0 Publications: 0	Continue toward goal	5-yr goal: 70 Total to date: 33
Total number of conference presentations by CCBSE senior personnel	**Y1 Annual Report**: 15 **Y1 ACTUAL**: 28	**Y2 Annual Report**: 9 **Y2 ACTUAL**: 23	Continue toward goal **Y3 Progress**: 1	Continue toward goal	5-yr goal: 90 Total to date: 52
Total number of submitted research proposals (PI/Co-PI from two or more ND-ACES institutions)	**Y1 Annual Report**: 0 **Y1 ACTUAL**: 1	**Y2 Annual Report**: 2 **Y2 ACTUAL**: 2	Continue toward goal Y3 Progress: 0	Continue toward goal	5-yr goal: 50 Total to date: 3
Number of submitted collaborative proposals (two or more ND-ACES senior personnel)	**Y1 Annual Report**: 2 **Y1 ACTUAL**: 6	**Y2 Annual Report**: 3 **Y2 ACTUAL**: 4	Continue toward goal Y3 Progress: 0	Continue toward goal	5-yr goal: 25 Total to date: 10

Color Key:

- **Behind Schedule**
- **On Track / In-Progress**
- **Ahead of Schedule / Complete**
- **N/A or Not yet started**

Center for Cellular Biointerfaces in Science and Engineering (CCBSE) Overall	**Year 1** **July 1, 2020-June 30, 2021**	**Year 2** **July 1, 2021-June 30, 2022**	**Year 3** **July 1, 2022-June 30, 2023**	**Year 4** **July 1, 2023-June 30, 2024**	**Year 5** **July 1, 2024-June 30, 2025**
Number of CAREER proposals submitted	**Y1 Annual Report**: 0 **Y1 ACTUAL**: 0	**Y2 Annual Report**: 0 **Y2 ACTUAL**: 0	Continue toward goal Y3 Progress: 0	Continue toward goal	5-yr goal: 2-4 Total to date: 0
Total external research funding (million $) – 5-year total is cumulative	**Y1 Annual Report**: $0; 12 proposals, two collaborative, totaling $14,368,361 were submitted (there were actually 11 submitted totaling $12,083,756 - one was added in twice in error) **Y1 ACTUAL**: $745,521 (three awarded proposals). 13 proposals, 6 collaborative, totaling $13,783,756 were submitted ***UPDATE Y1 ACTUAL***: 2 proposals were later removed from the total as they were from internal campus funding; notified 1 more had been submitted in Y1, ***bringing total in award Y1 to 12 submitted proposals*** (5 collaborative) totaling $13,708,756 - 2 were awarded, 1 of which was collaborative, for a total of $645,523, 9 were denied, and 1 is still pending).	**Y2 Annual Report**: $0 awarded at this time; 4 have been submitted in award Year 2, 3 are collaborative, for a combined total of $4,523,157 **Y2 ACTUAL**: A total of 11 proposals submitted in Y2; 2 were later removed for not being allowable, ***bringing total down to 9 submitted in award Y2*** (5 collaborative) for a total of $9,253,373 submitted - 7 are in a Submitted status, 1 was awarded for a total of $249,118, and 1 was denied.	Continue toward goal **Y3 Progress**: 0	Continue toward goal	5-yr goal: $25M Total to date: 21 proposals submitted totaling $22,962,129, of which: - 3 proposals subnitted, with a combined total of $1,138,886, ***were awarded*** for a combined total of $894,641 - 1 proposal submitted for $1,785,500 is in a ***Pending status*** - 7 proposals submitted, with a combined total of $8,364,949, are in a ***Submitted status*** - 10 proposals subnitted, with a combined total of $11,672,794, were denied
Number of projects funded with private sector partners	**Y1 Annual Report**: 0 **Y1 ACTUAL**: 0	**Y2 Annual Report**: 0 **Y2 ACTUAL**: 0	Continue toward goal Y3 Progress: 0	Continue toward goal	5-yr goal: 12 Total to date: 0
Number of graduate students trained (some may be counted in multiple years)	**Y1 Annual Report**: 30 **Y1 ACTUAL**: 56 (3 are STTAR interns) ***Update 06/2022***: Of the 3 STTAR interns, none are in any of the ND-ACES research areas.	**Y2 Annual Report**: 76 (48 are students not counted in Y1 report [3 of 48 are STTAR interns from Summer 2021]) **Y2 ACTUAL**: 9 graduate students added after Y2 reporting ***In total, 80 graduate students active in Y2*** ([6 of which are STTAR interns: 3 from Summer 2021 and 3 from Summer 2022, though none are in any of the ND-ACES research areas]).	Continue toward goal **Y3 Progress**: 63 (8 new in Y3)	Continue toward goal	5-yr goal: 140 Total to date: There are 99 unique graduate students to date (6 of which are STTAR students who did not intern in any of the ND-ACES research areas).
Number of conference presentations by graduate students (oral and poster)	**Y1 Annual Report**: 7 **Y1 ACTUAL**: 50	**Y2 Annual Report**: 9 **Y2 ACTUAL**: 48 + 3 more = 51	Continue toward goal **Y3 Progress**: 0	Continue toward goal	5-yr goal: 120 Total to date: 98

Center for Cellular Biointerfaces in Science and Engineering (CCBSE) Overall	**Year 1** **July 1, 2020-June 30, 2021**	**Year 2** **July 1, 2021-June 30, 2022**	**Year 3** **July 1, 2022-June 30, 2023**	**Year 4** **July 1, 2023-June 30, 2024**	**Year 5** **July 1, 2024-June 30, 2025**
Number of undergraduate students trained (some may be counted in multiple years)	**Y1 Annual Report**: 20 **Y1 ACTUAL**: 64 (5 are dREU, 20 are STTAR interns) ***Update 06/2022***: 41 students added in Y1 after Y1 report (5 are dREU and 20 are Summer 2021 STTAR interns, though no interns are working in any of the ND-ACES research areas) In total, 63 students active Y1	**Y2 Annual Report**: 77 (57 are students not counted in Y1 report [20 of the 57 are STTAR interns from Summer 2021]) **Y2 ACTUAL**: 5 students added after Y2 reporting ***In total, 93 students active Y2*** (43 of which are STTAR interns: 20 from Summer 2021 and 23 from Summer 2022, though no interns are working in any of the ND-ACES research areas)	Continue toward goal **Y3 Progress**: 24 (4 new in Y3)	Continue toward goal	5-yr goal: 70 Total to date: There are 108 unique undergraduate students (39 of which are STTAR students who did not intern in any of the ND-ACES research areas).
Number of conference presentations by undergraduate students (oral and poster)	**Y1 Annual Report**: 0 **Y1 ACTUAL**: 10	**Y2 Annual Report**: 0 **Y2 ACTUAL**: 7	Continue toward goal **Y3 Progress**: 0	Continue toward goal	5-yr goal: 80 Total to date: 17
Seed Funding: seed funding support of $60,000 in Translational Research Initiative Project and an additional $101,655 in other research opportunity support – 5-year total is cumulative ***[approved by NSF]***	**Y1 Annual Report**: Emerging Areas/Seed Award Request for Proposals has been issued and 4 proposals awarded totaling $103,568 **Y1 ACTUAL**: No change; total seed funding $103,568	**Y2 Annual Report**: Emerging Areas/Seed Award Request for Proposals have been issued and 5 new proposals awarded totaling $175,162.80 and additional funds totaling $85,508 provided to Y1 awardees, for a total of $260,670.80 **Y2 ACTUAL**: Total seed funding $260,670.80	Continue toward goal **Y3 Progress**: Emerging Areas Seed RFP deadline is 9/1/22	Continue toward goal	5-yr goal: $161,655 Total to date: $364,238.80
Number of CCBSE research participant meetings (to be scheduled monthly)	**Y1 Annual Report**: 5 **Y1 ACTUAL**: 10	**Y2 Annual Report**: 7 **Y2 ACTUAL**: 10	Continue toward goal **Y3 Progress**: 2 meetings	Continue toward goal	5-yr goal: 50-60 Total to date: 22

Ongoing Metric Tracking for ND EPSCoR NSF RII Track-1: New Discoveries in the Advanced Interface of Computation, Engineering and Science (ND-ACES)

8/31/2022

PROSPER Element: Education and Workforce Development	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Objective 4.1a: Retain/ advance CCBSE's early career faculty and graduate students (Activity 1: Early Career Faculty Mentoring Program) ***[Metric changes approved by NSF on 3/9/21 and 5/10/22]***	ECFs retained. ECF PD plans developed and implemented; Set baselines. Monthly Pillar meetings held between CCBSE research leads and faculty as a means of providing mentoring and guidance to ECF faculty. Information gathered from ECF about their mentorship and professional development needs and implemented; set baselines **Y1 Annual Report**: Developing a mitigation plan that will take baselines set by ECF faculty to identify mentor training materials and/or programs **Y1 ACTUAL**: Monthly pillar meetings held. Information gathered about ECF professional development needs and mentoring experiences. Baselines set for sense of belonging, work-self-efficacy, professional/ technical transferable skills, turnover intentions, and scholarly productivity	ECFs retained. 1 new faculty member to be hired at NDSU and 1 new faculty member to be hired at UND. Meet/ exceed baselines. Hold monthly Pillar meetings between CCBSE research leads and faculty as a means of providing mentoring and guidance to ECF faculty. PROSPER personnel (at least 2) will engage in training and/or independent study in mentorship best practices via the CIMER Project (https://cimerproje ct.org/) (Summer-Fall 2021). CIMER Project Trained PROSPER personnel will then train 25% of ND- ACES CCBSE Faculty in mentorship best practices **Y2 Annual Report**: New Faculty hired at UND. Two EWD Personnel trained and prepared to facilitate mentor training for CCBSE personnel. Four Mentor Training modules delivered in Fall 2021. Remaining modules will be delivered in Spring 2022. Due to scheduling issues as a result of increased workload issues related to COVID and other external factors, Mentor Training was not fully completed in Fall 2021 ultimately pushing back deadlines for mentor-mentee activities and survey follow-up **Y2 ACTUAL**: New Faculty hired at UND. Two EWD Personnel trained and prepared to facilitate mentor training for CCBSE personnel. Four Mentor Training modules delivered in Fall 2021 for 11 CCSBE seasoned faculty (25%) and the remaining 6 modules were delivered in June 2022 for 5 CCBSE seasoned faculty. Additional Mentor Training will occur in Year 3 of the project. In terms of baseline metrics, Overall, CCBSE early career faculty endorsed a slightly higher average sense of belonging in their respective work environments, with a .11 difference in standard deviations. Although there was a .14 decrease in their reported abilities, they continued to show extremely high levels of confidence in their abilities to successfully complete work tasks and responsibilities (i.e., work self-efficacy) and endorsed a high level of the necessary skills to perform their lab duties (i.e., professional/technical/ transferable skills). CCBSE early career faculty's desire to leave their respective department increased by .46, although the reported average score is still low, which indicates a preserved desire to grow within their program (i.e., turnover intentions).	5/10/22 new metric: ECFs and new hires retained. Meet/exceed baselines. Hold monthly Pillar meetings between CCBSE research leads and faculty as a means of providing mentoring and guidance to ECF faculty. **Y3 Progress**: NDSU new faculty member to start 9/26/2022.	5/10/22 new metric: ECFs and new hires retained. Meet/exceed baselines. Hold monthly Pillar meetings between CCBSE research leads and faculty as a means of providing mentoring and guidance to ECF faculty.	5/10/22 new metric: ECFs and new hires retained. Meet/exceed baselines. Hold monthly Pillar meetings between CCBSE research leads and faculty as a means of providing mentoring and guidance to ECF faculty.	Lead: **R. Navarro**, D. Condry ***[Approved by NSF 6/6/22]***

	PROSPER Element: Education and Workforce Development	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Color Key:	**Objective 4.1a**: (**Activity 2**: Early Career Faculty Professional Development Activities)	Develop list of ECF professional development activities available and disseminated to ECFs (alternatively develop and implement 2 PD activities); track engagement with PD activities with goal that at least 70% of ECF participate **Y1 Annual Report**: On track **Y1 ACTUAL**: List of ECF PD activities developed and information about these activities disseminated to ECF via email. Need to develop a more effective process of tracking participation in said activities.	Develop list of ECF professional development activities available and disseminated to ECFs (alternatively develop and implement 3 PD activities); track engagement with PD activities with goal that at least 70% of ECF participate **Y2 Annual Report**: We continue to develop list of professional development activities and disseminate information about said activities. Developing PD outreach presentations, infographics, etc. based on baseline survey where information about ECFs PD needs was gathered. Develop tracking mechanism for this activity **Y2 ACTUAL**: We continue working on this throughout the project.	Develop list of ECF professional development activities available and disseminated to ECFs (alternatively develop and implement 3 PD activities); track engagement with PD activities with goal that at least 70% of ECF participate **Y3 Progress**: update not available at this time	Develop list of ECF professional development activities available and disseminated to ECFs (alternatively develop and implement 3 PD activities); track engagement with PD activities with goal that at least 70% of ECF participate	Develop list of ECF professional development activities available and disseminated to ECFs (alternatively develop and implement 2 PD activities); track engagement with PD activities with goal that at least 70% of ECF participate	Lead: **R. Navarro**, D. Condry ***[Approved by NSF 6/6/22]***
Behind Schedule	**Objective 4.1a**: (**Activity 3**: Student Research Training Groups (RTG))	10 mentor/mentee pairs will be established; mentor/ mentee pairs will meet monthly; and mentee individual development plan created **Y1 Annual Report**: On track **Y1 ACTUAL**: 0 mentor/mentee pairs were established, student list was generated	10 mentor/ mentee pairs will be maintained or established; mentor/mentee pairs will meet monthly; mentee individual development plan created **Y2 Annual Report**: 14 mentor/ mentee groups were established for 2021-22. Mentor Memo-a monthly mentoring newsletter is sent out each month to encourage monthly conversations between mentors and mentees **Y2 ACTUAL**: 14 mentor/ mentee groups were established for 2021-22. Mentor Memo-a monthly mentoring newsletter were sent out each month to encourage monthly conversations between mentors and mentees.	10 mentor/ mentee pairs will be maintained or established; mentor/ mentee pairs will meet monthly; transition from mentee to mentor for graduate students progressing; mentee individual development plan created. **Y3 Progress**: Is in development for September.	10 mentor/ mentee pairs will be maintained or established; mentor/ mentee pairs will meet monthly; transition from mentee to mentor for graduate students progressing; mentee individual development plan created	10 mentor/ mentee pairs will be maintained or established; mentor/ mentee pairs will meet monthly; transition from mentee to mentor for graduate students progressing; mentee individual development plan created	Lead: **D. Condry**, ***[Approved by NSF 6/6/22]*** , R. Navarro
On Track / In-Progress	**Objective 4.1a**: (**Activity 3** - cont.)	50% of RTG students present work at one regional/national meeting **Y1 Annual Report**: On track **Y1 ACTUAL**: 39% of the 66 RTG students presented their work and 5 of those published (3 of them are a RTG student). ***Update July 2022*** : 37 of 66 RTG students, or 56%, presented in Y1. 8 students were listed as an author in a publication in Y1; 5 as first author	80% of students present work at one regional/national meeting; 75% of students publish (first author) paper prior to graduation **Y2 Annual Report**: so far, 8% of 100 RTG students presented their work and the ND EPSCoR conference is being held 4/6/22 where students are expected to present; 5 ACES students are listed first on a publication (3 of them are a RTG student). **Y2 ACTUAL**: 47 of 100 RTG students, or 47%, presented in Y2. 12 students were listed as an author in a publication in Y1; 8 as first author	80% of students present work at one regional/national meeting; 75% of students publish (first author) paper prior to graduation **Y3 Progress**: update not available at this time	80% of students present work at one regional/national meeting; 75% of students publish (first author) paper prior to graduation	80% of students present work at one regional/national meeting; 75% of students publish (first author) paper prior to graduation	

	PROSPER Element: Education and Workforce Development	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Ahead of Schedule / Complete	**Objective 4.1a**: (**Activity 3**: - cont)	Set baselines **Y1 Annual Report**: On track **Y1 ACTUAL**: Baselines were set for professional/ technical skills, self efficacy, persistence/ intention, and sense of belonging	Meet/exceed baselines **Y2 Annual Report**: Survey is being prepared and will be sent out in January 2022 **Y2 ACTUAL**: Follow-up survey was sent out to ND-ACES students. The baseline survey included 43 participants while the follow-up survey included 23 respondents. In comparison to the baseline survey, follow-up respondents reported slightly higher levels of confidence in their professional/technical skills, scale 1 work self-efficacy, sense of belonging, and persistence and intentions for undergraduate students. Graduate students reported lower persistence and intentions from baseline to follow-up when comparted to undergraduates.	Meet/exceed baselines **Y3 Progress**: update not available at this time	Meet/exceed baselines	Meet/exceed baselines	
N/A or Not yet started	**Objective 4.1a**: (**Activity 4a**: Graduate Student Cyber-infrastructure) ***[Metric changes approved by NSF 8/27/21]***	30% of the total participants are trained **Y1 Annual Report**: On track **Y1 ACTUAL**: 46/163 (28.2%)	80% response from CCBSE researchers and graduate students to the CI Needs Survey **Y2 Annual Report**: Survey has been developed and was approved by the PROSPER members. The survey was released on 2/17/22. Survey has been sent to all CCBSE researchers and graduate students. **Y2 ACTUAL**: Survey was completed by 31 ND-ACES participants across the three science pillars and across six institutions. Findings from the survey will inform CI related training and activities in Year 3 of the project and beyond.	2 (1 from CCAST and 1 from CRC) new or customized CI workshops developed; Both workshops offered once during Y3; 10% of CCBSE researchers and graduate students participate in the Y3 workshop or other CI training programs **Y3 Progress**: 1 new CI workshop developed by CCAST.	2 (1 from CCAST and 1 from CRC) new or customized CI workshops developed; Both workshops offered once during Y4; 10% of CCBSE researchers and graduate students participate in the Y4 workshop or other CI training programs	2 (1 from CCAST and 1 from CRC) new or customized CI workshops developed; Both workshops offered once during Y5; 10% of CCBSE researchers and graduate students participate in the Y5 workshop or other CI training programs	Lead: **A. Bergstrom**, **K. Hoang** ***[Approved by NSF 2/18/21]***, J. Wayt ***[Approved by NSF 5/10/22]***
	Objective 4.1a: (**Activity 4a**: Graduate Student Cyber-infrastructure)	2 CI assistantships awarded **Y1 Annual Report**: 2 awarded **Y1 ACTUAL**: 2 awarded (one awarded at NDSU [has since graduated] and one at UND [remains working on the project under the UND CRC])	2 CI GRAs hired **Y2 Annual Report**: 2 additional awarded (one awarded at NDSU and one at UND; trainings ongoing for Y2) **Y2 ACTUAL**: CI GRA's extended through June 30th, 2022. RFA for Y3 developed and advertised.	2 CI GRAs hired. **Y3 Progress**: 1 CI GRA hired for CCAST.	2 CI GRAs hired.	2 CI GRAs hired	
	Objective 4.1a (**Activity 4b**: STEM Teaching Assistantship) ***[Metric changes approved by NSF 2/9/22, 5/16/22 and 7/8/22]***	*THIS PROGRAM HAS BEEN MOVED TO Y2 DUE TO COVID-19*	Masters and/or Doctoral students receive and complete teaching assistantships at TCUs/PUIs/MCU **Y2 Annual Report**: TCU/PUI/MCU faculty to request additional summer salary **Y2 ACTUAL**: 3 doctoral student applicants approved for Y3 by state office. 2 applicants awarded teaching assistantship at MaSU, a third interviewing at NHSC.	Doctoral and/or Masters students receive and complete teaching assistantships at TCUs/PUIs/MCU **Y3 Progress**: For Fall 2022: 2 STEM TAs hired at MaSU, 1 hired at NHSC, and 1 hired at NDSU.	Continued	Continued	Lead: **J. Wayt** ***[Approved by NSF 5/10/22]*** A. Allard, M. Bobylev, M. Fries ***[Approved by NSF 8/27/21]***, N. Galt, K. Hartman, M. Hoffmann, K. Hossain, K. Katti, M. Kjelland ***[Approved by NSF on 7/8/2022]***, M. Parker, D. Condry, ***[Approved by NSF 6/6/22]***, H. van Gijssel, B. Voels

PROSPER Element: Education and Workforce Development	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Objective 4.1a: (**Activity 5**: % of participants in Activities 1-4b presenting at a workshop or conference)		95% of participants presenting **Y2 Annual Report**: 29.3% of participants presented since 7/1/2020 (44 of 150) **Y2 ACTUAL**: Through Y2, 39.6% presented at a workshop or conference. Cumulative for Y1/Y2, 45% of participants presented	95% of participants presenting **Y3 Progress**: update not available at this time	95% of participants presenting	95% of participants presenting	
Objective 4.1b: Engage/ develop K-16 student interest in biosciences (**Activity 1**: Distributed Research Experience for Undergraduates (dREU))	6 dREU students complete research, and present at the state conference and undergraduate research showcase. **Y1 Annual Report**: 6 students **Y1 ACTUAL**: 7 students, of which 5 presented at the ND EPSCoR state conference 2021	12 dREU students complete research and present at the state conference and undergraduate research showcase **Y2 Annual Report**: 1 new student, 3 still active from Y1. 1 of 4 scheduled to present at the ND EPSCoR state conference 2022; 2 other dREU students are co-researchers on other student presentations **Y2 ACTUAL**: 2 new dREU presentations and 1 dREU co-author at 2022 ND EPSCoR conference. 4 dREUs awarded for Summer 2022.	12 dREU students complete research, and present at the state conference and undergraduate research showcase **Y3 Progress**: 2 new dREU students and 1 still active from Y2.	12 dREU students complete research, and present at the state conference and undergraduate research showcase	6 dREU students complete research, and present at the state conference and undergraduate research showcase; 50% of REU students matriculate to graduate/ professional school; 8 REU students in graduate/ professional school	Leads: **J. Wayt** ***[Approved by NSF 5/10/22]*** D. Condry ***[Approved by NSF 6/6/22]***
Objective 4.1b: (**Activity 2**: Engage grade 6-12 students in NATURE/Sunday Academy)	Baseline was set at 350 students per year **Y1 Annual Report**: 117 TCU camp students **Y1 ACTUAL**: 117 TCU students; 3 Bridge Camp students; 298 Sunday Academy participants for 2020/2021	Meet/exceed baselines **Y2 Annual Report**: 91 Sunday Academy students 2021/2022 as of 1/31/22 * TCU and Bridge camps will be held June/July 2022 **Y2 ACTUAL****: There will be no Bridge Camp summer 2022. Additional 117 Sunday Academy students since 1/31/22 *****some Sunday Academy and TC camp attendee counts are still forthcoming for Y2***	Meet/exceed prior year's numbers **Y3 Progress**: Some Summer TC Camps are held June (the end of Y2) and some are held July/August (the beginning of Y3)	Meet/exceed prior year's numbers	Met/exceed prior year's numbers	Leads: **R. Navarro**, J. Wayt ***[Approved by NSF 5/10/22]*** , R. Burns ***[Approved by NSF 5/10/22]***
Objective 4.1b: (**Activity 3**: Training of Rural and tribal K-12 teachers in the use of PROSPER bioscience modules)	Module 1 developed **Y1 Annual Report**: On track **Y1 ACTUAL**: Developed 1 Module	Baselines number of teachers reached set via Module 1. Module 2 developed **Y2 Annual Report**: Two cellular modules were finalized in Fall 2021, training events for both modules are being planned for Spring 2022 **Y2 ACTUAL**: Modules developed, but no training events were conducted due to COVID restrictions and personnel changes.	Meet/exceed prior year's training numbers **Y3 Progress**: 4 rural teachers implementing bioscience lesson plans in Fall 2022 and completing a survey for impact tracking and evaluation of lesson plans.	Meet/exceed prior year's training numbers	100 total teachers trained over 5-year period	Leads: **R. Summers**, J. Wayt ***[Approved by NSF 5/10/22]***
Objective 4.1b: (**Activity 4**: Pre-service STEM teachers will engage in rural/tribal student teaching experiences)		2 pre-service teachers trained each semester (Fall/Spring); 2 pre-services teachers placed each semester **Y2 Annual Report**: 2 student teachers placed for Fall 2021, 1 student teacher placed in Spring 2022, and 1 student teacher recruited for Fall 2022 **Y2 ACTUAL**: 2 student teachers placed for Fall 2021, 1 student teacher placed in Spring 2022, and 1 student teacher recruited for Fall 2022.	2 pre-service teachers trained each semester; 2 pre-services teachers placed each semester **Y3 Progress**: 1 student teacher recruited for Fall 2022	2 pre-service teachers trained each semester; 2 pre-services teachers placed each semester	2 pre-service teachers trained each semester; 2 pre-services teachers placed each semester	Leads: **R. Summers**, J. Wayt ***[Approved by NSF on 5/10/22]***

Ongoing Metric Tracking for ND EPSCoR NSF RII Track-1: New Discoveries in the Advanced Interface of Computation, Engineering and Science (ND-ACES)

8/31/2022

	PROSPER Element: Broadening Participation	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Color Key:	**Objective 5.1**: Increase the participation of all groups engaged in bioscience education and careers (**Activity 1**: TCU bioscience students will conduct outreach in their local K-12 schools via bioscience lesson plans) ***[Metric changes approved by NSF 2/9/22]***	Create five ND-ACES related bioscience lesson plans **Y1 Annual Report**: 5 high school lesson plans developed from NATURE Sunday Academy STEM activities. **Y1 ACTUAL**: 5 high school lesson plans with 7 cultural supplements (3 Lakota and 4 Ojibwa) created from NATURE Sunday Academy informal STEM activities.	5 additional ND-ACES related STEM lesson plans **Y2 Annual Report**: 5 middle school lesson plans with no cultural supplements created from NATURE Sunday Academy informal STEM activities. The next set of NATURE Sunday Academy informal STEM activities will be selected in June 2022. **Y2 ACTUAL**: Additional lesson plans will be developed Summer 2022.	5 additional ND-ACES related STEM lesson plans **Y3 Progress**: update not available at this time	5 additional ND-ACES related STEM lesson plans	5 additional ND-ACES related STEM lesson plans	Leads: **R. Burns** ***[Approved by NSF 1/14/22]*** , **G. Lopez-Martinez** ***[Approved by NSF 7/8/22]***
Behind Schedule	**Objective 5.1**: (**Activity 1** - cont.) ***[Approved by NSF 2/9/22]***	2 TCU students deliver the bioscience lessons to 40 students **Y1 Annual Report**: TCU students could not go into K-12 facilities due to the COVID pandemic. **Y1 ACTUAL**: No change	6-12 grade STEM teachers identified for Y3 and TCU student involvement planned **Y2 Annual Report**: Efforts are underway to identify 6-12 grade STEM teachers for Y3 activities. **Y2 ACTUAL**: Working with NATURE Coordinators to identify STEM teachers for Fall.	Fall 2022 and Spring 2023 TCU students identified and introduced to 6-12 grade STEM teachers **Y3 Progress**: update not available at this time	Fall 2023 and Spring 2024 TCU students identified and introduced to 6-12 grade STEM teachers	Fall 2024 and Spring 2025 TCU students identified and introduced to 6-12 STEM teachers	
On Track / In-Progress	**Objective 5.1**: (**Activity 1** - cont.)	3 NATURE students matriculating into STEM degrees (either AS or above). **Y1 Annual Report**: 16 matriculated **Y1 ACTUAL**: No change	4 NATURE students completing STEM degrees **Y2 Annual Report**: 8 matriculated and 3 with graduate degrees. **Y2 ACTUAL**: New tracking in Fall 2022.	4 NATURE students completing STEM degrees **Y3 Progress**: update not available at this time	4 NATURE students completing STEM degrees	>10 NATURE students with STEM B.S and >5 NATURE students with STEM graduate/ professional degrees over 5 years	
Ahead of Schedule / Complete	**Objective 5.1**: (**Activity 2**: Support engagement in biosciences at the B.S. level (particularly for AI)) **[***Approved by NSF 2/9/22]***	Plan research assistantships for juniors and seniors. **Year 1 Annual Report**: 2 students received assistantships. **Y1 ACTUAL**: No change	2-3 students will have received research assistantships as juniors and seniors or post-associate assistantships **Y2 Annual Report**: Current RFA has been extended to post-associate assistantships. **Y2 ACTUAL**: 1 student identified fo post-back at MiSU.	2-3 additional students will have received research assistantships as juniors and seniors and 1 student will have completed their B.S. degree or post-associate assistantships **Y3 Progress**: update not available at this time	2-3 additional students will have received research assistantships as juniors and seniors and 1 student will have completed their B.S. degree or post-associate assistantships	7-10 students will have received research assistantships as juniors and seniors or post-associate assistantships and 3 of those will have completed their B.S. degree over 5 years	Leads: **G. Lopez-Martinez** ***[Approved by NSF 7/8/22]*** , **Ray Burns** ***[Approved by NSF 1/14/22]*** , **TCU ND-ACES researchers and academic officers** ***[Approved by NSF 2/9/22]***
N/A or Not yet started	**Objective 5.1**: (**Activity 3**: TCU bioscience faculty will be offered research techniques and equipment training) ***[Approved by NSF 2/9/22]***	One TCU faculty will visit CCBSE collaborators and learn a research technique/learn a HPC technique/expand knowledge in a Pillar area **Year 1 Annual Report**: 1 visit by a CCCC faulty member to NDSU. **Y1 ACTUAL**: No change, as the COVID pandemic continues to interfere with travel.	Survey for TCU STEM faculty re: training preferences developed and distributed. Preferences prioritized. Collaborating institutions' faculty requested to provide training in those areas identified through the survey. One training video on identified areas will be produced and released to TCU faculty. **Y2 Annual Report**: Survey instrument is being developed for distribution. TCU faculty made aware that requests may be forthcoming. **Y2 ACTUAL**: Survey will be complete 6/15/22.	Survey of TCU STEM faculty updated Preferences prioritized - continued Provide training - continued Training video - continued **Y3 Progress**: update not available at this time	Survey updated - continued Preferences prioritized - continued Provide training - continued Training video - continue, with two training videos produced and released	Five collaborative projects using the new skills over 5 years Survey updated - continued Preferences prioritized - continued Provide training - continued Training video - continued, with two training videos produced and released	Leads: **R. Burns** ***[Approved by NSF 1/14/22],*** **G. Lopez-Martinez** ***[Approved by NSF 7/8/22]***

PROSPER Element: Broadening Participation	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Objective 5.1: (**Activity 4**: TCU camps for middle and high school kids at the four partnering TCUs)	120 participants **Year 1 Annual Report**: 0 participants; prior RII Track-1 INSPIRE-ND overlapped with this Track-1 and 117 participants were counted in June/July 2020. **Y1 ACTUAL**: 126 participants June/July 2021.	140 participants **Y2 Annual Report**: TCU camps will be held June/July 2022; planning is underway for the TCU camps. **Y2 ACTUAL****: Planning occurred June 6-17, 2022. Camps are being held *****some TC camp attendee counts are still forthcoming for Y2.*	140 participants **Y3 Progress**: Some Summer TC Camps are held June (the end of Y2) and some are held July/August (the beginning of Y3)	140 participants	680 participants over 5 years	Leads: **Ray Burns** ***[Approved by NSF 1/14/22]*** , **G. Lopez-Martinez** ***[Approved by NSF 7/8/22]*** , **NATURE coordinators**
Objective 5.1: (**Activity 5**: Sunday Academies for middle and high school kids at the four partnering TCUs)	350 participants **Y1 Annual Report**: 0 participants (due to COVID pandemic, prior RII Track-1 was overlapped and 429 students were counted under INSPIRE-ND). **Y1 ACTUAL**: 298 Virtual Sunday Academy participants for 2020/2021.	350 participants **Y2 Annual Report**: 91 Sunday Academy students 2021/2022 as of 1/31/22 (Note: 9 Sunday Academy events postponed due to weather or COVID parameters). **Y2 ACTUAL****: Additional 117 Sunday Academy students since 1/31/22 *****some Sunday Academy and TC camp attendee counts are still forthcoming for Y2*	350 participants **Y3 Progress**: Initial planning occurred during faculty portion of the NATURE University Summer Camp June 2022	350 participants	1,750 participants over 5 years	Leads: **R. Burns**,***[Approved by NSF 1/14/22],*** **G. Lopez-Martinez** ***[Approved by NSF 7/8/22]*** , **NATURE coordinators**
Objective 5.1: (**Activity 6**: Bridge camps for graduating high school seniors at the four partnering TCUs)	10 participants **Y1 Annual Report**: Camp runs July 2020. **Y1 ACTUAL**: 0 participants in 2020. 3 participants in July 2021 due to the COVID pandemic; only 2 of 4 TCUs participated.	15 participants **Y2 Annual Report**: Camp will be held June/June 2022 – planning is underway. **Y2 ACTUAL**: Planning occurred June 6-17, 2022. ***Update July 2022: there was no Bridge camp Summer 2022.***	15 participants **Y3 Progress**: Planning to start later in Y3	15 participants	55 participants over 5 years	Leads: **R. Burns**,***[Approved by NSF 1/14/22],*** **G. Lopez-Martinez** ***[Approved by NSF 7/8/22]*** , **NATURE coordinators**
Objective 5.1: (**Activity 7**: University Summer Camp for participants)	20 participants **Y1 Annual Report**: Camp runs June 2021. **Y1 ACTUAL**: 14 participants in June 2021 virtual camp.	20 partipants **Y2 Annual Report**: Camp runs June 2022. **Y2 ACTUAL**: Face-to-face camp runs June 6-17 (student portion was cancelled due to renewed concerns around COVID-19 in tribal communities).	20 participants **Y3 Progress**: Planning to start later in Y3	20 participants	A total of 100 participants over 5 years	Leads: **R. Burns**,***[Approved by NSF 1/14/22],*** **G. Lopez-Martinez** ***[Approved by NSF 7/8/22]*** , **NATURE coordinators**

Ongoing Metric Tracking for ND EPSCoR NSF RII Track-1: New Discoveries in the Advanced Interface of Computation, Engineering and Science (ND-ACES)

8/31/2022

	PROSPER Element: Partnerships and Collaborations	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
	Objective 6.1a: Expand the intellectual reach of the CCBSE by building stronger collaborations with other academic institutions and federal labs (**Activity 1**: Determine and build upon the baseline)	Baseline established by senior personnel **Y1 Annual Report**: 29 collaborations with 24 academic institutions identified. 23 domestic and 1 international. **Y1 ACTUAL**: No change	20% increase in meaningful collaborations over prior year **Y2 Annual Report**: 45 collaborations with 50 academic institutions identified. 49 domestic and 1 international. **Y2 ACTUAL**: As part of the Y2 RSV response, the team has requested an expansion of the proposal definition of a collaboration	20% increase in meaningful collaborations over prior year **Y3 Progress:** Using the new definition, collaborations will be tracked in ERcore. On 8/11/22, the Management Team reviewed the .tracking mechanisms approved by NSF in the mitigation plan. Those mechanismns will be put into place during the first quarter of Y3.	20% increase in meaningful collaborations over prior year	20% increase in meaningful collaborations over prior year	Lead: **K. Rusch**, Co-leads: J. Mihelich, J. Ostrom-Blonigen
Color Key:	**Objective 6.1a**: (**Activity 2**: Support participant interactions with external collaborators with travel funding) ***[Approved by NSF 2/9/22]***			1-3 trips to external collaborators and 1-3 external collaborators coming to campuses **Y3 Progress**: 2 CCBSE applications have been received and both researhcers have traveled to meet with their prospective collaborator.	Continued with 2- 6 total visits	Continued with 2- 6 total visits	Lead: **K. Rusch**, Co-leads: J. Mihelich, J. Ostrom-Blonigen
Behind Schedule	**Objective 6.1a**: (**Activity 3**: Support interactions with external collaborators)			Fund at least one seed award between CCBSE and an external collaborator **Y3 Progress**: This RFP will be released in Fall 2022/Spring 2023.	Continue to fund one seed award per year	Continued	Lead: **K. Rusch**, Co-leads: J. Mihelich, J. Ostrom-Blonigen
On Track / In-Progress	**Objective 6.1b**: Create pathways for translating research results into commercially viable end products (**Activity 1**: Determine and build upon the baseline for partnerhips)	Baseline established using CDAs, MTAs, other efforts (grant applications, etc.) **Y1 Annual Report**: 5 instate partnerships with 2 organizations. **Y1 ACTUAL**: No change	20% increase in meaningful collaborations over prior year **Y2 Annual Report**: 45 collaborations with 50 academic institutions identified. 49 domestic and 1 international. **Y2 ACTUAL**: As part of the Y2 RSV response, the team has requested an expansion of the proposal definition of a partnership	Increase in partnership engagement or partner activities over the prior year - measured by the increased provision of valuable resources **Y3 Progress**: This will be measured using the new definitions approved by NSF in the mitigation plan.	Increase in partnership engagement or partner activities over the prior year - measured by the increased provision of valuable resources	Increase in partnership engagement or partner activities over the prior year - measured by the increased provision of valuable resources	Lead: **K. Rusch**, Co-leads: J. Mihelich, J. Ostrom-Blonigen, identified subject matter experts at NDSU and UND
Ahead of Schedule / Complete	**Objective 6.1b**: (**Activity 2**: Support Partnerships)	**Y1 Annual Report**: Identification of Y2 support efforts based on baseline data and determination of measures [# participants (if event), # of inquiries following communication effort, etc.]. **Y1 ACTUAL**: Provision for 3 informational workshops in Y2	Increased engagement by meeting of prior year's identified support efforts **Y2 Annual Report**: 3 workshops and 1 conference panel addressing prior year's support needs (initiating interactions with industry) were held and made the decision of use I-Corps for next year's workshops **Y2 ACTUAL**: Planning is underway for the first I-Corps training session to be held during the September 2022 All-Participants meeting	Increased engagement by meeting of prior year's identified support efforts **Y3 Progress**: UND trainers will present a 1 hour initial I-Corps workshop during the 9/14/22 All-Participants meeting.	Increased engagement by meeting of prior year's identified support efforts	Increased engagement by meeting of prior year's identified support efforts	Lead: **K. Rusch**, Co-leads: J. Mihelich, J. Ostrom-Blonigen, identified subject matter experts at NDSU and UND
N/A or Not yet started	**Objective 6.1b**: (**Activity 3**: Identify ND companies using tools like NAICS) ***[Metric changes approved by NSF 2/9/22 and 5/10/22]***		Following the April 2022 EAB meeting, together with CCBSE and Pillar leads, begin to develop a CCBSE prospectus for cultivating partnerships and exploring potential funding possibilities **Y2 Annual Report**: The team will work with UND Center for Innovation to provide I-Corp Hub training (tools/ resources/activities) to participants. **Y2 ACTUAL**: Team needs will be discussed during the September 2022 All-Participants meeting	Finalize a CCBSE prospectus **Y3 Progress**: Following the 9/14/22 All-Participants meeting, the PI and co-PIs will meet with the CCBSE leads and the I-Corps lead at UND to determine additional Y3 trainings that will help researchers identify ND companies.	Update CCBSE prospectus	Continued	Lead: **K. Rusch**, Co-leads: J. Mihelich, J. Ostrom-Blonigen, identified subject matter experts at NDSU and UND

PROSPER Element: Partnerships and Collaborations	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Objective 6.1b: (**Activity 4**: Identify partnership opportunities)		Begin to identify 3-5 opportunities, and determine 1-3 of which are actionable by CCBSE leads **Y2 Annual Report**: The team has limited experience with industry engagement; thus will be well served in Y3 with the NSF I-Corps training platforms. **Y2 ACTUAL**: Following the September 2022 All-Participants meeting, the PI/PD, co-PIs, and CCBSE leads will meet to determine Y3 priorities.	Identify 3-5 opportunities, 1-3 of which are actionable **Y3 Progress**: Following the 9/14/22 All-Participants meeting, the PI and co-PIs will meet with the CCBSE leads and the NDSU and UND industry development offices to identify partnership opportunities for Y3 (including STTAR internships).	Identify 3-5 opportunities, 1-3 of which are actionable	Identify 3-5 opportunities, 1-3 of which are actionable	Lead: **K. Rusch**, Co-leads: J. Mihelich, J. Ostrom-Blonigen, identified subject matter experts at NDSU and UND
Objective 6.1b: (**Activity 5**: Identify IP protocols at all 10 institutions)	Work with campuses to identify IP protocols with >50% protocols identified **Y1 Annual Report**: Protocols identified at 2 RUs, 1 MCU, and 3 PUIs – all ND University System campuses: 6 of 10 = 60%. **Y1 ACTUAL**: No change	100% protocols identified; Collaborative decision made regarding the handling joint IP and updated protocol document **Y2 Annual Report**: 4 of 4 TCUs surveyed. There are currently no IP protocols in place at the TCUs for invention IP. 2 TCUs (SBC and TMCC) are now working to develop these protocols. **Y2 ACTUAL**: Agendas, prepared for the annual campus visits, will include a discussion about these protocols and whether the campuses would like assistance.	Up to date protocol document and joint IP agreement **Y3 Progress**: Campus visits are currently being scheduled for Fall 2022. Currently scheduled are visits to 2 of 3 PUIs and 3 of 4 TCs.	Up to date protocol document and joint IP agreement	Up to date protocol document and joint IP agreement	Lead: **K. Rusch**, Co-leads: J. Mihelich, J. Ostrom-Blonigen, identified subject matter experts at NDSU and UND
Objective 6.1b: (**Activity 6**: Understand how tribal laws impact IP disclosures)	Work with TCU campuses located in ND to identify impacts with 50% identified **Y1 Annual Report**: 0 identified. The COVID pandemic prevented travel and TCU personnel were busy with the change to online delivery. **Y1 ACTUAL**: No change	Work with campuses to identify commercialization protocols with 100% protocol identified **Y2 Annual Report**: 4 of 4 TCUs identified (100%). There are currently no IP protocols in place at the TCUs for invention IP. 2 TCUs (SBC and TMCC) are now working to develop these protocols, which include tribal law. **Y2 ACTUAL**: See Activity 6.1b #5	Survey developed and released **Y3 Progress**: During the Fall 2022 meeting with the TCU presidents, the feasibility of this survey will be discussed. If determined feasible, a survey will be developed.	Survey results compiled	Results published	Lead: **K. Rusch**, Co-leads: J. Mihelich, J. Ostrom-Blonigen, identified subject matter experts at NDSU and UND
Objective 6.1b: (**Activity 7**: Identify commercialization protocols at all 10 participating institutions) ***[Change approved by NSF 2/9/22 and 5/10/22]***	Work with campuses to identify commercialization protocols with >50% protocols identified **Y1 Annual Report**: Commercialization protocols identified at 2 RUs, 1 MCU, and 3 PUIs, which equates to 6 of 10 participating institutions (60%). **Y1 ACTUAL**: No Change	100% protocols identified; Collaborative decision made regarding the handling joint IP and updated protocol document **Y2 Annual Report**: 4 of 4 TCUs surveyed. There are currently no IP protocols in place at the TCUs for invention IP. 2 TCUs (SBC and TMCC) are now working to develop these protocols. **Y2 ACTUAL**: Agendas, prepared for the annual campus visits, will include a discussion about these protocols and whether the campuses would like assistance.	Updated protocol document, and 1 invention disclosure **Y3 Progress**: Campus visits are currently being scheduled for Fall 2022.	Updated protocol document, 3+ invention disclosures, and 2+ provisional patents	Updated protocol document, 3+ invention disclosures, 2+ provisional patents, and 2+ patents	Lead: **K. Rusch**, Co-leads: J. Mihelich, J. Ostrom-Blonigen, CCBSE leads, Pillar leads, and I-Corps coordinator/trainer; and other identified subject matter experts at NDSU and UND all 9 CCBSE institutions

PROSPER Element: Partnerships and Collaborations	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
	Enroll participants in SHARPhub with 25% of CCBSE participants enrolled **Y1 Annual Report**: Five of 27 CCBSE researchers enrolled in SHARPhub = 19%. **Y1 ACTUAL**: No change	Continue to encourage CCBSE participants to enroll or take part in I-Corps activities, work with campuses to identify commercialization protocols and enroll participants in I-Corps **Y2 Annual Report**: Five of 28 CCBSE researchers enrolled in SHARPhub = 18%. Met with SHARPhub coordinator and learned that an I-Corps Hub will replace SHARPhub. As a result, the team has begun to examine the I-Corps training modules and will work with the CCBSE and Pillar Leads following the April EAB meeting to initiate next steps. **Y2 ACTUAL**: Mitigation plan was approved to change from SHARPhub to I-Corps. To ensure highest attendance, this kick-off will occur during the September 2022 All-Participants meeting.	Updated campus commercialization protocols, as necessary, continue to encourage CCBSE participants to enroll participants in I-Corps activities, and assistance with IP disclosures **Y3 Progress**: Following the 9/14/22 All-Participants meeting, the PI and co-PIs will meet with the CCBSE leads and the I-Corps trainer at UND to determine additional trainings for Y3 and to determine how CCBSE can be encouraged to enroll.	Continued	Continued	
Objective 6.1b: (**Activity 8**: Identify workshops / conferences to attend and mentoring opportunities (SHARPhub, I-Corps, USPTO Denver, SBIR, etc. ***[Approved by NSF 5/10/22]***	Identify initial workshops related to typical processes for participants to discuss IP. Hold 1+ workshop or conference attended by >40% CCBSE participants **Y1 Annual Report**: Delayed due to COVID pandemic **Y1 ACTUAL**: 3 planned workshops	Continue to identify workshops related to typical processes for participants to discuss IP. Hold 1+ workshop or conference attended by >60% CCBSE participants **Y2 Annual Report**: Held 3 workshops and one conference panel session. Another panel session will be held at the April 2022 conference. **Y2 ACTUAL**: A brainstorming session at the September 2022 All-Participants meeting will identify which workshops are needed.	1+ workshop or conference attended by >75% CCBSE participants **Y3 Progress**: During the 9/14/22 All-Participants meeting, an initial I-Corps workshop will be held .	1+ workshop or conference attended by 75%+ CCBSE participants and 1 CCBSE workshop or conference attended by 80% CCBSE participants	1+ workshop or conference attended by 85%+ CCBSE participants and 1 CCBSE workshop or conference attended by 80% CCBSE participants	Possible partners (ND entities): Bismarck-Mandan Development Assoc., Campus Career Centers, Innovate ND, Jamestown/ Stutsman Development Corp., Minot Economic Development Corp., NDSU EDA Makerspace (Brian Kalk), NDSU Ozbun Entrepreneurship Center (Kodee Furst), NHSC Applied Engineering Center (Ann Vallie), UND Center for Innovation
Objective 6.1b: (**Activity 9**: Based on other activities, determine potential funding possibilities with other SHARPhub EPSCoR states [KS, NE, OK, SD]) ***[Approved by NSF 2/9/22 and 5/10/22]***		After Spring 2022 meeting with the SHARPhub coordinator and April 2022 EAB meeting, together with CCBSE and Pillar leads and the ND I-Corps coordinator/trainer explore potential conversations with other EPSCoR states participating in SHARPhub **Y2 Annual Report**: Met with SHARPhub/now I-Corps Hub facilitator to explore changes ahead of meeting with CCBSE and Pillar leads. **Y2 ACTUAL**: An approved mitigation plan changed from SHARPhub to I-Corps. PI/PD, PA, and EOD+C members will survey other EPSCoR states to determine potential bioscience partners.	Begin conversations with other EPSCoR states with bioscience research agendas, including those that previously participated in SHARPhub **Y3 Progress**: Scheduled for Spring 2023. This process will also be coupled with travel RFPs that are issued for travel to other EPSCoR states.	Based on conversations with other EPSCoR states, determine and engage in action Items.	Engage in action items and determine sustainable potential of action items	Lead: **K. Rusch** Co-leads: J. Mihelich, J. Ostrom-Blonigen; CCBSE leads, Pillar leads, and I-Corps coordinator/ trainer; and other identified subject matter experts at NDSU and UND all 9 CCBSE institutions. Possible partners: EPSCoR offices

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	PROSPER Element: Communication and Dissemination	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
	Objective 7.1a: Provide clear communication between all participants (**Activity 1**: Facilitate communication through regular meetings)	Meeting attendance **Y1 Annual Report**: Monthly Pillar, CCBSE and Management/ Leadership meetings. Bimonthly PROSPER meetings **Y1 ACTUAL**: No change	Meeting attendance **Y2 Annual Report**: Monthly Pillar, CCBSE and Management meetings; bi-monthly PROSPER meetings **Y2 ACTUAL**: attendance complete	Meeting attendance **Y3 Progress**: Required meetings are being scheduled, or have already been scheduled, for the year.	Meeting attendance	Meeting attendance	Leads: **J. Walden** ***[Approved by NSF on 5/16/22]***, **C. Shovkoplyas**
Color Key:	**Objective 7.1a**: (**Activity 2**: Facilitate communication across the by providing updates)	At least monthly outreach to participants, stakeholders, and citizens **Y1 Annual Report**: 7 newsletters (July 2020-January 2021) **Y1 ACTUAL**: 12 newsletters	At least monthly outreach to participants, stakeholders, and citizens **Y2 Annual Report**: 7 newsletters (July 2021-January 2022) **Y2 ACTUAL**: 12 newsletters	At least monthly outreach to participants, stakeholders, and citizens **Y3 Progress**: 2 newsletters	At least monthly outreach to participants, stakeholders, and citizens	At least monthly outreach to participants, stakeholders, and citizens	Leads: **J. Walden** ***[Approved by NSF on 5/16/22]***, **C. Shovkoplyas**
Behind Schedule	**Objective 7.1a**: (**Activity 3**: Facilitate communication by providing internal communication training)	Training offered at least quarterly **Y1 Annual Report**: On track **Y1 ACTUAL**: 6 training sessions	Training offered at least quarterly **Y2 Annual Report**: 4 training sessions **Y2 ACTUAL**: 4 training sessions	Training offered at least quarterly **Y3 Progress**: update not available at this time	Training offered at least quarterly	Training offered at least quarterly	Leads: **J. Walden** ***[Approved by NSF on 5/16/22]***, **C. Shovkoplyas**
On Track / In-Progress	**Objective 7.1b:** Inform and educate stakeholders (**Activity 1**: Populate website and social media with relevant public-facing content)	Same metric framework for all: Baseline established of interaction (engagement rate) **Y1 Annual Report**: On track **Y1 ACTUAL**: baseline established	≥5% Increase in number of interactions per day divided by followers **Y2 Annual Report**: N/A until end of Y2 **Y2 ACTUAL**: ≥5% Increase	≥5% Increase in number of interactions per day divided by followers. **Y3 Progress**: Ongoing	Maintain engagement over the prior year. Maintain number of interactions per day divided by followers	Maintain engagement over the prior year. Maintain number of interactions per day divided by followers.	Leads: **J. Walden** ***[Approved by NSF on 5/16/22]***, **C. Shovkoplyas**
Ahead of Schedule / Complete	**Objective 7.1b**: (**Activity 2**: Assist team members from CCBSE and PROSPER with creating public-facing communication products)	*Needs research products; sessions begin in Y2*	5 sessions per year completed **Y2 Annual Report**: weekly drop-in training opportunities offered during Fall '21/Spring '22 **Y2 ACTUAL**: training offerings completed	5 sessions per year completed **Y3 Progress**: update not available at this time	5 sessions per year completed	5 sessions per year completed	Leads: **J. Walden** ***[Approved by NSF on 5/16/22]***, **C. Shovkoplyas**
N/A or Not yet started	**Objective 7.1b**: (**Activity 3**: Disseminate project milestones and talking points to stakeholders and decision makers in the state)	2+ press releases **Y1 Annual Report**: On track **Y1 ACTUAL**: 3 press releases	4+ press releases; Updating stakeholders on project milestones (quarterly) **Y2 Annual Report**: 4 press releases **Y2 ACTUAL**: 4 press releases	4+ press releases; Updating stakeholders on project milestones (quarterly) **Y3 Progress**: update not available at this time	4+ press releases; Updating stakeholders on project milestones (quarterly)	20 press releases over the 5-year period. Updating stakeholders on project milestones (quarterly)	Leads: **J. Walden** ***[Approved by NSF on 5/16/22]***, **C. Shovkoplyas**
	Objective 7.1c: Contribute to a scientifically informed citizenry (**Activity 1**: Offer workshop opportunities for faculty and graduate students)	*2 workshops planned annually. Workshops begin Y2*	40+% attendance by ND-ACES participants **Y2 Annual Report**: poster design workshop planned mid-Spring '22; Alda Center workshop already completed; data for attendance % n/a until workshops are completed. **Y2 ACTUAL**: Workshops completed attendance - 42 at poster sessions. 19 at Alda sessions and 2 at EOD + C offerings.	55+% attendance by ND-ACES participants **Y3 Progress**: update not available at this time	75+% attendance by ND-ACES participants	90% of ND-ACES participants will have attended at least 1 workshop over the 5-year period	Leads: **J. Walden** ***[Approved by NSF on 5/16/22]***, **C. Shovkoplyas**

PROSPER Element: Communication and Dissemination	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025	Responsible parties
Objective 7.1c: (**Activity 2**: Include public engagement opportunities as part of the annual conference)	Annual conference with attendees from each of the participating campuses. **Y1 Annual Report**: Conference is April 2021. **Y1 ACTUAL**: 1 annual conference, 10 of 10 participating institutions.	2022 Annual conference with attendees from each of the participating campuses **Y2 Annual Report**: Conference is April 2022. **Y2 ACTUAL**: 1 annual conference, all institutions with participants.	2023 Annual conference with attendees from each of the participating campuses. **Y3 Progress**: The Y3 annual conference is scheduled for 3/29/2023 in Fargo.	2024 Annual conference with attendees from each of the participating campuses	2025 Annual conference with attendees from each of the participating campuses.	Leads: **J. Walden *[Approved by NSF on 5/16/22]***, **C. Shovkoplyas**
Objective 7.1c: (**Activity 3**: Ensure that we have a diverse representation of science and scientists on website, to help engage all publics)		Scoring by external evaluation firm's diversity rubric **Y2 Annual Report**: discussed with The Mark in Y1/planned for Y2. **Y2 ACTUAL**: Analyzing The Mark's report.		Scoring by external evaluation firm's diversity rubric		Leads: **J. Walden *[Approved by NSF on 5/16/22]***, **C. Shovkoplyas**
Objective 7.1c: (**Activity 4**: Engage with local publics about the value and the benefits of the science)	Science cafés planned annually. Science cafés begin Y2 **Y1 Annual Report**: On track **Y1 ACTUAL**: Although planned for Y2, 1 science café was held.	1-2 Science cafes supported **Y2 Annual Report**: planned, 1-2 in Fall '21 pending faculty availability 1 café held 10/26/2021, one cafe held March 2022. **Y2 ACTUAL**: 2 science cafes	2 Science cafés supported **Y3 Progress**: Science café's are being planned.	2-3 Science cafés supported	2-3 Science cafés supported	Leads: **J. Walden *[Approved by NSF on 5/16/22]***, **C. Shovkoplyas**

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	PROSPER Overall Milestone Metrics	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025
Color Key:	Meet annually with TCU presidents to report on the impacts of the collaboration efforts between CCBSE, PROSPER, and the TCUs. Report also on the numbers of American Indian students who are involved in ND-ACES programming	4 meetings/ year, one with each TCU president **Y1 Annual Report**: Not reported **Y1 ACTUAL**: Due to the COVID pandemic, these meetings were changed to a virtual format. Met with 4 TCU presidents during Summer/Fall 2020.	4 meetings, one with each TCU president **Y2 Annual Report**: Due to the COVID pandemic, one of these meetings was changed to a virtual format. Met with 4 of 4 TCU presidents during Summer/Fall 2021 **Y2 ACTUAL**: 4 meetings in Y2: 4 of 4 TCU presidents Summer/Fall 2021. Y3 planning is underway.	Projected: 4 meetings, one with each TCU president **Y3 Progress**: Scheduling for the Fall 2022 campus visits is underway. Currently scheduled are visits 3 of 4 TCs.	Projected: 4 meetings, one with each TCU president	Projected: 4 meetings, one with each TCU president 5-YEAR TOTAL: 20 total meetings across the 5-year project Total to date: 8 meetings
Behind Schedule	Meet annually with MCU and PUI presidents to report on the impacts of the collaboration efforts between CCBSE, PROSPER and those campuses. Report also on the numbers of their students who are taking advantage of the programming	4 meeting/year, one with each MCU and PUI president **Y1 Annual Report**: Not reported **Y1 ACTUAL**: Due to the COVID pandemic, these meetings were changed to a virtual format. Met with PUI president during Summer/Fall 2020.	4 meetings - one with each MCU and PUI president **Y2 Annual Report**: Met in-person with 2 PUI presidents in July 2021 **Y2 ACTUAL**: In-person visits with 2 PUI presidents in Y2. Y3 planning is underway	Projected: 4 meetings - one with each MCU and PUI president **Y3 Progress**: Scheduling for the Fall 2022 campus visits is underway. Currently scheduled are visits to 2 of 3 PUIs.	Projected: 4 meetings - one with each MCU and PUI president	Projected: 4 meetings - one with each MCU and PUI president 5-YEAR TOTAL: 20 total meetings across the 5-year project. Total to date: 3 meetings
On Track / In-Progress	Number of TCU visits (some of these visits will be virtual due to COVID-19)	4 visits - one visit at each TCU **Y1 Annual Report**: Not reported **Y1 ACTUAL**: Due to the COVID pandemic, these meetings were changed to a virtual format. Met with 4 of 4 TCUs Y1 during Summer/Fall 2020.	4 visits - one visit at each TCU **Y2 Annual Report**: Due to the COVID pandemic, one of these meetings was changed to a virtual format. Met with 4 TCUs Summer/ Fall 2021. **Y2 ACTUAL**: 9 visits in Y2 (one virtual): Fall 2021 - 5 of 5 TCUs; Spring 2022 - 4 TCUs.	Projected: 4 - one visit at each TCU **Y3 Progress**: Scheduling for the Fall 2022 campus visits is underway. Currently scheduled are visits to 3 of 4 TCs.	Projected: 4 - one visit at each TCU	Projected: 4 - one visit at each TCU 5-YEAR TOTAL: 20 total meetings across the 5-year project Total to date: 13 meetings
Ahead of Schedule / Complete	Number of MCU and PUI visits (some of these visits will be virtual due to COVID-19)	4 visits, one visit at each MCU and PUI **Y1 Annual Report**: Not reported **Y1 ACTUAL**: Due to COVID pandemic, met virtually with 1 MCU and 3 PUIs.	4 visits, one visit at each PUI and MCU **Y2 Annual Report**: Visits to 1 MCU and 3 PUIs Summer 2021. **Y2 ACTUAL**: 8 visits in Y2: Summer 2021 - 1 MCU, 3 of 3 PUIs, plus 1 PUI had another visit; May 2022 - 3 of 3 PUI visits. Y3 planning is underway.	Projected:4 one visit at each PUI and MCU **Y3 Progress**: Scheduling for the Fall 2022 campus visits is underway. Currently scheduled are visits to 2 of 3 PUIs.	Projected:4 one visit at each PUI and MCU	Projected:4 one visit at each PUI and MCU 5-YEAR TOTAL: 20 total meetings across the 5-year project Total to date: 13 meetings
N/A or Not yet started	Number of legislator visits	2 visits **Y1 Annual Report**: not reported **Y1 ACTUAL**: 9 visits in Y1: 6 with ND legislators and 3 with congressional delegation	2 visits **Y2 Annual Report**: 17 visits (14 with ND legislators and 3 with congressional delegation) **Y2 ACTUAL**: 17 visits in Y2: 14 visits with ND legislators and 3 with congressional delegation	Projected: 2 visits **Y3 Progress**: One meeting with 3 ND legislators is scheduled for 8/10/22.	Projected: 2 visits	Projected: 2 visits 5-YEAR TOTAL: 10 total visits across 5-year project Total to date: 26 visits

PROSPER Overall Milestone Metrics	Year 1 July 1, 2020-June 30, 2021	Year 2 July 1, 2021-June 30, 2022	Year 3 July 1, 2022-June 30, 2023	Year 4 July 1, 2023-June 30, 2024	Year 5 July 1, 2024-June 30, 2025
Number of annual conferences (some of these conferences will be virtual due to COVID-19)	1 annual conference **Y1 Annual Report**: Not reported **Y1 ACTUAL**: 1 conference - April 14, 2021	1 annual conference **Y2 Annual Report**: Conference to be held in April 2022 **Y2 ACTUAL**: Annual conference held 4/6/22 (hybrid)	Projected: 1 annual conference **Y3 Progress**: The Y3 conference is scheduled for 3/29/2023 in Fargo.	Projected: 1 annual conference	Projected: 1 annual conference 5-YEAR TOTAL: 5 total conferences across 5-year project Total to date: 2 conferences
Number of External Advisory Board meetings (some of these meetings will be virtual due to COVID-19)	2 EAB meetings **Y1 Annual Report**: Not reported **Y1 ACTUAL**: 2 EAB meetings: November 6, 2020 (virtual) and April 13, 2021 (virtual)	2 EAB meetings **Y2 Annual Report**: 1 EAB meeting: October 22, 2021 (virtual); April 5, 2022 (hybrid) to be held **Y2 ACTUAL**: 2 EAB meetings held in Y2: October 22, 2021 (virtual) and April 5, 2022 (hybrid)	Projected: 2 EAB meetings **Y3 Progress**: The Fall 2022 EAB meeting (virtual) is scheduled for 10/4/2022.	Projected: 2 EAB meetings	Projected: 2 EAB meetings 5-YEAR TOTAL: 10 EAB meetings across the 5-year project Total to date: 4 EAB meetings
Number of ND-ACES Management meetings (to be scheduled monthly)	12 meetings per year **Y1 Annual Report**: Not reported **Y1 ACTUAL**: 11 meetings held in Y1	12 meetings per year **Y2 Annual Report**: 7 meetings **Y2 ACTUAL**: 11 meetings held in Y2	Projected: 12 meetings **Y3 Progress**: 1 meeting held in Y3. 11 scheduled.	Projected: 12 meetings	Projected: 12 meetings 5-YEAR TOTAL: 60 meetings across the 5-year project Total to date: 22 meetings
Number of ND-ACES Leadership meetings (to be scheduled quarterly) ***[Approved by NSF August 2021]***	4 meetings per year **Y1 Annual Report**: Not reported **Y1 ACTUAL**: 4 meetings in Y1	4 meetings per year **Y2 Annual Report**: 1 meeting and no longer applicable – merged with monthly Management Meeting **Y2 ACTUAL**: No longer a metric	No longer a metric	No longer a metric	15 meetings across the 5-year project; however, this meeting was eliminated by a mitigation plan in August 2021, which combined the Leadership meeting with the Management meeting
Number of ND-ACES All-Participant meetings (to be scheduled twice annually)	2 meetings per year **Y1 Annual Report**: Not reported **Y1 ACTUAL**: 2 meetings in Y1 (July 2020 and April 2021)	2 meetings per year **Y2 Annual Report**: 1 virtual meeting on October 8, 2021 **Y2 ACTUAL**: 2 meetings in Y2 (October 2021 and April 2022): all participants were invited to the April 5, 2022 EAB meeting. Y3 All-participant meeting has been scheduled for September 14, 2022	Projected: 2 meetings **Y3 Progress**: Meeting 1 (virtual) is scheduled for 9/14/2022 and meeting 2 (face-to-face) is scheduled for 3/28/2023.	Projected: 2 meetings	Projected: 2 meetings 5-YEAR TOTAL: 10 meetings across the 5-year project Total to date: 4 meetings
Number of CCBSE and PROSPER meetings (to be scheduled every other month)	12 CCBSE and 6 PROSPER meetings **Y1 Annual Report**: Not reported **Y1 ACTUAL**: 10 CCBSE and 6 PROSPER meetings	12 CCBSE and 6 PROSPER meetings **Y2 Annual Report**: 7 CCBSE and 7 PROSPER meetings (PROSPER joining in on CCBSE meeting each month beginning Sept. 2021) **Y2 ACTUAL**: 10 CCBSE meetings in Y2; 5 PROSPER leads meetings in Y2	12 CCBSE and 6 PROSPER meetings **Y3 Progress**: 2 CCBSE meetings.	12 CCBSE and 6 PROSPER meetings	12 CCBSE and 6 PROSPER meetings 5-YEAR TOTAL: 25-30 meetings across the 5-year project Total to date: 21 CCBSE and 11 PROSPER meetings