MINISTRY OF EDUCATION
FEDERAL UNIVERSITY OF CEARÁ

Institutional Internationalization Program
(CAPES-PrInt)

INSTITUTIONAL PROPOSAL

DIAGNOSTICS

Strengths

Title

Scientific production with international relevance

Justification

he publication of articles in prestigious scientific journals of high selectivity and high scientometric indexes is an evidence of the international insertion of research groups involved in the themes and projects. The study ordered by CAPES to Clarivate Analytics (Research in Brazil) indicates that UFC is the 16th among the Brazilian universities in the total amount of articles production. This classification evolves perceptibly to 10th and 11th ranks if we only consider the impact of the top-1% and top-10% articles, which conveys that the institution is well situated in terms of high-impact scientific production. We highlight, among some contributions of higher relevance from the groups in the project, publications in journals such as Nature, Nature Physics, Nature Materials, Science, Nature Communications, Lancet Global Health, PNAS, Nanoletters, Physical Review Letters, Review of Modern Physics, ACSNano, Acta Mathematica, Progress in Materials Science, Nature Reviews Gastroenterology & Hepatology, Diabetes Care, Journal of the American Chemical Society, Annals of Internal Medicine, Green Chemistry, among others. The impact of international publications (with or without foreign co-authoring), measured by area of knowledge in the Clarivate Analytics Report points out that UFC's production is above the world average in 12 areas of knowledge, with special focus on the areas of Engineering, Science of Materials, Physics, Medicine, Dentistry, Chemistry, Mathematics and Biochemistry. The strategic themes and the collaboration projects on the PrInt proposal are all in these areas. As a result of the quality of its scientific production, UFC ranked 13th, 11th, 10th and 12th in the Folha de São Paulo University Rankings in 2014, 2015, 2016 and 2017, respectively, mainly due to the fact that in regards to internationalization and scientific production, the University has ranked 10th and 6th, respectively, in 2017, for example. With respect to international comparative data, the situation is basically the same, as evidenced by the analysis of the THE and QS rankings. Indeed, UFC is among the 40 best universities in Latin America according to 2017 THE rankings, an assessment in which international scientific production has high relevance.

Title

Organizational structure of support to internationalization

Justification

Thanks to the quality of its research and graduate studies, UFC has achieved international expression in the most diverse areas involved in the project. Given the priority of consolidating and even expanding the university's international openness, the President's Office has restructured and promoted the Office for International Affairs to the Office of the Provost for International Affairs (PROINTER) in 2017. This denotes the centrality that the internationalization

policy has at the University's Higher Administration. There is a clear institutional understanding that it is crucial to disseminate the excellence of research and graduate studies in consolidated areas at the international level, make two-way student and researcher mobility more productive and efficient, and optimize the formal and academic procedures of jointly supervised doctoral programs, double degrees, transference of academic records, among other operational aspects of internationalization. Some of the institutional purposes of PROINTER are: to articulate and improve the administrative procedures pertaining to international actions at UFC; to promote the compliance of curricular structures and teaching organization with international models; to assist foreign students interested in studying at UFC with legal, procedural and academic perspectives, ensuring their regularization and settlement at UFC and in the country; to welcome visiting and permanent foreign professors. One of the main activities at PROINTER, in association with the Houses of Foreign Culture (English, French, German, Spanish, Italian and Portuguese languages) has been to institute the foreign language proficiency policy in the academic and administrative spheres at UFC. A primary component of the actions in this policy concerns the Languages Without Borders Program, which comprises academically oriented language courses, the supervision of the IsF (English Without Borders) courses (CAPES), and the holding of proficiency tests (TOEFL). More recently, PROINTER, in conjunction with the Languages Without Borders Program, has launched a Proofreading Center for scientific papers. Established in a pioneer way in 1968, the Houses of Foreign Culture are historically responsible for cultural activities such as multicultural exchange and thematic seminars and workshops which often involve diplomatic representations and foreign missions in charge of disseminating science and technology from their home countries. In partnership with the University of Nankai, from China, the Confucius Institute was established in 2018.

Title

A high number of international publications co-authored with foreign researchers

Justification

UFC has distinguished itself in several international rankings, especially in regards to citations, publications and collaborations with international teams. Indeed, international co-authoring currently correspond to 41% of the total amount of articles with JCR (Journal Citation Reports) and result from an intense interchange of researchers, formalized in institutional or individual projects of international cooperation, eventually with foreign counterparts. The University also stands out in relation to the constant presence of UFC professors in scientific societies, editorial and scientific committees of international relevance. Restricting the analysis only to the graduate programs involved in the institutional proposal, which represent 57% of the doctoral programs and 41% of the doctoral programs coordinated at UFC (except for networking programs), the proportion of co-authoring with foreign researchers surpasses 40% of the production, mostly distributed among the countries considered as priority by CAPES for PrInt purposes, namely, the United States (9,3%), France (3,0%), Spain (2,7%), Germany (2,4%) and the United Kingdom (2,3%). Over the years, UFC has collaborated with prestigious universities, such as Harvard, MIT,

Virginia, Pennsylvania, Cornell, Purdue, Princeton, BU, Yale, Brown, California, Oxford, British Columbia, McGill, Ontario, Munich, Manchester, École Normale, among others.

Weaknesses

Title

Asymmetrical international insertion among areas of knowledge

Justification

UFC currently has 10 graduate programs classified by CAPES as being of international reference. Among these programs, 60% correspond to programs in areas of exact sciences and engineering, 30% in the medical field, 10% (one program) in human sciences.

Title

Low number of foreign students and researchers

Justification

Despite the policy of attraction of foreign students developed through the participation in several international programs, such as Be-a-doc, PEC-G, PEC-PG, GCUB-OEA, the Medical Residency Program with Cape Verde, École de Mines (Morocco), and other bilateral agreements, the percentage of foreign students is 0,68%. The attraction of researchers is accomplished with the Visiting Professor Program, whose focus has been the implementation of the University's internationalization process and, thus, stimulating them to eventually apply to permanent faculty positions. The percentage of foreign permanent professors is 2,7%.

Is there a well-defined institutional vocation?

No.

Elaborate on other relevant information about your institution's level of internationalization

There has been a remarkable upsurge in UFC's international insertion in recent years, especially upon considering the success of researchers and research groups in establishing partnerships with institutions of global excellence, and in gathering funds under projects financed by international entities or multinational corporations. Other aspects of international relevance encompass publications in high-impact magazines, participating in editorial boards of traditional periodicals, research activities featuring on magazine covers and in the international media, international awards to researchers and invitations to give lectures at the most traditional conferences. The following awards are the most prominent among the ones received recently: International Union of Materials Research Societies – Somyia Award, Royal Society, Enlaces Award CLAG 2017 – Conference of Latin Americanist Geographers, MCA Prize, Young Scientists Prize – Mathematics, TWAS-ROLAC, Royal Society- Newton Advanced Fellowship, International

Prominence, conferred by LG, among others. For the first time ever, four Brazilian universities featured on the Times Higher Education (THE) ranking among the foremost engineering institutions in the world, with the indicators for assessing their performances being grouped into five dimensions: teaching environment (representative of 30% of the score), research volume and reputation (30%), influence of the research (27,5%), internationalization (7,5%), and revenues owing to technology transfers (5%). The Federal University of Ceará is one of the aforementioned institutions, along with the University of São Paulo (USP), the State University of Campinas (Unicamp), and the Federal University of Minas Gerais (UFMG).

INSTITUTIONAL PROJECT

Institution of the Project Coordinator

UNIVERSIDADE FEDERAL DO CEARÁ

Goals of the Institutional Project

1.Institutional Context. The Internationalization Agenda (PIN) of the Federal University of Ceará (UFC), approved by the University Council (Resolution 45/CONSUNI, published on 11/2-17 – attached to PIN) is the current institutional mark of UFC's internationalization policy. The goals, strategies and actions of the Internationalization Agenda have been incorporated to the Institutional Development Plan for the 2018-2022 period as a result of contributions from the researcher community at UFC and approved by the Superior Councils in 2017. Both documents reinforce several initiatives and programs which have already been successfully implemented in recent years and propose innovations in management, in teaching and in research with the purpose of definitively establishing an international environment within the institution. The university's international openness is essentially oriented by the activities of research and graduate studies, especially with the impulse brought by the creation of the first doctoral programs at the University, in the mid 1990s. Despite its relatively recent activity, the establishment of excellence groups in these pioneer programs has disseminated rapidly and sustainably in a set of 58 academic graduate programs, 42% of which were awarded scores of 5, 6 and 7. According to the 2013-2016 quadrennial assessment, UFC counts with 10 programs of international excellence, three of them with grade 7, in the areas of Civil Engineering/Water Resources, Physics, Mathematics; and seven of them with grade 6, in Chemistry, Nursing, Chemical Engineering, Teleinformatics Engineering, Pharmacology, Geography and Medical Sciences. The institutional project for PrInt is structured involving these groups of excellence with strong international relevance, which opportunely approach the following themes of world relevance, strategic for the development of the country and the state of Ceará: i) materials and phenomena in nanoscale; ii) geometry and non-linear methods; iii) data science and complex systems; iv) social technologies; v) new chemical and biological products and their applications; vi) infectious, immunoinflammatory and chronic degenerative diseases; vii) water management and safety in a context of climate change. Although the central themes of the project gravitate around the

programs of excellence, the teams involved are, necessarily, interdisciplinary and represent, as a whole, approximately 60% of the programs with grades 5, 6 and 7. This arrangement, far from being an artificial juxtaposition, evidences the pattern of collaborations existent at UFC, some consolidated, others incipient, but also very promising. Usually, the collaborations based on the choice of themes and on the teams' formation involve common international partnerships and also articulated among themselves. In the proposal, the groups involved are leading projects which denote scientific excellence, for instance, 6 INCTs, 11 PRONEXs, 2 SisNANO Laboratories, 2 National Multiusers Centers from FINEP, among others. All teams have international cooperations formalized by research projects financed by programs such as CAPES-COFECUB (France), -DAAD (Germany), -AmSud (France), -CAFP-BA (Argentina), -FCT (Portugal), -MINCYT (Argentina), -DFATD (Canada), -PGCI, among others, by other foreign resources (Newton Fund, Melinda-Gates, European Union) or high-technology multinational companies (Ericsson, LG, Petrogal, SinoChem, Bayer and others). In aggregated numbers the research activities around the themes chosen to compose the proposal correspond to a great proportion of scientific production at UFC, mainly related to the most relevant publications. The great areas of knowledge represented in the collaboration projects of PrInt's proposal have high-impact indicators of our production above the world average (analysis accomplished for UFC at SciVal). It is the case, for example, of Chemical Engineering (30% above); Materials Science (25% above) and Odontology (22% above). Starting from this scenario, the Internationalization Agenda establishes the actions which enable us: i) to consolidate the excellence acquired at the international level; ii) to spread it to programs and research centers with a clear perspective of consolidating its international experience; iii) to innovate the undergraduate and graduate teaching practice in order to promote the programs' international openness; iv) to optimize the management of the processes related to mobility and international partnerships.

2. Choice of Strategic Themes and Collaboration Projects. The choice of priority themes (see list above) for the selection of collaboration projects integrating PrInt has considered the following guiding principles: i) direct involvement of the graduate programs with grades 6 and 7 on the CAPEs 2013-2016 quadrennial assessment, due to the international excellence of the referred courses; ii) multi and transdisciplinary approach, translated by the graduate programs' articulation (including those with grades 5 and, eventually, 4, and research groups, with impacts expected on the University's internationalization level, including in graduate and undergraduate teaching, and in accordance with UFC's Internationalization Institutional Agenda; iii) possibility of developing themes of international relevance which promote institutional visibility in high-impact scientific journals and events; iv) participation of the main researchers involved in the arrangements of Excellence Centers Projects (PRONEX), International Networks of Research and National Institutes of Research (INCT); v) history of international collaborations with defined and relevant impacts, and fundraising, including those from foreign development agencies and companies; vi) overcoming of the socioeconomic challenges and of the strategic areas concerning public policies in science, technology and innovation in the state of Ceará; vii) involvement with the local productive arrangements and, in particular, with the Technology Park at the Federal University of

Ceará. The selection of collaboration projects, among the seven priority themes, was accomplished by means of an internal call notice and proposals involving the articulation of the excellence research groups in programs with grade 5 and some centers of programs with grade 4.

The proposal has the participation of 25 graduate programs with predominance of grades 7, 6 and 5, arranged in 16 collaboration projects. These collaboration projects are majorly leaded by the programs of international excellence and have, as members, researchers from programs 5 and 4, which reveals a balanced arrangement among programs with international insertion and those with great potential of evolving in a near future. This configuration equally reflects the degree of the programs' maturity and excellence of the scientific production and is compatible with the survey performed by UFC at SCIVAL using the Scopus database and taking into account the indicator "Field-Weighted Citation Impact". Considering the result of this report, the coordination of the collaboration projects is in the areas of knowledge whose international impact of UFC's production is higher than the world average, and the collaborating programs are slightly below the world average. The collaboration projects' coordinations are, predominantly, in charge of researchers with wide international experience, majorly at level 1, and with a balance between seniors and young researchers.

The collaborations involve 20 countries, but only two of them are not listed as priorities for CAPES. Among the foreign institutions participating the projects, we emphasize: Univ. of Virginia, Pennsylvania State Univ., Purdue Univ., Univ. of British Columbia, Boston Univ., Univ. of Paris-Sud, Texas A&M Univ., Univ. of Melbourne, Univ. of Queensland, among others.

3. Goals of the Proposal. In short, the present proposal is founded at UFC's Internationalization Agenda and, by means of the accomplishment of a cutting edge research in several areas of knowledge, has the following goals: i) establishing at UFC's academic community a promotion policy for the increase of international mobility by means of visits, internships and undergraduate and graduate programs in foreign institutions, particularly in strategic areas that promote the creation of new research groups or graduate programs, as well as the international consolidation of the existent graduate programs and the national scientific and technological development; ii) to promote the updating and qualification of the graduate programs, jointly establishing parameters and strategies for the grade's increase, not only in the CAPES assessment for internationalization, but also pursuing international excellence criteria, following internal assessment models of the graduate programs, based on international comparatives; iii) to consolidate continued policies of curricular updating and flexibilization, guaranteeing rapid responses to the internationalization demands in terms of competences, practices and professional profiles which are appropriate to the international job market; iv) to intensify the curricular flexibilization of the undergraduate and graduate programs in order to accommodate several curriculums, enabling not only student mobility but also the credits transfer from studies accomplished abroad; v) enabling the offer of curricular components lectured in foreign languages, whether in the classroom-based modality, whether in virtual environments, such as

the massive platform of courses, with its inclusion in the pedagogical projects of the undergraduate and graduate programs.

THEMES AND GOALS OF THE PROJECT

Theme	Partner countries
Data Science and Complex Systems	Sweden; France; United States; Germany; Switzerland

Justification

The several research fronts in complex systems and data science involve teams working in graduate programs (GP) assessed by CAPES with grades 7,6 and 5. Important elements in this assessment, such as partnerships and international fundraising, are also present in the projects related to the themes. Besides the extreme academic and scientific relevance, also based on the high scientific level of the foreign team, the theme comprised several applications in accordance with socioeconomic challenges and strategic areas of public policies in the state of Ceará. A considerable share of the scientific staff already interacts in the elaboration of such policies. The projects continue very consolidated activities in the qualification of doctors and accomplishment of post-doctoral placements on the theme, followed by the renewal and internationalization of curriculums and teaching practices. In this sense, the projects are fundamental for the execution of UFC's institutional internalization agenda. The research theme addresses since the modelling and simulation of dynamic processes and transport phenomena in complex systems to the applications of data science in several scientific-technological areas. Several problems, such as the planning and development of smart cities and the study of dynamical processes in complex networks, finance and neuroscience can be modelled on terms of existence of emergent behaviours in complex systems, such as self-organization, criticality and invariance of scale. The scope of areas represented by the theme suggests that the projects might move the participant GPs to a new level of interdisciplinary work. The connection between the theoretical aspects in complex systems and potential applications depends on elaborate techniques in science data, related to signal processing and machine learning. In this sense, another aspect of the projects is data mining about mobile communication networks, wireless communication networks, reservoirs and water distribution and electricity, soil humidity, logistics of agricultural production, among other databases. The practice of our researchers in the area, with American, German, Swedish and French teams have results in high-level publications, formal cooperation agreements, bilateral financial support and doctoral and post-doctoral qualification in strategic areas.

GOALS

Goal 1

To qualify doctors to work in the area of Complex Systems and Data Science

Description

To adjust the UFC to world patterns requires students' qualification at doctoral level with international experience. Besides strengthening or organizing international collaborations, this modality also enables the openness of new research areas by the constant updating of the lines of research. The students involved in mobility will accomplish research activities for the development of new techniques of characterization of dynamic and structural properties of complex systems and investigation of social patterns in urban centers and social and political behaviour with the use of Statistical Physics principles. In the area of data sciences, the qualification will be promoted by means of studies on processes and resources optimization in agribusiness, including the optimization of communication networks, energy and water consumption, supply chains and transportation, using optimization methods based on the analysis of big data sets (complex networks, machine learning, among others).

Goal 2

To consolidate and promote the international insertion of the researchers associated with the graduate programs

Description

To establish a promotion policy of international mobility in the academic community at UFC by means of the UFC researchers' performance as visiting professors in partner foreign institutions, particularly in strategic areas which promote the creation of new research groups or graduate programs, as well as the international consolidation of existent graduate programs and the national scientific and technological development. For the graduate programs' update and qualification, the goal is to establish parameters and strategies of grade increase not only at CAPE's assessment, concerning internationalization, but also with respect to international excellence criteria, according to the graduate programs' internal assessment models, based on international comparatives. Therefore, it is fundamental to broaden our researchers' international insertion, particularly in areas in which we have an already consolidated experience of interactions with world-class excellence centers, as it is the case of Complex Systems and Data Science.

Goal 3

To maintain and intensify partnerships with groups of international excellence in the theme Data Science and Complex Systems

Description

The short-duration missions of Brazilian researchers abroad and also of foreign researchers in Brazil are fundamental to consolidate the research network which involves researchers from GPs, and, in the national context, to internally create an innovative and updated environment in the frontier of knowledge. These activities enable the insertion of the knowledge acquired in the research on the programs 's routine by means of seminars, training courses, and special courses in complex systems and data science.

Theme 2

Theme	Partner countries
Geometry and Non-Linear Methods	United States; France

Justification

The research theme is addressed by a project which articulates the graduate programs in Mathematics (grade 7), Teleinformatics Engineering and Economics (grade 5), whose driving force is the use of geometrical and analytical methods in the theory of information and signal processing, with applications in telecommunications engineering and finance. The GP in Mathematics is one of the pioneers, even in national scale, in terms of international collaborations formalized along the years, in several agreements and projects, for instance, Pronex, COFECUB, Science Without Borders, among others. The GP in Mathematics was promoted to grades 6 and 7 in consecutive assessments carried out by CAPES, whereas the GP in Teleinformatics Engineering, despite its recent creation, was promoted to the international excellence grade. Such changes of level are mostly due to the emphasis of the programs in international cooperation. Researchers from both GPs have taken part in joint research projects, funded by development agencies, some of them with a counterpart of foreign institutions. Recently, the research interests, originally focused on geometrical, dynamic or analytical aspects of signal processing and optimization in the presence of curvature, derived to possibilities of application to finance of the machine learning methods adapted to non-linear or singular settings. With these outcomes, the projects started to involve researchers from the GP in Economics, a nationally consolidated program and with an intense history of collaborations for the management of public finances in the state of Ceará. The project aims at integrating these internal collaborations and the foreign cooperation network maintained by the most internationally consolidated programs, involving, in the present proposal, prestigious American and French universities. The theme involves applications of the language, dynamics and analysis of geometry, especially in singular or stratified spaces, to research topics in areas such as complex systems, for example, the relationship between stochastic processes and phase transitions, and information geometry, in which the geometric nature of statistical manifolds in applications to signal processing is explored, especially in the form of sets of big data about financial assets.

GOALS

Goal 1

To qualify doctors to work in the area of geometry and non-linear methods

Description

To adjust the university to world patterns requires students' qualification at doctoral level with international experience. Besides strengthening or organizing international collaborations, this modality also enables the openness of new research areas by the constant updating of the lines

of research. The problems to be approached during the placements require the combination of Analysis techniques, Singularities, Differential Geometry and Dynamics for being related to processes of diffusion in singular or stratified manifolds, suggested by applications of signal processing to the analysis of returns of financial assets, to mention an example of the methods' application considered in the proposal.

Goal 2

To maintain and intensify partnerships with international groups of excellence in the area of geometry and non-linear methods

Description

The short-duration missions of Brazilian researchers abroad and also of foreign researchers in Brazil are fundamental to consolidate the research network which involves researchers from GPs, and in the national context, to internally create an innovative and updated environment of avant-garde scientific knowledge. These activities enable the insertion of the knowledge acquired in the research on the programs' routine by means of seminars, training courses and special courses in Geometrical Analysis, Dynamics, Free Boundary Problems, Signal Processing and Stochastic Calculus in Finance.

Goal 3

To consolidate and promote the international insertion of the researchers associated with the graduate programs

Description

To establish a promotion policy of international mobility at UFC's academic community by means of UFC researchers' practice as visiting professors in partner foreign institutions, particularly in strategic areas that promote the creation of new research groups or graduate programs, as well as the international consolidation of the existent graduate programs and the national scientific and technological development. The researchers' international insertion is an indispensable condition for the graduate programs' updating and qualification with respect to international excellence criteria. The proposal has as one of the central strategies that the partnerships, consolidated among the local and foreign teams, might be broadened to involve younger researchers and post-doctors, so as to include them in international research networks of excellence in the areas of Geometrical Analysis, Analysis of PDEs, Combinatorics, Singularities, Dynamics, Signal Processing and Mathematical Economics.

Theme 3

Theme	Partner countries
New Chemical, Biological Products and their Applications	France; Australia, United States; Canada; Italy; Mexico; Germany; United Kingdon

Justification

The theme presents lines of research in graduate programs with grades 7, 6 and 5 in CAPES 2013 – 2016 quadrennial assessment, grades that confer international and national excellence to the referred programs. The research topics comprised on the theme involve international collaborations in different stages of consolidation, some tracing back to 15 years, others still incipient, but with significant results in terms of publications, cotutelles and fundraising. The theme naturally articulates to other topics of the institutional proposal, particularly to the research in nanomaterials and the study of infectious, immunoinflammatory and chronic-degenerative diseases. The collaborations of the teams working in these three themes originated a history of success, for instance, in the study of products originated from biodiversity and its applications in the medical area, mainly in the prospection of compounds with potential for the treatment of cancer tumors. In support to this strategy, the institution has a Center of Research and Drug Development (NPDM) whose activity involves all the stages, since the prospection of new compounds and organic synthesis, with toxicity testing, cell imaging, “omics” technologies to pre-clinical testing. Applications to dentistry are also included in the theme, with a project of integration of the microfluidics and tissue engineering, which enables to evaluate the odontoblastic alterations, as well as its relationship with the interface formed between dentin and the dental materials. With respect to the research on new chemical products, the theme comprises consolidated groups in the study of coordination compounds and its applications as metallodrugs, biosensors, catalysers, inhibitors, detections in traits analyses, green chemistry and liberation of drugs. Besides the aspects of the proposal, we highlight the goal of consolidating a network of international excellence researchers to investigate different and complementary aspects of carbon dioxide capture to molecules of commercial interest. The current research apparatus installed in the area includes multi-users laboratories, such as the Analytical Facility, the Regional Center of Nuclear Magnetic Resonance, the Center of Research and Drug Development, the Reference Center in Genomics, besides the teams and resources in projects in scope of 3 INCTs and 3 PRONEXs.

GOALS

Goal 1

To qualify doctors to work in the area of new chemical, biological products and their applications

Description

To adapt the university to world patterns requires the students' qualification at doctoral level with international experience. Besides strengthening our organizing international collaborations, this modality also enables the openness of new research areas by the lines of research's constant updating. In the thematic proposal in issue, the students will accomplish studies at the University of Queensland, University of Cambridge, University of Leeds, Università di Milano, University of Aberdeen, Scotland, National Research Council, Canada, University of Oregon and University of Indiana. Students on split-site doctoral places will accomplish, in particular, a research for the validation of two natural products as potential antitumor compounds.

Goal 2

To consolidate and promote the international insertion of the researchers associated with the graduate programs

Description

The goal is to establish a promotion policy for academic mobility in the academic community at UFC by means of the practice of UFC researchers as visiting professors in partner foreign institutions which promote the creation of new research groups or graduate programs, as well as the international consolidation of the existent graduate programs and the national scientific and technological development. The international insertion of our researchers involved in the proposal is a necessary condition to the graduate programs' updating and qualification in terms of international excellence criteria. In the thematic proposal, missions of researchers from the GPs involved with partner institutions such as the universities of Queensland, Cambridge, Leeds and Aberdeen, as well as mutual scientific visits from UFC researchers to collaborators at the Australian National University and Fraunhofer Institute for Molecular Biology and Applied Ecology, among other institutions.

Goal 3

To maintain and intensify partnerships with international groups of excellence on the theme new chemical, biological products and their applications

Description

The short-duration visits of Brazilian researchers abroad and also of foreign researchers in Brazil are fundamental to consolidate the research network which involves researchers from the GPs and, in the national context, to internally create an innovative and updated environment in the frontier of knowledge. These activities enable the insertion of the knowledge acquired during the research in the programs' routines by means of seminars, training courses and special courses relative to the research topics. The institutional apparatus already associated to the research theme includes large laboratories at NPDM (Center of Research and Drug Development), Analytical Facility, INCTs and resources of PRONEX projects. A considerable part of this research structure derives from international collaborations whose strengthening and widening for other interdisciplinary research groups is one of the main axes of the this proposal.

Theme 4

Theme	Partner countries
Social Technologies	Canada; France; Argentina; Mexico; United States; United Kingdom; Spain; New Zealand; Italy

Justification

The theme addresses lines of research in graduate programs with grades 6, 5 and 4 in CAPES 2013-2016 quadrennial assessment, grades which confer international and national excellence to the referred programs. The theme's interdisciplinary feature is evident, given the articulation of several graduate programs (Geography, Nursing, Sociology, Tropical Marine Sciences, Pharmaceutical Sciences and Law) represented in the projects by research groups of excellence and consolidated experience in the coordination of international projects. The integration among these groups generates impacts on UFC's internationalization level. One of the proposal's focuses is the assessment of the communities' vulnerability in the context of climate change, aiming at the elaboration of strategies which assure water, food and energy safety, as a territorial strategy for the sustainable exploitation of natural resources. The projects aim at developing integrated actions of sustainability and governance, with a focus on projects of renewable energies, social technologies and health promotion. With respect to health promotion, the main strategy is the use of technologies to offer and improve health among individuals in different ages who need health care and education, creating environments which are favourable to health, strengthening community actions, development of personal abilities and reorientation of health services. Such technologies have been investigated by members of the project with a focus on the health of less privileged groups, such as children with problems in their sleeping behavior, who present a higher risk of obesity, depression and anxiety; risk behavior; people with disabilities, cancer, HIV-aids, diabetes, hypertension or cardiovascular diseases.

GOALS

Goal 1

To qualify doctors to work on social technologies

Description

To adapt the university to world patterns requires THE students' qualification at doctoral level with international experience. Besides strengthening or organizing international collaborations, this modality also enables the openness of new research areas for the constant updating of the lines of research. When it comes specifically to this proposal, split-site doctoral placements will be accomplished at the partner foreign foreign universities, such as University of British Columbia, Texas A&M and Kansas State University. Among the research topics to be developed during

these placements, it is worth mentioning the assessment of urban and rural communities' vulnerability in the Northeastern coast and in Amazon in the context of climate change, aiming at the elaboration of strategies to assure water, food and energy safety, the sustainable exploitation of the natural resources and reduction of socio-environmental vulnerability.

Goal 2

To consolidate and promote the international insertion of the researchers associated with the graduate programs

Description

The goal is to establish a promotion policy for the increase of international mobility at UFC's academic community by means of the UFC researchers' practice as visiting professors in partner foreign institutions, particularly in strategic areas which foster the creation of new research groups or graduate programs, and also the international consolidation of existent graduate programs and the national scientific and technological development. One-year placements of UFC researchers as visiting professors in some partner institutions at the proposal for strengthening of the collaborations described in the project and obtaining of scientific results in terms of the accomplishment of experiments, participations in events and publications are expected. In the context of the proposed theme, among the research problems to be approached with the purpose of consolidating the researchers' international insertion, it is worth mentioning: to create, validate and assess the effectivity of the health technologies for vulnerable groups (people with disabilities, Aids and cardiovascular alterations); to validate an instrument to identify adverse effects of psychotropic drugs and prevention strategies to aid the administration of practices for the health promotion of children with mental disorders and people with Aids; to analyze factors associated with the low adhesion to the pharmacological treatment with children with mental disorders and people with Aids.

Goal 3

To maintain and intensify partnerships with international groups of excellence in social technologies

Description

The short-duration missions of Brazilian researchers abroad and of foreign researchers in Brazil are fundamental to consolidate the research network which involves researchers from the GPs and, in the national context, to internally create an innovative and updated environment of avant-garde scientific knowledge. These activities enable the insertion of the knowledge acquired during the research on the programs' routine by means of seminars, training courses and special courses. Besides the prognosis of the offer of regular courses in English, we point out that the proposal also addresses the accomplishment of an annual International School (Summer School) that will be promoted by the partner graduate programs and will integrate the international universities on the theme of water, food and energy safety with the purpose of creating

methodologies, technological innovation and aggregating new knowledge to the scientific literature at global level.

Theme 5

Theme	Partner countries
Materials and Nanoscale Phenomena	United States; China; France; Ireland; Australia; India; Belgium; Spain; Italy; Canada; Germany

Justification

At the institutional dimension, this theme was chosen for representing lines of research in graduate programs with grades 7, 6 and 5 at CAPES quadrennial assessment, grades which reflect international and national excellence to the referred programs. The research in nanomaterials accomplished at UFC involves international collaborations with first-class institutions in the USA and Europe and has produced defined and relevant results and impacts. Therefore, the choice of nanomaterials is a strategic decision to maintain the high level of the research's internationalization in this area, demonstrated by the international insertion of the teams and programs with grades 7 and 6 participating in the project. Another strategic factor is the theme's convergent feature, evident in the articulation of research groups of excellence working in different graduate programs in the areas of Physics, Biochemistry and Chemical Engineering. Such articulation has expected impacts on several aspects of internationalization, including in graduate and undergraduate teaching, in compliance with UFC's internationalization institutional agenda. At the scientific dimension, nanoscience is a cutting-edge theme of the current science and the nanomaterials, in particular, have been the research's focus on several areas of knowledge in the last years, with integrated efforts on the synthesis, characterization, exploitation and technological applications of these new materials. The structural, electronic, optical, magnetic and mechanical properties of the nanostructured materials, dramatically different from the respective extended solids ("bulk"), are opening a wide range of possibilities in the applications to the most diverse areas of technology. The special properties of these materials enable to reveal the phases and atomic structures, new catalysts and adsorbents, as well as the interaction of these nanomaterials with biological systems. In the area of nanobiotechnology, the research at UFC is covered in an INCT (National Institute of Science and Technology) where competences to accomplish cutting-edge works in nanomaterials (nanoparticles, nanotubes, dendrimers, miscelles, etc.) established as markers, sensors or transporters for the delivery of drugs and biomolecules to cell systems. The INCT, with several researchers participating in the project's team, also fosters scientific contributions which explore the bio-nano interface (corona) phenomena and the interactions of nanomaterials with biological systems.

GOALS

Goal 1

To maintain and intensify partnerships with international groups of excellence in social technologies

Description

High-qualified researchers from the foreign universities (MIT, Univ. Cambridge, Univ. Antwerpen, among others) will visit Brazil supported by scholarships in the visiting professor modality. With the purpose of widening the possibilities of graduate qualification at international level, it is expected that foreign researchers from partner universities (Leipzig, Malaga, Melbourne, Missouri) lecture, during their visits to UFC, summer courses and lead workshops and international theme schools. Furthermore, the missions of foreign collaborators with a high scientific level will enable to continue or consolidate partnerships already established and well-succeeded with the universities of Antwerpen and Bremen, to mention a few examples. Finally, as part of the project, two visits from a senior MIT professor to the laboratories of the Physics and Chemistry departments at UFC are defined. The interchange of experiences will be then enhanced with the presence of two Brazilians post-doctors at MIT and at least two MIT students at UFC laboratories.

Goal 2

To consolidate and promote the international insertion of the researchers associated with the graduate programs

Description

The researchers' international insertion in the local teams is primordial to the graduate programs' updating and qualification in terms of international excellence criteria. The bilateral missions disposed in the project will have as goals to continue and intensify the international partnerships between the researchers from the research groups in the graduate programs in Chemistry, Physics, Chemical Engineering and Biochemistry and collaborators in institutions of academic excellence abroad such as the MIT, Univ. Cambridge, Univ. Antwerpen, among others. With respect to the research theme, the history of continuous collaboration, despite it is relatively recent, resulted, for instance, in a wide range of cutting-edge research. The project's members are senior researchers in the fields related to this project, namely, high-pressure vibrational spectroscopy, carbon nanomaterials and 2D materials. The experience acquired with the accomplishment of extremely high-end experiments at the partner international institutions will be incorporated by the local teams, given the laboratory structure and the already consolidated networks around INCTs, PRONEX projects and the Analytical Center Facility, to mention some of the multi-users equipments integrated to the proposal.

Goal 3

To qualify doctors to work in Science of Materials

Description

To adapt the university to world patterns requires students' qualification at doctoral level with international experience. Besides strengthening or organizing international collaborations, this modality also enables the openness of new research areas for the lines of research's constant updating. The qualification of young talents in the research areas is fundamental to create an innovative environment at the institution in terms of research as well as in what concerns teaching at undergraduate and graduate level. It is a central strategy of the project to qualify doctors and supervise post-doctoral placements of young doctors, providing them with distinguished academic credentials to work in an articulated way on interdisciplinary research in new materials in Physics, Chemistry and Chemical Engineering and associated areas. In this aspect, one of the main goals is the widening, with the inclusion of doctoral students and young doctors, of a researchers' network of international excellence for the investigation of different and complementary aspects of diamondene Physics; of the capture and conversion of CO_2 to molecules of commercial interest; and of applications of molecular dynamics to the study of biomarkers interaction with their respective substrates, to mention a few examples of topics approached in the theme projects.

Theme 6

Theme	Partner countries
Water and Residue Management & Safety in the face of climate change	France; United Kingdom; Spain; United States; Germany

Justification

The theme involves staffs of graduate programs with grades 7 and 5 according to the last CAPES's assessment, which confers the proper degree of international and national excellence to the proposal. The international insertion of the researches on the theme is proved by the several collaborations, agreements, bilateral projects and practices at foreign universities and high-impact international conferences, according to the description of the projects involved on the theme. It is worth to highlight the expressive raising of foreign funds as a counterpart to the projects on this theme. In support to the choice of the theme, it is also worth mentioning that the management of water resources is, for obvious reasons, one of the strategic points of the public policies in Ceará and in the Northeast region as a whole. For this reason, UFC has historically considered the area of water resources as central in its activities of research and graduate studies by promoting several cooperations with government and international agencies. One of the innovative aspects of the projects composing the theme in issue is the interdisciplinary articulation between Civil Engineering/Water Resources, Sociology, Tropical Marine Sciences and Biotechnology of Natural Resources. The related projects cover a wide spectrum of topics in an

integrated way, since the mapping of variability and climate risk, adaptive management of water infrastructure and governance of the water resource systems to sociological approaches concerning the conflicts for the use of water, as well as the analysis of economic aspects related to the allocation or water supply costs. Another aspect of the proposal aims at offering solutions in the process of complete treatment of solid urban waste, with efficiency and low cost of biodigestion operation. Also, with respect to the issue of water scarcity in the context of climate change, the utilization of photocatalytic processes in eutrophicated reservoirs is proposed, a well-succeeded process in laboratory which proposes to be replicated in real scale. These complementary dimensions of the project, with proposals of intervention in the causes and effects of climate change on water resources, demonstrate the unit of purposes and the cohesion of the lines of research on the theme. Great projects executed by the staff (the project ADAPTA CNPq-UFC-Columbia-Georgia) and with financial counterparts of the foreign partners, set the theme synergistically in compliance with the mission, tradition and competence of the institution in water resources.

GOALS

Goal 1

To maintain and intensify partnerships with international groups of excellence in water management and safety

Description

The short-duration missions of Brazilian researchers abroad and also of foreign researchers in Brazil are fundamental to consolidate the research network which involves researchers from the GPs and, in the national context, to internally create an innovative and updated environment in the frontier of knowledge. These activities enable the insertion of the knowledge acquired during the research in the programs' routines by means of seminars, training courses and special courses. In light of this context, a high degree of in and out mobility is expected from researchers of the partner institutions, such as Univ. Columbia, Univ Potsdam, Univ. Valladolid and Univ. St Andrews.

Goal 2

To qualify doctors to work on the theme "Water management and safety"

Description

To adapt the university to world patterns required students' qualification at doctoral level with international experience. Besides strengthening or organizing international collaborations, this modality also enables the openness of new research areas by the constant updating of the lines of research. The doctoral students will accomplish studies on the mapping of variability and climate risk, adaptive management of the water infrastructure and governance of the water resources systems to the sociological approaches concerning the conflicts due to the use of

water, as well as the analysis of economical aspects of the allocation or water supply costs. Another aspect of the projects will be in the line of full treatment of solid urban waste, with efficiency and low cost of biodigestion operation.

Goal 3

To consolidate and promote the international insertion of the researchers associated with the graduate programs

Description

The bilateral missions will have as a goal to consolidate the insertion of the teams' researchers in the graduate programs in Water Resources, Sociology, Agricultural Engineering, Biotechnology of Natural Resources and Tropical Marine Sciences in institutions of academic excellence abroad such as Univ. Columbia, Potsdam, Georgia, Valladolid, Braunscwheig. The scientific missions originated from Germany and the United Kingdom will be all financially supported by the partner institutions (see item 'counterparts to the projects').

Theme 7

Theme	Partner countries
Infectious, Immuno-Inflammatory and Degenerative Diseases	United States; Thailand; United Kingdom; Switzerland; Portugal

Justification

The theme gathers some of most qualified research groups at UFC, which jointly coordinate INCT and PRONEX besides various laboratories with cutting-edge equipment. The excellence of these teams' work, firmed in more than four decades of activities, goes beyond the strictly academic aspects and, indeed, it has been determinant to qualify the healthcare in the state of Ceará, making the College of Medicine and its associated structures, such as the University Hospital and the Maternity-School, reference centers when it comes to clinic surgical qualification. The projects are articulated with the Industrial and Technological Center of Ceará and FIOCRUZ Ceará. The programs in Pharmacology and Medical Sciences are consolidated as international excellence programs (grade 6) and Surgical Sciences as national excellence (grade 5). The internationalization of the health sciences at UFC traces back to pioneer researchers in the isolation of thermostable Escherichia coli enterotoxin which lead to the investigation on the dynamics of the enteric diseases, malnutrition, microbiome, genome, metabolome and environmental enteropathy, generating knowledge about the morbidity and etiologies of enteric infections, as well as its impacts on the growth and neurocognitive development of children in poor communities. These investigations, accomplished since then, resulted in the creation of the international network, MAL-ED (malnutrition enteric disease) whose main result was the development and the application of a test for molecular biomarkers – carbohydrates – to assess the function of the intestinal barrier. This fact, on its own, shows the international insertion of the

institution in this research area. The research accomplished in Neurogastroenterology is one of the axes of the present proposal and a central point of INCT-Biomedicine (http://inct.cnpq.br/web/inct-ibisab) coordinated at UFC. In addition, the theme comprises projects which aim to leverage Translational Neuroscience at UFC, strengthening, integrating and gathering a network of international researchers and scholars in Neuroimaging, Neuroimmunology and Functional Genomics applied to the investigation in malnutrition/dyslipidemia, CVAs, schizophrenia, neurodegenerative and sleeping diseases. It is, therefore, a theme with a strong transdisciplinary feature which comprises the identification of the disease, the description of its physiopathology, the identification of possible therapeutic targets and clinic trials.

GOALS

Goal 1

To qualify the researchers from the Graduate Programs involved in the collaboration projects on infectious, immuno-inflammatory and degenerative diseases abroad.

Description

Part of the research to be accomplished in collaborations involves the participation of UFC researchers who work at the Graduate Programs in Pharmacology, Medical Sciences, Morphofunctional Sciences and Surgery by means of the accomplishment of academic mobility using the modalities of senior visiting researcher scholarships abroad and junior visiting researcher abroad.

Goal 2

To expand and consolidate the international collaboration of Pharmacology and Medical Sciences at UFC with the Neurogastroenterology group from Barts and London School of Medicine and Dentistry

Description

To expand and consolidate Faculty of Medicine-UFC's international collaboration with the Neurogastroenterology group from Barts and London School of Medicine and Dentistry, United Kingdom, in the following themes: new experimental models of laryngo-pharyngeal reflux disease; characterizing the mechanisms and discovering new biomarkers involved in the diaphragm's pathobiology in the gastroesophagic reflux disease (DRGE); new treatments as natural products to improve the esophagus' epithelial integrity; and new devices to remedy crural disability.

Goal 3

Qualification of students with split-site doctoral placements

Description

Part of the research to be accomplished in collaboration involves the direct participation of doctoral students by means of the Split-Site Doctoral Placement abroad.

Goal 4

To consolidate the collaborative research between FM-UFC and the University of Liverpool (UoL) to study the cell pathobiology of pre-clinic and clinic acute pancreatitis.

Description

To consolidate the collaborative research between FM-UFC and the University of Liverpool (UoL) to study the cell pathobiology of pre-clinic and clinic acute pancreatitis. We have planned bilateral visits, divided in: a) 12-months visit to UoL for 1 split-site doctoral student (co-supervised by UoL's partner) to investigate the protection mechanisms of a new lectin of two-tree seeds (Canavallia brasiliensis and C. ensiformes) extracted at UFC; b) short visit to UoL by 1 senior researcher to work the main discoveries, new protocols and writing 4 papers; and c) visits to UFC by the new partner for the work's progress, critically discussing the discoveries and develop new strategies to sustain the collaboration**.**

Goal 5

To promote the Translational Neuroscience research at UFC, strengthening, integrating and gathering a network of international researchers and scholars in neuroimaging, neuroimmunology and functional genomics

Description

The aim is To leverage Translational Neuroscience at UFC, strengthening and gathering a network of international researchers and scholars in Neuroimaging, Neuroimmunology and Functional Genomics. The projects' execution will promote the strengthening of the research groups in Neuroscience at UFC, it will favor the reduction of disparities still existent over the whole country and the underuse of high-cost equipment and it will promote a highly desirable integration of lines of research for translational products. In order to fulfil the goal proposed, the researchers will be focused on four lines: 1) Malnutrition/dyslipidemias and brain injuries and cognitive disorders related to the CVA in early childhood and in ageing; 2) Research of neuroprotection drugs in models of neurodegenerative disorders in vitro and in vivo; 3) Sleep, circadian rhythm and neurodegenerative disorders: pre-clinic and clinic studies; 4) schizophrenia, depression and intestine-brain axis.

Goal 6

To expand and consolidate the international collaboration of the Graduate Program in Pharmacology at UFC with the Imperial College London

Description

To expand and consolidate FM-UFC's international collaboration with the Imperial College London, United Kingdom, in the areas of metabolome and proteome already in progress at the Center in Chromatography and Mass Spectrometry. We intend to publish 3 high-impact scientific works per year and 1 textbook about basic and translational research in Medicine, in the areas of metabolome and proteome in the context of intestine infections, environmental enteropathy and

child malnutrition. The collaborative research enables to anticipate the development of 1 national/international patent in the area of new metabolomic and proteomic markers. From this perspective, we are providing 1 split-site doctoral program, 1 postdoctoral program, 1 senior visiting professor and 2 short-duration missions abroad. We also plan to offer a School of High Studies to our graduate students in Pharmacology and in Medical Sciences.

Goal 7

To expand and consolidate the international network of the research team in Neurogastroenterology associated with INCT-Biomedicine

Description

To expand and consolidate the productive interchange between UFC and UVa in the training of highly-qualified human resources and in the research on Translational Medicine in the dynamics of enteric infections, malnutrition, neurocognitive, microbiome, genome, metabolome and environmental enteropathy. In terms of high-impact publications, we plan to expand from 4 to 6 scientific articles per year. In the next three years, we have also published 2 books for the international public. We also plan to develop 3 bioproducts of the intestinal microbiota for the control and treatment of the vicious cycle of clinic gastrointestinal infectious and environmental subclinics/enteropathy and child malnutrition recently developed in animal models and translational clinic research. This effort will lead to the production of 2 products, national/international patents and applications in translational medicine and public health. In light of this perspective, we plan to qualify new human resources: 1 split-site doctoral placement, 1 post-doctoral placement and two senior visitors abroad, as well as 2 short-term missions abroad.

POSTGRADUATE PROGRAMS LINKED TO THIS PROPOSAL

Theme 1

Data Science and Complex Systems

Postgraduate Program 1	**Capes evaluation (2017 evaluation grade)**
Teleinformatics Engineering	6

Justification

The Graduate Program in Teleinformatics Engineering (PPGETI), created in March 2005, is nowadays a consolidated program, with grade 6 according to the last quadrennial assessment. The teaching staff is composed by 24 permanent professors (17 of them are CNPq productivity fellows) and 6 associates. Up to 2017, the PPGETI professors were responsible for the qualification of 105 doctors and 245 masters, having a strong emphasis on the area of Telecommunications Engineering and Computer Engineering. Among the productions counted in 2017, we point out 82 articles published this year in journals listed on Qualis/CAPES. It is worth mentioning that, from the total of published articles in journals, the great majority is focused on levels A1 and A2 in the area Engineering IV. From the perspective of the industrial-academic

partnership, PPGETI has developed several research projects, technological development and innovation (P,D&I) with several industries, among which we highlight: Ericsson do Brasil, Digitro, Siemens do Brasil, Hewlett-Packard (HP), Rockwell, among others. The program also maintains or has maintained partnerships with foreign institutions such as the INT (Institut National des Télécommunications), Conservatoire National des Arts et Métiers (CNAM), Université Paris V, Laboratoire d'Informatique, Signaux et Systèmes de Sophia-Antipolis - CNRS, Université de Nice Sophia Antipolis, EURECOM, École Superieure d'Electricité (SUPELEC) and Institut National de Recherche en Informatique et Automatique (INRIA), Université Joseph Fourier (UJF) and INRIA, all located in France; Virginia Polytechnic University and University of Maryland Baltimore County, in the EUA; and ERICSSON Research Laboratories, in Switzerland. It is important to highlight that PPGETI, by means of P,D&I projects, brought more than 10 million reais to UFC in the last 4 years, with the support of the Informatics Law. With respect to the theme of Data Science and Complex Systems, the program has lines of research in Signal Processing and Images, Systems and Communications Networks and Recognition of Patterns and Dynamic Systems, in which 12 PQ-CNPq fellows work, four of them in level 1.

Postgraduate Program 2	**Capes evaluation (2017 evaluation grade)**
Computer Science	5

Justification

The Master's and the Doctoral Program in Computer Science (MDCC) at UFC were created, respectively, in 1995 and 2005. The program has qualified, since then, 47 doctors, as well as having organized graduate programs in public and private universities in the state. The grade 5, awarded in the previous assessment, was maintained in the 2013-2016 assessment. Among the 28 permanent professors of the program, in the year of 2017, 11 are productivity fellows from CNpq, two of them at level 1 and one of them a productivity scholar in Technological Development. In 2017, 37 articles were published in journals, 26 of them at Qualis A1 and A2 levels. In the last years, MDCC signed scientific cooperation agreements and/or cotutelle doctoral agreements with institutions such as Université de Valenciennes et du Hainaut-Cambrésis, Université de Lyon, Instituto di Scienza e Tecnologie dell'Informazione A. Faedo (Pisa), Purdue University, Université Libre de Bruxelles, among others. Furthermore, the GP participates in CAPES/AMSUD and BRAFITEC projects and has a project financed by the Marie-Curie Foundation of the European Community. It is worth highlighting the intense and successful history of innovation projects which have resulted in renowned technological advances with international awards and raised funds from global companies, such as LG, HP, Sony Ericsson, Lenovo and Hitachi, as well as projects in national scope with RNP, ANP Petrobrás and the State Government of Ceará (whether in public policies aided by data science and machine learning, whether it is in the establishment of the intercontinental/marine networks of optical fibers and data transmission). The GP has continuously received post-doctoral students, many of them alumni of the master's program at UFC and accomplished their doctoral studies at institutions abroad, and who aid in the undergraduate and graduate teaching activities. MDCC has the following lines of research:

Computer Science, Information Systems and Computer Science Theory, with the following distribution of themes: in Computer Science, lines of research in High-Performance Computing and Computer Graphics; in Information Systems, lines of research in Database, Software Engineering and Computer Networks; in Theory of Computation, lines of research in Algorithms and Optimization and Logic and Artificial Intelligence. The team of researchers at MDCC involved in the proposal is representative of these subareas and, therefore, extremely qualified for the purposes of the thematic projects.

Postgraduate Program 3	**Capes evaluation (2017 evaluation grade)**
Physics	7
Justification	

The Graduate Program in Physics was one of the pioneers in the creation of doctoral programs at UFC and, in 1993, the first doctoral thesis was defended and approved at the Program in Physics in the state of Ceará. The program's leadership has been reaffirmed in the following years and, in 2001, the program has reached the status of international excellence and has remained in a consolidated way until 2016, when it has been awarded with grade 7 in the quadrennial assessment. Among the several research activities accomplished by the program, it is worth mentioning the group on Physics of complex systems, which has been working on interdisciplinary problems and producing science of the highest level, publishing their articles in journals of high prestige, such as Nature, PNAS, Physical Review Letters, among others. It is also worth highlighting the strong network of international collaborators maintained through the years and which is composed of ETH, Boston University, École Politechnique and NY City College. These are the credentials which justify the participation of the Graduate Program in Physics in the execution of collaboration projects associated with the theme of complex systems.

Postgraduate Program 4	**Capes evaluation (2017 evaluation grade)**
Agricultural Engineering	5
Justification	

The Graduate Program in Agricultural Engineering of the Federal University of Ceará has concentration areas in Irrigation and Drainage, Management and Conservation of Hydrological Basins in the semi-arid and Agricultural Systems Engineering. The program is offered by the Federal University of Ceará at master's and doctoral level. It is a consolidated program with national excellence. In the last years, the program has been through a large-scale renewal of the teaching staff, some of them being alumnis of universities in Brazil (ESALQ, UNICAMP and UNESP) and from abroad (Tennessee, California and Arizona). One of the program's lines of research which deserves highlight is the development of technologies and machines for agriculture, especially from the semi-arid. The Center of Agricultural Sciences is the academic unit which produces most patents at the university, and one of the patents of the Agricultural Engineering program was licensed. It is in this context that the program participates in a collaboration project involving information and communication technologies.

Theme 2	
Geometry and Non-Linear Methods	
Postgraduate Program 1	**Capes evaluation (2017 evaluation grade)**
Computer Science	5

Justification

The Master's and Doctoral Program in Computer Science (MDCC) at UFC were created, respectively, in 1995 and 2005. The program has qualified, since then, 47 doctors, as well as having organized graduate programs in public and private universities from the state. The grade 5, awarded in the previous assessment, was maintained at the 2013-2016 assessment. Among the program's 28 permanent professors, in the year of 2017, 11 are CNPq productivity fellows, two of them at level 1 and one of them a productivity fellow in Technological Development. in 2017, 37 articles were published in journals, 26 of them at Qualis A1 and A2 levels. In the last years, MDCC has signed scientific cooperation agreements and/or cotutelle doctoral programs with institutions such as Université de Valenciennes et du Hainaut- Cambrésis, Université de Lyon, Instituto di Scienza e Tecnologie dell'Informazione A. Faedo (Pisa), Purdue University, Université Libre de Bruxelles, among others. Furthemore, the GP participates in CAPES/AMSUD and BRAFITEC projects and has a project financed by the Marie-Curie Foundation of the European Union. It is worth highlighting the intense and well-succeeded history of innovation projects which has resulted in renowned technological advances with international awards and it has raised funds from global companies, such as LG, HP, Sony Ericsson, Lenovo and Hitachi, as well as projects in national scope such as RNP, ANP Petrobrás and the State Government of Ceará (whether in public policies assisted by data science and machine learning, whether in the establishment of the international/maritime network of optic fibers and data transmission). The GP has continuously received post-doctoral students, many of them alumnis of the master's program who have concluded a doctoral program at institutions outside Brazil and who work at the undergraduate and graduate teaching activities. The MDCC has the following lines of research: Computer Science, Information Systems and Theory of Computation, with the following themes distribution: in Computer Science, lines of research in High-Performance Computing and Computer Graphics; in Information Systems, lines of research in Database, Software Engineering and Computers Networks; in Theory of Computation, lines of research in Algorithms and Optimization and Logic and Artificial Intelligence. The MDCC's researchers' team involved in the proposal is representative of these subareas and, therefore, extremely qualified for the purposes of the theme projects.

Postgraduate Program 2	**Capes evaluation (2017 evaluation grade)**
Economics	5

Justification

CAEN (Graduate Program in Economics at UFC) is a nationally consolidated and renowned program for the quality of its teaching and research developed in the field of Economics. The

program has formally started its academic activities in 1972, as one of the first masters in Economics in the Northeast region of Brazil, having its doctoral program started in 2000. The program's internationalization is in process of consolidation as it can be inferred from the evolution of its international publishing. Indeed, CAEN/UFC has published more than 7 articles in international journals during the triennium 2010-2012, a cypher that increased to 27 articles in the 2013-2016 quadriennium, surpassing 0,5 articles per capita to approximately 2 international articles per capita. On its turn, focusing only on qualified international production, in other words, at levels A1, A2 and B1, CAEN/UFC obtains the 19th rank among the 44 programs assessed. In the quadriennium 2013-2016, CAEN began to occupy the 20th rank among the 44 programs assessed in terms of total score. The teaching staff of 21 professors has 9 CNPq researchers, one of them at level 1. Concerning the research theme, it is worth highlighting that CAEN has a line of research in Industrial Organization and Regulation, which comprises several projects of Research in Finance, including quantitative methods for the study of actions and financial options. Furthermore, it hosts a Professional Master's in Finance and Securities responsible for the qualification of professional staffs who work at the financial market. Participating researchers of the project work with mathematical methods of assets pricing, combining econometric studies and applications to the portfolios performance via analysis of differential and stochastic equations.

Postgraduate Program 3	**Capes evaluation (2017 evaluation grade)**
Teleinformatics Engineering	6

Justification

The Graduate Program in Teleinformatics Engineering (PPGETI), created in March 2005, is today a consolidated program, with grade 6 according to the last quadrennial assessment. The teaching staff is composed by 24 permanent professors (17 of them are CNPq productivity fellows) and 6 associates. Up to 2017, the PPGETI professors were responsible for the qualification of 105 doctors and 245 masters, having a strong emphasis on the area of Telecommunications Engineering and Computer Engineering. Among the productions counted in 2017, we point out 82 articles published this year in journals listed at Qualis/CAPES. It is worth mentioning that, from the total of published articles in journals, the great majority is focused on levels A1 and A2 in the area Engineerings IV. From the perspective of the industrial-academic partnership, the PPGETI has developed several research projects, technological development and innovation (P,D&I) with several industries, among which we highlight: Ericsson do Brasil, Digitro, Siemens do Brasil, Hewlett-Packard (HP), Rockwell, among others. The program also maintains or has maintained partnerships with foreign institutions such as the INT (Institut National des Télécommunications), Conservatoire National des Arts et Métiers (CNAM), Université Paris V, Laboratoire d'Informatique, Signaux et Systèmes de Sophia-Antipolis - CNRS, Université de Nice Sophia Antipolis, EURECOM, École Superieure d'Electricité (SUPELEC) and Institut National de Recherche en Informatique et Automatique (INRIA), Université Joseph Fourier (UJF) and INRIA, all located in France; Virginia Polytechnic University and University of Maryland Baltimore County, in the EUA; and ERICSSON Research Laboratories, in Switzerland. It is important to highlight

that PPGETI, by means of P, D&I projects, brought more than 10 million reais to UFC in the last 4 years, with the support of the Informatics Law. With respect to the theme of Data Science and Complex Systems, the program has lines of research in Signal Processing and Images, Systems and Communications Networks and Patterns Recognition and Dynamic Systems, in which 12 PQ-CNPq fellows work, four of them in level 1.

Postgraduate Program 4	**Capes evaluation (2017 evaluation grade)**
Mathematics	7

Justification

The Graduate Program in Mathematics (PGMAT) at UFC is one of the pioneer programs of research and graduate teaching at the several fields of Pure and Applied Mathematics in the country. The program's current format, created in 1965, was initially designed in 1995 with the creation of the Doctoral Program in Mathematics. In the most recent CAPES quadrennial assessment, the program was promoted to grade 7, being the only one at this level outside the Southwest region and the Federal District. Besides institutional projects such as PRONEXs, COFECUB, Newton Fund, we highlight the intense exchange of researchers from the program with collaborators in several universities abroad, for instance, Universidad de Granada, Universitat Jaume I (Castelló), Universitat de València, Technical University of Denmark, University of Potsdam, Université Paris VII, Stanford University, Université de Tours, Rutgers University, University of Iowa, UNAM-México, Università degli Studi di Milano, Columbia University, Utrecht University, École Polytechnique, Heidelberg University, Penn State University, Purdue University, among others. The PGMAT has a prominent role at the graduate studies organization and research, supporting institutions such as UFPI, UFCG and UFPB, and in the qualification of doctors, 7 of them are currently PQ fellows. The teaching staff has 20 productivity fellows in a total amount of 24 professors, 7 of them at level 1 and 1 senior. When it comes to the awards, participations in international committees and conferences occurred in the last ten years, we emphasize the following awards: affiliated member of the Brazilian Academy of Sciences; winner of the Call Notice from Instituto Serrapilheira and Grant from the Newton Fund – Royal Society (London); professor indicated as a coordinator the area Mathematics/Probability and Statistics at CAPES. Among the lines of research, we highlight Geometric Analysis, Analysis of PDEs, Singularities, Dynamics and Combinatorics, areas which appear as combined in the project's theme, given the manifold character of the analysis of diffusion processes in singular or stratified spaces and its applications in signal processing and Finance. Some of the topics here have been developed in joint projects with Teleinformatics Engineering, always financed, the last one involving collaborations with French universities.

Theme 3

New Chemical, Biological Products and their Applications

Postgraduate Program 1	**Capes evaluation (2017 evaluation grade)**
Dentistry	5

Justification
The Graduate Program in Dentistry at UFC has progressed in terms of quality in the last years and it has been awarded with grade 5 in the last CAPES assessment. It is worth highlighting the fact that this is the only program in the area of Dentistry in the Northeast and North regions in Brazil to have this grade. Considering that the area of Dentistry is the largest area in the great area of Health Sciences, congregating more than 100 GPs, only a minority of being outside the Southwest region, this rank of PPGO can be clearly considered an outstanding position in the national scenario. The group has acquired great prominence in science and technological innovation for the production in the area of dental materials, tissue engineering and biofilms. Furthermore, it has maintained collaborations with foreign universities of great academic prestige. In the national scenario, the quality of the program is notorious in the qualification of human resources. It is worth mentioning a doctoral thesis which received an award by CAPES. It is in this context that, in collaboration with the Pharmaceutical Sciences and Physics, that the GP in Dentistry participates in this theme in collaborative projects with Purdue University and Oregon Health & Science University.

Postgraduate Program 2	Capes evaluation (2017 evaluation grade)
Biochemistry	5
Justification	
The Graduate Program in Biochemistry (Master's and Doctoral Programs) of the Federal University of Ceará (UFC) is one of the pioneers in graduate studies at UFC. The Graduate Program in Biochemistry at UFC concentrates its researchers in the plant area, maintaining great coherence with the main lines of research which comprise plant biochemistry (purification of biomolecules, followed by its characterization, study of its endogenous functions and possible biotechnology applications in agriculture and health), plant physiology (study of plant metabolism with focus on the physiological relations and the environmental adversities in the Brazilian Northeast as drought, salinity and bugs, nematodes, fungi and viruses attacks, utilizing as predominant models of cultures of agricultural importance to the region like beans and cashew) and molecular biology (studies of heterologous expression of proteins, phylogenetic and structural studies) and in all of these, the Genomics and Proteomics tools are applied. The main focus of the research with biomolecules is constituted in proteins and carbohydrates (polysaccharides) and it is in this context that a part of the program's researchers participates in the theme of the projects which comprise the development of new biological products and applications.	

Postgraduate Program 3	Capes evaluation (2017 evaluation grade)
Medical Microbiology	5
Justification	
The Graduate Program in Medical Microbiology at UFC has 1 concentration area (Human and Animal medical Microbiology) with 5 lines of research (Molecular and Microorganisms Genetics, Resistance to antimicrobials and Biotechnology and Innovation), which present clear	

interdisciplinarity. The program was awarded with grade 5 in the last assessment, but the qualitative and quantitative indicators clearly point out that the program has a great potential of being promoted to 6 in the next assessment. The program maintains partnerships in international projects in the areas of Emerging and Re-emerging Pathogens, with international institutions of excellence in the field of Medical Microbiology, such as Friedrich Loeffler Institut für Medizinische Mikrobiologie; Institute for Clinical Immunology at the University of Erlangen-Nuremberg; CDC - Mycotic Disease Branch; CDC - Division of Foodborne, Waterborne, and Environmental Diseases; CDC - National Center for Emerging and Zoonotic Infectious Diseases, among others. A group from the program works in the area of biofilms and it is in this context that it integrated the group of graduate programs which will contribute to the projects on this topic.

Postgraduate Program 4	**Capes evaluation (2017 evaluation grade)**
Physics	7
Justification	

The Graduate Program in Physics was one of the pioneers in the creation of doctoral programs at UFC and, in 1993, the first doctoral thesis was defended and approved at the Program in Physics in the state of Ceará. The program's leadership has been reaffirmed in the following years and, in 2001, the program has reached the status of international excellence and has remained in a consolidated way until 2016, when it has been promoted to grade 7 in the quadrennial assessment. Among the several research activities accomplished by the program, it is worth mentioning the recently established research group entitled Solid-Biological Interface Group-SoIBIN, which accomplishes scientific and technological research based on the physicochemical paradigm, applied to the understanding and the exploitation of the properties of solid surfaces in the context of Biology. The group has been working in an interdisciplinary way and one of the lines of research consists in the study of nanomaterials with applications in Dentistry. It is worth highlighting the scientific production of international standard published in scientific journals of high international prestige. It is in this context that the GP participates in a collaboration project on this theme.

Postgraduate Program 5	**Capes evaluation (2017 evaluation grade)**
Medical Sciences	6
Justification	

The graduate program in medical sciences was created in 2004 and in little time it has reached the grade for international excellence. The research projects developed by the members of the programs' permanent teaching staff are focused on the main issues of Medical Sciences and the lines of research address studies on Infectious and Parasitic Diseases, Teaching in Health, Clinic Pharmacology, Chronic-Degenerative Diseases, Pathogenesis of Immune Inflammatory Diseases. The researchers have maintained a well-succeeded history of collaborations with renowned institutions in the USA, United Kingdom and Portugal. Part of the teaching staff has worked with research on Translational Medicine and the program's participation in this theme will

occur precisely in the pre-clinic studies of the anti-tumoral compounds, which will be developed in partnership with an Australian university.

Postgraduate Program 6	Capes evaluation (2017 evaluation grade)
Pharmacology	6
Justification	

The Graduate Program in Pharmacology of the College of Medicine at the Federal University of Ceará (UFC) was created in 1978, initially the master's program and, in 1991, the doctoral program was created. Nowadays, the program is consolidated, with a grade 6 awarded since the year of 2008. In this creation, the research activities were destined, almost exclusively, for the search of natural products with a potential therapeutic action. The high level of international insertion has always been a highlight of the program, which has maintained a collaboration with great universities worldwide throughout the years and it has also reached important discoveries. The national leadership of a group of researchers can be assessed by the great number of CNPq researchers and their success in obtaining great funding projects in the national and international spheres. An example of this work is the recent establishment of the Center of Research and Drug Development (NPDM), which gathers teams of several departments from the university around the research in Translational Medicine. The Center has been excelling in the coordination of great projects, such as national networks and programs of excellence in the area of drugs related to the treatment of cancer. It is in this context that the program in Pharmacology participates in the projects of development of new compounds and their applications.

Postgraduate Program 7	Capes evaluation (2017 evaluation grade)
Chemistry	6
Justification	

The Graduate Program in Chemistry has obtained international quality by CAPES in the last assessment, when the program has been awarded with grade 6. It is a program with research in the traditional areas of Chemistry, involving Organic, Inorganic, Analytical Chemistry and Physical Chemistry. One line of research has as focus the synthesis of new chemical compounds and its applications in the fields of biology, environment and technology, namely: Coordination Compounds, Catalysis, Analytical methods, Biopolymers, Bioactive Materials, Inhibition of Corrosion and Sensors. The researchers have expertise and a history of national and international collaborations (Australia, Canada, England, France, Germany, Italy, Mexico and Scotland) in the study of chemical properties of selected compounds and their applications in several areas, such as metallodrugs, biosensors, catalysers, inhibitors, detections in analyses of traits, green chemistry and liberation of drugs. Another very strong line in the program is the research in natural products. The GP in Chemistry has the expertise and experimental facilities for the complete characterization of natural products, such as the Center of Nuclear Resonance and other advanced techniques. Part of the researchers at the GP works on the development of new

compounds, which will be evaluated in several fields and it is in this context that the program integrates the group of programs which will contribute to the collaboration projects on this theme.

Theme 4	
Social Technologies	
Postgraduate Program 1	**Capes evaluation (2017 evaluation grade)**
Pharmaceutical Sciences	4
Justification	
The Graduate Program in Pharmaceutical Sciences has a research line in the area of Clinical Pharmacy and Sanitary Surveillance with direct action in the health promotion. The research along these lines include the Clinical Pharmacy and Sanitary Surveillance. They comprise clinical, toxicological, epidemiological and pharmacoeconomic studies aimed at for research on diseases / health problems, focusing on their treatments, aiming at the promoting the safe, effective and economical use of medicines and related drugs in society. The research activities include the aspects of Clinical Pharmacology, Toxicology, Pharmacoepidemiology, Pharmacovigilance, Pharmacoeconomics, Pharmaceutical Care and Health Surveillance medications and correlates. It is in this context of expertise and complementarity with work developed by the Nursing program that the Pharmaceutical Sciences are willing to contribute to the development of collaborative social policies.	

Postgraduate Program 2	**Capes evaluation (2017 evaluation grade)**
Tropical Marine Sciences	5
Justification	
At CAPES's assessment of the quadriennium 2013-2016, the Program in Tropical Marine Sciences (PPGMT) has became the second-best program in the area of Environmental Sciences in the total amount of publications and in publications at level Quais A. As a recognition of its progress, the program had its grade increased to 5. The program's scientific production is based on the tradition of more than 50 years of research and innovation activities. The quality of the work accomplished is evidentiated by more than 11 thousand citations (base Scopus) received by the program's professors between 1996 and 2016, which confers a h-48 factor to the program. As a result of the program's scientific production, there are several research projects with funds raised in public and private agencies, with special emphasis to an INCT project renewed at Call Notice 2015, two PRONEM projects and two PRONEX renewed at the quadriennium, as well as the multi-user center of FINEP. It is with this profile of research and expertises that the program integrates the theme Social Technologies.	

Postgraduate Program 3	Capes evaluation (2017 evaluation grade)
Sociology	5

Justification

The Graduate Program in Sociology at UFC is a pioneer of the univeristy's graduate studies and it maintains exchange with national and international centers of excellence, in the area of social sciences, by means of agreements, research and research accomplished by means of the professors and students' exchange. For several assessments, it has maintained the level of national excellence, being awarded with grade 5. The research is conducted in several areas, with special emphasis on violence studies. The group's excellence is evidentiated by the fact that it hosts the coordination of the INCT on Violence Studies. In the national scope, the program directly contributes to several government agencies in projects in the area of justice, social inclusion and, more recently, coordinating the professional master's ProfSocio. In the institutional scope, the program is responsible for the Board of Advanced Studies, an agency which articulates collaborative and interdisciplinary studies. The program's researchers have contributed to the urban planning structuring programs in the city of Fortaleza, for instance, the plan Fortaleza40. Part of the researchers maintains collaborations with American and French universities and, with these competences in the cities studies and the rural and urban conflicts, the GP in Sociology integrates the team of programs which will directly work with the theme social technologies.

Postgraduate Program 4	Capes evaluation (2017 evaluation grade)
Law	4

Justification

The Graduate Program of the College of Law at UFC has started its activities with an Academic Master's program in Law, created in 1977, working in the qualification of 485 for forty years. In 2010, CAPES approved the establishment of its Doctoral Program in Law, which had its first thesis defense in November 2013, thus enabling the program's consolidation. It is essential to the academic qualification of professionals from the legal area in the Northeast region. It is worth mentioning that the doctoral program is the only one offered, in the state of Ceará, in the area of Law, by a Higher Education Public Institution. The Graduate Program in Law at UFC has agreements with several academic institutions, for instance, Universidade de Coimbra, Universidade de Lisboa, Università di Bologna, Université Sorbonne Paris Cité (Paris V), Université de La Rochelle, Universidade de Vigo, Università di Roma, Universidad de Servilla and Université Paris Saclay. As a result of these agreements, students can accomplish academic mobility, having two students from our program attending courses at the Master's Program of Universidade de Coimbra and Universidade de Lisboa in 2017. On its turn, there is a considerable number of students originated from universities in other countries, especially Portugal, Colombia and El Salvador, attending courses at PPGS/UFC by means of academic mobility. Among the research projects in progress at the GP in Law, we highlight, in the scope of the theme proposal, a project about the function of Law in environmental protection and a second one about the sustainable management of the living and non-living marine resources.

Postgraduate Program 5	Capes evaluation (2017 evaluation grade)
Nursing	6

Justification

The graduate program in Nursing has been recently awarded with grade 6, in clear recognition to its academic excellence. The program concentrates its research on health promotion in individuals, groups and communities, investigating policies, practices, institutional and governmental processes and resources, analyzing the population's life conditions in the health-disease process, the knowledge, attitudes, strategies and care behaviors. The program has been evolving and evidencing potential of internationalization, which is expressed in several aspects of the academic process, with significant production in national and international journals. The researchers develop studies, so as to expand and generate knowledge for the technical-scientific, political-social, epistemological and methodological development of the work in Nursing. The research is compromised by a transforming social practice and directed to the improvement of life quality, in the scope of individual and collective care, considering the complexity of the inequalities and of the regional necessities. It is with this profile and expertises that the GP in Nursing integrates the group of graduate programs which will contribute to the theme social technologies. The main strategy is the use of technologies to offer and improve health among individuals in different ages who need care and attention in health. Health Promotion is the process of capacitating people to increase the control and improve their health, the main strategies include the construction of public health policies, creating favourable environments to health, strengthening community actions for health, development of personal abilities and reorientation of health services. Scientific research has been fundamental to the improvement of human health. Technologies in health have been investigated by the project's members with focus in the health of less privileged groups, such as children with problems in the sleeping behavior, which present increased risk for obesity, depression and anxiety; risk behavior; people with disabilities, cancer, HIV/AIDS, diabetes, hypertension, cardiovascular diseases; people's adhesion to drugs.

Postgraduate Program 6	Capes evaluation (2017 evaluation grade)
Geography	6

Justification

The set of institutional initiatives that the Graduate Program in Geography has implemented, towards internationalization, has its origin in the Program's promotion to grade 5 at CAPES's assessment – triennium 2010- 2012 – and in the understanding that this process required an effective macro-regional-international articulation. From 2015 on, and after the program has been awarded with grade 6 in 2017, it has obtained the conditions of hosting a series of events, such as the 33rd Congress of the Conference of Latin-Americanist Geographers (2015), the V Brazilian Congress of Applied Environmental Education (2016), the VI Colloquium of the Center of Studies in Space and Representations (2016) and the Meeting of the Network of Environmental Studies

in Portuguese-Language Countries – REALP (2017). The program has been pointed out to collaborate with the projects in the theme Social Technologies due to the following characteristics: i) A reference program in the applied studies on sustainable locations and communities, having as main criteria the projects of combat to climate change with low costs; ii) The program accomplishes joint research in the construction of integrative methodologies in areas which are not directly associated, such as Environmental Sciences and Nursing; iii) The program adopts in its research quanti-qualitative criteria in the assessment of social technologies in vulnerable biomes areas of extreme relevance to sustainable development, not only in Latin America but also in the regions in which some of the partner institutions are located.

Theme 5	
Materials and Nanoscale Phenomena	
Postgraduate Program 1	**Capes evaluation (2017 evaluation grade)**
Biochemistry	5
Justification	

The Graduate Program in Biochemistry (Master's and Doctoral Programs) at the Federal University of Ceará (UFC) is one of the pioneers in graduate studies at UFC. The Graduate Program in Biochemistry at UFC concentrates its research in the plant area, being coherent with the main lines of research, which comprise plant biochemistry (purification of biomolecules, followed by its characterization, study of its endogenous functions and possible biotechnology applications in agriculture and health), plant physiology (study of plant metabolism with focus on the physiological relations and the environmental adversities of the Brazilian Northeast as drought, salinity and bugs, nematodes, fungi and viruses attacks, utilizing as predominant models of cultures with agricultural importance to the region like beans and cashew) and molecular biology (studies of heterologous expression of proteins, phylogenetic and structural studies) and in all of these, the genomics and proteomics tools are applied. The mains focus of the research with biomolecules is constituted in proteins and carbohydrates (polysaccharides) and the area of lectins has great relevance. The scientific leadership of a researchers' group from the program in this area enabled the coordination of an INCT (National Institute of Science and Tecnology) whose study focus is Nanobiotechnology, working on the study of the interaction between biomolecules with nanomaterials. It is in this context that the Biochemistry program participates in the theme of projects which involve the study of phenomena in nanoscale.

Postgraduate Program 2	**Capes evaluation (2017 evaluation grade)**
Chemical Engineering	6
Justification	

The Graduate Program in Chemical Engineering has been excelling at the university and, in the last quadrennial assessment, CAPES has acknowledged the profitable history of well-succeeded international collaborations developed by the program through the years, being awarded with grade 6. The program has a very qualified teaching staff with a high number of researchers of

international insertion and national leadership. Currently, the coordination of the assessing committee of Chemical Engineering at CNPq and the joint coordination of the professional masters in the area are performed by professors of the program in Chemical Engineering at UFC. One of the program's performance lines of excellence concentrates in the area of CO_2 adsorption and catalysis, and it is also worth highlighting the long-term collaboration with excellence groups from Spain and France. It is in this context that the GP participates in a collaboration project on this theme.

Postgraduate Program 3	**Capes evaluation (2017 evaluation grade)**
Physics	7
Justification	

The Graduate Program in Physics was one of the pioneers in the creation of doctoral programs at UFC and, in 1993, the first doctoral thesis was defended and approved at the Program in Physics in the state of Ceará. The program's leadership has been reaffirmed in the following years and, in 2001, the program has reached the status of international excellence and has remained in a consolidated way until 2016, when it has been promoted to grade 7 in the quadrennial assessment. The theoretical research in condensed matter Physics has always had prominent performance and nowadays it corresponds to 65% of the program's production. Among the several research activities accomplished by the program, it is worth mentioning the group in Physics in extreme conditions, which is composed by 5 researchers who have contributed to the progress in the knowledge of organic, inorganic and organic-inorganic materials. Theoretical tools using calculus of electronic structure and transportation have been intense in the context of INCT (National Institute of Science and Technology) and in NanoBioStructures, which accomplishes research in the frontier between Physics and Biology. Publications in high-impact magazines and invitations to international conferences evidentiate the group's leadership in the area. It is in this context that the GP participates in collaboration projects on this theme.

Postgraduate Program 4	**Capes evaluation (2017 evaluation grade)**
Biotechnology of Natural Resources	4
Justification	

The Graduate Program in Biotechnology of Natural Resources at the Federal University of Ceará (UFC) has been recently created as an outcome of the well-succeeded INCT of Nanobiostructures and Molecular Simulations. The program is structured as a unique concentration area, in Biotechnology and Natural Resources, which aims at the study of purification, characterization and application of land and maritime natural resources (plant, animal origin and microorganisms) aiming at the discovery of new biotechnology products/services usable in the different areas of science (health, agriculture, microbiology, etc.) The researchers have contributed to the detection, isolation, purification and the characterization (chemical, physical, physical chemical and structural) of biologically active molecules found in organisms of the marine and biodiversity in Brazil, as well as in the biotechnological application of biologically active molecules. In this line of

research, it is worth mentioning the works published in the characterization of biological activities of purified biologically active molecules of land and maritime (plant and animal) species found in the Brazilian biodiversity, and the discovery of new molecular markers and the development of hybrid systems by means of the functionalization with nanomaterials. It is in this context that the program integrates the institutional arrangement of scientific collaboration for the consecution of the projects in the theme “Materials and Phenomena in Nanoscale”.

Postgraduate Program 5	**Capes evaluation (2017 evaluation grade)**
Chemistry	6

Justification

The Graduate Program in Chemistry achieved international recognition on the CAPES standard after the last program appraisal, whereupon it attained a score of 6. This program involves research in the traditional fields: organic, inorganic analytical, and physical chemistry. One of its leading areas focuses on the synthesis and characterization of new nanomaterials with applications in the field of Biomedicine. Researchers have solid expertise and a history of domestic and overseas collaborations (US and Ireland) in this field of study. The GP in Chemistry is highly qualified and is in possession of experimental facilities for the complete characterization of nanomaterials (analysis centers and modern spectroscopy and microscopy techniques). Part of the research team works on the synthesis and functionalization of nanoparticles thus enabling the program to integrate the ensemble of programs that will contribute to collaboration projects in the field of materials and phenomena at the nanoscopic scale.

Theme 6

Water and Residue Management & Safety in the face of climate change

Postgraduate Program 1	**Capes evaluation (2017 evaluation grade)**
Chemical Engineering	6

Justification

The Graduate Program in Chemical Engineering has distinguished itself at the University and, after the last program appraisal, CAPES acknowledged its fruitful history of successful international collaborations, developed over the course of several years, which resulted in its achieving a score of 6. The program relies on highly qualified faculty, having a considerable number of researchers with renowned international insertion and national primacy. Currently, the CNPq Chemical Engineering advisory committee’s administration and the joint coordination of the professional master’s programs are carried out by professors of the Chemical Engineering Program at UFC. One of the program’s fields of excellence revolves around water quality. In this context, the GP partakes in a collaboration project in that particular area.

Postgraduate Program 2	Capes evaluation (2017 evaluation grade)
Civil Engineering (Water Resources)	7

Justification

The Graduate Program in Civil Engineering/Water Resources (POSDEHA) commenced its activities with the Master's Program in 1975, and, at the doctoral level, in 2004. Its areas of concentration are: Water Resources, in the fields of Surface and Subsurface Climate and Hydrology, Water Resource Management, Urban Waters, Hydrodynamics and Surface Water Quality; Environmental Sanitation, in the fields of Environmental Technology, Environmental Resource Management, and Resource-Oriented Sanitation; and Geotechnics, in those fields dedicated to optimizing, constructing and maintaining water infrastructures. In 2017, the program comprised 15 tenured professors and 7 research collaborators, of which 32% held CNPq productivity fellowships, of which 5 were level 1. In 2017, active students totalled 94 in the master's program and 97 in the doctoral program. As for scientific publication quality, it is noteworthy that 26% of submitted articles have been published in science magazines with an A1 or A2 Qualis level and 60% in journals with a Qualis level of B2 or higher. The GP has maintained various international cooperation agreements under such programs as BRAGFOST, CAPES/CAFP, BRAFITEC, in addition to collaborations with investigators at the University of Wollongong and the University of South Australia; Universidad de Valladolid; Columbia University (New York), University of New Hampshire, Missouri University of Science and Technology, University of Mississippi; Université de Montpellier and the Écoles Centrales in France (BRAFITEC); as well as solid partnerships in the UK involving Robert Gordon University, St. Andrews University and the Queen's University which have recently been granted exclusively foreign resources within a project in effect during the 2017-2020 quadrennial period. Researchers and doctors stemming from the programs are actively engaged in water resource management, climate change monitoring, and in public policies on environmental sanitation in association with government entities and international organizations. In conclusion, the faculty working on the above-mentioned projects have profiles of excellence in their fields and extensive experience in international cooperation in terms of research and graduate and undergraduate education.

Postgraduate Program 3	Capes evaluation (2017 evaluation grade)
Natural Resource Biotechnology	4

Justification

The Graduate Program in Natural Resource Biotechnology of the Federal University of Ceará (UFC) was recently created as a by-product of the successful INCT Nanobiostructures and Molecular Simulations Project. The graduate program is structured around a single area of concentration, Natural Resource Biotechnology, which aims at studying the purification, characterization and applications of water and land-based natural resources (animal, vegetable and microorganism-derived) in order to discover new biotechnological products and services for different scientific areas (healthcare, agriculture, microbiology, etc). Researchers have contributed to the detection, isolation, purification and characterization (in chemical, physical,

physicochemical and structural terms) of biologically active molecules in organisms that can be found in Brazilian marine and terrestrial biodiversity, as well as to the biotechnological application of biologically active molecules. A number of the researchers have worked in the fields of Environmental Microbiology and Molecular Microbial Ecology developing biotechnologies for the remediation of contaminated waters and soils. The program is thus able to integrate the institutional arrangements for scientific collaboration for the accomplishment of projects in water resource management.

Postgraduate Program 4	**Capes evaluation (2017 evaluation grade)**
Tropical Marine Sciences	5
Justification	

After the CAPES appraisal of the 2013-2016 quadrennial period, the Tropical Marine Sciences Program (PPGCMT) became the second best program in the field of Environmental Sciences in terms of total number of publications and level-A publications on the Qualis standard. In recognition of this, its CAPES score was elevated to 5. The scientific productions of the Program are underpinned by more than 50 years of research and innovation. The acknowledgment of the quality of the work done is conveyed in the more than 11.000 citations (on the Scopus database) attributed to program researchers between 1996 and 2016, which grants the program an h-index of 48. As a result of the program's scientific production, there currently exist several publicly and privately funded research projects, with an emphasis on an INCT project renewed by the 2015 public notice, two PRONEM projects and two PRONEX projects that were renewed in the quadrennial period, in addition to the FINEP multi-user center. Because of this profile of research and expertise, the program is able to integrate Water Resources in the field of Sustainability.

Postgraduate Program 5	**Capes evaluation (2017 evaluation grade)**
Sociology	5
Justification	

The UFC Graduate Program in Sociology is a graduate education pioneer at UFC and keeps sound relations with national and overseas centers of excellence in the field of social sciences, by means of agreements, research and exchange research supported by professors and students. The level of excellence has been steadily maintained over several program appraisals, obtaining a score of 5. Researchers execute their activities in different areas, with special focus on violence and urban studies. The group's excellence is conveyed by its hosting the coordination of the INCT Violence Studies Project. From a national perspective, the program directly contributes, along with various government agencies, to projects in the areas of justice, social inclusion and, more recently, by coordinating the ProfSocio professional master's program. Institutionally, the program is in charge of the School for Advanced Studies, an agency that articulates collaborative and interdisciplinary studies with an emphasis on strategic issues in the State of Ceará, such as water management and safety. A group of researchers has collaborated with the water resources program, especially in regard to the debate on water resource

management in its sociological and anthropological dimensions. A number of the researchers have maintained collaborations with French universities in this area, and as a result of such competencies the GP integrates the collection of programs that will contribute toward strengthening the international insertion of research on water safety.

Postgraduate Program 6	**Capes evaluation (2017 evaluation grade)**
Agricultural Engineering	5
Justification	
The UFC Graduate Program in Agricultural Engineering has areas of concentration in Irrigation and Drainage, Water Basin Conservation and Management in the Semi-arid Region, and Agricultural Systems Engineering. It offers nationally renowned, consolidated master's and doctoral programs. In recent years, the program has undergone a substantial overhaul of its faculty, hiring alumni of Brazilian (ESALQ, UNICAMP and UNESP) and foreign universities (Tennessee, California and Arizona). This process of faculty renewal and training has facilitated the emergence of new fields of research associated with agriculture in the Northeastern semi-arid region. Some of the researchers work in collaborative networks on this field in conjunction with US and Spanish institutions. The group formed by the researchers directly involved in the coordination of an INCT (National Institute of Science and Technology) project on the Semi-arid Region is a direct participant in collaboration projects on Water Resource Management and Safety.	

Postgraduate Program 7	**Capes evaluation (2017 evaluation grade)**
Chemistry	6
Justification	
The Graduate Program in Chemistry has attained international recognition on the CAPES standard after the last program appraisal, whereupon it achieved a score of 6. This program chiefly involves the traditional fields such as organic, inorganic, analytical and physical chemistry. Research focuses on the synthesis of new chemical compounds and their applications in biology, the environment and technology, namely: Coordination Compounds, Catalysis, Analytical Methods, Biopolymers, Bioactive Materials, Corrosion Inhibitors and Sensors. A number of the researchers in the GP work on environment-oriented areas utilizing materials technologies for adsorption and sensors as well as the development of analytical methodologies for water and soil monitoring. The program integrates the set of research groups that will contribute toward collaborative projects in Water Resources.	

Postgraduate Program 8	**Capes evaluation (2017 evaluation grade)**
Materials Science and Engineering	5
Justification	
In the 2013-2016 quadrennial appraisal carried out by CAPES, the Graduate Program in Materials Science and Engineering (PPGECM-UFC) was granted the seal of national excellence with a	

score of 5. The current challenge consists in consolidating the program as one of the finest graduate programs in Brazil in the field of Materials Science and to continuously foster the interaction with foreign institutions aiming at international excellence. Emphasis is given to the intense collaboration activities with international organizations and steel producers. The program has had success in signing cooperation agreements and building an advanced laboratory infrastructure for the characterization of materials. In the context of materials engineering, the program is part of a collaborative project with the UK for the development of sensors with the goal of monitoring water resource quality.

Postgraduate Program 9	**Capes evaluation (2017 evaluation grade)**
Ecology and Natural Resources	4

Justification

The Graduate Program in Ecology and Natural Resources develops research in the field of ecology and sustainable natural resource management, with particular focus on the Caatinga biome. The program has operated so as to balance the production of scientific knowledge at the regional and national levels, and, at the same time, based on current ecological trends, it has also participated in international debates on environmental issues and worked in partnership with UK and French universities. In such a scenario, the program has solid competencies in the field of soil conservation and is part of the group that will carry out research in the field of water supply safety. The consortium with Agricultural Engineering and Water resources (Grade 7) will help to improve the internationalization activities of the Ecology and Natural Resources program.

Theme 7

Infectious, Immuno-Inflammatory and Degenerative Diseases

Postgraduate Program 1	**Capes evaluation (2017 evaluation grade)**
Morphofunctional Sciences	4

Justification

The Graduate Program in Morphofunctional Sciences (PCMF) – master's and doctoral programs – was approved by CAPES in December 2013. Its history includes a perceived benchmark with the development of the Institute for Biomedicine in the Brazilian Semi-arid Region (INCT/IBISAB), which comprises a significant number of the researchers participating in this proposal, and that has created a proper environment for the development of research on Morphology. This graduate program seeks to follow a scientific and technological approach, with the direct translation of bench research in the field of Morphofunctional Sciences into societal transformation, taking into account regional features and the demand for new products that will benefit the population of the Brazilian Northeast, with an emphasis on the Semi-arid region. The PCMF relies on an experienced team of 18 tenured professors, CNPq productivity research fellows, with approximately one thousand published articles and around 200 successful program completions. In 2017, scientific production became one of the program's powerhouses. Of the 75 articles published in 2017, 90,6% were published in international periodicals and 42,5% were levels A1

and B1. With the recent acquisition of funds from the Institute for Biomedicine in the Brazilian Semi-arid Region (INCT/ISIBAB) and the FINEP Multi-user Project, the PCMF was able to procure and acquire state-of-the-art imaging laboratory equipment. The national collaboration network (UFRJ, USP Ribeirão Preto, USP-São Paulo, UNICAMP) was expanded from the humble beginnings of the program toward enlisting the experience of important international partners (University of Virginia, University of Costa Rica, University of Liverpool, Universidade de Coimbra, Harvard University, among others).

Postgraduate Program 2	**Capes evaluation (2017 evaluation grade)**
Medical Sciences	6
Justification	

The Graduate Program in Medical Sciences was created in 2004, and achieved international excellence in a short amount of time. The research projects undertaken by tenured faculty members concentrate on the main issues of Medical Sciences and the fields of research involve studies on Infectious and Parasitic Diseases, Health Education, Clinical Pharmacology, Chronic Degenerative Diseases, and Pathogenesis of Immuno-Inflammatory Diseases. Investigators have been able to secure a history of successful collaboration with US, UK and Portuguese universities. Some of the faculty have studied behavioral disorders with an emphasis on clinical neurosciences (Neuroimaging, Cognitive Neurosciences and Genetics). Another noteworthy feature is its long and fruitful collaboration with the University of Virginia's Center for Global Health, which has contributed toward the publication of articles on malnutrition/diarrheic effects on brain/cognitive development in children, and animal models. As a result of the above-mentioned experience and qualifications, the program partakes in collaborative projects on infectious and immuno-inflammatory diseases, thus consolidating existing partnerships and nurturing the creation of new collaborations with the University of Gothenburg (Sweden) and the University of Washington (USA).

Postgraduate Program 3	**Capes evaluation (2017 evaluation grade)**
Pharmacology	6
Justification	

The Graduate Program in Pharmacology of the School of Medicine of the Federal University of Ceará (UFC) was created in 1978, initially with the master's program and later, in 1991, the doctorate was created. Nowadays, the program is fully consolidated, with its 2008 attainment of a score of 6. Upon its inception, research activities were almost invariably oriented toward the development of natural products with potentially therapeutic properties. The high level of international insertion has always been a distinctive feature of the program, which over the course of many years has maintained collaborations with prominent universities and made important discoveries. The national primacy of a group of researchers can be perceived by contemplating the large number of CNPq researchers and their success in acquiring research grants at the national and international levels. One such instance is the coordination of the INCT project in

Biomedicine whose work in the area can be singled out for its contribution to the qualified productions stemming from UFC publications in prominent international magazines. In this context, the Pharmacology program participates in projects in the field of infectious and immuno-inflammatory diseases.

Postgraduate Program 4	Capes evaluation (2017 evaluation grade)
Medical-Surgical Sciences	5

Justification

The Graduate Program in Medical-Surgical Sciences of the Department of Surgery of the Federal University of Ceará (UFC) is nationally renowned (with a score of 5). Research is carried out in the fields of metabolism, cellular physiology and biology on stress, and molecular behaviour in neoplasms. The program has maintained international partnerships with Maastricht University in the Netherlands, the University of St. Louis/USA, and Seton Hall University in Belgium. Innovation-wise, it has been very prolific, acquiring several patents and working on processes with potential healthcare applications in cases of breast cancer and burns. The program is part of the PrInt proposal as one of the core units of a collaboration project. Researchers who are already internationally active are expected to consolidate and expand their work. These activities will be particularly more intensive in the field of Neuroscience, in which the program maintains a traditional collaboration agreement with Seton Hall University in Belgium.

Activities Linked to the Themes

Theme 1

Data Science and Complex Systems

Goal 1

To train qualified doctors for work in the field of Complex Systems and Data Science

Activity 1	Start date	End date
Accomplishment of Split-Site Doctoral Studies	08/2018	06/2022

Description

This action will involve research aiming at the development of new techniques for the characterization of the dynamic and structural properties of complex systems, the investigation of social patterns in urban centers, as well as political/social behaviour, by utilizing the principles of Statistical Physics. In the field of Data Science, students will be trained by studying the optimization of procedures and resources in agrobusiness, including the optimization of communication networks, water consumption, and energy, transport and supply chains, by using optimization methods based on the analysis of large datasets (complex networks, machine learning, among others). Students will do their research at ETH Zurich; Boston University, City College of New York, École Polytechnique, Grenoble INP, TU Munich, TU Ilmenau, KTH Royal Institute of Technology, Université Paris Sud and Nice-Sophia-Antipolis

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of students that have completed split-site studies	1	4	9

Goal 2

To consolidate and promote the international insertion of researchers associated with our graduate programs

Activity 1	Start date	End date
International placement of UFC researchers as visiting professors	08/2018	12/2021

Description

UFC researchers in the fields of Computer Science and Physics will act as visiting research fellows at ETH Zurich; Boston University, City College of New York, AT&T Labs; École Polytechnique, Grenoble INP. As for the researchers in the Teleinformatics and Computer Engineering programs, they are to engage in long-term placements at TU Munich, TU Ilmenau, TU Darmastadt and the University of Armed Forces, in Germany; KTH Royal Institute of Technology, in Sweden; and Université Paris Sud and Université Nice-Sophia-Antipolis, in France.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of Brazilian visiting professors abroad	0	5	9

Goal 3

To sustain and intensify partnerships with international groups of excellence in Data Science and Complex Systems

Activity 1	Start date	End date

Accomplishment of bilateral missions	08/2018	06/2022

Description

Bilateral missions will seek the integration of the research groups in the GP's in Teleinformatics Engineering, Computer Science and Agricultural Engineering, involving the application of complex systems, data science and signal processing to strategic economic areas with the partner groups stationed at ETH Zurich; Boston University, City College of New York, AT&T Labs; École Polytechnique, Grenoble INP, TU Munich, TU Ilmenau, TU Darmastadt and the University of Armed Forces, in Germany; KTH Royal Institute of Technology, Sweden; and Université Paris Sud and Université Nice-Sophia-Antipolis, in France. Such work is underpinned by a history of funding by such agencies as COFECUB, PROBRAL and PRONEX, foreign counterparts (ESA projects) and multinational companies such as Ericsson.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of bilateral missions	0	9	18

Activity 2	Start date	End date
Attraction of young talent toward academic innovation	08/2018	12/2020

Description

Attracting young and talented researchers is of paramount importance for creating environments of innovation within institutions, in regard to both research and graduate/undergraduate education activities. This is an institutional strategy relying on the attraction of young students with promising academic histories (in terms of international mobility, innovative and impactful publications, and propensity for teamwork) so that they can develop work in the graduate programs in Physics, Computer Science and Teleinformatics, promoting an overhaul of the related research fields and the international exposure of students and post-doctoral researchers.

Activity 2 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of 'Young Talent' researchers	0	1	3

Theme 2

Geometry and Nonlinear Methods

Goal 1

To train qualified doctors for work in the fields of Geometry and Nonlinear Methods

Activity 1	Start date	End date
Accomplishment of Split-Site Doctoral Studies	01/2019	06/2021

Description

This action will comprise research activities involving applications of Differential Geometry, Partial Differential Equation Dynamics and Analysis, and Geometric Analysis, especially in singular or stratified spaces, to research topics in such fields as Complex Systems, while studying the relationship between stochastic processes and phase transitions, for instance, and Information Geometry, where the geometric nature of statistical manifolds is explored in conjunction with applications in Signal Processing, especially in regard to large datasets on financial assets. Students are to carry out their work at Purdue University, Penn State University and Université de Strasbourg.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of students that have completed split-site studies	0	2	3

Goal 2

To sustain and intensify partnerships with international groups of excellence in the field of Geometry and Nonlinear Methods

Activity 1	Start date	End date
Accomplishment of bilateral missions	12/2018	12/2021

Description

Bilateral missions will attempt to integrate research groups in the GP's in Mathematics, Teleinformatics Engineering, Computer Science and Economics with respect to geometric and analytical nonlinear methods in order to study nonlinear elliptic operators in geometric contexts, and non-Gaussian diffusion process generators. Ultimately, the fine properties of these operators are only accessible by means of combined techniques of Microlocal Analysis, Singularity Theory and free boundary problems, topics on which the researchers at Purdue, Penn State, Université de Strasbourg and Université de Montpellier are internationally renowned experts. Among the predictable applications, emphasis is given to the studies of financial assets whose temporal evolution follows non-Gaussian stochastic processes. The action also intends to apply nonlinear

optimization models in Information Geometry to Signal Processing, thus modeling filtering processes.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of missions accomplished by foreign researchers in Brazil	0	6	12

Goal 3

To consolidate and promote the international insertion of researchers associated with our graduate programs

Activity 1	Start date	End date
International placement of UFC researchers as visiting professors	01/2019	12/2021

Description

UFC researchers in the fields of Mathematics, Teleinformatics Engineering, Computer Science and Economics will act as visiting research fellows at Purdue University, Penn State University and Université de Montpellier. Below are some of the research subjects that will be studied in partnership with our foreign collaborators, invariably requiring doctoral training and postdoctoral supervision: i. Full classification of singular surface germs in regard to the extrinsic metric; ii. Optimization problems in graphs from a fixed parameter tractability perspective; iii. Degenerate-elliptic operators in manifolds with singular strata; iv. Non-Gaussian diffusion processes and applications to data concerning returns on financial assets; v. Information Metrics and Statistical Divergence Geometry with applications in financial asset pricing models.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of Brazilian visiting professors abroad	0	2	3

Theme 3
Novel Chemical & Biological Products and their Applications
Goal 1
To train qualified doctors for work in the field of new chemical/biological products and their applications

Activity 1	Start date	End date
Accomplishment of Split-Site Doctoral Studies	01/2019	06/2021
Description		
The action will involve research activities aiming at: the development of metallic compounds with such potential applications as metallopharmaceuticals and biosensors (coordination complexes and Sensors); the synthesis of nanostructured oxide-based materials (catalysis); the development of modified electrodes for application as electrochemical sensors for quantifying organic contaminants in water and food products (Analytical Methods); the investigation of organic molecules applied as corrosion inhibitors in metals and alloys, aiming at the use of electrochemical techniques and molecule modeling methods so as to establish a computational protocol that will enable the classification of organic molecules according to their corrosion inhibition efficacy. Students will carry out their work at the University of Queensland, the University of Cambridge, the University of Leeds, Università di Milano, the University of Aberdeen, in Scotland, the National Research Council, in Canada, the University of Oregon and the University of Indiana. PhD students in sandwich program will do research for validating the anti-tumoral activity of two natural compounds. Applications in Dentistry are also included in this Theme, where a project including microfluidics and tissue engineering will be carried out in order to evaluate ondontoblastic changes, as well as its relationship with the interface between dentin and dental materials.		

Activity 1 - Indicator 1				
Type	**Indicator**	**Current situation**	**Goal for the 2nd year**	**Final goal**
Quantitative	Number of students that have completed split-site studies	1	6	12

Goal 2
To consolidate and promote the international insertion of researchers associated with our graduate programs

Activity 1	Start date	End date
International placement of UFC researchers as	01/2019	12/2021

visiting professors

Description

Some of the researchers, who are associated with the various graduate programs in this proposal, will partake in post-doctoral placements as visiting professors at partner institutions, in order to develop the research topics and bolster the collaborations between researchers, students and institutions.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of Brazilian visiting professors abroad	0	3	6

Goal 3

To sustain and intensify partnerships with international groups of excellence in the fields of chemical/biological products and their applications

Activity 1	Start date	End date
Accomplishment of bilateral missions	01/2019	12/2021

Description

This action aims at the accomplishment of foreign missions (at Oregon Health and Science University) aiming to devise research protocols using cariogenic biofilm models and/or oral models for method and therapy tests to be utilized in the control of dental cavities and ordinary mouth infections. Another scientific objective of the missions is to investigate the use of tissue engineering associated with microfluidics, making use of microorganisms and oral biofilms to comprehend potential systemic repercussions of biofilm-dependent mouth diseases, as well as to develop and test new dental materials and therapies, assessing their interactions and effects in relation to specific cells or tissues. Chemistry and Biochemistry graduate students are to go on missions at Queensland, Cambridge, Leeds and Aberdeen for the development of new analytical methods using low-cost, rapid instruments whose goal is to enhance analytical procedures, in addition to the scientific objectives laid out in the section on split-site doctorates. Such missions are to be supported by short-length visits to UFC by foreign researchers so that they may work on the above-mentioned fields, and for the implementation of workshops and international schools.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of bilateral missions	0	5	9

Activity 2	Start date	End date
Technical training in laboratories at foreign partner institutions	01/2019	12/2021

Description

Technician-led training-site visits to the laboratories of the foreign partner institutions participating in this proposal

Activity 2 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of completed technical training placements	0	1	3

Theme 4

Social Technologies

Goal 1

To train qualified doctors for work in the field of social technologies

Activity 1	Start date	End date
Accomplishment of Split-Site Doctoral Studies	08/2018	06/2022

Description

Split-site Doctoral Studies are to take place at the University of British Columbia, Texas A&M and Kansas State University in order to develop work on relevant research topics. Among such topics, we give emphasis to the assessment of the vulnerability of urban and rural communities on the Northeastern and Amazon seaside areas in the face of climate change, while aiming to devise strategies for ensuring food, power and water safety, the sustainable utilization of natural resources and the reduction of social-environmental vulnerability.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of students that have completed split-site studies	1	5	10

Goal 2

To consolidate and promote the international insertion of researchers associated with our graduate programs

Activity 1	Start date	End date
Accomplishment of bilateral missions	08/2018	12/2021

Description

Accomplishment of bilateral missions abroad by Brazilian researchers at such institutions as Texas A&M, Yale, University of British Columbia, Universitat Autonoma de Barcelona, Universidad de Alicante, among others. Reciprocally, the project also allows for short-term visits by foreign researchers to the graduate programs participating in this proposal. These missions aim at enabling doctoral training, the implementation of workshops and advanced studies schools (including courses in English at UFC) and scientific collaboration on the topics covered by the project.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of bilateral missions	0	6	13

Goal 3

To sustain and intensify partnerships with international groups of excellence in the field of social technologies

Activity 1	Start date	End date
Implementation of Advanced Studies Schools	01/2019	12/2021

Description

This project encompasses the creation of an annual International School (Summer School), to be promoted by the partner graduate programs and which will integrate international universities under the topics of food, power and water safety, with the purpose of creating methodologies, technological innovation and aggregating new knowledge to scientific literature on a global scale.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of international advanced studies schools	0	2	2

Activity 2	Start date	End date
International placement of UFC researchers as visiting professors abroad	08/2018	12/2021

Description

The proposal allows for year-long international placements of UFC researchers as visiting professors at some of the partner institutions. This will be done in order to strengthen the collaborations laid out in the project and to obtain scientific results in terms of experiments, event participations, and publications. Among the research problems to be worked on during international Junior post-doctoral placements, for instance, we mention: the creation, validation and evaluation of the efficacy of healthcare technologies for vulnerable groups (people with disabilities, Aids and cardiovascular alterations); the validation of instruments for identifying adverse effects caused by psychotropic drugs and preemptive strategies for enhancing health promotion practices for children with mental disorders and HIV-positive people; the analysis of associated factors concerning low adherence to the pharmacological treatment of children with mental disabilities and HIV-positive people.

Activity 2 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of Brazilian visiting professors abroad	0	2	4

Theme 5

Materials and Nanoscale Phenomena

Goal 1

To sustain and intensify partnerships with international groups of excellence in the field of materials and nanoscale phenomena

Activity 1	Start date	End date
Attraction of young talent toward academic innovation	08/2018	07/2022

Description

Attracting young and talented researchers is of paramount importance for creating environments of innovation within institutions, in regard to both research and graduate/undergraduate education activities. The main strategy consists of attracting young talented researchers with promising academic histories so that they can engage in graduate research in Physics, Chemistry and Chemical Engineering. One of the main objectives is the expansion of a network of researchers of international excellence, including young doctors, for the investigation of various complementary aspects of CO_2 capture and conversion into molecules of commercial interest.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of young talented researchers enrolled	0	1	2

Activity 2	Start date	End date
Accomplishment of scientific missions in Brazil by foreign researchers	08/2018	12/2021

Description

Highly qualified researchers from foreign universities (MIT, Univ Cambridge, Univ Antwerp, among others) are expected to come to Brazil under Visiting Research Fellowships. With the purpose of increasing the possibilities of graduate education at the international level, the proposal allows for foreign researchers from partner universities (Leipzig, Malaga, Melbourne, Missouri) to visit UFC to teach summer courses on new trends in catalyst/adsorbent synthesis and advanced characterization techniques. Furthermore, foreign collaboration missions of a high scientific level will enable the resuming or the consolidation of previously established successful partnerships with the Universities of Antwerpen and Bremen, for example. Lastly, the project determines there must be two visits by a senior MIT professor to the laboratories of the Departments of Physics and Chemistry at UFC. This exchange of experiences will be further enhanced by the visit of two Brazilian post-doctoral researchers to MIT and of at least two MIT students to UFC laboratories.

Activity 2 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of foreign researchers visiting UFC	2	7	13

Activity 3	Start date	End date
Accomplishment of scientific missions abroad by Brazilian researchers	08/2018	12/2021

Description

Bilateral missions shall seek to continue and intensify international partnerships between the researchers in the research groups of the Graduate Programs in Chemistry, Physics, Chemical Engineering and Biochemistry, and collaborators at such institutions of academic excellence as MIT, Cambridge University, University of Antwerpen, among others. As for the research subject, the history of continuous collaboration, though relatively recent, has yielded a high-impact article published in Nature Communications in 2017, which has inspired an array of avant-garde scientific research. The members of the project are experienced researchers in their fields, namely vibrational spectroscopy at high pressures, carbon nanomaterials and 2D materials. The experience acquired from the realization of high-quality experiments at foreign partner institutions will be incorporated by Brazilian research groups, given the laboratory structure and the networks which have already been established under INCTs, PRONEX projects and the Analysis Facility Center, to name one of the multi-user instruments integrating the proposal. Similarly, bilateral missions, especially those of UFC researchers, doctoral and post-doctoral scholars at Antwerp, Ghent and Bremen, for instance, will enable the application of molecular dynamics methods to the study of the interaction of biomarkers with their respective substrates.

Activity 3 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of scientific missions abroad by Brazilian researchers	0	14	14

Goal 2

To consolidate and promote the international insertion of researchers associated with our graduate programs

Activity 1	Start date	End date
International placement of UFC researchers as visiting professors	08/2018	07/2022

Description

A number of UFC researchers participating in the projects are expected to engage in post-doctoral placements as visiting professors at foreign partner institutions with excellence. Such placements involve collaborations with foreign researchers of a high scientific level and will enable the resuming or consolidation of previously established successful partnerships with MIT, the University of Leipzig and the Universities of Antwerp and Bremen, to name a few.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of UFC researchers acting as visiting professors abroad	0	2	5

Goal 3

To train qualified doctors for work in the field of materials science

Activity 1	Start date	End date
Accomplishment of Split-Site Doctoral Degrees	08/2018	07/2022

Description

The accomplishment of split-site doctoral degrees at partner institutions in the US and other countries aims to ensure student participation in established networks of collaboration with groups of excellence. One of the novel aspects of these doctoral studies is the participation in experiments in state-of-the-art laboratories for work in the fields related to the project, namely vibrational spectroscopy at high pressures, carbon nanomaterials and 2D materials.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of students that have completed split-site studies	0	7	13

Theme 6

Water and Residue Management & Safety in the Face of Climate Change

Goal 1

To sustain and intensify partnerships with international groups of excellence in the field of water management and safety

Activity 1	Start date	End date
Attraction of young talent toward academic innovation	06/2019	07/2020

Description

Attracting young and talented researchers is of paramount importance for creating environments of innovation within institutions in regard to both research and graduate/undergraduate education activities. One of the project's strategies consists in attracting young talented researchers with promising academic histories so that they can engage in graduate research in the Water Resources and Sociology programs.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of talented researchers attracted to the project	0	1	1

Activity 2	Start date	End date
Promotion of graduate and undergraduate courses by foreign partner professors	01/2019	12/2021

Description

A relevant portion of the project is concerned with the promotion of actions oriented toward undergraduate students in order to prepare the next generations for the international experience. This initiative started in the Graduate Program in Agricultural Engineering, with the reception of over 12 students from the Netherlands, France and Germany in recent years. There are planned courses taught in English, summer schools and other activities led by foreign researchers visiting UFC.

Activity 2 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of scientific events and courses delivered by foreign researchers	0	2	3

Activity 3	Start date	End date
Accomplishment of scientific missions by researchers	01/2019	12/2021

Description

Bilateral missions shall aim to consolidate the international insertion of the researchers in the groups of the Graduate Programs in Water Resources, Sociology, Agricultural Engineering, Natural Resource Biotechnology and Tropical Marine Sciences into institutions of academic excellence such as the University of Columbia, Potsdam, Georgia, Valladolid and Braunscwheig. Scientific missions from researchers and students in Germany and the UK to UFC will be funded by partner institutions (see Counterpart session).

Activity 3 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of scientific missions accomplished by foreign researchers at UFC	1	3	6
Quantitative	Number of scientific missions accomplished by UFC researchers abroad	1	9	18

Goal 2

To train qualified doctors for work in the field of water management and safety

Activity 1	Start date	End date
Accomplishment of Split-Site Doctoral Degrees	08/2018	12/2021

Description

The proposal includes split-site doctoral studies at partner institutions in the US, UK and Germany, so as to facilitate student participation in already consolidated collaborative arrangements with groups of excellence. One of the innovative aspects of such doctoral studies involves the interdisciplinary articulation of Civil Engineering (Water Resources), Sociology, Tropical Marine Sciences and Natural Resource Biotechnology. The related projects encompass a wide range of topics, from the mapping of climate variability and risks, adaptive water infrastructure management and the governance of water resource systems to sociological approaches to water-related conflicts, in addition to the analysis of the economic aspects of water supply costs and allocation.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal

Quantitative	Number of students with completed Split-Site Doctoral Degrees	2	6	12

Goal 3

To consolidate and promote the international insertion of researchers associated with our graduate programs

Activity 1	**Start date**	**End date**
International placement of UFC researchers as visiting professors	08/2018	12/2018

Description

UFC researchers will receive Senior visiting professor fellowships at partner institutions in the US, Germany, France and Spain. It is important to mention that the involved researchers have significant international experience and a considerable history of fundraising activities, especially in regard to the counterparts established in this proposal by foreign institutions.

Activity 1 - Indicator 1

Type	**Indicator**	**Current situation**	**Goal for the 2nd year**	**Final goal**
Quantitative	Number of Brazilian researchers abroad	0	2	2

Theme 7

Infectious, Immuno-Inflammatory and Degenerative Diseases

Goal 1

To qualify graduate program faculty engaged in collaboration projects in the field of infectious, immuno-inflammatory and degenerative diseases

Activity 1	**Start date**	**End date**
Promotion of international mobility of UFC Senior/Junior researchers	01/2019	06/2020

Description

The researchers associated with our graduate programs will work as visiting scholars at foreign institutions.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of UFC researchers as visiting professors abroad	0	3	5

Activity 2	Start date	End date
Foreign scientific missions undertaken by UFC researchers abroad	01/2019	12/2021

Description

UFC researchers will engage in scientific missions under the collaboration projects with the purpose of pursuing research, data analysis and/or advanced techniques training activities.

Activity 2 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of scientific missions of UFC researchers abroad	0	4	8

Goal 2

To expand and consolidate the international collaboration of the UFC Pharmacology and Medical Sciences programs with the Barts and London School of Medicine and Dentistry's neurogastroenterology group.

Activity 1	Start date	End date
Consolidation of scientific partnerships with the Barts and London School of Medicine and Dentistry's neurogastroenterology group	01/2019	12/2021

Description

To expand and consolidate the international collaboration of the School of Medicine of UFC with the Neurogastroenterology group at Barts and London School of Medicine and Dentistry, in the United Kingdom on the related subjects.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of collaboration co-tutelle agreements	0	1	2

Goal 3

Completion of split-site doctoral degrees

Activity 1	Start date	End date -
Selecting students for split-site doctoral studies abroad	01/2019	12/2020

Description

Students associated with the research projects, and those with better academic performances, will be selected for the international split-site degree program.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of students with completed Split-Site Doctoral Degrees	1	5	9

Goal 4

To consolidate the collaborative research between the UFC School of Medicine and the University of Liverpool (UoL) with the purpose of investigating the cellular pathobiology of acute clinical and pre-clinical pancreatitis

Activity 1	Start date	End date
Foreign researcher visits to UFC	08/2018	12/2020

Description

To make use of the resources acquired for the missions in order to enable foreign researcher visits to UFC

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of foreign visitors coming UFC	0	1	1

Goal 5
To promote translational neuroscientific research at UFC by bolstering, integrating and gathering an international network of researchers and academics in the fields of Neuroimaging, Neuroimmunology and Functional Genomics

Activity 1	Start date	End date
Development of new protocols in Neuroimaging, Neuroimmunology and Functional Genomics	03/2019	12/2022

Description
Some of the goals and activities are: 1. To develop/practice new protocols for the gut-brain axis, neuroinflammation, microglia cultures, RNA sequencing, microbiota-related alterations due to malnutrition/dyslipidemia and stroke effects, and associated cerebral/cognitive effects; 2. To develop/practice new protocols for testing purinergic receptor antagonists as well as their pathways, cognitive deficits, brain injuries and neuroinflammation; 3. To develop/practice new protocols using in vivo streptozotocin-induced dementia models in order to study cognitive deficits, brain damage and neuroinflammation; 4. To develop/practice new protocols for assessing the influence of physical exercise on amyloid and tau purification in mice experiencing sleep deprivation; for assessing how the circadian rhythm and sleep affect or are affected by a certain pathology, and for the interaction between circadian-rhythm and clock genes; 5. To develop/train new protocols for investigating how sleep deprivation and a number of treatments can influence beta-amyloid and tau in cerebrospinal fluid (CSF) and for investigating the role played by sedentary lifestyles and rest-activity cycles in mood and neurodegenerative disorders in human beings; 6. To develop/practice new protocols for alterations in the gut-brain axis and for the influence of psychotropic, probiotic or prebiotic pharmaceuticals; 7. To develop/practice new protocols for neuroimmune alterations related to the catabolic pathway of tryptophan in development disorders; 8. Development/practice of electroencephalography and functional magnetic resonance imaging procedures for studying mental disorders and medication efficacy.

Activity 1 - Indicators

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Publication of 01 text-book on malnutrition-related diseases	0	1	1
Quantitative	Accomplishment of 14 short-term missions undertaken by UFC's	0	10	14

	researchers at foreign institutions			
Quantitative	Training of six students engaged in split-site programs	0	3	3
Quantitative	Organization of two symposia	1	1	2

Goal 6
To expand and consolidate the international collaboration of the UFC Graduate Program in Pharmacology with Imperial College London

Activity 1	**Start date**	**End date**
Consolidation of the partnership with Imperial College London	01/2019	12/2021
Description		
To expand and consolidate the international collaboration of the UFC School of Medicine with Imperial College London, in the UK, in the fields of metabolome and proteome, with research activities already underway at the Center for Cromatography and Mass Spectrometry		

Activity 1 - Indicator 1

Type	**Indicator**	**Current situation**	**Goal for the 2nd year**	**Final goal**
Quantitative	Number of scientific collaborations and co-tutelle agreements	0	1	2

Goal 7
To expand and consolidate the international research network on neurogastroenterology, under the Biomedicine INCT Project

Activity 1	**Start date**	**End date**
Organization of an advanced studies school	01/2019	12/2021
Description		
The establishment of advanced studies schools for students in the Pharmacology and Medical Sciences programs has an important multiplier effect in that it enables those not directly supported by the collaboration project to benefit from the knowledge generated by the partnerships. This		

feature enhances student learning and also contributes to the overhaul of research fields and of the performance of adjacent research groups.

Activity 1 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of advanced studies school	0	1	1

Activity 2	Start date	End date
Foreign researcher visits to UFC	08/2018	12/2020

Description

For the purpose of developing the collaboration project, University of Liverpool researchers are expected to visit UFC to teach courses and give seminars

Activity 2 - Indicator 1

Type	Indicator	Current situation	Goal for the 2nd year	Final goal
Quantitative	Number of foreign visitors to UFC	0	1	2

STRATEGIES

Strategy for the consolidation of existing international partnerships, as well as the construction of new partnerships and cooperation projects to increase the relationship between the Brazilian institution and research groups abroad.

The following strategies have been considered for this proposal on account of being laid out in the Institutional Internationalization Agenda, and because they substantiate the planned internationalization activities of the 2018-2022 Institutional Development Agenda: i. To expand and consolidate research groups involving scholars of international research centers, augmenting UFC engagement in international systems of science, technology and innovation; ii. To make the procedures for the development of scientific/technological projects with foreign partners simpler, more flexible, and more agile; iii. To implement policies in the UFC community with a view to promoting international mobility through the engagement in visits, placements and graduate/undergraduate programs abroad, especially in strategic areas fostering the creation of new graduate programs or research groups, the international consolidation of existing graduate

programs and the scientific/technological advancement of the State of Ceará and that of Brazil; iv. To intensify institutional exchange programs, attracting young talent from abroad while conversely enabling the presence of UFC students, faculty and staff at foreign institutions of excellence; v. To support international congresses, symposiums and seminars, while attracting foreign students and researchers as a mean of establishing and consolidating scientific partnerships and publicizing research and study opportunities. vi. To promote the revamping and continued improvement of graduate programs, agreeing on parameters and strategies for improving CAPES internationalization scores, as well as increasing compliance with international standards of excellence based on the University's own assessment models for graduate programs, while also taking international statistics into account; vii. To allocate institutional funds for the support of internationalization programs, in addition to the funding obtained by research projects and similar ventures; viii. To stimulate partnerships between graduate programs and national and overseas companies in order to obtain financial support for research and technological development projects involving foreign teams.

Strategy to attract foreign students to Brazil

Currently, the policies for attracting foreign students are concretized via institutional participation in several international programs such as Be-a-doc, PEC-G, PEC-PG, GCUB-OEA and bilateral agreements which allow for student engagement. The strategies for heightening student gravitation are as follows: i. To institutionalize mechanisms of academic mobility encompassing national and international higher education institutions, attracting young scientific talent and highly qualified researchers to develop activities in research and education; ii. To support the execution of international symposiums and seminars, attracting foreign students and researchers in order to start and consolidate partnerships, and publicize research activities and learning opportunities; iii. To promote the international visibility of research and graduate programs, especially by making all of the relevant information and data available in English; iv. To propose continued policies for revamping and granting greater flexibility to curricular structures, ensuring fast responses to internationalization demands in terms of content, practices and professional profiles which are adequate for the global market. v. To make graduate and undergraduate curriculums less rigid, and to integrate and revise them periodically while conforming to international standards. vi. To simplify the adaptation of UFC curricular structures and academic calendars to attain equivalency with respect to those of foreign organizations, facilitating mutual credit transfers in two-way student mobility; vii. To support the offering of courses in foreign languages by including them in graduate and undergraduate programs' pedagogical projects; viii. To adopt internationally utilized mechanisms of admission to graduate and undergraduate programs, as with the GRE; ix. To internationally disseminate public notices for graduate, undergraduate, research fellowship and grant programs for foreign researchers and students; x. To publish notices that minimize bureaucratic hurdles, which are internationally attractive and that can be publicized on specific websites for work, research and graduate education opportunities and offerings; xi. To publicize

research activities at events, in articles and in non-academic environments; xii. To identify and catalog UFC laboratories and research groups, publicizing their activities on our websites and bilingual publications.

Strategy to attract faculty and researchers with international experience to Brazil

The pivotal institutional objective of attracting foreign researchers and post-doctoral students is to attain UFC gravitation toward international parameters of excellence, and this is to be done by definitively exposing graduate and undergraduate programs to the global setting. In several national and international rankings, UFC has figured among the foremost institutions in Brazil, notably thanks to publication, citation and international research indicators. Currently, one of the core strategies for attracting researchers consists in the Visiting Scholar program, whose focus has been the implementation of internationalization and innovation at the University by giving preference to foreign candidates for teaching positions. Favourable institutional conditions have been fixated by such normative resolutions as the possibility of recruitment & selection processes in English and simplified recruitment & selection mechanisms for Visiting Professors. Below are some of the strategies outlined in the Institutional Internationalization Agenda: i. To grant flexibility to the relevant regulations in order to facilitate foreign professor mobility for work in regular programs; ii. To enhance UFC relations with the immigration department of the Federal Police and with honorary consulates and local foreign vice-consulates, as well as to orientate and support foreign students and professors in regard to bureaucratic procedures; iii. To promote and publicize, at the international level, all of the post-doctoral and faculty recruitment & selection processes at UFC.

Strategy to prepare the scholarship holders for the period abroad as well as for their return, especially in order to increase the knowledge appropriation by the institution.

Complying with global standards requires the continuous participation of young researchers with international experience in local research groups, thus multiplying the opportunities for exchange, and expanding and strengthening new areas of research, which is achieved by constantly updating master's, doctoral and scientific initiation programs. Recently, UFC has increased the possibilities of work for former fellows by creating the Research Associate position, which conveys institutional acknowledgment of post-doctoral, visitor and research collaborator activities, even though they are not given any formal contracts of employment with the University. Selection processes for split-site doctoral or post-doctoral studies are overseen by the Office of the Provost for Research and Graduate Studies (PRPPG), in order to prioritize exchange agreements with international centers of excellence, under the supervision of professors with a high scientific level. Selection criteria also include language proficiency and possible post-placement partnerships. PRPPG, in conjunction with PROINTER, provides students with an array of academically oriented language learning opportunities via the Languages Without Borders Program, for instance, which

was institutionalized through a resolution passed by the Superior Councils. TOEFL exams are held periodically, at no cost to students. Proficiency levels based on a common reference framework are overseen by PRPPG by means of reports on graduate students' progress. Other initiatives comprise: i. Disclosing information about international academic mobility and foreign fellowships to graduate and undergraduate students; ii. Accompanying, orientating, supporting and submitting student applications for international mobility; iii. Creating mechanisms to enable sound logistics in language proficiency examinations, notably those required of exchange students and/or students in academic mobility; iv. Heightening curricular flexibility in graduate and undergraduate programs so as to cover various curricular structures and academic calendars, thus facilitating credit transfers of the studies carried out abroad.

Describe innovative strategies that will be used by the institution that were not mentioned above.

In 2017, the Superior Councils of UFC passed the Institutional Internationalization Agenda and the Institutional Development Agenda for the 2018-2022 quinquennial plan, as a result of an intense series of thematic seminars on research, education, extension and resource & staff management activities, including every sector of the academic community with the formidable participation of representatives of graduate programs and research groups. Both documents stress the need to incorporate the advancements on innovation and research achieved by UFC in recent years into education and management activities, as well as the accreditations resulting from institutional appraisals (MEC, INEP and CAPES, in terms of IGC (General Program Index), and quadrennial assessments) and those verifiable in several academic rankings. Some of the primary objectives of the aforementioned agendas include the renewal, flexibility and international openness of graduate and undergraduate curriculums and practices; the academic integration of the two levels of education; the flexibility of faculty workloads in order to accommodate different teaching experiences (besides the expositional classroom-hour format) and scientific research, innovation, initiation and dissemination activities; and the promotion of research and graduate program visibility to national/international societies and markets. In light of the above, the following strategies are singled out: i. To rigorously evaluate proposals for new graduate programs according to international standards and parameters, as planned in the UFC Internationalization Agenda; ii. To integrate programs and research groups in related fields and subfields while stimulating the collaborative increase in quality indicators; iii. To grant flexibility to working hours so as to allow for collaboration missions, in particular international ones, or for scholar dedication to complex research projects which are likely to yield excellent indicators, without detriment to teaching activities at a departmental level; iv. To hold work forums in graduate programs in order to diffuse strategies for improving program appraisal, visibility and internationalization strategies; v. To improve the collection and presentation of data on UFC research activities, starting with the standardization of institutional information in articles and other scientific publications; vi. To ensure favourable working conditions for recently admitted professors for the consolidation of

their research and entrance into competitive research systems, as is the case with CNPq productivity fellowships and Junior Visiting Scholar fellowships abroad; vii. To incorporate practices of scientific initiation into the activities of graduate programs in order to enable curricular revamping and integration; viii. To implement free schedules for formal curriculum courses, providing students with the opportunity to attend research seminars and workshops, visit laboratories or take problem-based courses or design thinking courses; ix. To transpose program appraisal experience, in terms of internationalization and exposure to international excellence, from graduate programs toward undergraduate studies.

POLICIES

Policy for selection of foreign partners, considering that 70% (at least) of the resources should be earmarked for partnerships with institutions based on countries that Capes maintains effective cooperation (listed in Annex I of the call).

Though UFC has not determined strategic partnerships or countries in principle, an assessment of our effective international collaboration history from 2012 to 2017 reveals a predominance of institutions in the following countries: the United States, France, Germany, Canada, the United Kingdom and Australia. These collaborations are realized within projects under programs like COFECUB, PROBRAL, STIC-AMSUD, CAPES/Humboldt, among others, within research networks (PRONEX, INCT, among others), and can also arise from individual researcher initiative. The internal notice for the selection of projects for the “Print” proposal granted researchers and their teams full discretion over what international partnerships to choose, within the terms of the CAPES notice. Furthermore, the engagement in international partnerships under the proposal is completely voluntary on the part of research groups, even though it is an accurate account of the history of successful collaborations we have been able to secure, without detriment to the creation of a number of collaborations that will be facilitated by the opportunities stemming from the “Print” proposal. In brief, the countries below are the ones engaged in the collaboration projects, followed by their respective number of participations: USA (12), Germany (7), France (7), UK (4), Spain (4), Canada 3), Italy (3), Portugal (3), Norway (1), Ireland (2), Belgium (1), New Zealand (1), Argentina (1), Mexico (1), Thailand (1), Switzerland (1), Sweden (1), Australia (1), India (1) and China (1). It is noteworthy that, of the 20 countries with which we are engaged in collaborations, only 2 (Portugal and Thailand) are not priority countries, as laid out on the CAPES list.

Grant policy and internal selection process for specific actions, within the funding lines of the Capes-PrInt program. In the case of cooperation projects with foreign institutions, the proposer should specify the application of funds, the plan of activities, reciprocal funding, academic mobility, technical - scientific production, counterparts in the partner institutions, among others.

The internal selection of projects and beneficiaries under the proposal bases itself on Public Notice 01/2018, published by the Office of the Provost for Research and Graduate Studies, whereupon the institution laid out the objectives of the institutional proposal, ever mindful of the premises contained in the UFC Internationalization Agenda; the prioritized research subjects, the reasons for the preference given to them, and the description of their characteristics; the requirements for project drafting, including the necessary listing of goals and indicators; the funding categories, the projects' budget ranges; and lastly the assessment criteria, in conformance with the guidelines determined by the CAPES Notice. The proposal evaluation committee, in accordance with the internal notice, comprises 11 level-1 CNPq researchers (including two Senior investigators), with experience in the coordination of international projects. Of the 38 submitted project proposals, 16 were selected to constitute the institutional proposal. Evaluation criteria, which are also laid out in the notice, took into account the conformity to prioritized research subjects; the scientific excellence and primacy of the proposal's coordinator and that of their team, in addition to their international expression and experience in foreign collaborations, certified by existing scientific productions; the scores of the graduate programs involved in the proposal; the expected foreign counterparts; the proposal's innovative aspects with regard to existing projects, particularly in terms of interdisciplinary articulation; the proposal's impacts upon the University's research and education structures as well as their conformance with the Institutional Internationalization Agenda; and the proposal's budget adequacy. With the approval of the institutional proposal, the execution of the integrating projects will be overseen by the "Print" Managing Group at UFC, whose coordination will be trusted to the Office of the Provost for Research and Graduate Studies while the Office of the Provost for International Affairs will be in charge of vice-coordination activities.

Policy for hiring faculty with recognized scientific performance at an international level.

One of the core institutional programs, which has gained momentum since 2002, is the autonomously funded recruitment of Visiting Professors at several levels, from young doctors to Senior Researchers, prioritizing proposals with a focus on internationalization and innovation. The two to four-year periods contribute to the openness of graduate programs to international research fields and groups. As a result of every public notice issued thus far, we have been able to recruit foreign professors with long research experience at American or European institutions, as is the case with ICTP/Université Aix-Marseille, Università degli Studi di Milano, Technische Universitat Munchen, Antwepen University, City College of New York, ETH, among others; as well as Brazilian professors working abroad and/or with solid histories of international cooperation. Another form of recruitment involves procuring foreignly trained doctors, Brazilian or otherwise, and those with post-doctoral experience at foreign institutions, for the purpose of eventually renewing graduate faculty. As a matter of fact, a number of the more scientifically or academically prominent visitors, including those who (jointly) supervise post-doctoral students, have become tenured UFC professors. The 2018 notice is expected to facilitate shorter visit periods with a more

specific focus, namely carrying out experiments and coordinating advanced learning schools or international workshops. Thus, we hope to attract high-level proposals from those researchers who, though unable to disconnect themselves from their home institutions for two years, can engage in more intensive and possibly more productive visiting periods within our Graduate Programs. Recently, UFC has increased the possibilities for Visiting Scholar work, with the Research Associate position, which conveys the institutional acknowledgment of post-doctoral, Visiting Scholar and Research Associate activities, despite not being given a formal contract of employment with the University. Professors of such stature are able to work on research and graduate education.

Policy to increase proficiency in foreign languages for students, postgraduate faculty and technical staff that have a direct relationship with the proposed Internationalization Project.

Through the Office of Linguistic Internationalization, operating under the Office of the Provost for International Affairs, UFC has crafted an institutional policy for supporting foreign language learning and the increase of student, faculty and administrative staff proficiency levels by means of specific programs and actions: i) The Languages Without Borders Program (LwB), based on the experiences with the solely English-language version of the program, intensifies the offering of online and classroom-based courses in five (5) languages: German, Spanish, French, Italian and Portuguese as a Foreign Language, with a focus on academically oriented language learning, international mobility and English proficiency prep courses. The Portuguese as a Foreign Language course offers classroom-based language and Brazilian culture classes to research professors, visitors and students from abroad at UFC, as well as academically oriented courses to students engaged in mobility programs (PEC-G, PEC-PG and PAEC-OEA); ii) The implementation of the Laboratory for Academic Text Editing, Translation and Revision (LETRARE) at UFC, which undertakes: a) the revision of academic texts written in English; b) the translation of official documents and information published on the UFC website, and c) facilitating the writing of texts in English in accordance with the publication criteria of international periodicals (i.e. the editing process), with a view to contributing to the increase of UFC-derived publications in international periodicals; and iii) The “Houses of Foreign Culture” Project, which has, since the 1960s, offered basic language and culture courses in German, Spanish, French, English, Italian and Portuguese as a Foreign Language to the academic community and the general public, in addition to holding Spanish, German and Italian proficiency tests. Also as a result of this linguistic internationalization policy, UFC has partnered with the Confucius Institute to offer experimental Mandarin courses, as a means of increasing language and culture learning possibilities, for promoting exchange and consolidating international partnerships. The University also holds international events in order to stimulate foreign language practice and widen the repertoire of intercultural knowledge.

Policy for recognition of academic and scientific activities performed by faculty and students abroad.

UFC is thoroughly aware that its international insertion stems from the combined research efforts, as mentioned before, amassed mostly over the last twenty years through the creation of the first doctoral programs, producing formidable academic innovation at UFC, which was initially focused on graduate programs. Recently, given the intense exchange in double-degree programs (Engineering programs, in particular) and the Science Without Borders Program, UFC has been redefining its undergraduate programs, particularly Exact Sciences and Engineering programs, adopting standards that are more inclined toward internationalization. The policy for attracting foreign students currently relies on several programs such as Be-a-doc, PEC-G, PEC-PG, GCUB-OEA and other bilateral agreements that allow for student participation. Essentially, UFC is currently undergoing a crucial moment at which the international experience resulting from research and graduate activities is expected to spread to all levels of education and bring structural changes to academic management. Concretely, this institutional realization, endorsed by the entire academic community in seminars held during 2017, has motivated the inclusion of the objectives below in the 2018-2012 Institutional Development Agenda and in the Internationalization Agenda, as their implementation is also demanded (and overseen) by the UFC Office for Corporate Governance: i. To propose continued policies for revamping and granting flexibility to curricular structures, ensuring swift responses to internationalization demands in terms of internationally market-appropriate content, practices and professional profiles; ii. To heighten the flexibility of graduate and undergraduate curricular structures so as to encompass various frameworks and schedules, thus facilitating credit transfers from abroad and generating opportunities for two-way student mobility; iii. To support the offering of courses in foreign languages by including them in graduate and undergraduate programs' pedagogical projects; iv. To oversee the academic performances of students in "out" mobility programs and create ways of benefitting from their experiences upon their return; v. To develop bilateral collaborative arrangements in education, by promoting UFC adhesion to international schools, for instance, and particularly by having University regulations allow for Foreign Scholar engagement in regular program teaching activities.

Policy for hosting and support of foreign faculty, researchers and students.

The Office of the Provost for International Affairs is in charge of welcoming and supporting foreign students in regard to regulations and settlement at UFC and in Brazil. All of the relevant details and guidelines can be found in the International Student Handbook at: http://prointer.ufc.br/images/arquivos/manual_estudante_estrangeiro_UFC.pdf. For the purpose of minimizing the hurdles inherent to linguistic and cultural adaptation, UFC's Office for Linguistic Internationalization offers Portuguese as a Foreign Language and Brazilian culture courses to foreign graduate and undergraduate students in international mobility under the Languages

Without Borders Program, as well as specific academic reading/writing courses. The House of Portuguese Culture also offers Brazilian culture and language courses to the international community within the University and to the general public. The Exchange Student Support Program (PAI) is a project sponsored by the Office of the Provost for International Affairs (PROINTER), under the direct supervision of the Office for Academic Mobility. Its purpose is to aid, integrate and advise foreign students in international mobility at UFC during their initial moments in Fortaleza and at the University, as well as to provide UFC students with academic and cultural exchange, creating an international environment within the institution. The main instrument of this endeavour is individual student sponsorship. Every year, an average of 80 carefully selected and trained UFC students commit themselves to this cause. They welcome exchange students at the airport, accompany them during bureaucratic procedures and altogether assist them during their adaptation to Brazilian culture. The Program organizes field trips, cultural events and social gatherings for students and their sponsors, and works with PROINTER to hold a Welcoming Ceremony at the beginning of every semester. The Program also contacts exchange students prior to their arrival in order to help them with housing and all other necessary issues.

Policy for the appropriation of knowledge and experience acquired abroad by the beneficiaries of the actions of the Institutional Internationalization Project.

UFC is thoroughly aware that the international experience acquired and consolidated in research and graduate studies must be absorbed by all of the University, particularly with a view to the revamping, flexibility and internationalization of undergraduate studies. Therefore, through the participation of the entire academic community in seminars held in 2017, the Superior Councils were able to prepare and approve the 2018-2022 Institutional Development Agenda, which comprises the policies, objectives and strategies previously outlined in the Internationalization Agenda. With regard to incorporating international experience into educational practices, and for the purpose of allowing for internal/external governance & control, the following goals and objectives must see implementation in the 2018-2022 quinquennial plan: i. To propose continued policies for revamping and granting flexibility to curricular structures, ensuring swift responses to internationalization demands in terms of internationally market-appropriate content, practices and professional profiles; ii. To heighten the flexibility of graduate and undergraduate curricular structures so as to cover various frameworks and schedules, thus facilitating credit transfers from abroad and providing opportunities for two-way student mobility; iii. To support the offering of courses in foreign languages by including them in graduate and undergraduate programs' pedagogical projects; iv. To oversee the academic performances of students in "out" mobility programs and create ways of benefitting from their experiences upon their return; v. To establish bilateral teaching agreements by promoting UFC adherence to international schools, for instance, and especially by having UFC regulations allow for Foreign Scholar engagement in regular teaching activities. Additionally, the following strategies have been determined: i. To intensify exchange programs with a view to the joint supervision of graduate and undergraduate students

enlisting overseas-based researchers; ii. To promote the continued revamping and betterment of programs whilst jointly setting evaluation parameters and strategies based on international criteria for excellence; iii. To stimulate international mobility, publicizing international exchange opportunities for the students.

Policy for management and operationalization of the Institutional Internationalization Project.

UFC has established goals, actions, and criteria for the promotion of internationalization in programs, norms, and administrative structures. Our planning and governance models, internally and externally acclaimed, enable UFC to manage its own internationalization program. As mentioned above, the university established selection and monitoring criteria, based on academic excellence and international integration, for the use of its own funds or those transferred from development agencies or companies. The institutional model of resource management for international research and collaboration was, for example, replicated at the local Research Support Foundation (FUNCAP - Foundation for the Support of Scientific and Technological Development of Ceará), given the historical participation of UFC professors in their committees and particularly in the preparation and judgment of international cooperation call notices. In terms of academic and management structures, the emphasis on internationalization at UFC is highlighted by its pioneering project known as Casas de Cultura Estrangeiras (Foreign Language/Culture Centers) and by the creation of the Offfice of the Provost for International Relations in 2017, through the restructuring and expansion of the International Affairs Department. The Internationalization Committee was also established in 2017, chaired by the President and with the participation of the Provosts for International Relations and Research and Graduate Studies. One of the attributions of this committee is to establish mechanisms for monitoring and evaluation of initiatives and procedures related to internationalization at UFC in all dimensions of academic activity. In brief, UFC policies and internationalization plans in all dimensions are managed and monitored jointly by the Offices of the Provosts and the Internationalization Committee, according to the objectives, strategies, goals, and indexes guided by the Internationalization Institutional Agenda and by the 2018-2022 Institutional Development Plan. This management and monitoring logic will also be applied, in particular, to the implementation of the Institutional Internationalization Program - PrInt (and its component projects), with the obvious modification that the Management Group (Coordinated by the Office of the Provost for Research and Graduate Studies and the Office of the Provost for International Relations) is the entity that will play the managerial and advisory role in all phases of the project, from the definition of institutional actions to be financed to the analysis of results and indicators.

Policy for monitoring and internal evaluation of the goals of the Institutional Internationalization Project.

UFC defines as priority actions: the promotion of inter-university exchange doctorate internships that will implement and expand joint supervision and double-diploma agreements; postdoctoral internships, sabbatical leave and scientific missions in international centers of excellence; attraction of visiting professors and foreign students; promotion of cooperation projects with a history of collaboration or prospect of impact results; and, finally, high-level international training events, such as advanced studies schools and multidisciplinary workshops. In line with these priorities, UFC employs its own resources to hire visitors of varying degrees of seniority, focusing on internationalization and innovation. In addition, the university awards scholarships for foreign students and prioritizes the allocation of scholarships to foreign graduate students linked to institutional programs such as GCUB-OEA. Finally, UFC has allocated funding and capital resources to support the most internationally renowned research groups. These management principles, expressed in the institutional internationalization and institutional development plans, supported the internal notice of project selection and the own preparation of the PrInt institutional proposal; therefore, they should guide the management of Internationalization, Research and Graduate Studies processes, and especially of the PrInt Management Committee. The administration of the PrInt project by the Management Group, which includes the Office of the Provost for International Relations and Office of the Provost for Research and Graduate Studies, must be carried out in an agile and integrated way among the different projects, always based on the indicators and goals established in the internal notice and in each project individually. In a simplified way, the Office of the Provost for Research and Graduate Studies will be in charge of the academic management, such as selective processes for the financing and mobility modalities of projects, while the Office of the Provost for International Relations (PROINTER) will deal with the formalization procedures of agreements and mobility. The actions related to language proficiency will be carried out by the Languages Without Borders (Idiomas sem Fronteiras – IsF) institutional program, managed by PROINTER. Regarding the financial execution of the project, we opted for the model in which CAPES transfers the resources in the form of a Researcher Assistance term, such as what is practiced in PROEX, PROCAD and in the agreements financed through COFECUB, PROBRAL and the like.

Policy for the conciliation of national development programs supported by Capes to the internationalization effort.

The Office of the Provost for Research and Graduation Studies, the Office of the Provost for International Relations and the Management Committee of PrInt will act in a joint way to follow up the execution of the actions foreseen in this proposal, articulating them in order to intensify the scientific exchange between the local and foreign teams. In this way, academic excellence and international experience are expected to diffuse among groups and graduate programs is

disseminated in the initial stages or in consolidation, in terms of internationalization. To this end, the demands regarding the mobility financing, generally received by the Office of the Provosts, will be evaluated considering the adequacy to the institutional plans of internationalization and institutional development in which this global proposal is firmly anchored. In particular, Office of the Provosts will work with the various academic units to sensitize researchers and their work groups to integrate their research projects, supported by development agencies, to the greater plan of academic excellence expressed in this proposal. In other words, institutional monitoring will be carried out of both the current projects and the new proposals submitted to the national development agencies in order to ensure that the purposes and actions are linked to the institutional development and internationalization, which are the primary objectives of UFC at this moment.

Describe here other innovative policies that will be adopted by the institution that were not addressed in the above items.

In 2017, UFC Councils approved the Internationalization Institutional Agenda and the Institutional Development Agenda for the five-year period 2018-2022. It was the result of an intense routine of thematic seminars on research, teaching, extension and people and resources management during which, throughout the year, all sectors of the academic community participated with a strong representation of graduate programs and their research centers. It was indicated, in both documents, the need to incorporate into education and management the advances in research and innovation obtained by UFC in recent years and certified by the institutional evaluations (MEC, INEP and CAPES, in terms of IGC, four-year evaluation) and by various academic rankings. Some of the main purposes defined in these documents are the renewal, flexibility and international openness of curricula and practices in undergraduate and graduate education; the academic integration of these two levels of education; the flexibility of the teachers' working hours to include new didactic experiences (in addition to the expository class hours format) and research, innovation and scientific initiation and dissemination work; and the promotion of research and graduate studies visibility at the national and international society and market. In this regard, we highlight the following policies defined in the preparation of the plans: i. to rigorously evaluate proposals for new graduate programs according to international standards and parameters, as indicated in UFC Internationalization Agenda; ii. to articulate programs and research groups in areas and subareas, stimulating the collaborative increase of quality indicators; iii. to make the working time more flexible in formats that allow collaborative missions, especially international ones, or dedication to complex research projects that result in excellent indicators, without doing harm to teaching activities at the departmental or academic level; iv. to maintain a graduate work forum in order to disseminate strategies to improve the programs evaluation, visibility and internationalization; v. to improve the gathering and presentation of data on research at UFC, starting with the standardization of information about the institution in articles and other scientific productions; vi. to guarantee favourable working conditions for new personnel

to consolidate their research and to enter competitive research systems, such as the CNPq productivity grants and fellowships of junior visiting professor abroad; vii. To incorporate scientific initiation practices into curricular activities of the undergraduate courses in order to promote curricular updating and integration; viii. To adopt a schedule that allows for free hours without any formal curricular components, allowing participation in seminars and research workshops, visits to laboratories or courses based on problems or design thinking; ix. to transfer the experience in evaluation to internationalization criteria and to the exposure to excellence in world-wide levels from the graduate level to the undergraduate level.

FURTHER INFORMATION

Number of postgraduate courses taught in English between 2013 and 2016.
Quantity of courses **20**

Number of joint supervision postgraduate programs between 2013 and 2016.
Quantity of programs **217**

Number of double degree postgraduate programs between 2013 and 2016.
Quantity of programs **71**

Number of bilateral postgraduate programs between 2013 and 2016.
Quantity of programs **1**

Number of products derived from research projects and contributions to international databases between 2013 and 2016.
Quantity of products and contributions **82**

Number of Capes' development programs from which the institution benefited between 2013 and 2016.
Quantity of programs **22**

Number of Capes' international cooperation projects from which the institution benefited between 2013 and 2016.
Quantity of projects **62**

Insertion of materials, themes and subjects in foreign language in the postgraduate program curricular structure.

Almost all the thematic research projects proposed by the different teams expect the accomplishment of minicourses, advanced studies schools, workshops, seminars in technical training and other similar academic activities in English Language should be offered, during the

visit of foreign collaborators at UFC. In some cases, the availability of online materials in English Language on academic activities at UFC is mentioned, carried out by the faculty of the institution. Based on this spirit, the Office of the Provost for Research and Graduate Studies, with the approval of the Management Committee, will establish as mandatory the offer of curricular activities or the accomplishment of scientific events in English, when headed by foreign researchers at the university. In addition to these specific initiatives, as part of the implementation of the Office the Provost for International Relations (PROINTER), the following guidelines or strategies (which can be monitored and enforced by governing and controlling bodies, once formally included both in the Internationalization Agenda and in the Institutional Development Agenda): i.to develop bilateral collaborative partnerships in education, e.g. by promoting UFC membership in international schools and facilitating the participation of foreign teachers in the teaching of regular courses in UFC; ii.to expand the Distance Education (EAD) platform, offering open-source courses to partner universities and schools in the country, and courses in English to foreign institutions .; iii.to intensify the design of a flexible curriculum for undergraduate and graduate courses in order to propose different syllabuses and curriculums, facilitating articulation and credits transfer for students; iv.to provide curricular components in English in the pedagogical projects of the undergraduate courses and in the curricular proposals of the graduate courses; v.to establish linguistic proficiency as a criterion for academic assessment, providing students with foreign language training through the Houses of Foreign Culture (Casas de Cultura) and other institutional programs.

EXPECTED BENEFITS

Theme 1

Data Science and Complex Systems

INTERNATIONAL COOPERATION PROJECTS

Name of the project 1	Start date	End date
Heterogeneous wireless technologies for universal access to Internet broadband with applications in rural areas	01/08/2018	30/06/2022

Description

In addition to the wide range of new applications covered by wireless telecommunications and the Internet of Things (IoT) and their immense economic and social potential, the lack of Internet services in rural and low population density areas is the last frontier to achieve access to broadband Internet. The rural part of Ceará is an example of a challenging scenario, where more than 40% of Brazilian homes still do not have access to the Internet, and among those that have it only 22% are located in rural areas. In addition, only 13% of schools in rural areas have Internet access. At the same time, it is possible to complement rural access scenarios by integrating the terrestrial 5G network system and the optical ring (digital belt) to a satellite network, allowing support for data collection, analysis and management of IoT services. A careful study of the integration of these networks to serve rural areas in Ceará is of interest in this proposal. Another relevant problem is water consumption and agriculture. In 2015, 75% of water consumption in Brazil was due to agricultural activity. In addition, about 27% of the water captured and directed to this activity was lost in the process. At the same time, Ceará has been facing the longest drought since 1910, causing incalculable social and financial losses. To change this scenario, it is necessary to design low-cost solutions to be used in agroindustry to keep it competitive and efficient in terms of water use. To that end, low-power wireless sensor networks operating at low frequencies provide a good balance between cost-effectiveness, water use efficiency and crop productivity. This project will study, develop and evaluate innovative solutions to enable wireless

technologies to be applied in rural areas in an efficient way. Resorting to the hybridization of different technologies, such as mobile phones, wireless sensors and satellite systems, it is intended to show how broadband Internet access can be directed to rural areas of low population density, especially in the state of Ceará. Applications in agriculture will allow the digitization of farms and fields and new methods of GNSS reflectivity will allow monitoring of soil moisture, wetlands and lakes to better understand water cycles and optimize their use in agriculture.

Work missions related to the cooperation project

Year	Quantity	Amount
2022	3	R$ 47.368,00
2021	3	R$ 47.368,00
2019	2	R$ 31.579,00
2020	3	R$ 47.368,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2021	Visiting Professor (1 month)	1	R$ 23.155,29
2019	Split-Site Doctoral Program (12 months)	1	R$ 76.276,80
2020	Split-Site Doctoral Program (12 months)	1	R$ 76.276,80
2019	Visiting Professor (1 month)	1	R$ 23.155,29
2021	Split-Site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Senior Visiting Professor Abroad (4 months)	1	R$ 48.470,40
2020	Visiting Professor (1 month)	1	R$ 23.155,29
2019	Senior Visiting Professor Abroad (4 months)	1	R$ 48.470,40
2020	Young Talents - A (12 months)	1	R$ 116.110,58

Name of the project 2	Start date	End date
Complex systems topology and dynamics: Applications to mobility, intelligent cities and living systems	01/01/2019	30/06/2022

Description

It is recognized today that the existence of emergent behaviours in real complex systems, such as self-organization, criticality, and scale invariance, is often associated with the intrinsic relationship between the topology and the dynamics of the problem. In order to clarify this relationship and to understand its consequences, the present research project consists of the modeling and simulation of dynamic processes and transport phenomena in complex systems using techniques from Statistical Physics, Computational Physics and Computer Science. The

research to be carried out falls within research lines that constitute the frontier of knowledge in the area of Complex Systems today, with emphasis on Theoretical and Computational Physics. Of course, the increase in the amount of scientific information must go hand in hand with the development of systemic analysis tools that can clarify the origin of the mechanisms that regulate the global properties of complex systems, whether on a microscopic or macroscopic scale. The research approach we intend to carry out is applied to different scientific-technological areas, from the planning and development of intelligent cities to the study of dynamical processes in complex networks, finance and neuroscience. Dynamical processes involving many interacting agents, relating through a network, represent complex systems, where only a detailed description of the topology of the associated networks, the elementary units that constitute them, and the existing microscopic interactions can elucidate the various and intricate nuances of observed global behaviours. In this way, modelling and simulation of complex systems that use detailed mathematical models as well as modern computational techniques to obtain their numerical solutions, represent nowadays crucial activities in several branches of knowledge, with applications in Biology, Engineering, Physics, Chemistry, Computer Science, Economics and Sociology. The search for a natural environment for high level and multidisciplinary scientific research in complex systems certainly points to the activities of theoretical groups of Statistical Physics, Computational Physics and Computer Science. It is in this context that the proponent members of the present project develop research activities on the mathematical modelling and simulation of complex systems.

Work missions related to the cooperation project

Year	Quantity	Amount
2019	3	R$ 58.989,00
2021	2	R$ 39.204,00
2020	2	R$ 39.204,00

Resources to maintenance the projects

Year	Amount
2021	R$ 10.000,00
2020	R$ 10.000,00
2019	R$ 10.000,00

Scholarships related to the cooperation project

Modality		Year	Quantity	Amount
2022	Split-Site Doctoral Program (6 months)		1	R$ 40.478,40
2020	Visiting Professor (1 month)		2	R$ 46.310,58
2020	Split-Site Doctoral Program (6 months)		3	R$ 121.435,20
2019	Visiting Professor (1 month)		1	R$ 23.155,29
2021	Split-Site Doctoral Program (6 months)		1	R$ 40.478,40

2019	Senior Visiting Professor Abroad (6 months)	1	R$ 65.678,40
2019	Split-Site Doctoral Program (6 months)	1	R$ 40.478,40
2021	Visiting Professor (1 month)	2	R$ 46.310,58
2022	Visiting Professor (1 month)	1	R$ 23.155,29
2019	Young Talents - A (6 months)	1	R$ 59.155,29
2021	Young Talents - A (6 months)	1	R$ 59.155,29

WORK MISSIONS NOT RELATED TO THE COOPERATION PROJECT

Year of work missions	Quantity of work missions per year	Amount of work missions
2019	2	R$ 24.000,00
2021	2	R$ 24.000,00
2020	2	R$ 24.000,00
2022	1	R$ 12.000,00

SCHOLARSHIPS NOT RELATED TO THE COOPERATION PROJECT

Year of the scholarships	Modality	Quantity	Amount
2020	Junior Visiting Professor Abroad (12 months)	1	R$ 113.716,80
2019	Split-Site Doctoral Program (12 months)	2	R$ 152.553,60
2020	Split-Site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Split-Site Doctoral Program (12 months)	1	R$ 76.276,80
2018	Split-Site Doctoral Program (6 months)	1	R$ 40.478,40
2022	Split-Site Doctoral Program (6 months)	1	R$ 40.478,40
2022	Split-Site Doctoral Program (6 months)	2	R$ 80.956,80
2019	Visiting Professor (3 months)	1	R$ 51.955,29
2020	Post-Doutoral Program (12 months)	1	R$ 69.310,58

OTHER PROGRAM ACTIONS

Year	Actions	Description	Amount
2019	Accomplishment of an International workshop	An international workshop will be conducted in cooperation with the Advanced Studies School to bring together the Physics and Complex System Engineering and Humanities areas.	R$ 30.000,00

Theme 2

Geometry and Nonlinear Methods

INTERNATIONAL COOPERATION PROJECTS

Name of the project 1	Start date	End date
Geometry and non-linear analyses in singular spaces and applications	01/08/2018	31/07/2022

Description

The project brings together the graduate programs in Mathematics (grade 7), Teleinformatics Engineering (grade 6) and Economics (grade 5) and has as a guiding principle the use of geometric and analytical methods in the Theory of Information and signal processing, with applications in Telecommunications and Finances. The PPG (Graduate Program) in Mathematics is one of the pioneers, nationally, in terms of international collaborations, formalized, in the last years, in many agreements and projects, for example PRONEX, COFECLUB, Science Without Borders, among others. The Mathematics major was promoted to grades 6 and 7 in consecutive CAPES assessments, whereas the GP in Teleinformatics Engineering, despite its recent installation, has been awarded with international quality status. In the last years, researchers of both GPs have participated in joint research projects, financed by funding agencies, some of which with counterpart from foreign institutions. Recently, the interest of research, originally focused in geometric, dynamical or analytical aspects of signal processing and optimization in the presence of curvature, derived to possibilities of application to Finances of machine learning methods adapted to non-linear or singular contexts. With these developments, the projects started to involve researchers of the GP in Economics, a program with intense history of collaboration with administration and public finances bodies in the State of Ceará. The project seeks to integrate these internal collaborations to the foreign cooperation network maintained by the most internationally consolidated majors, involving, in the present proposal, prestigious American and French universities. Such integration is fully aligned with the UFC Internationalization Agenda. In general terms, the mathematical models defined in the project are elaborated in terms of partial differential equations, deterministic or stochastic. Complex phenomenon, involving nonlinearities, phase transitions and structure emergencies which optimize energy can be geometrically understood as manifestations of a space curvature, object of study of differential geometry and its analytical counterpart, Geometrical Analysis. The theme involves the use of geometric, dynamical and analytical techniques in singular or stratified spaces to the study of the relation between stochastic processes, phase transitions and geometry of information applied to large data sets about financial assets.

Resources to maintenance the projects

Year	Amount
2020	R$ 10.000,00

2019	R$ 10.000,00
2021	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2018	Visiting Professor (15 days)	3	R$ 48.465,87
2020	Visiting Professor (15 days)	3	R$ 48.465,87
2019	Split-Site Doctoral Program (12 months)	1	R$ 76.276,80
2019	Junior Visiting Professor Abroad (12 months)	1	R$ 113.716,80
2021	Split-Site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Visiting Professor (15 days)	3	R$ 48.465,87
2020	Senior Visiting Professor Abroad (12 months)	1	R$ 123.076,80
2019	Visiting Professor (15 days)	3	R$ 48.465,87
2020	Split-Site Doctoral Program (12 months)	1	R$ 76.276,80
2020	Junior Visiting Professor Abroad (12 months)	1	R$ 113.716,80

WORK MISSIONS NOT RELATED TO THE COOPERATION PROJECT

Year of work missions	Quantity of work missions per year	Amount of work missions
2020	2	R$ 24.000,00
2019	2	R$ 24.000,00
2021	2	R$ 24.000,00

SCHOLARSHIPS NOT RELATED TO THE COOPERATION PROJECT

Year of the Scholarships	Modality	Quantity	Amount
2019	Split-Site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Senior Visiting Professor Abroad (12 months)	1	R$ 123.076,80
2021	Split-Site Doctoral Program (12 months)	1	R$ 76.276,80
2020	Split-Site Doctoral Program (12 months)	2	R$ 152.553,60
2021	Young Talents - A (12 months)	1	R$ 116.110,58
2022	Split-Site Doctoral Program (6 months)	2	R$ 80.956,80
2018	Post-Doctoral Program (6 months)	1	R$ 35.755,29
2018	Young Talents - A (3 months)	1	R$ 51.955,29

OTHER PROGRAM ACTIONS

Year	Actions	Description	Amount

2020	Implementation of an advanced studies school in geometric methods and dynamics	The interaction with researchers in Purdue and other partners will foster the organization of an international advanced studies school in geometric methods and dynamics with the intention of expanding the existing collaboration to other research groups and institutions. Applications to diffusion processes, theory and geometry of information and transitions of topological phases must be addressed.	R$ 50.000,00

Theme 3

New Chemical and Biological Products and their Applications

INTERNATIONAL COOPERATION PROJECTS

Name of the project 1	Start date	End date
Tissue engineering and microfluidics in the control of biofilm dependent oral diseases and their local and systemic implications	01/01/2019	31/07/2022

Description

Biofilms are involved in the etiopathogenetic of dental caries and periodontitis, the two most common oral diseases for dentists in their practice. In addition, contemporary medicine is facing the spread of biofilm-related infections and the presence of oral biofilm has been linked to systemic problems such as ventilator-associated pneumonia, infective endocarditis, and other cardiovascular diseases. Considering that microorganisms, when organized in biofilms, are inherently more tolerant to host defenses and antibiotic treatments, and that the estimated costs are US $ 544.41 billion, studies of oral microorganisms associated with dental caries, methods for their control and treatment, as well as to understand their potential systemic repercussions are relevant. The integration of microflora with tissue engineering is responsible for the development of devices capable of integrating complex physical environments that mimic the normal environment of organs and cultured tissues, making these models similar to those found in vivo. Microfluidic devices simulate interactions between cells, tissues and even between various organs and treatments, allowing the study of various biological processes, which are not possible using conventional or 2D cell culture systems. In dentistry, microfluidics is an emerging technology that also allows the assessment of odontoblastic changes as well as its relationship with the interface formed between dentin and dental materials, representing an innovative technology for the understanding of cellular and extracellular interactions by the evaluation of the pulp response (differentiation, viability, morphology). This project includes 3 research activities: (1) Studies on biofilms related to dental and oral caries; (2) Evaluation of dental materials used in

restorative dental caries treatments using microfluidic devices; (3) Evaluate potential "organ-on-chip" applications for the study of oral microorganisms. The main objective is to investigate the use of tissue engineering associated with microfluidics, using microorganisms and oral biofilms, to understand potential systemic repercussions of biofilm-dependent oral diseases (dental caries), as well as to develop and test new dental materials and therapies, thus evaluating their interactions and effects on specific cells or tissues.

Work missions related to the cooperation project

Year	Quantity	Amount
2021	1	R$ 26.445,00
2019	1	R$ 26.445,00
2020	1	R$ 26.445,00

Resources to maintenance the projects

Year	Amount
2019	R$ 10.000,00
2020	R$ 10.000,00
2021	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2021	Visiting Professor (1 month)	1	R$ 23.155,29
2021	Split-site Doctoral Program (6 months)	1	R$ 40.478,40
2019	Split-site Doctoral Program (9 months)	1	R$ 61.264,80
2020	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2019	Visiting Professor (1 month)	1	R$ 23.155,29
2020	Senior Visiting Professor Abroad (6 months)	3	R$ 197.035,20

Name of the project 2	Start date:	End date:
Combination of synthesis, imaging and genetic model in vivo: innovative approach from Brazil and Australia for the pre-clinical and clinical development of anticancer drugs	01/01/2019	31/07/2022

Description

This project aims to combine Brazilian and Australian efforts in the pre-clinical studies of two compounds of Brazilian biodiversity, pisosterol and 2,3,9-trimethoxypy- terocarp, which had their cytotoxic potentials previously proven by our research group through cellular and molecular

studies. Pisoterol is a cytotoxic blocker of the amplification of the MYC oncogene in leukemia and glioblastoma cell lines. The amplification of MYC is a mechanism associated with the invasion and aggressiveness of many tumors, and its inhibition is of great value in anticancer therapy. 2,3,9-trimethoxypyrotecarpane is a non-tubulinic, selectively cytotoxic agent for tumor cells, therefore with fewer side effects on non-proliferative cells when compared to tubulin antimitotics. These results strongly suggest that both natural products are promising antitumor compounds and justify further studies, combining synthesis of derivatives, imaging tests, and essays with genetic models of cancer to validate them as new antitumor drugs. The development of the project will require innovative techniques in organic synthesis and pre-clinical drug development, based on "omic" techniques, "high-content" analyzes and in vivo trials with more reliable genetic models of cancer. The validation of two natural products as new leading antitumor compounds may be of great interest to the pharmaceutical industry, especially the Brazilian industry, which imports 90% of the drugs in clinical use. In addition, the identification of new antitumor drugs originating from Brazilian biodiversity will project Brazil into the scenario of drug development. The project will involve a multidisciplinary research team, UFC, and the Australian National University (ANU, Australia), which has already established an official cooperation agreement. The Brazilian team will be composed of researchers from graduate programs as Pharmacology (CAPES 6), Chemistry (CAPES 6) and Medical Sciences (CAPES 6), while the Australian team will be composed of researchers from the Cancer Therapy Group (College of Medicine, Biology and Environment) and the School of Research in Chemistry. It is noteworthy that the Australian group has strong collaboration with international pharmaceutical industries and that the Australian university (ANU) is ranked as the 20th best university in the world.

Work missions related to the cooperation project

Year	Quantity	Amount
2021	2	R$ 48.116,00
2020	2	R$ 48.116,00
2019	2	R$ 48.116,00

Resources to maintenance the projects

Year	Amount
2019	R$ 10.000,00
2020	R$ 10.000,00
2021	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2020	Visiting Professor (1 month)	1	R$ 23.155,29
2021	Split-site Doctoral Program (6 months)	3	R$ 121.435,20
2019	Post-Doctoral Program (6 months)	1	R$ 35.755,29

2021	Post-Doctoral Program (6 months)	1	R$ 35.755,29
2020	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2020	Senior Visiting Professor Abroad (3 months)	1	R$ 39.866,40
2019	Senior Visiting Professor Abroad (3 months)	1	R$ 39.866,40
2019	Split-site Doctoral Program (6 months)	1	R$ 40.478,40
2020	Junior Visiting Professor Abroad (3 months)	1	R$ 36.986,40
2021	Visiting Professor (1 month)	2	R$ 46.310,58
2019	Visiting Professor (1 month)	1	R$ 23.155,29

Name of the project 3	**Start date**	**End date**
Analysis and development of new chemical compounds with potential applications in biological and chemical technologies	01/08/2018	31/07/2022

Description

The objective is to focus on the usage of chemical compounds and their application in the biology, environment and technology field, specifically in the areas of: Coordination Compounds, Catalyse, Analytical Methods, Biopolymers, Bioactive Materials, Sensors and Corrosion Inhibition. The project aims to investigate the chemical proprieties of selected compounds and their applications in several areas, such as metallo-pharmaceuticals, biosensors, catalyzers, inhibitors, trace analysis detections, green chemistry and drug delivery. Those topics have been present in over 60.000 articles over the past five years (based on databases from Web of Science). The activities included in this project will be developed in collaboration with researchers from the undergraduate program of Chemistry and Biochemistry from UFC and institutions from Australia, Canada, England, France, Germany, Italy, Mexico and Scotland. Although almost all the collaboration cited here is already ongoing, new ones are expected to come. The objectives of the project are: 1) Developing metallic compound with possible application as metallo-pharmaceuticals and biosensors; 2) Synthesis of materials with a nano-structured oxide base; 3) Development of modified electrodes for application as electrochemical sensors to quantifying organic contaminants in fresh waters and food; 4) Development of new analytical methods using fast and low cost instruments to improve analytical processes, as well as fingertip impressions of chemical elements and species in different samples; 5) Usage of biopolymers (polysaccharides) in the development process of innovative pharmaceutical nano-formulations for the application in the delivery of medicine; 6) Isolation and characterization of natural bioactive products, production of semi-synthetic byproducts and synthesis of bioactive substances through biocatalysts; 7) Analysis of organic molecules applied as metals and alloys corrosion inhibitors aiming to use electrochemical techniques and molecular modeling methods to establish a computer protocol that makes it possible to classify organic molecules accordingly to its corrosion inhibition efficiency.

Resources to maintenance the projects

Year	Amount
2021	R$ 10.000,00
2020	R$ 10.000,00
2019	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2020	Split-site Doctoral Program (6 months)	1	R$ 40.478,40
2021	Visiting Professor (2 months)	2	R$ 75.110,58
2018	Split-site Doctoral Program (6 months)	1	R$ 40.478,40
2021	Visiting Professor (5 months)	1	R$ 80.755,29
2021	Training (3 months)	1	R$ 25.466,40
2020	Training (3 months)	1	R$ 25.466,40
2019	Visiting Professor (2 months)	1	R$ 37.555,29
2019	Training (3 months)	1	R$ 25.466,40
2019	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2020	Visiting Professor (2 months)	4	R$ 150.221,16

WORK MISSIONS NOT RELATED TO THE COOPERATION PROJECT

Year of work missions	Quantity of work missions per year	Amount of work missions
2021	2	R$ 24.000,00
2022	2	R$ 24.000,00
2019	4	R$ 48.000,00
2020	4	R$ 48.000,00

SCHOLARSHIPS NOT RELATED TO THE COOPERATION PROJECT

Year of the scholarships	Modality	Quantity	Amount
2019	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Split-site Doctoral Program (12 months)	2	R$ 152.553,60
2020	Junior Visiting Professor Abroad (12 months)	2	R$ 227.433,60
2020	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2019	Visiting Professor (3 months)	3	R$ 155.865,87
2022	Visiting Professor (3 months)	2	R$ 103.910,58
2021	Young Talents - A (12 months)	1	R$ 116.110,58
2018	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2021	Post-Doctoral Program (12 months)	1	R$ 69.310,58
2018	Senior Visiting Professor Abroad (3 months)	2	R$ 79.732,80

OTHER PROGRAM ACTIONS

Year	Actions	Description	Amount
2021	Organization of an international seminar	An institutional / international seminar will be held to bring together institutional seminar groups that conduct research using biodiversity to make innovation in the so-called Bioeconomy.	R$ 50.000,00

Theme 4

Social Technologies

INTERNATIONAL COOPERATION PROJECTS

Name of the project 1	Start date	End date
Health Technologies: actions and strategies for health promotion	01/08/2019	31/07/2022

Description

This project will be developed by involving actions and strategies that promote individual, group and collective skills and capabilities to promote health and well-being. The main strategy is the use of technologies to improve health among individuals at different ages who need health care and education. Health promotion is the process of empowering people to increase control and improve their health; the main strategies include building public health policies, creating health-friendly environments, strengthening community health actions, developing personal skills and reorienting services in health. Scientific research has been instrumental in improving human health. Health technologies have been investigated by project members with a focus on the health of disadvantaged groups such as children with sleep behavior problems, who are at increased risk for obesity, depression and anxiety, as well as people with risk behavior, disabled people, cancer, HIV / AIDS, diabetes, hypertension, cardiovascular disease patients, and drug adherence. These subjects will be investigated interdisciplinary by the Graduate Program in Nursing and the Graduate Program in Pharmaceutical Sciences of UFC in partnership with the Graduate Program in Nursing of the University of British Columbia / Canada. All the highlighted topics show international relevance and priority for global strategies to improve people's health. Considering the breadth of the study topics, it is important to incorporate a variety of research methods. The team aims to increase understanding and evidence-based best practice using randomized clinical trial, systematic reviews and methodological studies. These types of studies, in partnership with the University of British Columbia, will allow the transfer of knowledge and will have a significant impact on the proposed area. Canada is a leading country in Health Promotion

and public health policies involving all aspects of health improvement and for this reason we have established the partnership. The main objective of this proposal is to develop studies and partnerships on health promotion focusing on the development of actions and strategies that promote individual, group and collective skills and capacities in health promotion, and the creation, validation and application of technologies for health assessment.

Work missions related to the cooperation project

Year	Quantity	Amount
2019	2	R$ 46.520,00
2020	5	R$ 116.300,00
2021	3	R$ 69.780,00

Resources to maintenance the projects

Year	Amount
2019	R$ 10.000,00
2020	R$ 10.000,00
2021	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2019	Split-site Doctoral Program (6 months)	1	R$ 40.478,40
2020	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2020	Junior Visiting Professor Abroad (6 months)	1	R$ 60.638,40
2019	Visiting Professor (1 month)	1	R$ 23.155,29
2019	Junior Visiting Professor Abroad (3 months)	1	R$ 36.986,40
2018	Split-site Doctoral Program (6 months)	1	R$ 40.478,40
2020	Visiting Professor (15 days)	1	R$ 16.155,29

Name of the project 2	Start date	End date
Socio-environmental technologies and integrated methodologies in territorial sustainability: community alternatives to face weather changes	01/01/2019	31/12/2021

Description

Society has always sought in nature the resources needed to meet its needs. However, without considering the natural limitations of the most fragile environments, this search has led to unprecedented forms of degradation. This situation is exacerbated by current climate changes, increasing the vulnerability of unassisted populations, as is the case in large areas of Brazil; especially on the coasts that are part of the Caatinga and Amazon biomes, which possess unique environmental characteristics and considerable social and environmental potential. In this

perspective, the research intends to evaluate the vulnerability of communities to climate change scenarios, aiming at the elaboration of strategies that guarantee water, food and energy safety, as a territorial strategy for the sustainable use of natural resources, in addition to developing technologies and integrated actions of sustainability and governance, focusing on renewable energy projects, especially in the main cities of the regions selected for the study. The methodologies that will be developed integrate the areas of environmental, social and health sciences, in order to incorporate analytical methods that allow for a better understanding of the management systems of social and environmental resources and the diffusion of key territorial and urban policies in the face of climate change in the biomes in study. It is worth mentioning that the project meets the Sustainable Development Objectives of the UN Agenda 2030, focused on community analysis and diagnostics, with participatory methodologies and low-cost technologies adapted to the sustainability of local families and institutions. In this process, science is articulated to socio-educational practices of dissemination of research. The proposal has as international partners universities from the United States, England, France, New Zealand, Spain, Argentina, Mexico and Italy and has financial resources (consumption and capital) already approved by national and international development agencies.

Work missions related to the cooperation project

Year	Quantity	Amount
2021	1	R$ 12.440,00
2020	1	R$ 12.440,00
2019	1	R$ 12.440,00

Resources to maintenance the projects

Year	Amount
2020	R$ 10.000,00
2019	R$ 10.000,00
2021	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2019	Junior Visiting Professor Abroad (12 months)	1	R$ 113.716,80
2020	Split-site Doctoral Program (6 months)	3	R$ 121.435,20
2021	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2019	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2020	Junior Visiting Professor Abroad (12 months)	1	R$ 113.716,80

WORK MISSIONS NOT RELATED TO THE COOPERATION PROJECT

Year of work missions	Quantity of work missions per year	Amount of work missions
2021	1	R$ 12.000,00

2022	1	R$ 12.000,00
2020	2	R$ 24.000,00
2019	2	R$ 24.000,00

SCHOLARSHIPS NOT RELATED TO THE COOPERATION PROJECT

Year of the scholarships	Modality	Quantity	Amount
2020	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Junior Visiting Professor Abroad (12 months)	1	R$ 113.716,80
2021	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2019	Split-site Doctoral Program (12 months)	2	R$ 152.553,60
2022	Visiting Professor (3 months)	2	R$ 103.910,58
2019	Post-Doctoral Program (12 months)	1	R$ 69.310,58
2022	Young Talents - A (12 months)	1	R$ 116.110,58
2022	Post-Doctoral Program (6 months)	1	R$ 35.755,29

OTHER PROGRAM ACTIONS

Year	Actions	Description	Amount
2021	Summer School in the field of humanities	A large international school will be held in the field of humanities in collaboration with partner institutions with the goal of attracting international students to the UFC as well as allow for the transmission of knowledge generated in the collaboration projects for local students and researchers who are not directly involved in the projects.	R$ 100.000,00

Theme 5

Materials and Nanoscale Phenomena

INTERNATIONAL COOPERATION PROJECTS

Name of the project 1	Start date	End date
Capture and conversion of CO_2: from nanoscale to process project	01/08/2018	31/07/2022

Description

One of the main causes of global warming has been attributed to the escalation of the greenhouse effect, due to the increased concentration of carbon dioxide (among other gases) in the Earth's

atmosphere. Most power plants in the world operate by burning fuels, and exhaust gases are one of the main anthropogenic sources of CO_2 emissions. Although there is an ongoing debate on the real role of anthropogenic greenhouse gas emissions on global warming, the amount of CO_2 emitted is undoubtedly a potential raw material for producing organic molecules of interest, from fuels to high value-added polymers. However, there are several challenges to overcome in order CO_2 is considered a feasible reagent. In addition to being a very oxidized and extremely stable molecule, in exhaust gases it is presented in low concentrations (5-14%, vol) at atmospheric pressure and usually along with other contaminants (water vapor, NO_x, SO_x, ...). All these factors limit the separation of CO_2 in a purity degree usually required for conversion. In this context, there is a growing interest of the scientific community to identify heterogeneous catalysts that convert CO_2 into valuable molecules, which is currently an open and active field of research. A group of researchers linked to GP in Chemical Engineering (PGEQ/ UFC) has consolidated experience in the development of materials and processes focused on adsorption-based separations, focusing on CO_2 capture. In the last 15 years, international collaborations have been established with the University of Malaga and the University of Leipzig. The research has not only experimental character (synthesis and characterization of materials), but also molecular scale phenomena simulation and the performance of the reaction and separation process itself. Concerning this last aspect, the PGEQ team initiated recent interactions with groups from the universities of Missouri, Melbourne and Alberta. We have also received contributions from researchers with a background in Chemistry, regarding the synthesis and characterization of solids with catalytic properties to convert CO_2 into molecules of interest. In this particular aspect, there is an already international collaboration initiated with IRCE-Lyon. The main objective of this project is to consolidate a network of researchers of international excellence to investigate different and complementary aspects of the capture and conversion of CO_2.

Work missions related to the cooperation project

Year	Quantity	Amount
2019	2	R$ 31.212,00
2021	2	R$ 33.534,00
2020	2	R4 31.579,00

Resources to maintenance the projects

Year	Amount
2019	R$ 10.000,00
2020	R$ 10.000,00
2021	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2020	Visiting Professor (15 days)	2	R$ 32.310,58

2021	Visiting Professor (15 days)	2	R$ 32.310,58
2019	Visiting Professor (15 days)	2	R$ 32.310,58
2021	Split-site Doctoral Program (12 months)	2	R$ 152.553,60
2019	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Young Talents - A (12 months)	1	R$ 116.110,58
2020	Split-site Doctoral Program (12 months)	1	R$ 76.276,80

Name of the project 2	Start date	End date
Inorganic, organic and inorganic-organic hybrid (nano)material synthesis: new structures and new physical phenomena	01/08/2018	30/06/2022

Description

Advances in condensed matter Physics have led to the discovery of new materials with low dimensionality that exhibit new physical fundamental phenomena and functionalities, with applications in solid state devices, production and storage of energy and health sciences, among others. For example, the isolation of graphene in 2004 initiated a vast field of research dedicated to exploring the unique characteristics of two-dimensional (2D) materials. In addition to graphene, a wide range of other materials has been added to the family of 2D materials, such as hexagonal boron nitride (HBN), transition metal dihalide (TMDCs) and transition metal carbides and nitrides. Several techniques have been used to obtain 2D materials, the main ones being the mechanical exfoliation technique and the method of chemical deposition in vapor phase, recently under high pressures. Some consequences are the appearance of new phases and the change of the samples reactivity, data that can be used to obtain materials that are not accessible under ambient conditions. Several new materials were obtained through high pressure experiments. For example, high pressure methods have been an established routine to obtain new superconductors, materials with unseen stoichiometries, unconventional chemical bonds, and electrets. Another example of promising new materials are the perovskites of inorganic-organic hybrid halides that have emerged as materials with excellent semiconductor and light absorption properties. The energy conversion efficiency of small perovskite solar cells soared from 3.8% to 22.1%, approaching that of commercialized rivals. Thus, this is one of the hot topics of science, being the fastest growing photovoltaic technology. In another aspect, solid state physics has been inserted into the health sciences through the crystal engineering that makes intensive use of structural chemistry and (nano)technology formulation to reduce toxicity and improve bioavailability, and to develop new combined therapies. This collaborative project involves highly qualified research groups in the USA, Ireland, China, India and Argentina, focused on the development of new inorganic, organic and inorganic-organic hybrid materials. The combined

experience of international partners with the local team will lead to the discovery of new structures and new physical-chemical phenomena.

Work missions related to the cooperation project

Year	Quantity	Amount
2022	1	R$ 12.000,00
2021	2	R$ 30.844,00
2019	2	R$ 30.844,00
2020	2	R$ 30.844,00

Resources to maintenance the projects

Year	Amount
2019	R$ 10.000,00
2020	R$ 10.000,00
2021	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2019	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2020	Young Talents - A (12 months)	1	R$ 116.110,58
2020	Senior Visiting Professor Abroad (6 months)	2	R$ 131.356,80
2021	Visiting Professor (15 days)	1	R$ 16.155,29
2020	Junior Visiting Professor Abroad (12 months)	1	R$ 113.716,80
2019	Visiting Professor (15 days)	1	R$ 16.155,29
2020	Visiting Professor (15 days)	1	R$ 16.155,29
2020	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2021	Split-site Doctoral Program (6 months)	2	R$ 80.956,80

Name of the project 3	Start date	End date
Theoretical and experimental bases for the development of biosensors based on nanomaterials and lectins for the detection of tumor cells	01/08/2018	31/07/2022

Description

Bioprospecting, isolation, characterization and application of purified compounds from the Brazilian flora are huge challenges that add value to biodiversity and contribute to the socioeconomic development of the country. Among the various compounds found in nature, lectins comprise a group of proteins of non-immune origin, widely distributed in nature, with high biotechnological potential due to their ability to decipher, in a specific and reversible way, cell glycoside. Some lectins are available commercially as supplies for isolation and detection of

glycoconjugates, some of which are aberrantly expressed in diseases such as cancer. An important way to diagnose such diseases is to monitor changes in glycosylation patterns. Lectins have been used to detect and characterize tumor cell biomarkers using tools such as ELISA and lectin-array. However, such techniques exhibit disadvantages, such as low sensitivity and need for fluorescent labelling during the essay. Surface Chemistry is a new field of science that has brought numerous important applications to lectins. These molecules, when functionalized in different nanomaterials, offer the possibility of designing low-cost sensors for the desired applications and specifications (sensitivity and selectivity). With the advancement of materials science and nanotechnology, lectins were integrated into several biosensors projects, providing a diagnostic tool for diseases with low levels of biomarkers that could detect cancer at the initial tumor stage. Currently, the initial diagnosis of brain cancer (glioma) is extremely difficult and this is one of the reasons for treatment failure. The development of a biosensor to detect the early stages of tumor onset will greatly contribute to the survival of many patients. However, the low number of lectins available in the market is a limiting factor for the development of sensors for the various existing diseases. In this sense, this project aims to bio prospect new lectins from Brazilian flora, to characterize them chemically and structurally, to evaluate the interaction of new lectins and others already discovered, with different types of glycans and nanomaterials, and to develop a biosensor capable of detecting glioma.

Work missions related to the cooperation project

Year	Quantity	Amount
2019	2	R$ 59.551,00
2021	5	R$ 65.628,00
2020	9	R$ 191.390,00

Resources to maintenance the projects

Year	Amount
2019	R$ 10.000,00
2020	R$ 10.000,00
2021	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2020	Visiting Professor (1 month)	2	R$ 46.310,58
2019	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2019	Visiting Professor (1 month)	2	R$ 46.310,58
2020	Split-site Doctoral Program (12 months)	1	R$ 76.276,80

WORK MISSIONS NOT RELATED TO THE COOPERATION PROJECT

Year of work missions	Quantity of work missions per year	Amount of work missions
2020	2	R$ 24.000,00
2018	1	R$ 12.000,00
2022	2	R$ 24.000,00
2021	2	R$ 24.000,00
2019	2	R$ 24.000,00

SCHOLARSHIPS NOT RELATED TO THE COOPERATION PROJECT

Year of the scholarships	Modality	Quantity	Amount
2019	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2020	Split-site Doctoral Program (12 months)	2	R$ 152.553,60
2019	Senior Visiting Professor Abroad (6 months)	2	R$ 131.356,80
2021	Visiting Professor (3 months)	2	R$ 103.910,58
2018	Junior Visiting Professor Abroad (6 months)	1	R$ 60.638,40
2019	Young Talents - A (12 months)	1	R$ 116.110,58
2018	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2021	Post-Doctoral Program (12 months)	2	R$ 138.621,16

OTHER PROGRAM ACTIONS

Year	Actions	Description	Amount
2019	Technical staff training	Train laboratory technicians	R$ 20.000,00
2020	Technical staff training	Train laboratory technicians	R$ 20.000,00

Theme 6

Water and Residue Management & Safety in the Face of Climate Change

INTERNATIONAL COOPERATION PROJECTS

Name of the project 1	Start date	End date
The impact of climatic changes in the natural resources or dry regions	01/01/2019	31/12/2021

Description

The outlook of this project is to consolidate a research international network on drylands natural resources, with researchers of both basic and applied sciences, interacting in a multidisciplinary and transversal way. It is intended to achieve this goal through: collaborative research; submission of research projects to development institutions (in Brazil and abroad); exchange of students in both directions; co-responsibility in courses; and joint publication of scientific articles. The proposal involves 3 graduate programs (GP): one from the Agricultural Sciences Center (Agricultural Engineering, grade 5); one from the Faculty of Sciences (Ecology and Natural Resources, grade 4); and one from the Technology Center (Hydraulic and Environmental Engineering, grade 7). Each PPG brought together a solid international experience: Agricultural Engineering collaborated with people in Germany (Potsdam, Leipzig), the United States (USDA), the Netherlands (Wageningen, Twente), Spain (Valladolid, Córdoba), Portugal (Madeira, Fernando Pessoa) Switzerland (ETH), France (Lyon) and Cuba (Havana); the Ecology course works with partners in France (IRD, Montpelier) and Portugal (Lisbon); and Hydraulic Engineering with researchers in Canada (Alberta) and United Kingdom (Cambridge). The internationalization proposal is focused on four institutions: U. Leipzig, USDA, IRD and U. Valladolid. The scientific goal is to assess the impacts of climate change on natural resources, focusing on adaptation strategies aiming at water availability and biodiversity. Three tasks were established: (1) to quantify changes in ecosystem services and their impacts on water resources; (2) to investigate the influence of anthropogenic actions in the degradation and desertification of river basins, and methods of recovery; and (3) to investigate adaptation strategies to reduce the risk of water scarcity, including in situ study of evaporation in reservoirs and efficient use of water in food production. This project should consolidate a network of natural resources in drylands; and internationalization must benefit the institutions and, above all, science and society from areas with water shortages. The overall objective of this proposal is to investigate, using an inter and multidisciplinary approach, the impacts of climate change on water resources and to develop adaptation strategies to reduce the risk of water scarcity, to promote soil conservation and to enable the restoration of biodiversity degraded areas.

Work missions related to the cooperation project

Year	Quantity	Amount
2019	1	R$ 26.438,00
2020	1	R$ 26.438,00
2021	1	R$ 26.438,00

Resources to maintenance the projects

Year	Amount
2019	R$ 10.000,00
2021	R$ 10.000,00
2020	R$ 10.000,00

Scholarships related to the cooperation project			
Year	**Modality**	**Quantity**	**Amount**
2020	Split-site Doctoral Program (6 months)	1	R$ 40.478,40
2019	Visiting Professor (3 months)	1	R$ 51.955,29
2019	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2020	Visiting Professor (2 months)	1	R$ 37.555,29
2021	Visiting Professor (2 months)	1	R$ 37.555,29
2020	Young Talents - A (12 months)	1	R$ 116.110,58

Name of the project 2	Start date	End date
Facing the effects and causes of climate changes: building resilience	01/08/2018	31/12/2021

Description

This project confronts two important dimensions of climate change and water pollution, one a cause and the other an effect of the anthropic action on the environment. The first dimension is the contribution of organic matter from solid urban waste to the increase of greenhouse gases and the pollution of surface and underground water resources, and the second is the impact of global warming, changes in the hydrological regime and anthropogenic eutrophication in the quality of human water supply. Solutions to the two theoretical extremes of environmental sanitation are proposed, that, in practice, intertwine in the biosphere. One of the biggest global challenges currently faced by humanity is the access to a safe source of potable water. This is particularly acute in developing countries where human activities negatively impact the quality of water. In eutrophicated reservoirs, the level of nutrients is high, thus interfering in the growth of cyanobacteria, production and release of harmful toxins. These toxins can cause acute and chronic symptoms in humans and animals resulting in health problems and even deaths. In another dimension, the use of the organic fraction of urban solid waste (FORSU) as a source of renewable energy has been considered important due to the treatment that can be provided to this fraction and to the promotion of energetic matrix diversification. Among FORSU treatment methods, the biological products stand out for providing recycling with waste recovery through the conversion, in aerobic or anaerobic conditions, of organic compounds to agricultural purposes, as in the case of composting or biogas production through controlled anaerobic digestion. This multidisciplinary project is an excellent opportunity for high-level human resources, postdoctoral, doctorate and master's degree researchers to learn from the collaboration with leading specialists in the United Kingdom and Germany. The project will facilitate the training of new researchers with the competences acquired throughout the project, thus, from a multidisciplinary stance, benefiting the programs. In addition to contribute to improve water quality in Brazil with a sustainable, safe, robust and low-cost treatment solution, the ameliorated water

availability will be essential to the economic growth where there is a huge demand of water to hydropower, agriculture, industry and domestic use.

Work missions related to the cooperation project

Year	Quantity	Amount
2021	1	R$ 22.449,00
2019	1	R$ 22.449,00
2020	4	R$ 92.848,00

Resources to maintenance the projects

Year	Amount
2021	R$ 10.000,00
2020	R$ 10.000,00
2019	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2020	Training (3 months)	1	R$ 25.466,40
2019	Senior Visiting Professor Abroad (12 months)	1	R$ 123.076,80
2020	Senior Visiting Professor Abroad (6 months)	1	R$ 65.678,40
2019	Training (3 months)	1	R$ 25.466,40
2019	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2020	Split-site Doctoral Program (6 months)	3	R$ 121.435,20
2019	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2021	Split-site Doctoral Program (12 months)	1	R$ 76.276,80

Name of the project 3	Start date	End date
Resilience of water resources in a changing world: climate and society	01/07/2019	31/12/2021

Description

As part of a national effort to raise the excellence of Brazilian academic performance worldwide, the present project proposes four strategic dimensions necessary to reach internationalization in an interdisciplinary way: (1) development of collaborative networks (2) creation of undergraduate and graduate courses (3) promotion of the international visibility of graduate programs and (4) support to excellence in research. This project has a strong focus on Water Safety (WS), which is an imperative to promote sustainable development. Social processes like economic and cultural globalization impose frenetic transformation rhythms, resulting in a new geological time: the

Anthropocene. Therefore, concepts, values and social structures become volatile. In this process of economic production, humanity makes use of material and energy resources in a planetary scale (the planet's ecological footprint represents 170% of its supportability). The relevant energy sources to this development are hydrocarbon, increasing global warming. This process can significantly modify the occurrence patterns of natural climate variability in its multiple time scales. These socio-natural processes produce a crescent complexity and uncertainty to social systems, the increase of water resources systems notably tends to amplify the conflicts of interests in this sector. Adaptive management of water resources is an alternative to guide an action in an environment of complexity and uncertainty. This project aims to impact the current state-of-art, identifying alternative solutions to these problems on technical and scientific fields through a Case Study of a water resource system in the State of Ceará and Northeastern Brazil. New methodologies and conceptual structures capable of generating analyses of complex problems in the society/environment interface are being designed by UFC's Civil Engineer/Water Resources and Sociology Programs. New methodologies and structures are already being developed and will increase in scope and impact if the initiatives of both programs are further extended to international research networks.

Work missions related to the cooperation project

Year	Quantity	Amount
2020	2	R$ 78.602,00
2021	2	R$ 52.891,00
2019	7	R$ 184.017,00

Resources to maintenance the projects

Year	Amount
2021	R$ 10.000,00
2020	R$ 10.000,00
2019	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2021	Visiting Professor (2 months)	2	R$ 75.110,58
2019	Visiting Professor (2 months)	2	R$ 75.110,58
2020	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2020	Visiting Professor (2 months)	2	R$ 75.110,58
2019	Split-site Doctoral Program (6 months)	1	R$ 40.478,40
2019	Senior Visiting Professor Abroad (3 months)	1	R$ 39.866,40
2020	Senior Visiting Professor Abroad (3 months)	1	R$ 39.866,40

WORK MISSIONS NOT RELATED TO THE COOPERATION PROJECT

Year of work missions	Quantity of work missions per year	Amount of work missions
2022	1	R$ 12.000,00
2021	2	R$ 24.000,00
2019	4	R$ 48.000,00
2020	4	R$ 48.000,00

SCHOLARSHIPS NOT RELATED TO THE COOPERATION PROJECT

Year of the scholarships	Modality	Quantity	Amount
2020	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Senior Visiting Professor Abroad (6 months)	2	R$ 131.356,80
2022	Junior Visiting Professor Abroad (6 months)	1	R$ 60.638,40
2019	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Split-site Doctoral Program (12 months)	2	R$ 152.553,60
2018	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2020	Young Talents - A (6 months)	2	R$ 118.310,58
2021	Young Talents - A (12 months)	1	R$ 69.310,58
2020	Split-site Doctoral Program (6 months)	2	R$ 80.956,80

OTHER PROGRAM ACTIONS

Year	Actions	Description	Amount
2020	Summer school in water safety	Water safety is a strategic theme for the world and especially for the state of Ceará. We will conduct a school with the participation of international collaborators to disseminate the results obtained in the execution of water safety projects involving the different dimensions concerned in the matter.	R$ 30.000,00

Theme 7

Infectious, Immunoinflammatory and Degenerative Diseases

INTERNATIONAL COOPERATION PROJECTS

Name of the project 1	Start date	End date
Internationalization of UFC in translational and epidemiological research on neuro-gastroenterology	01/01/2019	30/06/2022

Description

The topics covered here involve approaches that allow, for example, the identification of infectious agents that affect the population, with the possibility of applying the knowledge generated from these domains. We intend to improve our search routine by enabling a multi-user unit for high-tech equipment. INCT-Biomedicine (http://inct.cnpq.br/web/inct-ibisab) allowed the investment in high technology nuclei, with the incorporation of properly trained personnel to work with these devices and achieve the full potential of scientific production in the institution. The consolidation of international collaborations will lead us to master even deeper levels of research, reaching the molecular structure. To that end, mass spectrometry is a recommended method. The recent acquisition of the INCT-IBISAB mass spectrometer allows us to expand our research into proteomic studies, analysis of molecules with low atomic weight, discovery of new biomarkers, drugs and metabolic studies with high resolution, sensitivity and specificity. The interaction with Imperial College will make the research produced in the UFC be of general and current interest. These studies allow a better understanding of the aspects related to the intestinal permeation function, absorption, lesion and inflammation of the intestinal barrier, as well as metabolites associated with malnutrition and enteropathy. This initiative is important for the consolidation of the UFC's interaction with Univ. of Liverpool in the study of the participation of inflammatory cells and their mediators in the phytopathological repercussions of pancreatitis caused by alcohol and bile acids. In addition, the interaction with the Queen Mary Univ. will give us the opportunity to establish new experimental models of laryngopharyngeal reflux disease. We will characterize the mechanisms and obtain new biomarkers involved in the pathobiology of the crural diaphragm in the gastroesophageal reflux, to develop new treatments, such as those obtained from natural products to improve the epithelial integrity of the esophagus, and to develop innovative approaches to improve deficiency. The scientific impact of this initiative includes repercussions in terms of research, human resources training, knowledge transfer and technology, which can guarantee us the opportunity to open new frontiers with the potential of new knowledge and application of perspectives for the society of Ceará and in the Brazilian Northeast.

Work missions related to the cooperation project

Year	Quantity	Amount
2020	3	R$ 33.200,00
2021	3	R$ 33.200,00
2019	4	R$ 12.247,00

Resources to maintenance the projects

Year	Amount
2021	R$ 10.000,00
2020	R$ 10.000,00
2019	R$ 10.000,00

Scholarships related to the cooperation project			
Year	**Modality**	**Quantity**	**Amount**
2020	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2019	Junior Visiting Professor Abroad (6 months)	1	R$ 60.638,40
2019	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2019	Senior Visiting Professor Abroad (6 months)	1	R$ 65.678,40
2020	Senior Visiting Professor Abroad (6 months)	1	R$ 65.678,40
2021	Senior Visiting Professor Abroad (6 months)	1	R$ 65.678,40
2020	Junior Visiting Professor Abroad (6 months)	1	R$ 60.638,40

Name of the project 2	Start date	End date
Improving the translational research in neuroscience at UFC	01/07/2019	30/06/2022

Description

Neuroscience research has acquired a degree of complexity proportional to technological progress in various areas of knowledge, including neuroimaging systems and protocols in Neurobiology. Scientific production in Neuroscience in high-level journals requires the efficient / rational application of state-of-the-art methods to evaluate biological phenomena and their high-quality documentation. Advances in Neuroimaging, Neuroimmunology and Functional Genomics have had a tremendous impact on Neuroscience research, increasing its translational application. This proposal brings together the efforts of Neuroscience researchers from different doctoral programs of the Faculty of Medicine of the Federal University of Ceará (UFC), including Medical Sciences, Pharmacology, Morphofunctional Sciences and Surgery Sciences, ensuring a more transversal and multidisciplinary approach and taking advantage of the benefits of an existing international collaboration network. Existing multi-user medical equipment (including magnetic resonance imaging, laser scanning confocal microscopy, fluid cytometry, luminex, real-time PCR, etc.) is available to our research team, but the availability of highly trained personnel to effectively exploit the protocols applied to translational neuroscience is still a necessity. This proposal aims to gather and integrate renowned international neuroscientists from our international collaboration network to train and qualify human resources in the areas of Neuroimmunology, Neuroimaging and Functional Genomics with emphasis on: Malnutrition/dyslipidemias and brain lesions and cognitive disorders related to stroke in early childhood and aging; Research of neuroprotection drugs in models of neurodegenerative disorders in vitro and in vivo; Sleep, circadian rhythm and neurodegenerative disorders: preclinical and clinical studies; and schizophrenia, depression, and bowel-brain axis. Strengthening UFC Neuroscience research groups will help narrow disparities across the country and underuse expensive equipment and promote a highly desirable integration of research lines into translational products.

Work missions related to the cooperation project

Year	Quantity	Amount
2019	9	R$ 113.130,00
2020	14	R$ 164.894,00

Resources to maintenance the projects

Year	Amount
2019	R$ 10.000,00
2021	R$ 10.000,00
2020	R$ 10.000,00

Scholarships related to the cooperation project

Year	Modality	Quantity	Amount
2019	Split-site Doctoral Program (6 months)	2	R$ 80.956,80
2020	Split-site Doctoral Program (6 months)	4	R$ 161.913,60

WORK MISSIONS NOT RELATED TO THE COOPERATION PROJECT

Year of work missions	Quantity of work missions per year	Amount of work missions
2019	2	R$ 24.000,00
2020	2	R$ 24.000,00
2021	2	R$ 24.000,00
2022	1	R$ 12.000,00

SCHOLARSHIPS NOT RELATED TO THE COOPERATION PROJECT

Year of the scholarships	Modality	Quantity	Amount
2020	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2021	Split-site Doctoral Program (12 months)	2	R$ 152.553,60
2019	Junior Visiting Professor Abroad (12 months)	1	R$ 113.716,80
2020	Senior Visiting Professor Abroad (6 months)	2	R$ 131.356,80
2019	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2019	Young Talents - A (12 months)	1	R$ 116.110,58
2019	Split-site Doctoral Program (12 months)	1	R$ 76.276,80
2019	Post-Doctoral Program (12 months)	2	R$ 138.621,16
2022	Senior Visiting Professor Abroad (6 months)	1	R$ 65.678,40

OTHER PROGRAM ACTIONS

Year	Actions	Description	Amount
2020	Training of technical staff	Training of technical staff	R$ 30.000,00

Amount of expected benefits	
Amount related the Cooperation Projects	R$ 10.430.606,19
Amount related to missions not associated with the Cooperation Projects	R$ 696.000,00
Amount related to scholarships not associated with the Cooperation Projects	R$ 6.027.510,89
Amount related to other actions	R$ 340.000,00
Total amount of the Project	**R$ 17/494.120,08**
COUNTERPART	

Internationalization of the curriculum - Incorporation of international themes in postgraduate classes.

Almost all of the thematic research projects proposed by the different teams foresee the realization of minicourses, high school studies, workshops, technical training seminars and other similar academic activities in English Language during the visit of foreign collaborators to the UFC. In some cases, it is mentioned the availability of online materials of academic activities in the UFC, carried out by professors of the institution, in English Language. All of these activities are planned for undergraduate and graduate studies. Based on this motto, the Office of the Provost for Research and Graduate Studies, with the agreement of the Management Committee, will establish as mandatory the offer of curricular activities or the accomplishment of scientific events in English Language, headed by foreign researchers in their missions in the UFC. In addition to these specific initiatives, as part of the implementation of Print, the following guidelines or strategies (which can be monitored and enforced by governance and control bodies, once formally affixed in the Internationalization Agenda and in the Institutional Development Agenda): i. developing bilateral collaborative partnerships in education, for example, by promoting UFC membership in international schools and, in particular, facilitating the participation of foreign teachers in the teaching of regular courses in UFC regulations; ii. expand the EAD, sheltering from open content to partner schools and universities in the country to courses offered in English for foreign institutions; iii. intensify the curricular flexibility of undergraduate and graduate programs in order to accommodate different matrices and curricular schedules, facilitating the use of studies made abroad and enabling the mobility of students in both directions; iv. to provide regular supply of curricular components in English Language in the pedagogical projects of the undergraduate courses and in the curricular proposals of the postgraduate courses; v institute linguistic proficiency as an element of academic evaluation, providing students with opportunities for training in foreign languages through the Houses of Culture and institutional programs.

Production of international publicity material in other languages, including course websites.

The production of institutional advertising material in other languages, especially in English, is a priority of UFC Senior Administration. Indeed, one of the objectives presented in the Institutional Development Agenda (document that orientates the management of UFC in the five-year period of 2018-2022 and focus of monitoring from the governance and from internal and external control) for the first semester of 2018 is to have all the pages from all graduate programs in both Portuguese and English. The graduate programs that constitute PrInt have their pages in at least two different languages. So, the University is concluding this semester the upgrade of leaflets and elaborating an extended listing of its academic activities that will be finalized in the second semester of 2018. We have the intention to provide precise information on the possibilities of qualification and researches at UFC, increasing visibility on institutional quality productions in order to promote exchange programs to students and researchers, and provide systemic data to academic rankings and evaluations, in a comprehensive and exhaustive way.

Training and qualification of staff for institutional internationalization.

The qualification of the institution's the civil servants in order to allows for its internationalization can pursue two different paths. In the scope of linguistic qualification, civil servants can enroll in the Houses of Foreign Culture of English, German, French, Spanish and Italian. In the context of technical qualification, the University regulated in its resolutions the policy of temporary paid leave for servants that register for graduate programs, post-doctoral programs or licenses for short-term training programs. The criteria established for the approval (it goes through the decision of the Research and Graduate Studies council) of the leave request by civil servants is the academic excellence of the institution, and also the positive direct impact that degree will bring to the servant's performance in their job at the University. At the moment, UFC has civil servants with linguistic qualification to assist researchers and students from abroad. One of the objectives listed in the Institutional Development Agenda in the human relations contexts is the expansion of the number of servants with proficiency in other languages, mainly in the boards of undergraduate and graduate programs.

Counterparts offered by foreign partnership institutions, when applicable.

All partner institutions in the collaboration projects on PrInt displayed consensus concerning students and researchers entrance to laboratories, and libraries, and the exemption of academic fees for students. That entrance does not entail any charge on CAPES. Some partners have also stated clearly that they are submitting internal propositions to their Universities or to promotion agencies, trying institutionally to ensure financial aid and to dock counterparts to the cooperation project. That is the case of the University of Málaga, in Spain, which had its proposal submitted.

On the other hand, there are direct counterparts. In the case of the collaboration project named “Fighting the effects and causes of climate changes” to be produced in partnership with universities in the United Kingdom and Germany, the mobility of the foreign members to Brazil will the sponsored by the foreign partners. The first financial input comes from a great project approved by the Royal Society and concerns the funding of the research that refers to water contamination, conducted in the Graduate Program in Water Resources. The second input comes from the climate protection Brazil-Germany cooperation network in Management of Urban Solid Waste – ProteGEEr. UFC is one of the eight Brazilian universities to integrate this consortium led, on the German side, by the Technische Universität Braunschweig. Researchers from the Program in Water Resources have already attended business meetings in both Brazil and Germany with the researchers from the Technische Universität Braunschweig. The Graduate Program in Mathematics counts partially on Newton Fund resources (Royal Society) to organize a workshop in geometry and non-linear methods.

Other counterparts, when applicable.

DOCUMENTS

Description	Type	Date
27042018-Formulario-Print-English-UFC.pdf	Institutional Internationalization project	21/05/2018 14:24:22
Comprovante de Inscrição	Registration receipt	10/05/2018 16:29:20
anexocurriculos(1).pdf	CVs – foreign members	10/05/2018 16:06:44
SumExecEnglish.pdf	Executive summary (English version)	10/05/2018 15:40:22
SumExec.pdf	Executive summary (Portuguese version)	10/05/2018 15:40:04
Carta UFC_apresentacao.pdf	Presentation letter signed by the Rector	10/05/2018 15:39:50
PIN-final.pdf	Internationalization Plan	05/05/2018 12:10:30