

TC ABSTRACT

I. Basic project data

▪ Country/Region:	Uruguay
▪ TC Name:	Strengthening technical and human capacities for genomic services exports
▪ TC Number:	UR-T1119
▪ Team Leader/Members:	Pablo M. Garcia (CUR/TIU); Mikael Larsson (INT/TIU); Yu, Kwang Hoon (OPR/PTR); Pablo Angelelli (CUR/CTI); Joonseob Kwon (INT/TIU); and Yasmin Esteves (INT/TIU).
▪ Indicate if: Operational Support, Client Support, or Research & Dissemination.	Research and Dissemination
▪ Reference to Request: (IDB docs #)	N/A
▪ Date of TC Abstract:	March 10, 2014
▪ Beneficiary:	Uruguay
▪ Executing Agency and contact name:	Pasteur Institute, Uruguay
▪ IDB Funding Requested:	US\$590,000
▪ Local counterpart funding, if any:	US\$400,000
▪ Disbursement period:	48 months
▪ Required start date:	July 1, 2014
▪ Types of consultants (firm or individual consultants):	Individuals
▪ Prepared by Unit:	Trade and Investment Unit (INT/TIU)
▪ Unit of Disbursement Responsibility:	Integration and Trade Sector (INT/INT)
▪ Included in Country Strategy (y/n); ▪ TC included in CPD (y/n):	No
▪ GCI-9 Sector Priority:	Competitive Regional and Global Integration

II. Objective and Justification

- 2.1. Technology and scientific Research and Development (R&D) are transforming traditional healthcare services, allowing disruptive innovations to better suit medical and preventive treatments to patients, thus improving people's lifestyles and health. One such advancement is occurring in the area of Genomic Medicine (GM), a specific segment of what is known today as the field of Personalized Medicine (PM), which involves the sequencing of a human genome and the use of that information to prevent, diagnose and treat complex diseases. Among some of the derived benefits of this type of customized medicine, there are many testing methods that can be directly improved through the application of sequencing technology, such as diagnostics, early diagnostics, prognostics (predicting the possible diseases based on hereditary characteristics), and pharmacogenomics tests (taking into consideration the patient's genotype to optimize drug treatment), just to name a few.
- 2.2. While being a relatively new trend that has gained momentum only recently, the international market for PM is expected to reach US\$452 billion by 2015,

whereas the genetic testing global market is at US\$730 million. In this context, the development of technology and scientific research have allowed to reduce costs at an incredible amount. A decade ago, the cost of sequencing a full human genome used to be close to US\$300 million and nowadays it is estimated to cost US\$3,000, and expected to cost less than US\$1,000 in the near future. In this sense, the improvement of technology availability and R&D in developing countries as well as the advantages of offshoring and outsourcing initiatives in this field will allow costs to be reduced significantly more, giving more people the opportunity to benefit from it. Uruguay, an example of a developing country searching for growing opportunities arising in this field, is currently developing massive sequencing systems able to sequence the DNA and ARN of people and other living beings. With a pool of skilled physicians and scientists, as well as institutions that are already providing these services, Uruguay has many opportunities in this field of study and business. One of the most recognized institutions that is already on this path and has substantial potentialities in the country is the *Institut Pasteur de Montevideo* (IPMont), a non-profit organization that aims at contributing to prevent and treat illnesses through education, research and collaboration with healthcare public policies.

- 2.3. In this context, the general objective of the project is to develop local capacity in Uruguay for the analysis of human genomic sequences, both in research and support for genomic medicine and scientific development of new products and technologies. The specific objectives of the current project are: (i) fostering the creation of a strong technical multidisciplinary core group of researchers working on human genomics in Uruguay, as well as attracting a diverse group of experts from prestigious institutions from around the world; (ii) establish an intensive program of human resources training, integrating the training offered in Uruguay with a specific training program in South Korea; (iii) produce scientific and technical advances in the sequencing of human genomes in Uruguay; and (iv) promote the Latin American integration in the field of human genomics, facilitating the exchange of human resources in the region, continuing training and facilitating the access to high-value complex equipment.
- 2.4. As precedents to the project, in 2006 IPMont created two Technological Platforms in aimed at developing technologies, providing services and training personnel in the areas of experimental genomics and in bioinformatics analysis (Molecular Biology Unit and Bioinformatics Unit). Since then, these two Units have achieved important advances, including the development of several conjoint projects in agrogenomics (massive sequencing of rice, cereals, microorganisms such as bacteria, yeasts and parasites, etc.). But the advancements in human genome that ultimately will impact the field of PM would need further strengthening of both the technological and human capacities of the institute.
- 2.5. In recognition that international cooperation with academic and industry leaders is paramount to the development of the field, IPMont has established a key partnership with a large company in South Korea (Macrogen Inc., the worldwide leader in mass sequencing with focus on the field of sequencing and analysis of

the human genome). The Cooperation Agreement signed between both organizations established the compromise to work together towards the consecution of the present project and builds the ground for a sustainable partnership beyond said work. Furthermore, another key partner will be the Seoul National University, through its Institute of Medical Genomics, which will contribute with its extensive academic expertise in the field. These two Korean partners are of outmost priority to the project, since they would provide excellence in training both in experimental genomics and bioinformatics.

- 2.6. The latest worldwide advances in sequencing capabilities are rapidly generating a scenario where genomic medicine will play an increasingly important role in human health. At the same time, the growing knowledge about the human genome variability can interpret in a new way evolutionary processes leading to the distribution of differences between human populations. The current automated procedures lead to obtain genomic sequences, reducing somewhat more routine tasks (either of "wet-lab" and bioinformatics). So it is becoming increasingly important to interpret intelligently the data generated as well as to maximize the benefit of having a growing number of genomes available. In this sense it is strategic to develop such capabilities nationally, which will be required at both fundamental and applied research, in diagnosis, as well as in the development of new biotechnology products. Given the enormous prospects arising from the development of the field, this project aims at establishing a core group of people in Uruguay with the ability to creatively analyze human genome data generated from the new sequencing technologies, as well as to create the foundations of a highly specialized exports servicing sector.
- 2.7. The objective and activities of this operation correspond to the Banks' Sector Strategy to Support Competitive Global and Regional Integration, as it will enhance trade and investment in the global/regional integration context between Uruguay and South Korea through: knowledge sharing, patent exploitation and human capacity enhancement in the area of Personalized Medicine.

III. Description of activities and outputs

- 3.1. The project will have two components: strengthening human capacities in Uruguay and the sequencing of human genomes. The first component will be established through a comprehensive training program. The second component will establish a sequencing program of 200 Uruguayan genomes.
- 3.2. **Component I: Strengthening Human Capacities in Uruguay for genomic services exports.** The goal of this component is the formation of a core group of researchers consisting of about 10 people (who could later become themselves trainers), whose training will end in a specialization in human genomics. Most of these technologists core group will consist of graduate students (preferably PhDs) and recent postdocs with expertise in genomics, bioinformatics, human genetics, population, quantitative, biological anthropology, biostatistics or other disciplines related to human genomics. The definitions of the profiles of interest shall be made by an Advisory Committee (AC) that will be created specifically for the

project. In the first stage each member of the core group will have an individual training plan (in general courses locally), so as to allow a leveling base that will ensure the success of the second stage, which will include an extensive training stay in South Korea (Seoul National University, Macrogen and other reference centers) for each member of the core group. The main output of this component will be the successful training and education of at least 10 highly qualified technologists in the area of human genomics and personalized medicine that will comprise the core of the multidisciplinary new laboratory on human genome, this group will in turn train and educate at least 150 more students and technologists in the areas of bioinformatics, genomics and personalized medicine. It is also expected that, as a direct result of this component, two start-up SME's will be created in Uruguay in the field of human genomics.

3.3. Component II: Sequencing of Human Genomes for genomic services exports.

The goal of this component is to produce scientific and technical advancements in the sequencing of 200 human genomes during the three year project. Description of the activities: This technical component will be divided in 3 stages. In a first stage (9 months), there will be a characterization at the genomic level of key individuals with (admixed) Amerindian and African ancestry in Uruguay. The relative lack of historical registers and scarcity of ethnical information deserves special interest for both subgroups. In this stage, a number of 20 genomes will be sequenced and the bioinformatics analysis will be performed at the IPMont. In a second stage (12 months), the pilot-sequencing program will be extended to 80 more genomes using the validated protocols from first stage, but now with the aim of covering the genomic variability of the whole country. In this stage a number of 80 genomes will be sequenced and the bioinformatics analysis will be done at the IPMont. In a third stage (18 months), a comprehensive program for medical genomics will be established, starting with the sequencing of 100 more genomes, targeting cancer prevalence in Uruguay. It will focus in lung cancer due to its complexity, difficulty of treatment and increasing burden of the public health system¹. Such study will start with a sub-study of 50 pairs tumor/normal samples. In Uruguay the National Cancer Institute has a very good infrastructure and protocols that allows conducting the full study in the required time, following the standard ethical requirements. In the case of normal/tumor sequencing, the standard coverage is an average 50x (40x normal and 60x tumor). The bioinformatics analysis will be done at the IPMont. The output of this component is to generate genome information able to unveil ancestral origins of both Amerindian and African ancestry in Uruguay, as well as to generate a series of scientific results in personalized medicine and lung cancer genomics and treatment that will be groundbreaking for the development of the field in the country

¹ In Uruguayan men, lung cancer is the second leading cause by incidence (49.53 cases per 100.000 inhabitants), just behind prostate cancer, but the first in mortality (91.5% of the cases). In Uruguayan women, lung cancer constitutes the fourth leading cause by incidence, but the third by mortality (7.74 cases per 100.000 inhabitants).

IV. Indicative Budget (USD)

Indicative Budget (USD)

Activity/Component	Description	IDB/Fund Funding	Counterpart Funding	Total Funding
Component 1	Training and Travel	90,000		90,000
	Consultants	80,000	80,000	160,000
	Dissemination	40,000	40,000	80,000
Component 2	Genomes sequencing services	150,000	190,000	340,000
	Consultants	90,000	90,000	180,000
	Training and Travel	90,000		90,000
Others (Contingency, administration and Monitoring)		50,000		50,000
TOTAL		590,000	400,000	990,000

V. Executing agency and execution structure

- 5.1. This operation will be executed by the Institut Pasteur de Montevideo. IPMont has an extensive experience in executing international cooperation projects. In addition the Institute has a specific operational Unit to carry out the management and coordination of the Project. The contracting of project consultants and services will be carried out by the IPMont according to the Bank's policies for the Selection and Procurement of Consulting Services Financed by the Bank.

VI. Project risks and issues

- 6.1. The success of the project will depend on a significant level of engagement and participation of the partners. The operation will mitigate the risk by engaging high level authorities from each organization in the supervision of the project. URUGENOME will be also a key successful case for government officials to promote in an intensive promotion strategy. In such case, the project has already obtained approval and support from the Uruguayan Ministry on Education and Culture and from the Directorate for Science and Technology in Uruguay.
- 6.2. Another risk is the reduced number of specialists in genomics and bioinformatics in Uruguay, although to some extent there are human resources and expertise in the area of human population genetics. To mitigate the scarcity of possible highly trained students and postdocs in the area of bioinformatics, IPMont will attract a diverse pool of talents from the region and it will seek an aggressive policy of attracting returning scientists which are currently part of the Uruguayan Diaspora living abroad.

VII. Environmental and Social Classification

- 7.1 This operation does not present environmental and social risks. It was classified as Category "C" in the Environmental and Screening Classification