

Over 4,000 people have taken part in this hands-on science education project

Citizen science project 'Stick Out Your Tongue' draws up the first oral microbiome map for the youth of Spain

- **Luis Serrano, director of the Centre for Genomic Regulation (CRG), Jordi Portabella, Director of the Research and Knowledge Area of "la Caixa" Bank Foundation and Toni Gabaldón, Leader of the Comparative Genomics Group at CRG, have presented the preliminary results, and given the awards to the winning projects of the citizen science project *Stick Out Your Tongue* at the CosmoCaixa science museum.**
- **In the year following its launch, this project has brought bioinformatics closer to society, and highlighted the importance of the microbiome, with the participation of over 4,000 individuals.**
- **The results of the scientific study have revealed an initial oral microbiome map of young people, pointing to significant differences according to their geographic location, dietary or lifestyle factors, such as smoking or owning a pet.**
- **Aside from its scientific component, the project turned out to be an innovative educational tool that has made it possible for educators to teach statistics, biology, informatics, and research in a contextualized way within an actual project.**

Barcelona, March 11, 2016.- Jordi Portabella, director of the Research and Knowledge Area of "la Caixa" Bank Foundation, Luis Serrano, director of the Center for Genomic Regulation (CRG), and Toni Gabaldón, leader of the Comparative Genomics Group at CRG and scientific coordinator of the project, presented the preliminary results, and gave the awards to the winning projects of the citizen science project *Stick Out Your Tongue*, this morning at the CosmoCaixa science museum.

This project, which was launched by the Centre for Genomic Regulation in collaboration with "la Caixa" Bank Foundation and supported by the Severo Ochoa Programme of Excellence of the Spanish Ministry of Economy and Competitiveness, came to life one year ago, and has been actively participated in by the community since then. *"We're very happy with the experience, and with meeting the challenge of a citizen science project in biomedicine. We have involved society in most phases of the project: from the establishment of initial hypotheses to the bioinformatic and statistical analysis, including the collection of samples,"* said Luis Serrano, ICREA research professor, and director of the Centre for Genomic Regulation.

Most such projects are participated in by citizens who have a certain specialization in the field, such as ornithology enthusiasts, or amateur astronomers, for observation studies. The newness of this discipline, the availability of resources and the general unawareness of this field of research, have all led to bioinformatics and basic science in general remaining distant from society. "*Stick Out Your Tongue has made it possible for us to bring this new discipline closer to people, and prove that anyone can make a contribution. It's a big step forward that opens many possibilities for future citizen science projects,*" added Serrano.

Stick Out Your Tongue has been participated in by nearly 4,000 people throughout Spain, either by contributing a saliva sample, analyzing a sequence to identify the species or proposing a research project through analysis of data resulting from sample collection. The youngest participant was 11, and the oldest 64, although most participants were in the 15-17 year age group.

Bacteria, geography and lifestyles

At the scientific level, the results are still very preliminary. Nevertheless, there are trends that are already apparent. Their analysis is expected to be completed soon, allowing their publication in scientific journals of reference.

Availability of some 1,500 samples from the all over the country gave researchers the unprecedented opportunity to develop a microbiome map of a very special population segment: young people. "*Thanks to this high number of samples, we were able to draw up, at high-resolution, the oral microbiome profile of the young Spanish population, and find subtle differences with the general pattern,*" states Toni Gabaldón, ICREA research professor and scientific director of *Stick Out Your Tongue*.

Within this homogeneity, some significant differences have been found. For example, a few of the factors that make a definitive contribution to these differences are geographic distribution, the type of water a person drinks and other items related with lifestyle, such as drinking sugary beverages, smoking, dental hygiene habits or whether or not one has pets at home. Scientists have been able to define the main families that make up Spanish youths' microbiome, and they have also detected certain changes with regard to a number of environmental factors. The data also reveal that certain communities of bacteria are always found together. It is necessary to go further, and define in detail these communities to better know the composition of the microbiome, identify the healthiest communities and make use of our knowledge, translating it into proposals that improve oral health.

Science, a tool for education

Part of the project was a contest with a number of categories in which citizens could propose their research projects, based on the data generated by the project. "*Citizen science and particularly Stick Out Your Tongue make a decisive contribution to developing scientific culture in society, while quality research is being performed. Some of the contestants were individuals, but most were groups of secondary school students from all over the country. That teachers have used Stick Out Your Tongue to*

work on different abilities and knowledge, such as statistics, biology or informatics, in a cross-disciplinary, contextualized way in a real case is unprecedented. This way, Stick Out Your Tongue has become, at the same time, a science project and an innovative educational tool," states Jordi Portabella, director of the Research and Knowledge Area of "la Caixa" Bank Foundation.

Not only that, the project has involved development of a number of freely-available resources to make known the human microbiome, bioinformatics and research in general. The website www.sacalalengua.org features informative videos, explanations, infographics and, as a way to close the project, a humorous on-line tool has been developed to reach the young members of the public in an innovative way.

About the contest

For this initial approach to participative bioinformatics, in a contest format, a number of challenges were proposed (with differing levels of difficulty) for citizens to ease into bioinformatics in an easy, personalized way. Surprisingly, the category with the most participants was the most difficult, as it required not only bioinformatic but also statistical analysis.

In category A, based on statistical analysis of personal information, the winners were a youth from Seville (Andalusia) who studied the effect of the chlorine in pools on dental health, and a group of students from the Ximén d'Urrea Secondary School in Alcora (Valencian Community) who researched the relationship between nail-biting and the frequency of teeth-brushing with the appearance of aphthous (mouth) ulcers. A group of students from the same school also won in category B, meant to achieve better data visualization.

Categories C and D, both focused on bioinformatic analysis, were widely participated in. In category C, the aim was to analyze DNA sequences and identify the bacteria that correspond to these sequences. The two winning teams in this category, the secondary schools of Santurtzi (Basque Country) and Santanyí (Balearic Islands), analyzed over 300 sequences each. In category D, based on the same challenge but starting with raw data from the sequencer, the winner was a young man from Amposta (Catalonia) who competed as an individual.

Last, the category E winners, on statistical, bioinformatic analysis of samples and personal data, are two teams from a secondary school in Alcora (Valencian Community) and a youth from Barcelona (Catalonia). This category, despite being the most complex, is also the one most in line with the initial objective of Stick Out Your Tongue. Among the winning projects are a study on asthmatics on the relationship between their asthma and changes in their oral microbiome, a study on the influence of regular consumption of antibiotics and the oral microbiome or an exploratory analysis of the effects of smoking on the microbiome.

Although the studies presented by the citizens are limited, and could be considered insufficient, many of them do match certain tendencies previously published, and from other fields. Once CRG scientists complete their more advanced analysis of the data, we will see if they confirm these tendencies or point the way to new ones.

Both the Centre for Genomic Regulation and la Caixa Foundation consider this initial experience to be very enriching. Not only for the scientific advancements, as the organizers have made clear in today's press conference, but for its contribution to scientific culture, the participation of citizens in research, and its educational role.

The '[Saca la Lengua](#)' project is an initiative of the Centre for Genomic Regulation and the "la Caixa" Foundation, with the participation of the Centre for Research into Environmental Epidemiology (CREAL), the support of the 'Centro de Excelencia Severo Ochoa 2013-2017' programme (SEV-2012-02-08) of the Ministry of Economy and Competitiveness, and contributions by the companies Illumina and Eppendorf. The scientific and technical services of the CRG, which will make this project possible, are co-financed by the European Union through the strategic funds for regional development (ERDF).

Stick Out Your Tongue contest results:

Category	Winner/s
A: Statistics! (Statistical and mathematical analysis of data)	<ul style="list-style-type: none"> • Francisco Hidalgo Zamora, Seville (Andalusia). • Students of the Ximén d'Urrea Secondary School, Alcora (Valencian Community) <ul style="list-style-type: none"> ○ Cristina Barreda Agut ○ Nuria Cámara Castillo ○ Alba Ruiz Herrando ○ Nadia Porcar Gozalbo ○ Ada Fernández Puchol
B: Now I see it! (New proposals for data visualization)	<ul style="list-style-type: none"> • Students of the Ximén d'Urrea Secondary School, Alcora (Valencian Community) <ul style="list-style-type: none"> ○ Sara Pons Buendia ○ Chourok Aknin ○ Liseth Stefania Guerrero Pinza
C: Initiation in bioinformatics (Identification of species according to DNA sequences)	<ul style="list-style-type: none"> • Students of the Carmelitas San José Ikastetxea Secondary School, Santurtzi (Basque Country) <ul style="list-style-type: none"> ○ Endika Ubeda-Portugues Calzada ○ Borja Pecharroman Valderas ○ Iker Egaña Llano ○ Joseba Souto Couso ○ Imanol Lara Palazzo ○ Aitor Alcázar Martínez • Students of the Santanyí Secondary School, Santanyí (Balearic Islands) <ul style="list-style-type: none"> ○ Lambert Schaffernich Aneas ○ Álvaro Martín Ortega ○ Sergi Morlà Casado ○ Antonio Marín Pia ○ Elliott Delaplace
D: Pipeline (Advanced bioinformatics to analyze sequences)	<ul style="list-style-type: none"> • Èric Matamoros Morales, Amposta (Catalonia)

E: The ultimate challenge

(Bioinformatics and statistics. Integration of environmental factors and habits with sequences and identified species).

- Albert Torelló Pérez, Barcelona (Catalonia)
- Students of the Ximén d'Urrea Secondary School, Alcora (Valencian Community)
 - Jordi Monfort Vicente
 - Pia Gallego Porcar
 - Achouak Aknin
 - Neus Andreu Moratalla
 - Judit Medina Palanques
 - Eva Calbo Catalán
 - Sara Nadal Bosch
 - Inés Tena Monferrer
 - Sonsoles García Bello

For more information and interviews:

"la Caixa" Bank Foundation

Press Department – Irene Roch – iroch@fundaciolacaixa.org

Tel.+34 93 404 6027 – Mobile +34 669 457 094

Centre for Genomic Regulation (CRG)

Press Department – Laia Cendrós – laia.cendros@crg.eu

Tel.+34 93 316 0237 – Mobile +34 607 611 798