

Letter to the Editor / Carta al editor

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Genomics in Paraguay: Building Capacity in a Challenging Context

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Dear Editor,

We would like to share a reflection motivated by the strategic research project "Strengthening a Research Platform in Strategic Health Areas: Enhancing the Impact of Genomics" (ESTR01-20)¹, recently funded by the National Council for Science and Technology (CONACYT) and led by the GenomIICS group of the "Instituto de Investigaciones en Ciencias de la Salud-Universidad Nacional de Asunción" (IICS-UNA), which aims to strengthen national capacities to face the genomic era in Paraguay.

For the first time in Paraguay, the government has shown a strong commitment to funding scientific research projects with significantly increased budgets, ranging from USD 500,000 to USD 1,000,000². This unprecedented level of investment represents a turning point for the national scientific system and will enable the development of high-impact strategic initiatives, strengthen capacities, and promote the leadership of national researchers in priority areas for health and national development.

The ESTR01-20 project represents an important milestone in biomedical research in Paraguay. The project encompasses collaboration with national institutions—including INERAM, Hospital General de San Lorenzo, Hospital Nacional, Instituto Nacional del Cáncer, the National Programs for Tuberculosis and Leprosy Control all entities of the Ministry of Health, Hospital de Clínicas-UNA and SENEP—as well as international institutions, such as Vall d'Hebron (Spain), the EUSAT-RCS Consortium (European Union), Fiocruz (Brazil), Institut Pasteur (Uruguay), Universidad de la República (Uruguay), Universidad Nacional de Córdoba (Argentina), and USFQ (Ecuador). It seeks to consolidate genomic technologies as transversal tools for research, teaching, and innovation, with applications in infectious diseases, cancer, immunogenetics, and precision medicine. These initiatives align with global health research trends and reinforce the role of public institutions in generating high-impact scientific knowledge and local capacity building.

However, the implementation of genomic platforms in low- and middle-income settings is accompanied by significant operational and infrastructural challenges. Among these, delays in obtaining critical reagents, particularly those required for library preparation and sequencing, have been recurrent⁽¹⁾. Limited local availability, complex import processes, elevated costs, and restricted access to specific technologies directly impact project timelines and require constant adaptation by research teams.

In addition to reagent availability, digital infrastructure has emerged as a critical bottleneck. Genomic research is inherently data-intensive and strongly depends on stable electric power grid and high-quality Internet connectivity. For IICS at the San Lorenzo campus of the National University of Asunción, internet access is provided through the National Center of Computation (CNC), which receives its signal from the Paraguayan Communications company (COPACO). However, the quality and stability of this connection are often insufficient for genomic analyses. On some days, connectivity is so limited that even basic tasks, such as accessing institutional

¹<https://www.conacyt.gov.py/fortalecen-capacidad-cientifica-salud-plataforma-nacional-genomica>

²<https://www.conacyt.gov.py/node/35012>

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email, become difficult, while the transfer, analysis, or remote processing of large genomic datasets is substantially delayed. In some instances, personal mobile phone connections are essential for completing basic tasks.

To successfully implement the ESTR01-20 strategic project, it will be essential to either contract external Internet services from private providers or consider alternative solutions like satellite-based connectivity. While these measures may provide temporary relief, they also reflect the urgent need to strengthen digital infrastructure at both institutional and national levels to support modern research.

Entering the genomic era requires not only access to sequencing platforms but also robust computational capability. The increasing volume and complexity of genomic data demand an expanded bioinformatics infrastructure, including high-performance computing resources, secure data storage, and trained personnel capable of managing and interpreting these datasets efficiently.

An additional challenge is the provision of technical training and operational support. In Paraguay, capacity building in genomics is largely self-managed by researchers, who must independently acquire the technical expertise required for sequencing, data analysis, and platform maintenance, mostly abroad. While this reality has fostered a strong culture of autonomy and problem-solving in researchers, it also highlights the need for structured training opportunities and sustained institutional support to ensure the long-term sustainability.

These challenges are not unique to our institution, nor do they diminish the relevance of the efforts undertaken. In contrast, they highlight the limitations that must be addressed for Paraguay to fully integrate into the genomic era. Simultaneously, they highlight the resilience, creativity, and commitment of researchers, students, and support personnel who continue to advance scientific research despite these constraints.

We believe that it is essential to openly acknowledge these realities while encouraging the scientific community to persevere and decision makers to address them. Each obstacle becomes a learning opportunity, and each solution contributes to building local capacity. Sustained investment, improved logistics, strengthened digital and computational infrastructure, and continued institutional and governmental support are key to ensuring that genomic research flourishes in Paraguay.

Entering the modern genomic era is not an instantaneous achievement but rather a gradual process that requires patience, perseverance, and a collective effort. The foundations laid today will shape the future not only in biomedicine but also in other strategic sectors such as agro-livestock sector, food systems, animal science, data science and Bioeconomy in Paraguay.

Sincerely,

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