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Subregional Headquarters for the Caribbean

Meeting on Biotechnology: Development and
Climate Change in the Caribbean
Port-of-Spain, Trinidad and Tobago
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**REPORT OF THE MEETING ON BIOTECHNOLOGY
DEVELOPMENT AND CLIMATE CHANGE IN THE CARIBBEAN**

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Background

The Economic Commission for Latin America and the Caribbean (ECLAC) Subregional Headquarters for the Caribbean in collaboration with the University of the West Indies (UWI), convened a meeting of technical experts working in the field of biotechnology. The main focus of this technical meeting was to provide a forum where scholars in the field of biotechnology could converge to share information on their accomplished and current research agendas. The meeting was intended to establish the link between biotechnology and climate change and to examine the modalities of utilizing biotechnologies to address the anticipated impacts of climate change. It was expected that a regional, coordinated approach to development of biotechnology approaches in the Caribbean would be developed that would benefit the agriculture sector through improved food security, as well as the social sector through improvements in security and health care, among other purposes.

The meeting was held at the ECLAC Subregional Headquarters for the Caribbean, Port of Spain, Trinidad and Tobago, on Tuesday 28 April 2009.

An agenda and list of participants are annexed to this report.

Agenda item 1: Opening

Ms. Charmaine Gomes, Sustainable Development Officer, welcomed the participants and introduced the members of the head table. She stated that it was a pleasure for ECLAC to collaborate with UWI in this field and lauded the university's commitment to continued work in this area as evidenced by their co-sponsoring of the meeting. Ms. Gomes briefly commented on the importance of a scientific approach in alleviating or minimizing the impacts of climate change, and the ways that technology and in particular, biotechnology, can serve this objective from both a regulatory and a policy standpoint.

Mr. Neil Pierre, Director, ECLAC Subregional Headquarters for the Caribbean, welcomed participants and thanked UWI for collaborating with ECLAC in this area. He referred to the work that ECLAC and its other partners were doing in the area of biotechnology and expressed optimism that the outcome of meetings and workshops would benefit the region in helping to define appropriate responses to the prevailing challenges.

He identified the impacts of climate change as one of the major challenges of this century and stated that biotechnology was increasingly perceived as providing solutions to addressing these impacts. He made reference to 4th Assessment Report of the Inter-governmental Panel on Climate Change which noted that the impacts were unequivocal, and referred to the Stern Review with its well-documented economic and social impacts of climate change and the costs of adapting to and mitigating these impacts. The issue to be explored, he noted, was how biotechnological applications could provide solutions to the challenges posed by these impacts in ways that could make the region more competitive at the global level, as well as more resilient to external threats, either economic or natural. He also stated that it was important to note that biotechnology was not a solution to climate change but rather an effective tool to combat this global phenomenon. He made reference to the development of new, high-yielding, disease-

resistant and climate-adaptive crop species to compensate for the decline in food production. However, such an objective could only be achieved with considerable effort and investment in research and development with support from both government and the private sector within agreed policy frameworks.

In closing, the Director expressed confidence that those present representing the various interest groups from all sectors would continue to pursue relevant research that would provide results. He also thanked UWI for its collaboration with ECLAC in convening the meeting and looked forward to expanding on the partnership in this important area of work to positively impact on life in the region.

Professor Pathmanathan Umaharan of UWI conveyed his best wishes for a fruitful meeting. He noted that the decision to partner with ECLAC was most important and that the significance of this meeting should not be overlooked, coming on the heels of the hemispheric and regional meeting on biotechnology and bio-safety technology which was held in Port-of-Spain, Trinidad and Tobago, the previous day. Professor Umaharan noted the importance of the application of biotechnology and its role in human development and added that at UWI biotechnology was one of the research pillars as evidenced by the work done at the Biotechnology Centre at the University's Mona campus and the strong desire to add research capabilities to other campuses. He also cited specific examples in the field of agriculture and medicine where biotechnology could play a role in providing solutions to the challenges faced. In closing, he reiterated his congratulations on the hosting of the meeting and best wishes for success.

Mrs. Karen Rosemin of the Ministry of Science, Technology and Tertiary Education of Trinidad and Tobago greeted participants on behalf of the Minister. She provided information on the role of the Government of Trinidad and Tobago in the area of climate change and referred to the ECLAC project on the Economics of Climate Change in which the Government of Trinidad and Tobago was collaborating. She noted that government was in the process of developing a national policy to mitigate the impact of climate change that was part of the national policy on the environment and sustainable development. She stated that the main objective of the policy was that of creating an environment that would enhance the quality of life in Trinidad and Tobago, based on the principles of sustainable development. One of the main concerns of the government was the fact that Trinidad and Tobago was one of the highest emitters of green house gases on a per capita basis, mainly because of its industrial make-up. Revenues generated from industries, however, were significant to the Gross Domestic Product (GDP) of the country and therefore there was a pressing need to reduce the carbon footprint to protect the environment for generations to come. For this reason, the importance of a national policy for the energy sector could not be overlooked. Three significant areas of the policy were noted: natural gas, preservation of the environment and encouraging the use of renewable energy, notwithstanding the fact that the economy of Trinidad and Tobago was energy-based. She stated that Trinidad and Tobago was signatory to the United Nations protocol on climate change and more recently to the convention on Biological Diversity (CBD). She reiterated the government's commitment to promoting research and development as evidenced by a TT\$7 million fund established for the creation of a biotechnology centre at the University of Trinidad and Tobago (UTT). In concluding, Mrs. Rosemin observed that much more work was needed in order to advance this objective and she expressed the confidence that the discussions taking place at this meeting

would be fruitful and would assist the Government of Trinidad and Tobago in its own policy development.

Ms. Elizabeth Thorne of the ECLAC Subregional Headquarters for the Caribbean thanked those who played a part in the hosting of the meeting and wished all successful deliberations.

Agenda items 2 and 3: The history and applications of biotechnology

This session featured two presentations on molecular markers. The first presentation traced the evolution of DNA as the genetic material of the cell, present in both the nucleus and the cytoplasm. It noted that genes are switched on in the cell circuitry and recombination was about swapping genes and was referred to as recombinant DNA (rDNA) technology. The technology in terms of introducing DNA into cells was described as a random process in which genes could be targeted. This might be achieved through the use of vectors or DNA guns. The presentation compared rDNA technology with plant breeding to determine the strengths and weaknesses of rDNA. Some of the more important features of rDNA technology are as follows:

- It modifies both nuclear and cytoplasmic genomes
- It modifies genes through a parasexual process;
- It allows for the creation of novel pathways e.g as in formation of a blue rose;
- It can change the expression of a gene as in gene silencing;
- It is a faster process than plant breeding.

However, there are some challenges with rDNA as follows:

- It is limited to a small number of genes;
- It only manipulates single traits;
- Many stages in transformation are still unpredictable;
- The results are dubious and subject to public opinion.

The presentation examined the ways in which next-generation technologies might compensate for the shortcomings of present-day rDNA technology, as follows:

- Omics technologies which include genomics (faster method of sequencing DNA) and transcriptionics;
- The complexity of rDNA is increasing and is fast approaching that of plant breeding in that it can do many things that plant breeding can do;
- Gene targeting by microinjection and using homologous recombination would be appropriate for animals but not for plants;
- Markerless transgenic plants are being developed;
- Biological containment of transgenes to prevent contamination could occur through plastid transformation and Genetic Use Restriction Technology (GURT) that remove viable pollen from transgenic plants
- Somoclonal variation can be minimized;
- There could be full copy integration;

- Proper gene expression could be achieved;
- The unpredictable expression of transgenes in the environment could be controlled;
- More stable transgenics could be obtained.

The second presentation focused on addressing the ring spot virus in papaya in Jamaica. The process identified a gene that is resistant to the virus and transferred it into the papaya, with an 80% success rate in conferring resistance to the virus.

The ensuing discussion focused on the terminator technology that was the same as hybrid technology. It was noted that farmers who bought genetically modified seeds could replant seeds produced by those plants but the new offspring would not have the modified factor.

The matter of the World Trade Organization (WTO) and trade in transgenics was raised. However, the meeting observed that trade in modified organisms fell within the ambit of the Cartagena Protocol which made allowances for the ill effects of genetic engineering in that transformed foods had to be shown to be substantially different from conventional foods.

Chloroplast technology was useful in products that could be engineered into chloroplasts to produce chiral molecules such as bioplastics. It might also be used to produce chemicals that are part of the cell chemistry with the ability to change phenotypes so that the resulting proteins might be incorporated into the cytoplasm.

Stress tolerance using rDNA was also discussed. Participants felt that the technology had been ineffective in this regard since it can only move a few genes at a time unlike the benefits of plant breeding. However, the discussion noted that emerging technologies could now allow the possibility of screening for stress tolerance.

It was also observed that UWI did not have a gene rDNA library but used available international sources.

Agenda 4: Student research on biotechnology

This agenda item featured ongoing research that students are pursuing. The objective here was to provide a critique of the methodologies that are being employed with a view to providing support in challenges that are being encountered by the students. The presentations in this session were:

- Design of a telehealth network & cardiopulmonary ambulatory patient monitoring system in Trinidad & Tobago;
- Modifying spathe colour in anthuriums ; and
- Somatic embryogenesis of Guinea hen weed and Ackee: Experiences, challenges and lessons learnt.

In the first presentation, the key elements of a health initiative that is being spearheaded by the University of Trinidad and Tobago were described. This initiative involves the provision

of emergency health support utilizing internet-based techniques. This essentially involved the acquisition of appropriate ambulances that are properly equipped so as to allow for communication of emergency patient health data via the internet so that timely health care could be provided from the onset of a health episode and continued en route to a health facility. Several concerns were raised on the type of support and constraints that the health sector, as it is currently structure would impact on such a mechanism as well the challenge of obtaining the necessary support from the laboratories and ambulance services in agreeing to have their facilities outfitted with the relevant equipment to allow for this healthnet service. Moreover, in view of problems with transmittal of data, the system might need a dedicated line, subject to approval by the Telecommunications Service of Trinidad and Tobago (TSTT). It was clarified that *en route* to hospital, only the patient's vital signs would be transmitted from the ambulance to the lab, and no preliminary tests would be undertaken.

The second presentation focused on the variability in colour in anthuriums. It was thought that this may be attributable to the non-production of anthocyanins by both white and green anthurium spathes as well as to the presence of chlorophyll in green spathes and the absence from the whites. Differences in sulphide content were also examined as a possible factor in determination of colour in anthuriums. Shift in the hydrogen ion concentration (pH) in anthuriums was also considered as a contributing factor but while the mechanism for colour change with shift in pH was unknown, it was suggested that the use of acid-base titration may provide some answers. Therefore it was noted that the pH variable potentially opened up another new pathway, which might present more difficulties than genetic manipulation.

The third presentation focused on somatic clonal variations in Guinea hen weed and Ackee and attempted to find solutions to the variation that is apparent in these species. This was being done through an examination of the route that the somatic embryos took directly from plant material or from intervening callus phase to maturity and it was noted that this pathway may well influence the chance of variations. For ackee, there was need to verify whether fidelity was maintained.

Additional discussions surrounded toxicity of cassava which was also highlighted in an earlier presentation. It was reported that cyanogenic compounds in cassava were responsible for the bitter taste and while processing usually removes much of the toxic compounds for human consumption, animals died from consumption of raw cassava. In Jamaica, a project was underway to engineer plants with low cyanogenic compounds and increase protein and vitamin levels. It was noted also that Linamarin (toxic compound) was an important nitrogen source for root tuber development, and other bitter compounds in roots offered protection and their removal could increase vulnerability to infections.

Agenda item 5: Biotechnology, climate change and policy

Dr. Adrian Lennon of the UWI, St. Augustine campus presented entitled: "Application of Biotechnology to Climate Change". This presentation highlighted the threat of climate change, namely, the rapidity in which the changes occurred and the unpredictability of weather patterns. In addition, the evidence as seen in the region was discussed: sea level rise, the increased frequency and intensity of hurricanes, the increased frequency and severity of droughts and increased temperature. Several examples were featured of the possible use of genetic

engineering to address climate change through transforming species that could adapt better to climate change impacts. On the other hand, it was also pointed out that even though these plants might adapt in one way, transforming them could result in other less desirable changes.

Dr. Wendy Hollingsworth, Policy Networks International Inc, Barbados, presented on the topic “Key considerations for developing a Regional Biotechnology Policy/Strategy”. This presentation informed participants on progress made on the formulation of a Regional Biotechnology Policy/Strategy in the region - a Caribbean Community (CARICOM) Secretariat project. Participants were informed of the background and objectives of the project. Some of the findings based on national consultations held in a few countries were concentrated in the following areas: innovation and technology, regional priorities, institutional framework, information sharing and public awareness. A draft outline of the Regional Biotechnology Strategy was also highlighted in the presentation.

In the ensuing discussion, the question arose as to the existence of new economic models specifically for biotechnological research given the economic climate. The meeting noted that that there would be a recommendation/strategy to identify models.

It was stated that the proposed solution to climate change was not proportional to the scale of the changes i.e. enormity of changes and its rapidity, hence no close solution could be identified. Though climate change might be cyclical, there was no stopping it; therefore, the scale of solutions did not match the global catastrophe predicted.

The Chair suggested that a systems approach should be taken focusing on each component. This would create a platform for component by component solutions.

The importance of data in support of the contribution of biotechnological research to meeting environmental challenges such as climate change was addressed. In this regard, tertiary level institutions were encouraged to engage in data mining and management of such data that would be available to support the development and implementation of appropriate policies in biotechnology. Therefore there was need for a debate on data need at the institutional level.

There was a query as to whether or not there was a CARICOM approach about the general guidelines for consultations on biotechnology at the national level. It was noted that CARICOM was looking into the approaches implemented by other regions, such as Africa and New Zealand, and hoped to pattern or extract useful methods from their approach. This information would be useful in informing national policies.

One participant enquired if during the research in the region any biotechnology-related businesses were found, for example, companies making primers and kits; and whether there was a chance to gauge the import of these inputs into their work. The meeting was informed that during the consultations no such companies had been encountered and that a value would have to be placed on these inputs.

Participants concluded that the meeting had highlighted a cross section of actions taking place in the region as well noted some prevailing gaps. The meeting was informed that the Inter-American Institute for Cooperation on Agriculture (IICA) was concerned about follow-up activities. The representative of IICA informed the participants about the availability of a small

amount of money to assist in moving forward with the formulating a policy document to implement biotechnology or to support the functioning of a laboratory to promote research.

**Agenda item 6:
Wrap-up, reflections and the way forward**

At the close of the meeting, a representative of the ECLAC Subregional Headquarters for the Caribbean proposed the following:

- Tertiary level institutions should integrate their research agendas so as to improve research and development in biotechnology;
- The necessary linkages between scientists and policymakers should be created and this could be achieved through the convening of meetings at which research results would be shared and appropriate policies discussed;
- The allocation of financial resources would be critical to development of a research agenda in support of policy development;
- Considerable time and financial resources should be invested in identifying any negative feedback with a view to providing solutions;
- It was deemed important to provide the necessary infrastructural facilities as well as financial resources and expertise to encourage young researchers to tailor their research towards policy development and change;
- A mechanism to take the document from draft to adoption of policy should be devised;
- The science and use of the results from science should inform policy. As such a mechanism for keeping policymakers abreast of the results of science needs to be devised.

Annex I

Agenda

1. Opening
2. The history and applications of biotechnology
3. Applications of biotechnology
4. Student research on biotechnology
5. Biotechnology, climate change and policy
6. Wrap-up, reflections and the way forward

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