
PANAMA CITY 2017

ESTUDIONUBOSO

English insert

## Credits

Publication's general organization: Ela Spalding

Introductory texts:
Ela Spalding, Emily Zhukov, Román Flórez, Ana Berta Carrizo

Research copyright:
Gina Della Togna, Ph.D., Olmedo Pérez Núñez, María Lourdes Peralta Frías, Ph.D.

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Photography:
Tova Katzman, Gabriel Guandique, David Arias, Cine Animal, Ana Berta Carrizo, Olmedo Pérez Núñez, Anna Handick, Ela Spalding

Graphic design and layout: Lorena Carrasco

Printed in Panama, April 2018
Imprenta Monograma, Panama City
On ledger paper, and covers on vellum card.

This edition has 150 copies. It consists of 4 sections held together by a gold coloured string. Some also have a brooch made with recycled plastic by artist and facilitator, Emily Zhukov. This is section 1 of 4

ISBN - 978-9962-12-715-4

ABOUT THIS PUBLICATION
This publication is divided into four parts. The first booklet introduces the overall project and process of the Art and Science LAB 2017: Panama City. Then each artist-scientist team has a booklet that documents their experience through texts and images. The artists and scientists were asked to write brief texts describing their research and artwork as well as experiences during the LAB - the responses were varied in length, which reflects the nature of each project as well as individual personalities. Beyond being a physical registry, we hope that this document can serve as reference for future interdisciplinary exercises. At Estudio Nuboso we believe that our society urgently needs us to once again combine the fields of knowledge that have for too long been fragmented, in order to resolve upcoming challenges in a light and holistic manner. This is our contribution. Happy reading!

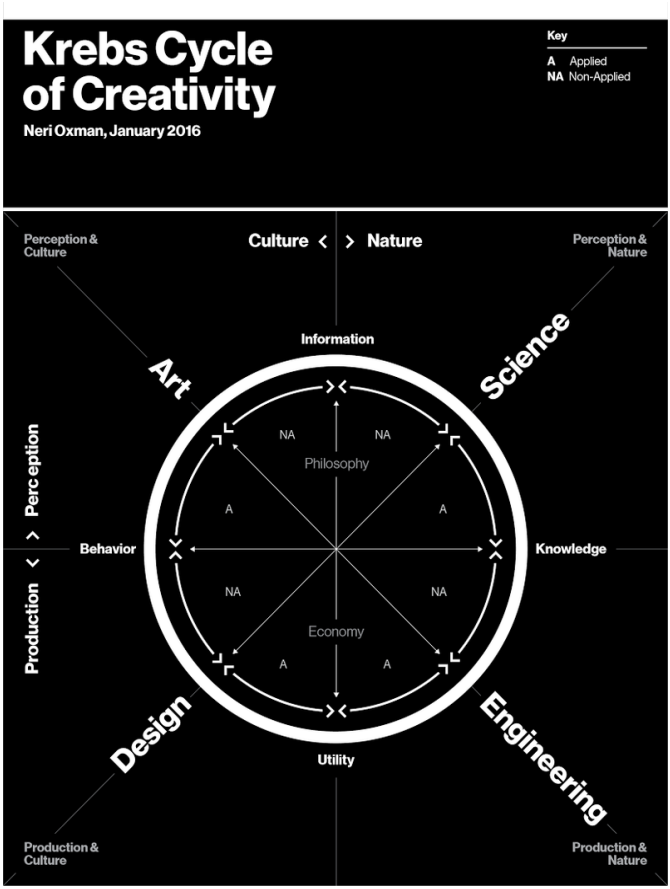
# INTRODUCTION

The Art and Science LAB is an initiative that promotes exchange and collaboration between scientists and artists, in order to share research that has a great impact on society and the environment. Participants engage in dialogue, building bridges between disciplines and ways of perceiving the world, to co-create works of art or art experiences that allow the general public to engage more closely with the selected topics.

As it is one of the projects that benefitted from the incentives offered as a result of the celebration of Panama City's 500 years, the capital city was the setting for the LAB's second edition. We worked with three research projects that address issues being faced by Panama's ecosystems, the causes of which arise directly or indirectly from human actions. We faced the challenge of creating a space for reflection and communication precisely within the context that creates the chaotic conditions that have given rise to some of these issues. Facilitators and participants alike were absorbed by the metropolis, going deeper into the complex aspects of a growing city, and understanding that cooperation is the key to survival.

We visited the edges of the metropolitan area, its coast and its forests, in order to recognize and share the resilience, the daily battle for a dignified life, and the profound desire to protect life's delicate balance. The Art and Science LAB 2017: Panama City, allowed us to see art, science, research and even the platform itself, as a powerful means to talk about how we can better relate to our surroundings for the common good of humans, ecosystems and other living beings.

**Ela Spalding**
Estudio Nuboso
LAB Facilitator




THE KREBS CYLCE OF CREATIVITY DIAGRAM

"The Krebs Cycle of Creativity is a map that describes the perpetuation of creative energy, analogous to the Krebs Cycle (a metabolic route that is part of cellular respiration in all aerobic cells). In this analogy, the four modalities of human creativity – Science, Engineering, Design, and Art – replace the four carbon components of the Krebs Cycle.

The role of Science is to explain and predict the world that surrounds us; converting information into knowledge. The role of Engineering is to apply scientific knowledge to the development of solutions to empirical problems; converting knowledge into something useful. The role of Design is to incorporate solutions that maximize functionality and improve human experience; converting utility into behaviors. The role of Art is to question human behavior and create an awareness of the world that surrounds us; converting behavior into new perceptions of information, re-presenting the data that started the Krebs Cycle with Science. In this "Cinderella moment" – when the clock strikes twelve again – new perceptions inspire new scientific explorations."

The Krebs Cycle of Creativity by Neri Oxman, 'The Age of Entanglement', MIT Journal of Design and Science, 01.13.16

# STRUCTURE OF THE ART AND SCIENCE LAB

The Art and Science LAB is a laboratory for experimenting with communication and interdisciplinary collaborations, whose main objective is to spread knowledge that is relevant to society regarding the way in which human beings coexist with the natural and cultural environment. The LAB consists of a creation phase that lasts four weeks and an outreach phase that lasts three months. The team of facilitators supports the artists and scientists in their interaction, co-creative process, and communication with communities; to then design and curate the vehicles to share the results of the collaboration with the general public.
Because it is a laboratory, we experiment with the structure to find the most effective ways to carry out the exchange and allow these experiences and the content of the research to reach the highest possible number of people. Therefore, the structure of this edition of the LAB was a little different from the one we carried out in 2015. We also seek to stretch the limits of disciplinary definitions in art and science, which broadens the spectrum for participation and dialogue to more worlds of knowing and doing.

## SELECTION

Scientists supported by SENACYT and other scientific institutions in Panama, and local or foreign artists are selected through an open call with the support of a selection committee composed of professionals from the fields of art, culture and science. This year we launched the call for scientists first, and once the research topics were selected, we launched the call for artists so that artists could apply already knowing what the research topics would be.
The Selection Committee was made up by: Oris Sanjur, Ph.D. (Associate Director for Science Administration at Smithsonian Tropical Research Institute), Orlando Hernández Ying, Ph.D. (art historian and museologist) and Pilar Moreno Raymundo (artist and psychiatrist, specialized in art therapy).

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*"Combining art and science allows us to open our mind to better appreciate and understand the world we live in. As beings that inhabit this planet, we are part of an ecosystem that requires more consciousness to promote its sustainability and our survival. We create more awareness when we can use art and science to communicate the relevance and impact of our actions as a species."*

- Oris Sanjur

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## THE SELECTED TEAMS WERE THE FOLLOWING:

URBAN SPRAWL:
María Lourdes Peralta Frías, Ph.D. and Geetha Iyer.
*Technological scientific management system to mitigate problems associated with uncontrolled urban growth: "Urban Sprawl"*

JUAN DÍAZ MANGROVES:
Olmedo Pérez Núñez, B.S. and Anna Handick.
*Measurement of biological and physiochemical variables in water, soil, and plant matter in the mangroves of Juan Díaz.*

ENDANGERED AMPHIBIANS:
Gina Della Togna, Ph.D. and Juan Carlos León.
*Applying assisted reproduction techniques in amphibian species that are in critical danger of extinction that can be found in captivity in Panama.*

# CREATIVE PHASE

from Nov. 6th to Dec. 3rd, 2017

## WEEK 1: Introduction

Four days of workshops, talks and group dynamic exercises to promote interaction among participants, dismantling initial expectations and preconceived ideas about the interaction between art and science, followed by a weekend retreat on Taboga Island. The workshops and talks addressed topics such as: art in science and science in art; the history of Panama City; interdisciplinary forms of expression, communication and collaboration; communication with the public, from local to global; visual perception and the art of exhibitions – audiovisual experiences and creation.

The facilitators during the Introduction Week were:
Ela Spalding (artist and LAB facilitator), Oris Sanjur (scientist and mentor), Mariela Aragón Chiari (actress and educator), Emily Zhukov (artist, educator, and LAB facilitator), Dominique Ratton Pérez (designer and manager), Jonathan Hernandez Arana (archaeologist, communicator and manager of the Museum of the City), Nyasha Warren (educator and consultant), Cine Animal (film production company).

The retreat in Taboga was very beneficial for the teams to begin to get to know each other better, without the restrictions of time and space that are imposed by city life and daily routines. Among strolls, conversations, drawing sessions and shared meals we all saw the benefits of conviviality to establish a basis of trust and disposition to continue working together during the following three weeks.

## WEEK 2: Field visits, laboratory, and community

Each scientist guided his/her artist partner through his/her world of laboratory and field research in order to gain a deeper understanding of the work and its context. The teams discovered "the community" or social space where they could carry out an action to bring them closer to their topic. This decision is not easy, as each research topic has a geographic scope of influence where there are people living, who are not necessarily easy to incorporate in a short period of time. However, it is interesting to think of the word community in the broadest sense, to include each person's networks, like-minded spaces or areas of influence within which each of us moves. Moreover, it became evident that the three projects address strong topics – potential massive extinctions, over-contaminated ecosystems, and human habitats that lead to poor living conditions – and that they share the common root of conscious or unconscious human behavior. It is a fine line, when addressing this type of topics, between generating a sense of guilt or provoking action and supporting the hope that we can change things.

## WEEK 3: To deepen the collaboration and actions with communities

During this week artists and scientists were already feeling the pressure of the short time available to achieve a community action, and also to create a piece or experience to show in two weeks. There is no doubt that the challenge imposed this year of completing everything in four weeks generated certain tension, but also a productive work dynamic that resulted in interesting

proposals. The artists balanced their schedules between downtime to write, draw, and develop their sketches, and running across the city for their production and exchange sessions with their scientist partners. Community actions were varied: a workshop for university students led by María Lourdes Peralta Frías, Ph.D. from the Urban Sprawl project; an educational happening in Parque Omar with passersby who frequent the park, to get a sense of the public's general knowledge of amphibians; and a plastic trash collection session in the mangroves of Juan Díaz, which would then grow into the collective creation of an outdoor installation as the final work.

### WEEK 4: Final showing – Anthropogenic Abrasion

We installed an outdoor exhibition in Summit Municipal Park, under the title Abrasión Antropogénica (Anthropogenic Abrasion) – two terms that refer to the terrible damage that humans are inflicting on the environment; damage that we can also revert or shift with creativity and collective effort. Summit Municipal Park, far from the center but still within the metropolitan area, is one of the places where people go to when they wish to connect with nature, and some call it "the Panamanian families' park," which in 2017 alone welcomed between 170 and 190 thousand visitors. In this sense it was positive to carry out the experience in this space, where visitors to our exhibit came with a certain disposition to enter into a dialogue with the content which for them and for us is extremely urgent. We had rainy weather, typical of a Panamanian month of November, both while installing as well as for the two days of the exhibit; however, we received 463 visitors (between school classes and families) and around 40 people attended the closing discussion.

## OUTREACH PHASE

### TRAVELING EXHIBITION AND PUBLIC PROGRAM from March to May 2018

With the intention of coming closer to the city's inhabitants and reaching the highest possible number of people, we created an infographic traveling exhibition, accompanied by short educational documentary videos (on QR codes), containing details of each research project and the artistic creation experience that took place during the LAB. The panels also included a Call to Action for each topic. Thus we invited the spectator to learn more about the city, to develop an awareness about local ecosystems that we are affecting with our actions, and to think about individual initiatives and solutions for these problems that affect us all equally.

### THE DOCUMENTATION

**The videos were made by Cine Animal** – with the direction of Carolina Borrero, photography by Christian Bradford and Tomás Cortés Rosselot, and editing by Gilberto Loffer.
Cine Animal is a collective of filmmakers and a producer for original audiovisual content with high social impact. They tell stories through emotions, which capture the essence of people and situations, aiming at developing a sense of identity and belonging, positioning Panama as a cultural center in the region.

**Carolina Borrero** is a director specialized in short documentaries, with a great interest in participating in projects that include innovation and research, and which contribute towards Panama's identity. Her videos seek to portray different realities, and at the same time, they pose an invitation to reconsider those very realities.

The photographs were taken mostly by Tova Katzman, who this year received the support of two volunteers Gabriel Guandique and David Arias, as well as Cine Animal.

**Tova Katzman** is an artist, photographer, videographer and visual storyteller, interested in the impact, the connections and the power of collaboration between human beings. After receiving her bachelor's degree in Photography, from the Massachusetts College of Art and Design in 2015, she documented the first Art and Science LAB and traveled extensively in South America. She currently lives in Panama with a Fulbright Scholarship for art and research, focusing on the various perspectives that people have about the Canal and the deeply complex stories it encompasses.

**Gabriel Guandique** is an empirical photographer and enthusiast, a lover of nature, art, and music. In photography he found the ideal tool to share a more personal vision of the world and in it he seeks to use the language of art to transmit and share knowledge, ideas, traditions, places, and the diversity of our natural world, to help to preserve it for future generations.

**David Arias**
www.davidjosearias.squarespace.com

The videos, which function as a public program online, will continue to be shared after the exhibition is completed thanks to their presence on the web and in this publication. In each booklet you will find a QR code that links to the correspondent video for that project, or you can simply visit our website: www.estudionuboso.org

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"The LAB is a pivotal point in the way we address the problems we are faced with, it is a commitment to collaboration and a re-union with the natural world. It is a space to reflect, play, and experiment, to change our attitudes and beliefs. But what does this look like? How do all of these ideas translate into something concrete? In one video, or several?

The first attempt in 2015 produced a sensorial registry of the experience, which together with a series of videos, inspired curiosity about the entire project. This second attempt is seeking pedagogic and utilitarian value that the videos can provide with their potential to be replayed and shared, to generate dialogues, bridges for new collaborations, spaces for exhibitions, and questions for more videos."

- Carolina Borrero Arias
Cine Animal

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Image captions:

p. 6 Drawing session led by Román Flórez in Taboga
p. 7 Group visit to the Amphibian Rescue Lab
p. 8-9 Final discussion and group photo in Summit; details of the installation in the park
p. 10 Images of the traveling exhibition prisms in various locations of the city: El Hatillo in La Exposición, Parque Heliodoro Patiño in Juan Díaz and in the Cultural and Sports Complex La Siesta in Tocumen.

# LAB FACILITATORS

## Ana Berta Carrizo

Cultural manager, photographer and anthropologist, she works on promoting the arts through social work focused on cultural and educational development in Panama. She is the executive director of Fundación Alemán Healy, and founder of their Arts Education Program, focused on promoting collective creativity and improving income producing opportunities for artists in general.

## Ela Spalding

Artist and cultural producer, focusing on the human-nature-culture relationship. Her art and facilitation work navigates exchanges between people, ecosystems and disciplines to provoke an active reflection on how we inhabit the world today . She is founder and creative director of Estudio Nuboso, founding member for Archipel e.V. a Berlin-based cross-cultural collective and community radio station, as well as associate curator in the Center for Contemporary Art and the Natural World. She shares her time between Panama and Berlin.

## Emily Zhukov

Artist and educator, a resident in Panama since 1994, where is an active collaborator in the local art community and a founding member of Estudio Nuboso. She is interested in the way in which languages and methodologies are developed and implemented in order to successfully transfer knowledge. A firm believer in the power of art to communicate across disciplines, she has worked with schools and communities to help to design spaces, projects, and curricula that integrate the arts.

## Román Flórez

Drawer, museologist, and architect. He has been a professor and researcher in the fields of drawing and graphic expression in architecture schools in Colombia and Panama. He was selected as resident artist in the first Art and Science LAB held in Chiriqui in 2015. Currently he is participating as museologist in academic, artistic and cultural projects, and as an artist in the production of graphic work and editorial illustration. He lives and draws in Panama City.

# ENDANGERED AMPHIBIANS

**Gina Della Togna, Ph.D.**
**Juan Carlos León**

Art and Science LAB, Panama City 2017
Section 2 of 4.

# INTRODUCTION

Artistic and scientific processes are both exploratory undertakings, propelled by curiosity, data gathering, and experimentation, and as such, they require not only discipline and rigor, but also openness to risks and unexpected results. When scientist Gina Della Togna, Ph.D. signed up to the LAB 2017 as an opportunity to develop new strategies to share her research about rescuing amphibians through assisted reproduction, she could not imagine that she herself would become the subject of artistic research. Artist Juan Carlos Leon arrived in Panama prepared to work with amphibians; however he found himself fascinated by the scientific work context and passionate professionalism with which Gina faces her work challenges. In a debate about the difference between "social outreach about a scientific topic" and "scientific outreach of a particular research project", using Juan Carlos' words, "Amphibian Action" and the "Gina" installation afforded two responses generated by the space for reflection and dialogue that LAB 2017 provided them.

In "Amphibian Action", a form of educational outreach, ice pops were handed out to passersby at Omar Park, in exchange for them filling out a survey. On the sticks of these ice pops there was engraved data about amphibians. This survey revealed that the general public knows very little about amphibians, including the very meaning of the word. The art installation at Summit Municipal Park titled "Gina" reflected another methodology for gathering and presenting this data. Making reference to the gaze through the microscope in the laboratory where Gina counts the sperm that will guarantee the continuation of the species, dozens of magnifying glasses over acrylic disks were inserted in the trunks of fallen palm trees. Each disk shared information about women in science, with the purpose of generating knowledge about current work conditions and promoting gender equality, not only in science but also in all of society. Both interactions invite the public to become empowered with "invisible" information. Just as amphibians are indicators of the health of an ecosystem, gender equality represents a healthy and sustainable society. The work "Gina", like the work carried out by the scientist who carries that name, makes us reflect on the often-unacknowledged contributions of important protagonists in the living network that protects us and ensures life.

**Emily Zhukov**
Estudio Nuboso
LAB Facilitator

# RESEARCH

## APPLICATION OF ASSISTED REPRODUCTION TECHNIQUES IN ENDANGERED AMPHIBIAN SPECIES

by Gina Della Togna, Ph.D.

Currently, 42% of all amphibian species that exist in the world are in danger of extinction. The epidemic caused by the chytrid fungus (Bd), and habitat fragmentation, are the main causes of this global extinction crisis. As a result, programs for reproduction in captivity have been created, with the goal of maintaining and reproducing endangered amphibian species.

The problem is that the reproductive biology for many of these species is unknown, making it difficult to facilitate their reproduction in captivity. For this reason, it is necessary to develop assisted reproduction techniques which help to stimulate reproductive behaviors or facilitate the production of offspring. My work entails studying the reproductive biology of the species that are found in the Panama Amphibian Rescue and Conservation Project, to facilitate the development of protocols for assisted reproduction in this species, in order to increase their numbers in captivity and prevent their extinction.

There are few of us, around 8 to 10, scientists that specialize in amphibian reproduction around the world, and I am the only Latina. However, we have developed collaborations and knowledge exchange mechanisms to share our expertise and to support conservation of this animal group that is so threatened.

Reaching this point in my career has required tremendous effort and dedication. Once I graduated from school, I studied for another 20 years, including a bachelor's, masters, doctorate and post-doctorate degrees. It has been a challenging and competitive path, as it is complicated to excel in science as a woman. However, I think I have succeeded, and I feel very proud to be able to contribute to science, to society, and mainly to the conservation of endangered species.

# EXPERIENCE

**by Gina Della Togna, Ph.D.**

As a scientist, my though process is generally very structured, based on evidence, somewhat rigid and systematic. Although I consider myself to be a person with a lot of initiative, my line of work does not allow me to apply it in total freedom, as I am bound by the scientific method.

During my experience in the LAB and with Juan Carlos, I was able to observe the artistic creative process, to which I had not previously had direct access. During this period of interaction, we were both able to share, compare, and at the same time combine, our thought and creative processes. It was interesting to observe Juan Carlos' artistic style, which contains a strong flavor of the scientific method. This resulted in excellent interactions and a flow of ideas and concepts, which allowed us to make more flexible interpretations of rigid aspects of science and convert them into an impactful art product.

Likewise, having the opportunity to get to know other scientists and artists, to observe their processes and learn from them, was an exceptional experience. I grew as a person and as a professional, I understood the complex processes of artistic creations and the challenges that other colleagues and artists face in their professional processes.

My participation in the LAB led to huge personal gains, full of surprises and learning.

# REFLECTIONS ON THE CONJUGATION OF ART AND SCIENCE

By Juan Carlos León

Establishing a connection between Art and Science can be understood as an exercise in disassociation or as a path towards dichotomy, but really it is a relationship that requires a shift in the practical way of generating knowledge. We could admit that one of the "common" dynamics between these two disciplines is the attempt to understand reality through generating knowledge based on searching and experimenting; although this could characterize many methodological and creative ways of assimilating and reproducing this knowledge, it is the practice of "observing" that lies at the heart of this attempt to comprehend and gestate these realities. Scientists and artists alike observe, and imagine future possibilities.

These conjugations between apparently separate disciplines are notable, appearing to be original and stimulating due to their interdisciplinary character and the convergence of multiple approaches to reality. From these junctures stem new worlds and discourses, unedited experiences and alternative spaces that enrich universal knowledge and creative thinking. I have always thought that experimentation, knowledge mediation and sharing the processes and results of the art and science connection must have a direct impact on the day-to-day life of citizens. Art can help to democratize science and technology from the generation of critical strategies about scientific content, contributing new modalities or ways of approaching and experimenting in the search for scientific knowledge, but what cannot happen in this relationship is for artistic practices to become mere descriptive containers for science. I am referring to an outreach constructed not from the representation of a scientific fact, but rather as an "outreach that experiments" through art; I am talking about the possibility of artistic practices to also be part of the system that generates scientific knowledge. This type of conjunction of art and science can generate new links and other forms of experiencing knowledge.

The creation of spaces, public programs or projects destined towards the growth of this relationship is decisive to achieve change in the production and the reception of interdisciplinary knowledge. The Art and Science LAB, organized by Estudio Nuboso in Panama represents for Central America, and for the southern region, one of the few experimental platforms that brings together researchers, scientists, and artists in a space of collaborative work. In its second edition this project focused on the dissemination of Panama's scientific work through art, benefitting local communities through a better understanding of their natural and cultural heritage1. Being part of this project gave me the opportunity to ask myself what is the role of the artist in the art and science conjugation, is he or she an active entity in the moment that knowledge is proposed and generated, or rather a "symbolic reproducer" of research carried out by the scientist? Also, regarding the dynamics that surround the production of knowledge related to the LAB, how to question the type of experimentation proposed by the organizers, if these were to lead to firmer lines of work that allow the growth of the projects and research that are carried out during and after the residency period; or is it an adventitious event, rooted in the immediate needs that the management demands. Or, what are the challenges to build this kind of experience in a space like the city of Panama? Along these lines, the intention of this text is to examine the project that arose from the Art and Science LAB, to make a few comments, and to show the main synergies and links that arose from the work with scientist Gina Della Togna, Ph.D., a Cellular and Molecular Biologist that works on the cryopreservation of the sperm of 4 types of amphibians of the genus Atelopus sp., and with whom I worked on the topic "Rescuing endangered frogs".

## LOGBOOK: ENCOUNTERS AND SHIFTS

When I was selected to participate in the LAB organized by Estudio Nuboso, I allowed myself to idealize from the angle of artistic possibilities about what would be the most adequate way to relate to the work on amphibians that was carried out by the scientist Gina Della Togna, Ph.D.. From the very beginning I was interested in being able to influence the research she carries out within the Panama Amphibian Rescue and

Conservation Project (PARC) laboratory. Although I did not yet know the scientific context, nor the work conditions at the PARC laboratory, I took the risk of proposing a "Sound Capsule for Amphibian Growth", a project that sought to generate a sound habitat for amphibians and humans; an exercise on the sound implications for the animals' habitat in the laboratory. Once I arrived in Panama, and after the first week of collaborative dynamics and of relating with our work group, I was able to see the commitments my work partner had with her daily work dynamics; and that her schedule allowed very little time to articulate a more fluid dialogue with the ideas that I was proposing, and moreover a sound exercise was not relevant for her research on sperm cryopreservation. First encounter, first shift.

The meeting, having a direct dialogue, and the subsequent conversations, generated new ideas (I had still not seen the laboratory); the following idea was based on the poorly regulated way of identifying individuals (frogs) in the laboratory. The project proposed generating a system to enumerate and identify the amphibians, a system that could recognize the skin characteristics of each individual and its variations over time, and according to these characteristics read new information about the preservation process. The idea was discarded due to the time it would take to produce such a project, and the bureaucratic and security implications for the laboratory.

Among phone calls and absences, given the tight schedule my work partner had, I began to understand that the "rescue" issue was the leitmotiv for this project's development, but once again I was doubting how illustrative that could be. We began to discuss the concept of dissemination or outreach, and I was able to grasp the difference between "social outreach about a scientific topic" and "scientific outreach of a particular research project", a dynamic that is often confusing, and a discussion that was not included in the Art and Science LAB. Second encounter, second shift.

After agreeing upon the very real limitations in terms of time and access to specialized knowledge, reasons for which I could not have an impact on the scientific outreach of the research, we decided to focus on a more pedagogic dynamic at the social level, which could address the issue of "frog rescue". I chose as a production exercise the possibility that the scientist would take the position of the creative artist and that it be she who proposed the project, while I assumed the role of informed and severe spectator in my criteria. From this exercise the third encounter was born. The new "scienti-artist" as we called Gina, proposed an indoor expository montage based on a public action recorded on video, a second video with frog skin marks and hidden messages; I proposed integrating drawings of the sperms, and Gina closed the project with an ice sculpture of a frog that would melt in the room, as symbol of the extinction of the species (valuable exercises but full of commonalities). Here is where our third shift started, and I noted for myself that art is not a decorative tool for another practice, or a mere exercise in representing another topic. This led us to a discussion of how art is produced and I was able to show that art, like science, includes provable methodological processes that develop and explore new knowledge. The following step was to question once more the production of our future project, and the questions pointed at ways in which a research project is constructed. Who makes these research projects possible?

After spending a short period of time at the Panama Amphibian Rescue and Conservation Project (PARC) Laboratory, I was able to see all the logistical aspects required to keep the individuals in this project alive (endangered species that are being reproduced in a laboratory context to then re-introduce them in their natural habitat). Upon observing first hand the delicate work to extract sperms that the scientist must perform, I made a few drawings that reflect upon the use of microscopic amplification to observe and value the quality of the sperms through their movement. These drawings were large format sketches that analyze the movement between amplification dynamics in the scientist's use of the microscope, and the use artists make of image amplification, which leads to pixelation. These drawings were not the purpose of the project, but they served to establish a "representational relationship" based on a single object of observation.

Visits to the laboratory and these relationship dynamics with the scientist through drawing as a medium to

modify the view of an object of study, allowed me to understand that the subjects to be studied were not the PARC amphibians, their sounds or their skin characteristics; it was also not the type of outreach or the exposition project, but rather the subject was who makes this work possible. What is this scientist's real work? This was veiled information that was not highlighted in our project. What is the real work of a scientist in Panama?

## GINA: EXPANDED PORTRAIT. FROM THE AMPHIBIAN LABORATORY TO THE DAY-TO-DAY WORK OF A SCIENTIST.

Watching Gina Della Togna, Ph.D., her scientific work, and understanding the professional challenges she faced in a context like Panama, is opening up the discussion as to what is the job of a scientist in this region of the world: "a Latin American scientist should have a different role, not only dedicated to gathering data and writing papers, which is already a key task. The scientist must go beyond and play an active role in political, social, and economic aspects so that his or her studies can reach decision-makers and have an impact on the affected populations." The project for this LAB sought to make the work of this scientist visible, and as her day-to-day work also speaks to gender disparities in the local scientific world, the outreach project also became an exercise that makes it possible to maximize invisible information about the context for women scientists.

The data we revealed in this installation shares information about the figure of the woman scientist, her professional context linked to day to day dynamics, and the problems that mark her condition as a woman-scientist and the inequality she faces to move her research forward. The project was set up in the natural space of the Summit Botanical Gardens. The outreach element was based on "observation" as a means to discover relevant information, for which 38 magnifying glasses were used, located strategically in a tree covered space, where 38 acrylic plates were placed, all of them with laser printed texts about scientist Gina Della Togna, Ph.D.'s work. This data allowed the user-spectator to learn how relevant this scientific work is, and to discover the person behind the project:

> *"Gina Della Togna, Ph.D. is a Panamanian scientist that works on the "sperm cryopreservation" of 4 species of Atelopus sp., which are currently in danger of extinction";*
> *"My work is very challenging because it involves first elucidating the reproductive biology of the species, about which we know little, and then applying this knowledge to develop protocols";*
> *"As of the year 2017, there were less than 10 scientists in the world working on the reproduction of endangered amphibians, two of them are women, and one of them is a Panamanian!!"*

Moreover we included other relevant data from the UNESCO Institute for Statistics, UN Women, and Indicators for Science and Technology Activities in Panama:

> *"In the year 2013 Panama had 252 researchers, of which 115 were men, and 137 were women, but the main positions were held by men";*
> *"In Panama, more than 40% of persons that graduated with science degrees are women. UNESCO. 2015";*

And phrases about gender-based conditions that were created by the scientist herself, such as:

*"For women to have access to knowledge and achieve gender equality, they must have access to science."*

This exercise in "social outreach" sought to bring the user-spectator closer to information that could inspire a reflection on the work conditions of local scientists, from a pedagogic perspective, with real data and reflections that could induce future women scientists to continue fighting for gender equality in scientific work.

## AMPHIBIAN ACTION

As part of the process, we developed an educational social outreach action for the proposed topic *"the extinction of amphibians in Panama."* Our hypothesis proposed that in the local context little is known about amphibians or about research projects, despite the fact that one of the symbols the country promotes is the golden frog. Amphibious Action took place in Omar Park and consisted of carrying out a survey with 6 questions about amphibian extinction, their importance and benefits, related phobia, and conservation in Panama, in exchange for La Italiana ice pops, a well known brand in Panama. The ice pops had 3 hidden phrases inside them, referring to the issue at hand, always starting with the question **DID YOU KNOW THAT...?:**

1. The Golden Frog is extinct in its natural environment and only exists in captivity?
2. Amphibians have molecules that serve to develop medicine to fight cancer?
3. 42% of all the amphibians in the world are in danger of extinction?

As a result of the action, 96 persons were interviewed: 40 men and 56 women of various ages; of which 61 DID know that amphibians are becoming extinct in the world, 32 DID NOT know and 3 persons knew nothing about the subject. We asked if amphibians were important for the ecosystem and 86 people responded YES, 4 said NO, and 6 did not know about the topic, but when asked if they knew about the benefits of amphibians for pest control, 75 persons said YES, 20 said NO, and only 1 person knew nothing about the topic. When asked if they knew about the Panama Amphibian Rescue and Conservation Project, the numbers changed radically. An affirmative answer was reduced considerably to 21 persons, while the negative increased to 75. And when asked if they knew that this is the largest and most advanced amphibian conservation project in the world, 87 persons responded NO, whereas only 9 said YES. As an additional fact that was not included in the survey, half of those surveyed did not know the meaning of the word amphibian.

Our hypothesis was proven by an action where the scientist directly activated the social space, although with a reduced number of participants. Numbers show that there is a communication void between scientific research projects and the citizens that must be addressed, not only by those who are generating the knowledge, but also by the institutions in charge of the general information the population is exposed to. Creating this communication bridge and valuable outreach strategies such as Estudio Nuboso's LAB could ensure a better future and use for this knowledge.

To conlude, the Art and Science Lab is one of the most important spaces for experimentation in Central America, which stands out as one of the growing strategies to modify the dynamic of local contemporary art. The questions remain open, the ways of conceiving the LAB and its topics could be modified, but the creative impulse and the generation of interdisciplinary knowledge proposed by Estudio Nuboso is a serious and committed investment in art and science as tools for social change.

# BIOGRAPHIES

## Gina Della Togna, Ph.D.

Gina received her bachelor's degree in Biology with a specialization in Zoology at the University of Panama. At the same university she received her Masters in Cellular Biology and Molecular Genetics. That same year, 2008, she received her doctorate in Cellular and Molecular Biology at the University of Maryland, where her research was focused on the reproductive physiology of Panama's golden frog (Atelopus zeteki). After this she received her post-doctoral degree at the Smithsonian Conservation Biology Institute in Washington, D.C., where she continued working on studying reproductive biology and developed assisted reproduction techniques for other species of amphibians that are critically endangered. Currently Gina works at Universidad Interamericana de Panama as Academic Researcher and she is an Associate Researcher at the Smithsonian Tropical Research Institute, specifically in the Panama Amphibian Rescue and Conservation Project, studying new species to support their conservation.

## Juan Carlos León

Artist, curator and cultural manager. He studied at the Instituto Tecnológico de Artes of Ecuador (ITAE) and at ESCUELAB Lima (a school for non-formal art and technology education). He is interested in activating the senses with technology, for this reason he co-founded DIFERENCIAL [art+technology+society] (2011-2015), a space created to connect and promote projects or activities that favor the development of a digital culture, through productive dialogue and creative learning about free culture, art, and technology. He coordinated the Interactive Science Museum in Quito, in 2014-2015, where he proposed an institutional change towards the concept of Open Science and scientific outreach through artistic practices.

**¿HOW CAN I HELP TO SAVE AMPHIBIANS?**

- Participate in events that promote conservation.
- Demand that authorities pay more attention to the problem.
- Support scientists.
- Avoid spreading diseases and conserve ecosystems by:
    - washing your shoes before and after visiting amphibian habitats.
    - Not using pesticides.
    - Don't let your pets run free in vulnerable ecosystems.

Image Captions:

p. 4 above left: eggs of *Strabomantis bufoniformis* preserved in formaline.
Above right: abdominal massage to obtain sperm from *Atelopus certus.*
Center: *Atelopus varius* individuals in captivity.
Below: pregnant female of the species *Atelopus glyphus.*
p.6 Juan Carlos León analysing the methods used to identify individual frogs in the PARC lab.
p. 9 video still of Cine Animal short documentary, text reads: Globally, women's salaries are 24% lower than men's, however, in all regions women work more than men. - UN
p.13-14 Installation details in Summit Municipal Park
p. 16-17 Amphibian Action in Parque Omar
p. 18 uan Carlos and Gina getting to know each other during induction week
p. 19 Above: Gina Della Togna extracting sperm from a frog of the Atelopus genus, with lab colleague adn Carolina filming her Left: Gina during the Amphibian Action in Parque Omar

# MANGROVES OF JUAN DIAZ

**Anna Handick**
**Olmedo Pérez Núñez**

Art and Science LAB, Panama City, 2017
Section 3 of 4.

# INTRODUCTION

*If we had a Fantastic,*
*As well as a Logic,*
*we would have discovered*
*the art of inventing.*

Fragments from Novalis in Grammar of Fantasy by Gianni Rodari.

Reaffirming their commitment to cultivating people's interest in dialoguing harmonically with nature, Estudio Nuboso ran the second Art and Science LAB - one of the most relevant projects for co-creation and spreading of scientific and artistic knowledge - addressing on this occasion phenomena associated with urban dynamics in one of the most vibrant and contrast rich cities in Central America: Panama City.

In an intricate urban fabric germinates one of the scientific investigations selected for this edition of the LAB, amongst the abundant bioclimatic landscape of the coastal edge of the Juan Díaz township (the most densely inhabited of the capital city), where a vast extension of mangrove holds on despite its illness and threats due to our consumption practices and peculiar vision of development.

This is the setting where the powerful subtlety of artist Anna Handick and the noble research work of chemist Olmedo Pérez Núñez met to collaborate together on a project that, during thirty days, was witness to the high level of reflection required to discover the common spaces between art and science, their undeniable ability to communicate and their powers to sensitise people while confronting us with the challenges we need to take on in order to protect life on our planet.

Throughout this document, you will discover interesting photographs, drawings and texts that show a creative process, which resulted in various different artistic and scientific actions highlighting the strong articulation between the passion of the scientists' research with the conceptual intensity of the artist. The testimony left by the sensibility of two highly creative disciplines working towards a common goal is there to show us the importance of mangroves and the hope for a possible future if we are able to become allies with our natural surroundings and its unfathomable beauty.

**Román Flórez**
LAB Facilitator

# RESEARCH

## MEASUREMENT OF BIOLOGICAL AND PHYSIOCHEMICAL VARIABLES IN WATER, SOIL AND PLANT MATTER IN THE MANGROVES OF JUAN DÍAZ.

by Olmedo Pérez Núñez

Different anthropogenic and natural activities are seriously affecting the mangroves located on the mouth of the Juan Díaz River. Among these affectations we can mention: the discharge of wastewater from the Water Treatment Plant of the Bay of Panama, the increase of urban development in the surrounding area, contamination due to solid waste that is carried by the Juan Díaz River as well as the tides that reach the mangroves. Also, the increase of natural enemies such as certain types of beetles and diseases that are reducing the forest wealth in the area.

This scientific project seeks to demonstrate the value of mangrove forests, highlighting the importance of their ecosystem services, that is: what mangroves do to reduce the amount of carbon dioxide in the atmosphere (blue carbon) and how much they retain; how they naturally treat the waters of the Juan Díaz River and that of the ocean (water quality index); and which tree and animal species are thriving in the ecosystem in order to measure the quality of habitat.

The results obtained over six months of analysis of the Juan Díaz River and ocean water, marine sediment, mangrove soil and vegetable matter of the existing mangroves will be useful to institutions and government officials who make decisions about this area. May they be of help to develop policies for the short, medium and long term, allowing better management and integration of the wetland within the city, and a greater understanding of the importance of this marine coastal ecosystem.

Image Captions:

p. 2 “two currents of thought, artistic and scientific, searching for communion or understanding, to save a wonderful creature: the mangrove”
p. 4 Above: “Mangroves offer a valuable ecosystemic service: capture of carbone dioxide from the atmosphere and in ocean water to create what we call blue carbon. They capture five times more than tropical forests.”
Below left: “Just like a distant horizon, a green line of hope made of mangroves stands, silent witnesses to the intense anthropogenic activity that deforests its soils.” Below right: “One day, when we understand and value in a fair dimension the ecosystem of the mangrove, will be able to enjoy exploring them, admiring their great biodiversity and unique ecosystem services.” Texts by Olmedo Pérez Núñez

# CARBONO JUAN DIAZ AND NEUMONIA

By Anna Handick

To know the work of Olmedo Pérez Núñez both in the laboratory as in the mangrove itself showed me the complexity of his efforts, which are not limited to simple chemical analysis, but also imply arduous field visits and strength in negotiations and convictions. Due to this diversity of facets, equally important, I decided to work along two lines to address the objectives proposed by the TOTH Laboratory: the chemical analysis and the environmental dimension.

The sequence of drawings "Carbono Juan Díaz" is my approximation to the chemical studies, my attempt to understand, transform and visualise their main content. The drawings represent the carbo retained by the biomass of the mangroves, the soil and mangrove sediment, as well as the $CO_2$ that would be emitted into the atmosphere if the mangrove did not exist. The grade of space occupied on the paper corresponds to the percentage of carbon in the different parts of the ecosystem (19% in sediment, 28% in soil, 53% in the biomass and 100% in $CO_2$). Each drawing is constructed with the common graphic representations of the chemical compounds and made with ink produced with charcoal from a mangrove tree collected in the Juan Díaz mangroves. This series of drawings is a direct translation of the data obtained during Olmedo's research into an artistic expression.

The strong impact that the state of contamination of the Juan Díaz mangrove had on me provided the impulse for my second line of work. The garbage was not an object of study in the TOTH Laboratory, however it is denominated one of the causes of the deteriorated state in which the ecosystem finds itself, which is also reflected in the low levels of carbon retained and the low quality of the habitat. From this strong impression of the mangrove turned into clandestine dump emerged the action-installation "Neumonía", which consisted of collecting plastic trash and mangrove seedlings in an area of 20 sq. meters and creating an installation-nursery in Summit Municipal Park with this trash and seedlings; inviting the visitors to the LAB's final showing to take part in the micro-representation of the constant fight and resilience inside the mangroves.

Image captions:

p. 5 Ink made with mangrove charcoal found in the Juan Diaz mangrove
p. 6 Photographs taken by Anna Handick
p. 7-11 Anna's work in progress and installation images
p. 12-13 Plastic trash collection and installation of "Neumonia"

# EXPERIENCES

**Olmedo Pérez Núñez**

To have worked with Anna Hanick was an unforgettable and fabulous experience. I am used to working with people who have a line of work very similar to mine. Upon meeting her, I realised that I would have to develop a mechanism to be able to integrate and understand her way of thinking. I feel that during the four weeks of the LAB de Arte y Ciencia 2017 I was able to do that.

In the beginning, as with any process, there was a certain mistrust motivated mostly by the feeling of uncertainty around the person with whom I would have to work with, and whether I would be able to complement my scientific thinking with their artistic thinking. Thank God, I found in Anna an accessible person, open to changes. We were able to understand each other well during the workshops in Casa del Soldado in Casco Antiguo and we realised that this experiment would end in unexpected results.

On the trip to Taboga Island, when we had a more personal conversation in front of our main actor, the dwarf mangrove, Anna provided me the tools that enabled our interaction and we were able to define clearly what we would like to get out of this social experiment: that a scientist see and feel life with another perspective, unimaginable to his senses; and that an artist understand better her surroundings applying a scientific methodology. The latter was reaffirmed when Anna was able to spend a full day sharing my work on mangroves in the Toth Laboratories.

Later, I had that pleasant experience when Anna executed her creative process in the studio in Emily's house. There I understood that I not only need to understand my work as an activity that generates numbers, but that I must also develop a sense of belonging with my object of study, to understand it better - in this case, the Juan Díaz mangroves.

Lastly, during the final showing with the public, Anna could already speak in a language very similar to mine when people asked her about the mangroves, and I could also use similar language to hers when they asked me about her creations. We had attained the hoped for empathy and understanding of our activities.
I would definitely repeat an experience like this one.

**Anna Handick**

When I responded to the call for the Art and Science LAB, I saw it simply as an opportunity to experience a more profound study of a scientific topic, to feed my work.

When the news came that I would work with Olmedo Pérez Núñez, a chemist researching the "Measurement of biological and physiochemical variables in water, soil and vegetable matter in the mangroves of Juan Díaz", I was at a loss, given that my knowledge of chemistry boils down to one year of lessons in high school, of which I only remembered that elements join to form compounds... while I had been interested in mangroves from the perspective of their biology, I had no idea how to address them from the chemical aspect.

The exchange with Olmedo and his patience in reinforcing my basic knowledge of chemistry made me see another world, that of elements, atoms and compounds... I understood that chemistry is the basis of everything and is elemental to understand certain processes; which as a strong parallel with my way of attempting to understand the world from my perspective as an artist.

Although it awoke my curiosity for exploring this, for me, little known field of chemistry in the TOTH Laboratory, I soon realised that due the duration of the LAB and the urgency of the topic, I would not have the luxury of recovering lost lessons during secondary school.

But the LAB didn't only consist in me working with Olmedo and his research on mangroves. It consisted in getting to know the way of thinking and working of each and every one of the participants. This exchange reaffirmed for me that individual paths that don't follow predestined routes require much will power and dedication, and are also viable and necessary. And even though each path of each participant is different, the simple fact of knowing the particularities of each one, makes us understand and appreciate their efforts more.

Time ran short to grasp everything deeply. Hence, the experience and the friendships, as well as the artworks that came out of the LAB, are just the beginning and not the end. The four weeks of the LAB, outside my day to day and in constant exchange with other ways of thinking and working, provoked a deep reflection on my own artistic practice, my approaches, objectives and visions. So the true experience is not yet written.

# BIOGRAPHIES

## Anna Handick

Born in Nuremberg, Germany. Studied Art in the Akademie der Bildenden Kuenste Núremberg with a mention in Sculpture in the class of Professor Claus Bury. In 2008 she was named Meisterschuelerin, and had her first solo show in Galeriehaus Nord, Nuremberg in 2009, followed by others in Nuremberg (2011, 2015), Managua (2013) and Bayreuth(2015). In 2012 she won an award for debutants from the Ministry of Education, Science and Art of Bavaria, Germany and the the Young Art Award from Gallery Ute Barth, Zurich, Switzerland. She took part in many group exhibitions, among them the Bienal Centroamericana (2016, San José, CR); Amor Paixão (2013, Sao Bernardo, Brazil) KHORA3 (2011, Shantou, China). Since 2016, she teaches in the Escuela Nacional de Artes Plásticas "Rodrigo Peñalba" in Managua where she lives.

## Olmedo Pérez Núñez

Born in Penonomé, province of Coclé, Panama. Holds a Bachelor in Chemistry from the University of Panama and Postgraduate degree in Business Administration. He has worked as Chemical Analyst and Laboratory Manager both in private and public contexts. He has also taught at the high school and university level. Since 2008 he has centred his activities on environmental topics, working for the Mineral Resources Laboratory of the Ministry of Commerce and Industry, the Environmental Quality Laboratory of the Ministry of Environment and Toth Research and Lab (where he is currently employed), focusing mainly on environmental externalities. Since 2015 he has been dedicated to the project funded by the SENACYT titled "Measurement of biological and physiochemical variables in water, soil and vegetable matter in the mangroves of Juan Díaz", which will end in December 2017.

¿HOW CAN I ADPAT MY DAILY ACTIVITIES TO SAVE THE MANGROVES?
Starting with small actions is key!
- Join beach clean up efforts.
- Dispose of garbage correctly.
- Avoid using disposable plastic containers.
- Do not allow the destruction of mangrove. Protest!

# URBAN SPRAWL

**María Lourdes Peralta Frías, Ph.D.**
**Geetha Iyer**

Art and Science LAB, Panama City, 2017
Section 4 of 4.

# INTRODUCTION

Planning this second editions of the Art and Science LAB was a new challenge from the beginning, given that this project, being an experimental platform without limitations, has naturally evolved to include other possibilities and include new variables compared to the first edition. The most notorious differences regarding the selection process were that one of the selected projects was lead by an engineer (engineering being also a science, even though the title may not be perceived as such initially) who studies the city's urban growth; and then a creative writer was selected as her partner. Yet another variation that was difficult to imagine, but that didn't generate fear of failure, on the contrary, it produced excitement in the facilitation team due to the rupture in our expectations and not being able to foresee the direction the project would take.

The theme of urban sprawl or uncontrolled urban growth is itself very complex, because it is a scientific concept that we don't think about even though we live it day to day, and has implications beyond what we see on the surface. It is a problem that affects us all: with water and power shortages due to technical problems, with intransitable sidewalks and the deficient public transportation, and the "peak hour" of traffic jams that becomes longer and longer and seems to have no specific times anymore. The prices of housing in the city center are increasingly unaffordable, and therefore it is the less fortunate with less privilege who end up acquiring low-cost housing in the outskirts, without knowing that they will probably have no paved road or sidewalk to reach a bus station, that for this same reason their garbage won't be collected, and because of poor infrastructure planning water supply will be a constant source of stress. Everything we consider basic needs from the perspective of those living comfortably in the urban center, are actually a luxury on the borders of the body that forms it. This reality, as well as that of the amphibians and the mangroves, lives on the edges of our city and is suffering constant inflammation.

In this booklet you will be able to admire the synergy and the impeccable work done by the engineer María Lourdes Peralta Frías, Ph.D. and artist Geetha Iyer; where they gave birth to the metaphor of our city as a body, and they act as doctors who analyse and provide a diagnoses, the consequences and future of the state of health of Panama City.

**Ana Berta Carrizo**
Estudio Nuboso
LAB Facilitator

# RESEARCH

## TECHNOLOGICAL SCIENTIFIC MANAGEMENT SYSTEM TO MITIGATE PROBLEMS ASSOCIATED WITH UNCONTROLLED URBAN GROWTH: "URBAN SPRAWL"

By María Lourdes Peralta Frías, Ph.D.

The accelerated urban growth that characterises a great number of developing countries such as Panama can take place through population concentration in small areas, where space for new developments are limited, and tall buildings make use of the horizontal space vertically. Another result of this rapid urban growth manifests itself in urban sprawl, which differentiates itself from the aforementioned by less population density, more combinations of land use and development in the periphery (areas that used to be rural), which goes hand in hand with a lack of planning and controlled land use.

The causes of this growth on the periphery are numerous and highly complex. More important are the effects of this dispersion, which include environmental impacts that are often irreversible, such as excessive removal of plant cover, reduction of open space, greater air pollution, more energy consumption, visual contamination, reduction of species diversity, among others. The concentration of population without the appropriate planning of critical infrastructure for proper development, translates into inadequate provision of drinking water, traffic jams from and to the area, increase in flooding events, inadequate systems for waste disposal, all of which significantly affect the quality of life of the inhabitants.

The purpose of the research on urban sprawl is to offer information for decision making and the taking of actions that will mitigate the impacts of this problem.

Image Captions:

A The response of the real estate market to the need for housing is the construction of ordered neighbourhoods, with streets of reinforced concrete, drinking water distribution systems, wastewater management, sidewalks for pedestrians, but all with little or no coordination with the overall development of the area; which is why islands are created that are often completely disconnected from primary infrastructures.
B Urban growth that occurs in a non-coordinated fashion in the area of 24 de Diciembre, showing characteristics similar to rural areas.
C Construction sites that have not been registered in official documents get incorporated through aerial images captured with drones.
D The messy and uncontrolled growth of the city poses inimaginable challenges to public service institutions, such as with garbage collection. "Pataconcitos" (a take on the large city garbage dump Cerro Patacón) appear due to various factors such as difficult access to neighbourhoods and the lack of education regarding the proper disposal of waste.

# STUDIES OF A CITY IN MOVEMENT

by Geetha Iyer

See how the body of the city flows. How it awakes, how it eats, drinks, works, rests. How it treats its wast, how it lives in its surroundings, how it communicates its desires to neighbouring cities grazing the forests in the distance. The big mistake of living in the shade of a city is to think that we are more alive or more clever than she is. That she is composed of immovable rooms, endless ways, open doors and constant lights. The earth moves below the feet. The forests dry up and the city starves. The sea rises and drowns it.
To be a city is to think of the health of its entire body, from the heart to its distant fingers and toes. To be a city is to think of inextricable relationships of reciprocal exchange. Blood carrying nutrients, nutrients feeding cells, cells building organs - judicial, environmental, educational, for basic rights to water, air, coexistence.

Just like us and our cities, my final installation in the LAB was also a work in progress, a story about incomplete stories originating from an exchange of ideas and experiences between a Panamanian researcher and civil engineer and a nomadic writer, far away from home, docking in Panama for a while. I wrote short stories on long strips of paper and installed them along a bamboo path in the Summit Municipal Park. The stories use imagery and ideas that came out of conversations with my partner in the LAB María Lourdes Peralta Frías, Ph.D., and the other scientists and students in her team. We also built a house with a roof of umbrellas and open walls to fill with paper blocks. We invited visitors to share their own stories in this space; this small affluent of the flowing body of the city.

I wanted to create a non-linear narrative, somewhat decentralised, organic, shared and constructed with the participation of the readers that found themselves inside the installation. Hence it was possible to read the stories, fragmented and woven between the branches of trees and bamboo and spread on the ground of the path, in any order, depending on the way the person entered and exited the path. I was also aware of the fact that I would not be able to full represent a city in which I did not grow up, nor the wishes and fears of its inhabitants, with my limited point of view. That is why this installation does not represent something final, but something that will evolve with time and further work.

**Study 1: Dispersive growth**
The city sleeps, but its toes and fingers are already twitching. Its edges light up in constellations of unnamed suns as we rise, hours before dawn. We walk kilometers upon tongues of silt till we come upon rivers of tarmac. The sun will pierce into the empty shells of our homes and the rain will knock on the doors and receive no answer. Our little roads and footpaths will come. Water in tubes and tanks will come. Infrastructure—the blood vessels and nervous system of the great beast we call our city—will tap into our homes like an intravenous intervention. We rise before dawn to escape the atrophy. We walk from our homes to catch a bus to catch a cab to clean a house to build a house to buy a house to move our children close to city's beating heart, it's head electric with ideas like minimum wages and the right to an education. Long before you noticed, the city spoke to us. It laid down the first faint lines of communication.

Image captions:

p. 7-9 Visitors to the Anthropogenic Abrasion installation in the Summit Municipal Park walking through the bamboo path; details of "Studies of a City in Movement"; and visitors helping to make the building blocks of a metaphoric home.

**Study 2: Organized movement**
We've been standing in lines all our lives, why not make ourselves comfortable? All we need is a roof overhead. All we need are windows and doors. Family by our side. Good neighbors, who'll keep to their lines, who'll follow the rules. We set these desires in motion. We live in cars. Whole neighborhoods, inching through the streets. We are blood cells, innumerable and sluggish. We are row-houses on wheels, we are islands. We flag down runners to stock our tanks with water, feed us oranges and lottery tickets. We're living the dream of being mountains. There's a chain of them on the horizon, sheer-edged and crowned in clouds. When we enter their shadows, our blood slows to a crawl, and sometimes our engines stall.

~

**Study 3: Plastic lives**
Our garbage has taken on a life of its own. It lingers in the corners of kitchens. We kick it out every couple days but it always comes back, like a semi-feral animal returning to the doorstep for shelter and chicken bones, a bit of attention. We chuck scraps at it, and it makes a nest for itself out of the raggedy single-use synthetics we discard after grocery shopping. It grows unhealthily fat off our wastes. It depresses us, so we go comfort-shopping. It eats up the price tags we throw at it. Some of us can pay to have it taken away forever, in trucks that arrive at the crack of dawn. Our children ask, Where does it go, and we say, To live on a faraway mountain, where it can be free among others of its kind. Some of us cannot afford the euphemisms, and we heave our beasts onto the street, far enough away that we'll lose its scent. It reproduces quickly, out here in the city wilds. The streets are populous with its pups, piling upon each other in heavy, steaming mounds. Scavengers tear open their bowels, strew their guts in the streets. Small animals and tree seeds, ever optimistic, take shelter in the carnage.

~

**Study 4: Organic movement**
It rains. The horizon disintegrates into white noise. We raise our voices against a wall of raindrops and their chorus drowns us. There are places in the city where the gutters have already choked, and the sewers spew in reverse. We're lucky—where we live, the water runs in rivers so straight only a civil engineer could have mapped them out. On either side of the road it courses in channels, silt-red and thick as tongues. It bleeds into the gutters. It pools into the hollows of discarded plastic cups and other synthetics. Flushed out of houses, it courses through the city's veins. The city wallows in its plenty. It dips its feet into the sea, digs in with its toes, does not even feel where its body ends and ocean begins. Salt water numbs any sense of pain as black water bleeds through our tips.

~

**Study 5: Vertical growth**
We are mountains, gathered in a chain on the horizon. Here we have everything we've ever needed, and some things we never knew we'd want: a view of the land around us, filtered air, water that flows uphill, and the push-button lights of our own constellations of suns. We live in the city's beating heart, stacked one upon the other with so much space between our selves it's easier to :-) than to smile. Some of us live so far up our feet never touch the ground—up here in the clouds our heads are electric with ideas like free market economics and geoengineering. Up here, we're seeding clouds to bring back the rains. It's early days, but do not worry—every flood of plenty begins with a drizzle. Clouds hit our sheer mountain faces, and condensation trickles down for the rest of us to drink.

# THE STORY OF DISPERSED URBANE

If I am not to blame for this problem, someone must be...

A short story written by María Lourdes Peralta Frías, Ph.D.
with illustrations by Geetha Iyer

The story of Dispersed Urbane is just like anybody else's, a story of dreams that slowly come to reality. Many years ago he married and decided to buy a house for himself and his future family. Seeing the cost of housing in the city center, he decides to search for something towards the East. Being an area less intervened by construction, he hoped to feel the fresh air at sunrise, to have a garden to plant roses and play outside with his best friend, and so it was. For a long time he had water from rural water systems, pleasant sunrises, fresh sundowns, and was able to have a life within a community with similar dreams.

As years went by water became more scarce, especially in summer, but nothing to worry about. The buses to leave the area passed by a little fuller than before, but they were new friends, so Dispersed was still happy. His journey to work was a little longer, but no crisis yet.

All of a sudden, new neighbours, in gated communities, who arrived spontaneously. These neighbours looked like a mass production, with identical small houses and each of them with a car. Now Dispersed's residential compound is barely visible. His garden is enclosed by walls, by neighbours. His rural water system is in disuse, and a huge water tank stands at the entrance of the town, but Dispersed and his family only have water a few hours a day. Rainy days are a challenge, between the fear of flooding and the traffic jam to leave and return home.

Dispersed decides to buy a car... it's not possible to keep using the public transportation, however, to get to work on time with the car he has to leave earlier each day, to the point of having to finish off the night's sleep in his car in front of his workplace. Dispersed is tired. He barely has time to share with his family. When he comes home he has to collect water for the next day. When he reaches his limit he asks himself, Why is this happening? Who's fault is this?

He goes on a search for answers in the Water Institution, who say: D*o you may remember that your water system was rural and only for a few neighbours. Do you also remember when we connected your house to the public system, to the urban central system? Since then we have been able to provide you with water, but now your new neighbours have arrived in masses; others simply don't pay and we have no way of serving them all. We can only give each of you water for a few hours a day.* The answer kept describing a scenario in which many factors had contributed to reduce water availability, such as garbage in rivers, forest destruction, extraction of sand and others.

In his search for answers, Dispersed goes onto the Road and Bridges Institution. This visit was different from the last, not because of the information received, but because he finds that one of his new neighbours works there, Myth Highway. With a heavy heart Myth tells him of the difficulties the institute is having with supporting some areas, especially those in which people settled before they were able to build roads and bridges. He tells him of constructions so far away that they are hard to reach. Dispersed and Myth talk about the precarious conditions of the roads, the traffic jam, the floods, but they no longer feel alone anymore, and they will not falter on their search for answers and solutions.

The days go by and Dispersed goes on a new goal, to understand the problem of the "pataconcitos" in his neighbourhood. Every day he sees his neighbours go out with trash bags which, before reaching their final destination, end up on the side of the road. Even though this is wrong, he understands that keeping the bags in the house for too long is also not an option. But, why don't the collecting trucks come by? Are there not enough? He gets the distance problem and how narrow the streets are or the lack thereof, which he hadn't though of before meeting Myth. In the Cleaning Institution, Bin Broomstick welcomes him, a kind old man, still with dreams to realise and wishes to keep helping his community. Between them, the come up with a plan to help with the sanitation of the community and to make the services more efficient. It was a successful day and something was achieved.

Dispersed has always been an individual committed with the environment, now he feels that perhaps he hasn't enough for his neighbours to be more responsible. His sadness is greater, now that he knows of the negative impacts of urban development on the environment. Dispersed sees how garbage reaches the rivers and then the sea; he heard about the amphibians that protect us from insects being endangered, precisely due to the lack of protection of natural areas. Recently, through an art and science exhibition he found out that the mangroves that he so much enjoys looking at will probably disappear if urgent actions are not taken. The story of Dispersed Urbane is like that of many residents in Panama and the world, who each day gain more awareness about good citizen and environmental practices, and now his interest is to keep contributing to general wellbeing.

# EXPERIENCES

**María Lourdes Peralta Frías, Ph.D.**

My experience in the Art and Science LAB 2017 can be summarised as personal and professional growth. In the interaction with the artist, in my case Geetha, I gained a better understanding of the way in which art and science can go hand in hand. This artist is the best proof of that, given that she also has an education in science which allows her to see reality from a unique perspective. I value greatly the way she makes art, almost through a scientific method or approach, in a very well conceived manner but without limitations to her imagination and creation. Her scientific side allowed us to have a good and easy interaction that made me feel very comfortable. I greatly appreciate her respect for everything that surrounds her, be it people, animals, the environment, other peoples' time, just to mention a few.

From a personal point of view, I learned that there are many ways to make science and its results reach a population who needs to be able to interpret these impacts in such a way that they may be of value in their daily lives. In this process I was able to give a new form to my writing, developing a light narrative that describes my research from the perspective of the person who suffers from the problem.

In the LAB the artist and I had the opportunity to establish a relationship of trust, which was supported by the activities and workshops provided. I felt very pleased by the way in which Geetha provided emotions to each one of the aspects of the research, from making everybody think about what is a home, to being able to describe garbage as a living being that refuses to leave the house.

I find it relevant to add that the interaction with the group in general was very enjoyable. Each artist brought their own particularity, as did each scientist. I can also emphasise that the support that Cine Animal provided was of great value in the process of creating forms to transmit ideas, how to evaluate their potential impact and effects. The Cine Animal team is rich in experts in their area and in individuals with a lot to give.

Without a doubt, the entire LAB facilitation team, in particular the professionals and artists of Estudio Nuboso, were a key element in achieving the objectives of this art-science experience. The activities were designed for the scientists and artists to transcend the invisible barriers of specialisation for science to be understood through art and viceversa.

Panama is a rich country in natural resources and scientists, that has yet to develop its full potential, and it is through experiences such as this that its wealth can become known. I extend my most sincere congratulations to the makers, funders and facilitators of this LAB 2017 and much future success.

**Geetha Iyer**

During one of the first days of our collaboration, my working partner, María Lourdes Peralta Frías, Ph.D., pointed out that the problem of unplanned urban growth has many roots, various interested actors, and many more challenges to face. There are no simple solutions to the problem, therefore, I realised there would not be a simple artistic answer to the phenomenon. However, the other thing she said was that, deep down, her work looks for solutions for people to be able to have "a dignified life". This stayed with me, because this does not represent a scientific or an artistic objective, but is something that bring together our differing work.

What interests me the most as a writer is to understand and capture a reality composed of different realities. In the LAB I was inspired both by the scientific research about the infrastructure of roads and pipe networks as by the stories of the people that come to the city looking for a better life - defined by access to water, electricity, safety, transportation, work, education.

María Lourdes shared with me, as a scientist and a citizen, her observations and experiences of the city's growth. It is a story that has echoes in the stories of other cities in other countries, of people thinking of the days to come, not necessarily of the centuries to come. With her team, she showed me the areas of the city that they are studying. Some are developing organically in a mosaic of individual homes, surrounded by gardens; others are prefabricated by developers and look like intricate computer chips, outlined by concrete. Both types of development fail to take into consideration access to basic resources such as water, proper access to roads or coexistence with the neighbouring forests and rivers.

We exchanged ideas about how to represent this unsustainable phenomenon, in which our development model still refuses to take into account that both our natural and economic resources are limited and that we should share them equally amongst everyone. There are great inequalities between those with power and those without. There is a lack of communication between government institutions, developers and the general public. There are great distances between dreams and realities, but the common root of each one, I think, is the fight for a dignified life. There are so many roots interweaving that we should learn to see the networks they form, don't you think?

# BIOGRAPHIES

## María Lourdes Peralta Frías, Ph.D.

Holds a Bachelor in Civil Engineering from the Universidad Tecnológica de Panamá. Obtained her Masters and Ph.D. in Civil Engineering from Purdue University, Indiana, United States. Also has a specialization in University teaching. Since 1997 she teaches in the Department of Civil Engineering of the Universidad Tecnológica de Panamá, where she works as degree coordinator, coordinator of research and of the Masters in Construction Project Administration. In her research she focuses her efforts on the analysis of critical infrastructure, directing studies financed by national institutions.

## Geetha Iyer

Geetha Iyer received an MFA in Creative Writing & Environment from Iowa State University in 2014. Her writing appears or is forthcoming in journals including Orion, Gulf Coast, Ninth Letter, the Mid-American Review, and the Massachusetts Review, among others. Recognition for her work includes the O. Henry Award, the James Wright Poetry Award, the Calvino Prize, and the Gulf Coast Fiction Prize. She was a 2016 writer-in-residence at the Sitka Center for Art and Ecology and a 2017 artist within the collaborative Art + Science Lab with Estudio Nuboso. She grew up in the United Arab Emirates and presently lives in Panama.

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The Art and Science LAB was organized by

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with financial support from

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Secretaría Nacional de Ciencia, Tecnología e Innovación

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