Genetic Barcelona Project

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Genetic Barcelona Project:

The Genetic Creation of Bioluminescent Plants for Urban and Domestic Use

(©Alberto T. Estévez, architect, Barcelona, 2003-2006).

Foto 1

Foto 2

Foto 3

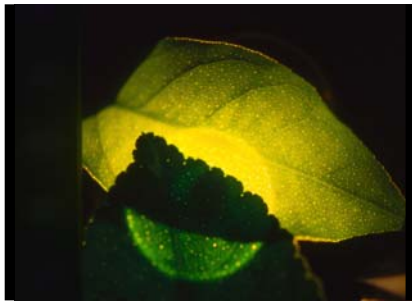

Foto 4

Foto 5

Foto 6

Abstract

The interdisciplinary Genetic Architectures program fuses design and research, and in this project, is working toward the creation of plants with natural light emitting abilities for urban and domestic use. The first phase has introduced GFP (Green Fluorescent Protein) from the jellyfish *Aequorea victoria* into the DNA of seven lemon trees.

Introduction

In 2000 the Universitat Internacional de Catalunya, Barcelona, initiated a post-graduate research specialization titled Genetic Architectures at its school of architecture (ESARQ). I founded the program and was ESARQ's first director. Our Genetic Architectures program, which I currently direct, applies two academic approaches, 1) scientific genetics (researching biologically useful plants, trees, etc.) and, 2) understanding digital generation, production, visualization, and fabrication as a genetic process involving computation and genetic

algorithms in collaboration with science, bioethics, and engineering for experimental architectural research.

Process

In the first phase of applying genetics to architecture we considered introducing luminous protein into the DNA of vegetation. Various natural bioluminescence color possibilities existed as witnessed in fish, glow-worms, algae, or from certain jellyfish, such as *Aequorea victoria* from the north-west Pacific. Since the 1962 discovery of GFP in *Aequorea*, hundreds of studies have developed in a snowballing effect. "In 1992 *Aequorea's* GFP cDNA sequence was determined, demonstrating that its hetrologic expression in non-jellyfish organisms produces fluorescence without any cofactors." (1) With such properties, and its easy availability, *Aequorea's* GFP became the cellular marker most used by genetics. Yet, while geneticists consider GFP a working tool, I see it as a fascinating potential component in the application of genetics to architecture.

Consequences

It is clear that world consumption of electricity must be radically reduced. For example, Barcelona, with a small area and very high density, spends ten million euros annually just on the maintenance of its street lights (repairs, repainting, etc.), this, in addition to the consumption of electricity. Barcelona's scenario may be multiplied by cities globally pointing out the critical need for alternative energies our research is addressing. I have no doubt bioluminescence will substitute for artificial lighting as part of a solution to these problems.

Like much in conventional medical research, genetic research for architecture requires precautions with special emphasis on avoiding accidents and contaminations. We are setting strict procedures for testing in hermetic environments, breeding plants without pollen, while we investigate naturally occurring plant GFP in chloroplast in order to avoid pollination problems.

From the beginning this research has been conceived as architectural and urban. Today, our seven GFP lemon trees (and their implications) with living, luminescent leaves (published here for first time) present infinite possibilities. As we look back to the pioneering work of genetic artists such as Eduardo Kac, we may project evolving science, architecture, and design collaborations where genetics becomes integral to architectural research and production. (2)

NOTES

(1) Fernández Vaquero, *et alt*., "Análisis de la dinámica celular con proteínas fluorescentes" (*Analysis of Cellular Dynamics with Fluorescent Proteins*). Centro Regional de Investigaciones Biomédicas (CRIB) y Facultad de Medicina de Albacete, Universidad de Castilla-La Mancha, *Biojournal.net*, n. 1, Albacete, Spain. February 2005.

(2) See Kac, Eduardo, "Transgenic Art". *Leonardo Electronic Almanac*. v. 6, n. 11, 1998.

CAPTIONS

© Alberto T. Estévez, *Genetic Barcelona Project*, creation of plants emitting natural light through genetic treatment for urban and domestic use, Barcelona, 2005**.**

Fig. 1. 1—The magical light of the potential GFP trees (illustration: Aleix Bieto and Gabriel Montañés). 2—Lemon tree leaf with GFP (photo of Alberto T. Estévez with conventional reflex photo camera). 3—Comparison between lemon tree leaf with GFP and another without GFP, called lemon tree type “fine” (photo of Alberto T. Estévez with conventional reflex camera). 4—Comparison between lemon tree leaf with GFP (right) and another without GFP (left) of the same type, called lemon tree type “fine” (photo of Josep Clotet and Alberto T. Estévez with special UV photo camera). 5—The same leaves after 5 minutes, demonstrating that the light is permanent, not a instant effect (photo of Josep Clotet and Alberto T. Estévez with special UV photo camera).

Fig. 2. Genetic Barcelona Project, creation of plants emitting natural light by genetic treatment for urban and domestic use, Barcelona, 2005. (Simulated illustration: Aleix Bieto and Gabriel Montañés).