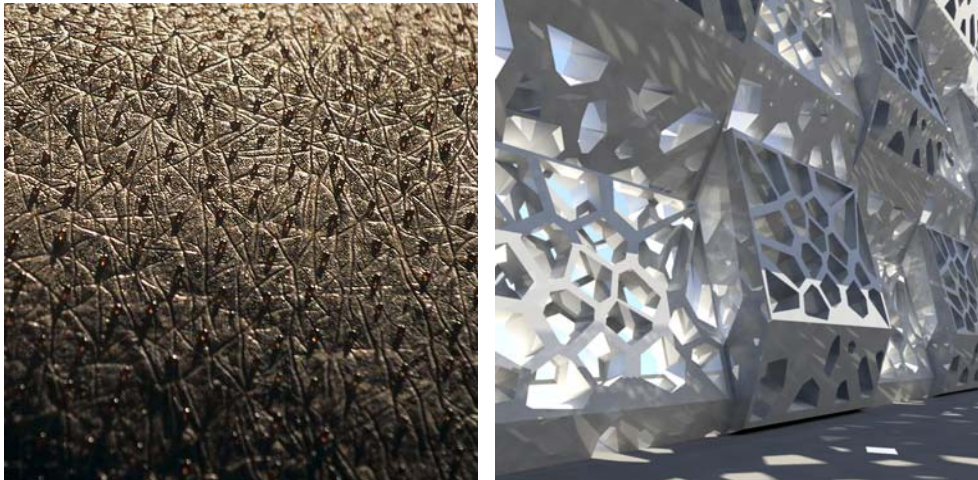


## **Biomimicry II**

### ***Building Envelopes: materials and technologies***

Thursdays 1 pm – 4 pm – Room 225  
Ilaria Mazzoleni, Instructor - [imsciarc@yahoo.com](mailto:imsciarc@yahoo.com)



Hippopotamus Skin – Building Envelope (student project by S. Maansson & W. Raksaphon)

*"Biomimicry [is] innovation inspired by nature. In a society accustomed to dominating or 'improving' nature, this respectful imitation is a radically new approach, a revolution really. Unlike the Industrial Revolution, the Biomimicry Revolution introduces an era based not on what we can extract from nature, but on what we can learn from her". (Janine Benyus)*

*The seminar traditionally finds inspiration from the animal world, conducts analysis and translates the learned principles to the design of building envelopes and in their integration at a larger city scale. Part II of the seminar focuses its attention to materiality and building technologies that, while continuing to learn from nature, can be used to design and build architectural envelopes that use nature in a structural and performative way.*

#### **Course Intent**

The first of this two semester seminar, undertook the research component of a select animal. Through research and a series of guest lectures introduced by life scientists, engineers and architects, the students gained substantial knowledge and understanding of the animal characteristics, physiological and behavioral adaptations to a specific environment (habitat). Following the research and analysis students began to develop ideas for a building envelope inspired from the animal studied. Development of the building envelope was explored through a series of generative drawings, physical and virtual study models, discussed during several multidisciplinary workshops. This initial design will now be expanded upon and further explored in Part II of the seminar through more precise details and modeling techniques.

Progressing from the fall semester projects, the second seminar, open to all students (Part I does not constitute a prerequisite), deepens the understanding of the structural

characteristics and materiality of the building envelope, through an engaging exploration of methodologies to fabricate experimental prototypes; an endeavor explored through the process of making, informed by the intelligence of the structural material properties. These proponents will be advanced through physical models and detailed drawings which express the research and innovative inspiration extracted from the biomimetic studies of the selected animal. The final envelope design will be analyzed using various computational techniques to develop a method of panelization, fabrication and assembly.

Students will be exposed to the theoretical principles explained by material and aerospace scientists, building engineers and architects, through case studies and field trips, including the Jet Propulsion Laboratory (JPL), which will deepen and develop their specific interests of building envelopes and the materiality emphasized by biomaterials and composites. Invited guest lecturers include: Façade Engineer Karen Mozes, Architect Marcelyn Gow, JPL Scientist Yoseph Bar-Cohen, among others.

A selection of students work will be presented at a Biomimicry Conference in Summer 2011.

## WORKSHOP

Midway through the seminar a set of workshops in collaboration with Professor Geoff Spedding, from USC Department of Aerospace and Mechanical Engineering, will focus on the development of an airplane design inspired by seagulls. The workshops will engage in the design of the seagull inspired airplane and focus on the optimization of the internal airplane layout along with the design for the interior layout of cabin to accommodate passengers.



The gull-wing model on the right appears not only novel, but strange too. Why has this configuration not been developed before? The left image shows that in fact it may have been in use for tens of millions of years. *Left image source not known. Right image produced by RJ Huyssen.*



These three panels show the streamlines as air flows around the wings and body of a new gull-wing aircraft design. Left is the wing-body combination with no tail, middle shows a much more efficient flow pattern produced by adding a short tail section. Right panel shows a deflected tail producing high lift. *All images from data taken at USC by GR Spedding and RJ Huyssen. All images produced by RJ Huyssen.*