

CASE STUDY HOMEOSTATIC FACADE

BY DECKER YEADON, NEW YORK, 2011

Environmental Design Challenge

Develop a self-reactive system for buildings to control solar heat gain and reduce energy consumption in climates with large temperature difference.

SCOPING

Design Question:

How might we have the building control heat by itself responding to the environment

Biologized Question:

How does nature regulate internal heat?
How does nature regulate temperature?



Retrieved from: archdaily.com

What it is

- Prototype for an expanding, contracting architectural skin.
- A double-skin glass facade system that opens and closes itself in response to the internal temperature of the building.
- Latest green-building technology

What it does

- Electively regulating temperature throughout a building's interior.
- Material itself expands and contracts responding to sunlight condition to regulate heat gain.
- Reduce energy consumption and its associated emissions.

Its Advantage

- No computer programming or physical adjustments required.
- Low energy consumption
- Superior precision, regulation can be highly localized.

(Brow, B., & Swac, M., p.138)

(Laba, S., fastcodesign.com)

"How they can utilize the most cutting edge material technologies in design applications, offering innovative solutions."

(Minn. K., archdaily.com)

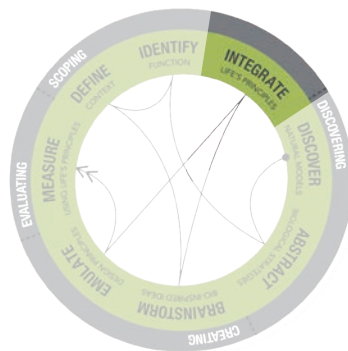
STEPS IN THE PROCESS



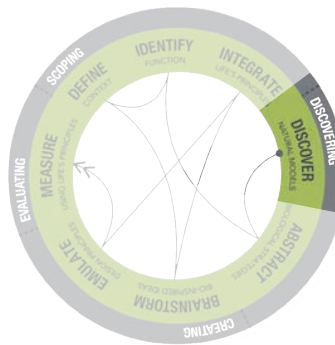
URBAN HIGH-RISE
WITH EXCESS HEAT GAIN FROM DAYLIGHT DURING CERTAIN TIME OF DAYS



SOLAR CONTROL
ON BUILDING ENVELOPES RESPONDING TO DAYLIGHT CONDITIONS



HOMEOSTASIS
REGULATE THEIR INTERNAL CONDITIONS



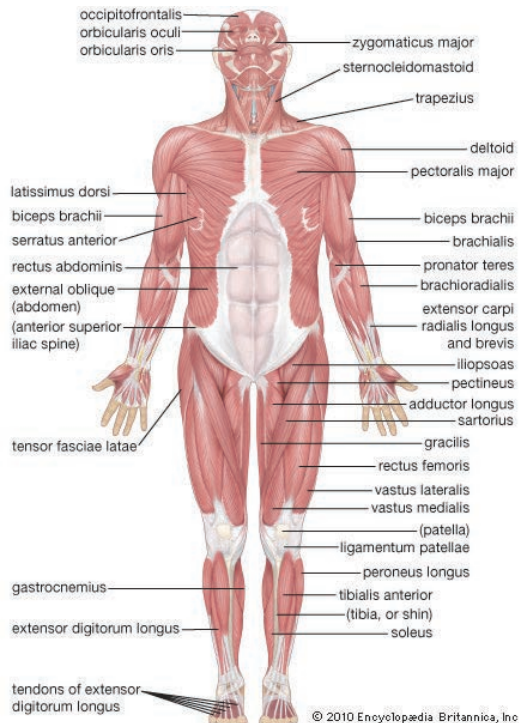
ANIMAL MUSCULATURE
EXPAND AND CONTRACT TO REGULATE TEMPERATURE SUCH AS SWEATING

Retrieved from: asknature.org

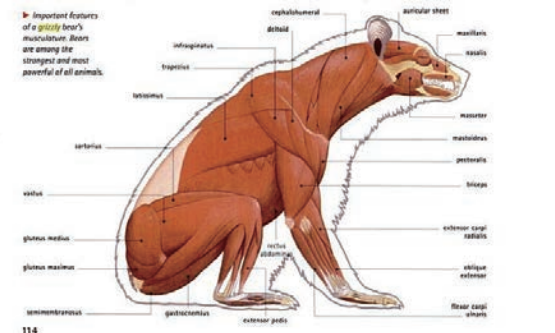
NATURAL ORGANISM ARCHITECT EMULATE

Homeostasis in organisms allows them to regulate their internal conditions such as temperature.

(asknature.org)



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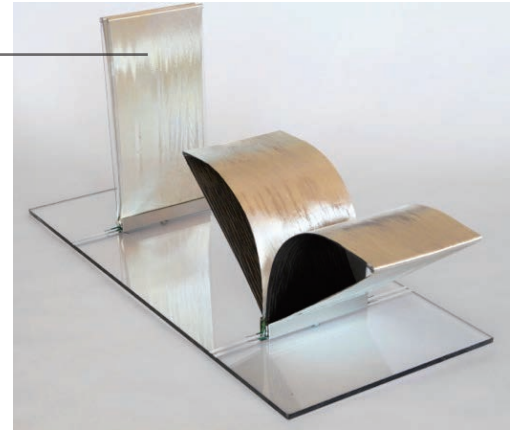
HOW THE ORGANISM WAS USED AS A MODEL

Dielectric Elastomers (DE), clad in silver electrodes.

Electroactive Polymer (EAP) that expand under electrical current.

Provide roller at top edge of core for fluid movements

(Brow, B., & Swac, M., p.138)



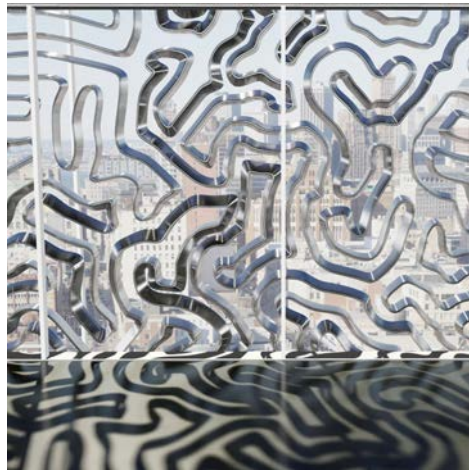
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INTERIOR ELEVATION PHASES

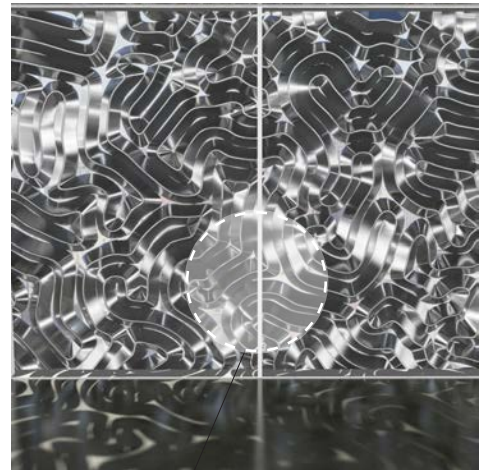
RESPONDING TO DIFFERENT HEAT-GAIN CONDITIONS



MINIMUM OBSTRUCTION

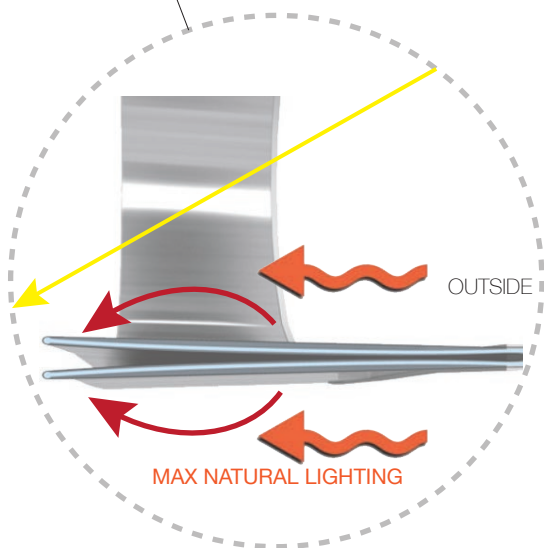


PARTIALLY SHADED



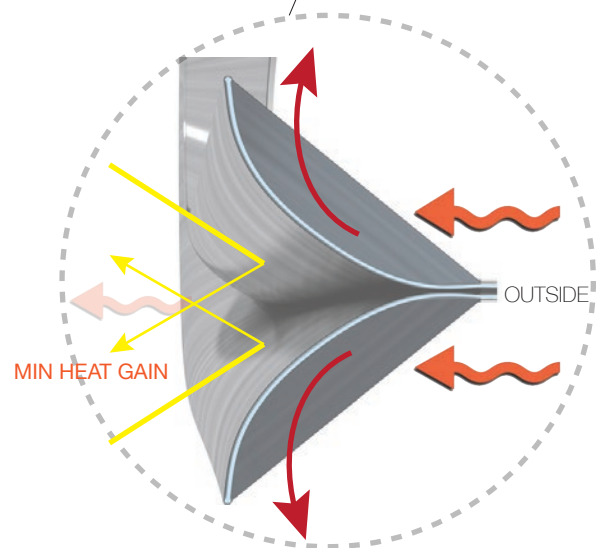
MAXIMUM SHADING

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SURFACE CONTRACT

MINIMIZE OBSTRUCTION AND ALLOWS MAXIMUM OF NATURAL LIGHTING TO COME INTO THE SPACE



SURFACE ELONGATE

CREATES MAXIMUM SHADING TO PREVENT DIRECT HEAT GAIN AND REFLECT INTERIOR ILLUMINATION