



G R E A T L A K E S
B I O M I M I C R Y

G R E A T L A K E S B I O M I M I C R Y



“Without a doubt, a new technology creates new experiences. But early adopters, who gravitated to it, were early adopters before we got there. Our job is to find the disconnected and connect them, to find people eager to pursue a goal and give them structure to achieve that goal. We start with an existing worldview, a point of view, a hunger waiting to be satisfied.”

Seth Godin
b.1960



Biomimicry: Innovation Inspired by Nature

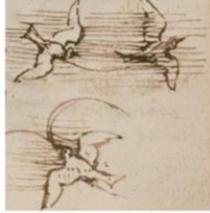


FIGURE 37 Cat. 12, folio 4 verso. Birds in flight using lines to depict airflow [2014a]

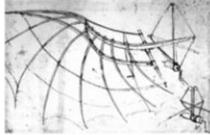


FIGURE 5: Illustrated wing structure by Leonardo da Vinci. From *Codex Atlanticus* dated to between 1486 and 1490. This particular wing illustration, based on da Vinci's earlier study *Codex on the Flight of Birds*, was an important step in the design of a human-powered flying machine.

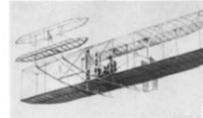
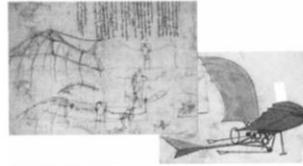


Fig. 2 Aircraft evolution. (a) da Vinci drawings. (b) 1903 Wright brothers aircraft. (c) 2011 Eurofighter aircraft (Google images)

GREAT LAKES BIOMIMICRY



At the boundary between the 15th and 16th centuries, Leonardo da Vinci was observing and drawing the morphology and anatomy of birds and theorizing about how the flow of fluids around their bodies (particularly their wings) led to their ability to fly. Da Vinci's work anticipated the fundamentals of aero and hydrodynamics centuries before they emerged as fields of study. Da Vinci's fascination with flight even led him to design a 'flying machine' for human flight.

The act of looking to and studying nature, with a focus on understanding function was also evident in the wing shape design and understanding of the need for flight control structures appreciated by the wright brothers. Obviously, the work of these early students of biomimicry ushered in the era of modern airplanes which have completely transformed our world.

Biomimicry: Innovation Inspired by Nature

Bird-friendly Glass



Shinkansen Bullet Train



Optimized Cargo Shipping



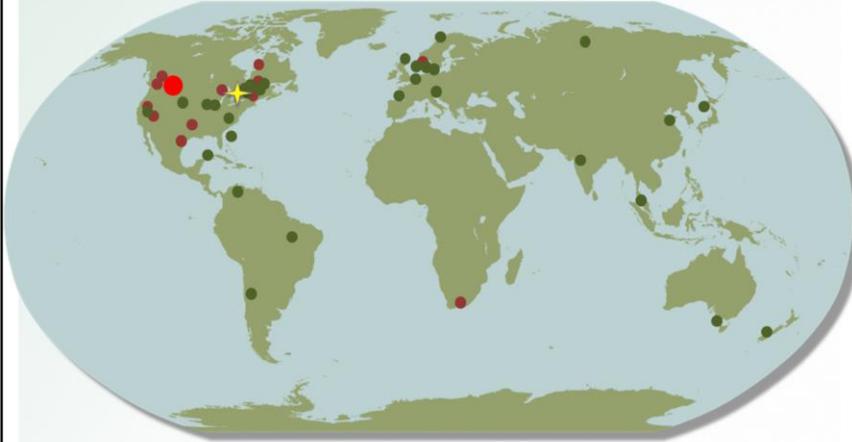
Biomimicry provides us with the tools to turn our most formidable challenges into solutions that not only transform our community but that also produces technologies, products and services we can market to the world....to change the world; to meet the grand challenges. Clearly NEO has this vision. We can be a leader in creating the tools to make it happen.

The blueprint is already there...we know where we want to go, what we need are new tools to get us there. Biomimicry is one of those new tools. For example, biologists and engineers already know that materials like silk, bone, nacre, and keratin have properties that our most advanced manufactured materials can't outperform...better yet, we are beginning to understand the secrets to their performance...secrets we can use to make the most advanced materials at a fraction of the cost and without poisoning our environment.

Individual ants emit pheromones which have a scent that attracts other ants. In a simple case, two ants leave the nest at the same time and take different paths to a food source, leaving scent trails as they go. The ant that took the shorter path will return first, and his trail will now be marked with twice as much pheromone as the path taken by the second ant, which has yet to return. Nest mates will be attracted to

the shorter path because of its higher concentration of pheromone. As more and more ants take that route, they too lay pheromone, further amplifying the attractiveness of the shorter trail. Southwest Airlines remodeled its cargo shipping operations using ant foraging algorithms. This helped them find the shortest path (in terms of time) for cargo to reach its destination. This saves the company \$2 million annually in labor costs.

Global Network Development



GREAT LAKES BIOHICRY



Economic Impact of Biomimicry

WORLDWIDE IMPACT

In the next decade, biomimicry is expected to:



Contribute \$425 billion annually to U.S. GDP



Provide \$50 billion mitigating natural resource depletion/reducing CO2 pollution



Represent about \$1.6 trillion of global GDP

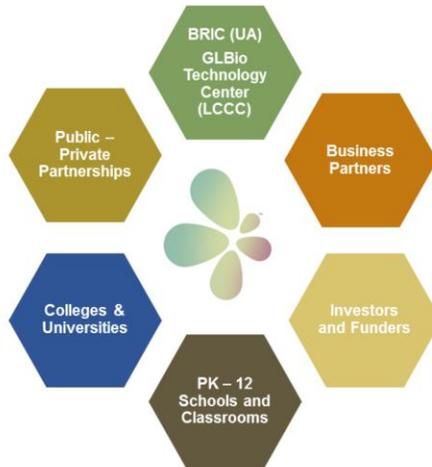


Account for 2 million U.S. jobs (by 2030)

Data provided by Fermanian Business and Economic Institute, Nazarene University



“Great Lakes Biomimicry commits to educationally driven regional economic development by creating conditions for innovation inspired by nature.”



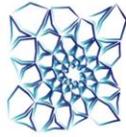
G R E A T L A K E S B I O M I M I C R Y



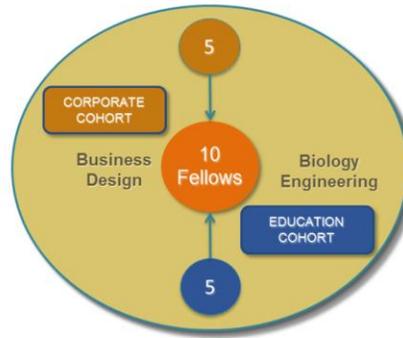
Talent Development: PhD Program

Integrated Bioscience PhD and
Biomimicry Fellowship Program

The
University
of Akron



BIOMIMICRY
RESEARCH
INNOVATION
CENTER



GREAT LAKES BIOMIMICRY



Talent Development: Corporate Sponsors



GREAT LAKES BIOMIMICRY



Talent Development: Educational Programs



Amherst Public Schools



Elyria City Schools

GREAT LAKES BIOMIMICRY



Logos of NIHF, LRA, Amherst, Elyria City, CMSD, APS, MC2, CMZ, TIES

Talent Development: Higher Education Partnerships



Ohio Department of Higher Education



GREAT LAKES BIOMIMICRY



Great Lakes Biomimicry Inc.

- Unique hybrid entrepreneurial not-for-profit model
- Received 501(c)(3) authorization
- Virtually self-funded for first four years
- **33,000+** volunteer hours invested – no compensation paid first four years
- \$450K In-Kind support from 11 Service Partners since inception
- Secured 18 PhD Fellow sponsors
- Formed Corporate Innovation Council –13 corporations
- Commitments for \$2.5M for PhD Fellow sponsorships
- Established *Biomimicry Research and Innovation Center* (UA)
- Opened *Great Lakes Biomimicry Technology Center* (LCCC)
- Discussing Cuyahoga County location for *GLBio Inc*

G R E A T L A K E S B I O M I M I C R Y



“It is the future that one lives into that shapes one’s being and action in the present. The reason it appears that it is the past that shapes one’s being and action in the present is, for most people, the past lives in their view of the future.”

Werner Erhard
b.1935

