Endowment Proposal: Brandeis Institute for the GOLEM (BIG.Brandeis.edu)
The Technological Synthesis of Life and its Impact on the Human Condition

In the 17th century, during the dawn of mechanical precision and the "clockwork revolution," the Maharal, a brilliant Rabbi, envisioned a time in the future when alchemists would create artificial humans. The myth of the Golem spread. And while the "technology" (of molding clay and uttering an incantation) was an oversimplification, it led to deep examination of the impact of science and engineering on the human condition.

The questions raised by the Golem have persisted for centuries. The Golem Myth was the basis for literature such as Shelley's *Frankenstein* and Kapek's *RUR*, as well as much of modern science fiction including by Isaac Asimov and Philip K. Dick. There is continued attention and fear surrounding the modern Golem myth (of "true" Artificial Intelligence encapsulated in a human-shaped machine.) This fear is demonstrated by the popularity of movies such as *Blade Runner*, *Terminator*, *AI* and *I Robot*.

In the year 2000, Brandeis scientists published a *Nature* article in the young field of Artificial Life called "Genetically Organized Lifelike Electro-Mechanics" (GOLEM). It was the first robot that creatively designed and automatically manufactured other robots. And while simple and toy-like, these scientific results called forth a broad discussion over the ethics of self-reproducing technologies, as well as on the nature of machine creativity.

Although the intelligent humanoid robot does not exist, many advances towards it are being made both in hardware and software. Golems that are neither intelligent nor human-shaped are ubiquitous: Golem Salesmen (vending machines) have made pushcarts obsolete; Golem Bankers (ATM's) have destroyed the age-old profession of Bank Teller; Golem Typists (computer printers) have drained the secretary pool; and Golem Producers (disc recorders) are a stake in the heart of the recording industry.

Public excitement over **Robotics**, coupled to ever growing interest in **Artificial Life** (from Computer Science) and **Synthetic Biology** (from Biochemistry)—multidisciplinary fields at the junction of information and life sciences—have also led to increased fears. This research demands recognition of **ethical legal and social issues (ELSI)**, such as human-machine interaction and hybridization (Cyborgs), potential immortality, out-of-control self-replication, genetically modified organisms, and externalization of costs. With science and engineering achieving increasing automation and control over nature at smaller and smaller scales, with directed evolution of more complex biochemical and molecular mechanisms, with robotic fabrication at the **MEMS** and **Nanotechnology** level, it is critical to study, predict, and plan our response to these new technologies and to the gradual mechanization of both thought and labor.

Brandeis University's historic strengths in cognitive and neuroscience, artificial life and biochemistry, its smaller scale and focus on interdisciplinary research, and its core mission in social justice and ethics, make it the natural place to create a unique new permanent Institute with **a multi-century mission to build the modern GOLEM** by bringing together Artificial Life, Robotics, and Synthetic Biology research and coupling it to a parallel program in ELSI, including the Jewish literary tradition on the Golem. Thus, as we create, understand, simulate, and fabricate ever more complex bio-mimetic machines with more and more built-in intelligence, we also prepare the human spirit for the forthcoming—and inevitable—collision of natural and artificial life foreseen by the Maharal.

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Proposed Budget

			Endowment	Cash
Administration				
Pollack	Director (relieving endowment)		$ 4,000,000	
TBD	Executive Director (endowment)		$ 2,000,000	
	Operating Funds (endowment)		$ 2,000,000	
Sub-total:	**$**	**8,000,000**	**$ 8,000,000**	
Key Scientist				
e.g. Knight, Endy, Arkin	Senior Synthetic Biologist (endowment)		$ 5,000,000	
	Lab Technician (Endowment)		$ 1,500,000	
	Relocation/Start-up			$ 1,500,000
Sub-total:	**$**	**6,500,000**	**$ 6,500,000**	
Faculty Team				
eg Phd from Wood Lab	Junior Nano-MEMS Roboticist (endowment)		$ 3,000,000	
TBD	MEMS Technician (endowment)		$ 1,500,000	
eg Zoloth, Turkle	Senior Philosopher/Ethicist (endowment)		$ 4,000,000	
eg Phd from Arnold Lab	Junior Evolutionary Biochemist (endowment)		$ 3,000,000	
e.g. Cussat-Blanc	Junior Evolutionary Roboticist (endowment)		$ 3,000,000	
Sub-total:	**$**	**14,500,000**	**$ 14,500,000**	
Project Support				
	Annual Research Pool (endowment)		$ 10,000,000	
	Startup Fund for Interdisciplinary projects			$ 1,500,000
Sub-total:	**$**	**10,000,000**	**$ 10,000,000**	
	Renovation/Construction			$ 7,000,000
Total:	$	39,000,000		$ 10,000,000
Total Campaign	**$**	**49,000,000**		