



DESTINATION STARTUP

Modendo, Inc.

One-Sentence Summary of What You Do: Modendo, Inc. adapts and optimizes systems that can create a robust, flexible and compact prototype of an ultrathin endoscope for use in neuroscience labs.

Affiliated Institution: University of Colorado Boulder

Have you formed a company yet? Yes

Funding/Financing: Grant Funding

Please describe your company and the problem you are trying to solve: Modendo Inc., the company, seeks to develop an instrument (ultrathin endomicroscope or UTE) that provides, to brain scientists, high-resolution imaging capabilities for currently inaccessible regions of the brain. Modendo addresses the critical need in the scientific and medical fields for endoscopes that are minimally invasive (diameter $\sim 100\mu\text{m}$). Current endoscopic solutions are appropriate for insertion in large cavities but they produce excessive damage in applications such as deep brain imaging. Modendo will create a minimally-invasive, robust, flexible, and compact prototype for endomicroscopy. UTEs are digitally programmed, contain no moving parts, can reach very narrow cavities within the body, and most importantly, can penetrate tissue with minimal damage. An important application is deep brain imaging, photo-stimulation, and photo-ablation, which could help unlock treatments for diseases such as Parkinson, Schizophrenia, and Epilepsy. The key innovation is in achieving the fundamentally thinnest mechanism to transmit a high information content image in real time and in parallelizing it to multiple brain sites. The multimode fiber probes have a cross-area 10 times smaller than the thinnest existing endoscopes. Further, the UTE will be able to deliver multiple functions: 3D imaging with micrometer resolution, fluorescence and reflection imaging, as well as laser pattern generation for photo-stimulation and ablation. Modendo will adapt and optimize systems demonstrated in academic labs to create a robust, flexible, and compact prototype instrument that is amenable for use in neuroscience labs for scientific studies in animal models, a stepping stone for future medical instrumentation targeted at diagnosis and disease treatment in humans.

What is/was your go-to-market strategy? While the company's initial focus is on de-risking and validating UTEs in animal functional neuro-imaging, the long-term vision is to translate the technology towards medical applications. The company's unique approach to imaging will enable high-impact instrumentation for biomedical applications in the next decade: First in advancing neuroscience through animal model studies; later in developing new medical diagnoses and treatments in neurosurgery; and finally, in extending the application to other organs such as the lungs.



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The R&D will enable high-impact innovations in biophotonics instrumentation as well as in ensuing biomedical applications. If successful, the Modendo technology could disrupt the endoscopy market enabling a new class of fundamentally less invasive techniques. While it is too early to estimate the specific UTE market size, learning from past developments in the medical field and considering the exponential growth of endoscopic surgeries, it could reach \$1b within a decade after medical adoption. There is no product or technology in the market that provides the ability to image deep inside the brain with such minimal invasiveness and optical resolution. Current optical technologies are limited to shallow regions of the brain or much lower resolution approaches such as MRI. The current optical techniques are based on GRIN rod lenses provided by companies such as Inscopix or Doric Lenses. The main problem with GRIN lenses is their relatively large diameter (0.5-2mm), while simultaneously suffering from limited length, rigidity, and significant aberrations. Such probes cannot be easily inserted into the brain since they cause massive tissue compression and bleeding.

How will/do you generate revenue? Modendo's growth plan is to first validate the new UTE technology in the niche research market of animal brain imaging, for which the value of the scientific output is worth the high price of the endoscopic system. The validation stage will quickly grow into the medical instrumentation sector, where the company will seek external investment funding. For the animal research market, we will build a direct-sales team in the US and partner with distributors who have a strong sales force servicing the research markets in Asia and Europe.

After de-risking the technology, Modendo will target the medical sector. First, from a technological readiness level (TRL), the UTE technology will require 2 years development to reach a TRL 6 sufficient for the research market. Second, integrating the feedback from first-adopters, namely neuroscientists using the UTE system in animal brains, is a necessary first step to translate it to the medical sector. The business model will evolve as Modendo introduces new products for the medical sector. Product sales will ensure rapid development and broad dissemination of the technology and an early source of revenue. With a SBIR Phase-I grant, the opportunity to capitalize on this market interest will be greatly accelerated by our capacity to expand our product development team. Bringing to market our technologies at an accelerated rate will also enhance the opportunity to secure strategic investments. Once generating revenues, through initial partnerships, the company will be in a position to raise funds from investors aligned with the company's strategic objectives.

How will this showcase benefit your company or technology? Modendo is looking for additional team members and strategic partners to identify pathways to improve functionality and reliability. Strategic partnership could enable Modendo to overcome important technical hurdles required to create an easily transferable prototype for validation by end users, to de-risk the technology, and to bring it to market following the company's roadmap. This event is perfect to reach partners in the area, collaborators and maybe future potential investors. This will be a great opportunity to disseminate our technology, improve our elevator pitch thanks to the coaching experts in the event, and learn from others' entrepreneurs experience.



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Who are the members of your team and why is this the right team to get the job done?

Modendo's founders team is composed of Prof. Piestun from the Univ. of Colorado Boulder, as well as Prof. Moser and Prof. Psaltis, both from the École Polytechnique Fédérale de Lausanne (EPFL). Their research labs have pioneered the various aspects of the core science enabling image and selective energy delivery through MMF. The team has been enriched with the addition of Dr. Caravaca Aguirre, who has been a key innovator in the field of MMF imaging for the last 9 years. He led the initial research efforts in the UTE technology, followed by significant advancements in photo-acoustic and fluorescence endomicroscopy. He is a key member of the team that demonstrated the first in-vivo neuronal imaging and optogenetics using MMF. Additionally, Prof. Tomáš Čížmár, a Professor at IPHT in Jena (Germany) and at the Institute of Scientific Instruments in Brno (Czech Republic) is a technical advisor for Modendo. This team has vast research and entrepreneurial experience, exceptional drive, and profound knowledge to bring this technology to market.

The team has produced four seminal patents that have been issued. Altogether, they protect and provide freedom to operate in the space of MMF endoscopes. Modendo has exclusively licensed the EPFL patents and has an exclusive option to license the Colorado patents. Through access to academic innovation in these three labs, the company has also direct access to future academic IP developments. The company has already established a relationship with suppliers of the main components required for the prototype to ensure a reliable sourcing.