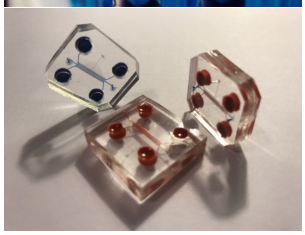
BiomimX
THE BEATING ORGANS-ON-CHIP

Recreating human complex diseases in a chip

Background- Current *in vitro* cell culture and *in vivo* animal experimentation models remain unsatisfactory for efficient and accurate preclinical evaluation of drug efficacy and toxicity. These are necessary experiments in drug development prior to testing in human trials. While animal studies remain the gold standard for the preclinical evaluation of drugs, approximately 40% of the newly developed drugs fail clinical trials despite the preclinical validation with animal models, in part, due to species differences. This results in a drug development pipeline (DDP) accounting for >95% failure rate, >1.8B$ cost, >12 years to bring a new single drug to the market. **Based upon the uBeat® proprietary technological platform, BiomimX introduces beating Organs-on-Chip (OoC), novel *in vitro* human tissue models that bring human-relevant data early in DDP.** Beating OoC aim to increase the efficacy of drug discovery programs by merging for the first time 4 key components: 1) human cells for direct clinical translation; 2) 3D tissue architecture; 3) miniaturization, for faster and cheaper results and 4) motion, replicating tissue-specific human mechanics.



Technological platform- BiomimX established its **uBeat®** technological platform (EP3289065B1 granted by EPO, US, China & India, +FTO) by engineering microfluidics and microfabrication deep-tech into advanced biological systems, which are fully compatible with 3D cell culture. Specifically, uBeat® introduces the concept of "3D mechanical motion" which is unique in the field of OoC and it is pivotal in reproducing human healthy and disease models. Additionally, BiomimX' proprietary technology **uSense** (EP3620508B1 granted by EPO) provides real-time sensing capabilities, enabling the collection of quantitative clinically relevant data. Our technologies are simple, versatile and highly scalable, offering effective solutions for drug discovery and development across a wide spectrum of uses.

Pipeline — uBeat® unlocks an ecosystem of qualified models filling existing gaps in strategic therapeutic areas

Osteoarthritis (OA)- OA is the most common musculoskeletal disease, affecting 75% of the population older than 55. Yet, no disease modifying treatments are available due the absence of translatable preclinical models. **uKnee** is the first *in vitro* model of human OA cartilage generated by exposing human chondrocytes to OA-resembling mechanical alterations. uKnee is able to faithfully emulate OA traits (anabolic-catabolic imbalance, inflammation, calcification) and is characterized by a genetic profile correlating with OA clinical evidence *(Occhetta, Nature Biomed Eng, 2019)*. uKnee demonstrates relevant responses to clinically used drugs (e.g. IL1Ra and Celecoxib) and hyaluronic acid-based therapies (from Fidia Farmaceutici and Synartro BV).

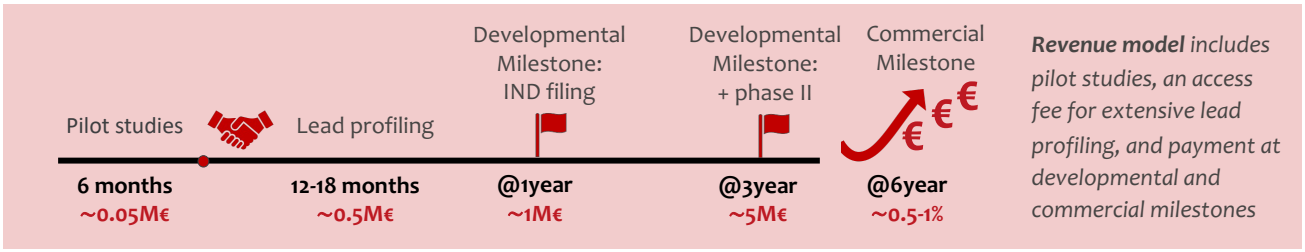
Fibrosis- Fibrotic diseases cause >800,000 deaths annually worldwide, lead by cardiac and lung fibrosis. **uScar** is the first *in vitro* model replicating cardiac fibrosis in a chemical-free setup. Mechanical stresses are used as the key trigger of the fibrotic phenotype switch in a healthy cardiac model, without the need of pro-fibrotic stimuli (e.g. TGFb). This enables for the first time to perform unbiased screening of TGFb-related targets *(Occhetta, Int Bio, 2016)*. uScar demonstrates treatment responses to clinically used drugs (e.g Tranilast, a modulator of the TGFb pathway) and advanced miRNA gene therapies. The same uScar concept is currently being translated to other models of fibrosis, such as Idiopathic Pulmonary Fibrosis.

Cardiovascular system- Cardiovascular toxicity is one of the leading causes of drug attrition, responsible for 21% of discontinued drugs and for 45% of post approval drugs withdrawn from the market. The key reason is that current preclinical models for evaluation of cardiac safety are not predictive enough. **uHeart** faithfully emulates synchronously beating, mature and functional cardiac tissues *in vitro*. uHeart is generated exposing 3D co-cultures of relevant cardiac cell populations (human induced-pluripotent stem cell derived cardiomyocytes, and fibroblast) to cyclic mechanical stretching resembling the heartbeat *(Marsano, Lab Chip, 2016)*. Thanks to uSense, uHeart detects electrophysiological alterations and was qualified on 12 drugs returning 100% specificity and 92% accuracy (collaboration with Accelera) *(Visone, Biofabrication, 2021)*. Notably, uHeart can detect toxic effect of drugs that cannot be classified in animals nor in other *in vitro* models (e.g. Terfenadine). uHeart is being further developed to model cardiac diseases such as dilated cardiomyopathies, focusing on genetic disorders.

Future pipeline- The versatility of uBeat® allows BiomimX to rapidly extend its solutions to different human organs/diseases, thus exponentially increasing market opportunities. BiomimX has scientifically demonstrated the validity of models of gut-on-chip (uGut), neuromuscular junction, and multi-organs systems (i.e. Liver-Tumor and Liver-Heart).

Market Opportunity and Competitive Landscape- The Global Pharmacuetical R&D Market is estimated to reach 227B$ by 2025. BiomimX targets the cell culture market share (41B$ in 2026, CAGR 12.6 %), where Pharma and Biotech accounts for the largest share. Whithin this market, 3D cell cultures are gaining demand over 2D cell cultures and there has been heightened focus on products like Organ-on-Chip (OoC). OoC market itself is projected to be >1.6B€ by 2030 (CAGR 31%). The introduction of OoC in the DDP has been predicted to lead to an R&D cost reduction of up to 26% for Pharma and Biotech, drastically increasing success rates by ~40%. Worldwide pharma agencies (FDA, EMA, IQ Consortium) are notably in the front line to accelerate OoC adoption in DDP and in 2022 the first clinical trial (NCT04658472, promoted by Sanofi) has been approved by FDA, based only on efficacy tests conducted on OoC. Currently, OoC market is still highly fragmented, with only few players in the production and commercialization phase. This presents market opportunities.

Business Model- BiomimX partners with Pharma/Biotech in drug discovery programs via long-term agreements. The benefit for customers is not limited to the short and less expensive preclinical phase (e.g. reduction in animal models), but the use of Beating OoC reflects in a higher probability of succeeding later in clinical trials, making us a high value partner.



BiomimX is already on the market with its qualified models of OA and fibrosis, having successfully completed two pilots (with one of the top Pharma and Synartro BV, Biotech leader in OA) and is currently negotiating a long-term agreement with Synartro. Additional target customers include 1) CROs for technology transfer of the uBeat® setup for provision of drug screening services in vertical applications cardiotoxicity (partnerships in place with IQVIA and JCI), and 2) Research Laboratories for uBeat® Platform for off-the-shelf provision (5 active customers).

Team- BiomimX founding team has high-level technological, industrialization and translational competences . All co-founders, inventors of uBeat®, hold a PhD degree, two are Professors at Politecnico di Milano.

- CEO, Paola Occhetta, has a deep experience in OoC industrial development and application in drug discovery and since 2017 has successfully raised 1.25M€ in non dilutive funds.
- CTO, Marco Rasponi, brings >15 years experience in OoC development, is executive Board Member of the European Organ-on-Chip Society (EUROoCS) and coordinates several multicentric projects.
- Co-founder, Alberto Redaelli, is chair of the Biomedical Engineering Division of Politecnico di Milano, internationally recognized expert in cardiovascular field. They both altogether raised >30M€ in academic grants.
- COO, Roberta Visone, expert in *in vitro* cardiac models and 3 junior R&D complete the operative team.
- BiomimX has the support of business and financial advisors Fabrizio Bacchi, Scott Woodward and Marita Cavalcanti.

R&D and clinical partners- Continuous interactions with research laboratories (as Spin-off of Politecnico di Milano) and long lasting partnerships with state-of-the-art research hospitals in the field of OA (University Hospital of Basel, Istituto Ortopedico Galezzi) and cardiac diseases (Humanitas Hospital, FNUSA Brno), are key strengths for R&D activities.

Investment opportunity- BiomimX is seeking a Seed investment of €5 Million to complete the optimization of the production strategy of the uBeat® Platform and to expand its portfolio of complex diseases. The investment will take BiomimX through market validation and reach the breakeven point in three years.

Use of proceeds-

- optimization of the production of uBeat® Platform and HW/SW robust design – 2M€
- Release of >4 new qualified models of complex disease based on uBeat® Platform – 1.5M€
- Establishment of business and commercial department – 0.75M€
- Capital expenditure and new IP – 0.75M€

For more information…

www.BiomimX.com

Paola Occhetta (CEO) paola.occhetta@biomimx.com +39 3479192666