

Biomedical Technologies and Innovation Doctoral Programme (BIOTIN)



Title of the PhD Project	Organoid based on-chip disease models
Acronym	ORGANOMIC
Research Fields of the Project	Stem cell technologies, microfluidic systems, and biomaterials
Keywords	organoid, disease model, ophthalmology, microfluidic chip, biomaterial
Host Institution, Department and Campus Location	Izmir Biomedicine and Genome Center, Dokuz Eylul University Health Campus, Balçova, İzmir
PhD Awarding Institution and Graduate Programme	Dokuz Eylul University, Izmir International Biomedicine and Genome Institute, PhD in Biomedicine and Health Technologies
Name and Affiliation of Main supervisor	Assoc. Prof. Sinan Güven (IBG)
Name and Affiliation of Co-supervisors	Assoc. Prof. Bora Garipcan (BOUN) Assoc. Prof. Cumhuri Tekin (IZTECH)
Research Environment and Infrastructure	IBG Güven Lab has capacity to fabricate microfluidic devices, perform biomaterial synthesis and surface modifications. Cutting edge instrumentation for facilitating microfluidic and 3D dynamic cultures. Besides, IBG has currently 9 core facilities, covering 6.600m ² of space. <i>Flow Cytometry and Cell Sorting Facility (FCCF)</i> : The flow cytometry facility at IBG is equipped with three state-of-the-art machines, making it the best equipped flow cytometry facility in Turkey to date. Two cell analyzers are hosted: BD Canto II and a BD LSR Fortessa X20. The cell sorting is performed on the latest BD FACSARIA III. <i>Imaging Core</i> : The Combination System of Electron and Confocal Microscopy (Shuttle & Find-Zeiss Sigma 500 Electron Microscopy + Zeiss LSM 880-Confocal Laser Scanning Microscopy with Airyscan), <i>Histopathology Core</i> , <i>Vivarium and In Vivo Imaging Facility</i> : The vivarium has the capability to host 20.000 rodent and 2.000 zebrafish within its 3.500 m ² space. <i>Biobanking Core Facility</i> : The equipment includes automatic H&E, immunohistochemistry staining, cytospin and a Tissue MicroArray device. (https://www.ibg.edu.tr/research-programs/groups/guven-lab/)
Scientific Context of the Project	Tissues and organs comprise cells, intra- and inter-cellular components that are highly organized both in organismal space and developmental time. Tissue functionality arises from the finely orchestrated interactions of such components, which are regulated by a multitude of chemical and physical stimuli. Organ-on-a-chip platforms hold a great promise to generate models to mimic the natural biological tissue

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	<p>microenvironments and to recapitulate tissue and organ formation and maturation. Induced pluripotent stem cell (iPSC) derived organoids are emerging tools that bring inspiring <i>in vitro</i> venues to study development of complex physiological systems and form disease models. Such organoid based on-chip disease models are capable of recapitulating dynamics of the organ formation and anlage cellular condensations at the early development. This project will focus on generate ocular and neural organoids from healthy and patient derived iPSCs towards generation of assembloids. Bioengineering approaches will be utilized to design and fabricate 3D microenvironments with well-defined shape and material composition mimicking intricate native niches hosting the assembloids. Neuro induction of ocular organoids will be investigated using MultiOMICS approaches under dynamic mechanotransduction provided by microfluidic chip. Our group harmonizes fundamental sciences such as chemistry, biology, and physics with principles of engineering to generate innovative and effective therapeutic approaches, tissue mimics and medical microdevices for medicine and pharmaceutical sciences. The focus of the lab is to bioengineer novel native-like 3D cellular microenvironments, organ-on-a-chip platforms, and cell therapy approaches and to translate them for direct applications in human health.</p>
<p>Brief Workplan</p>	<p>Year 1. Generation of induced pluripotent stem cell derived organoids</p> <p>Year 2. Microfluidic system design and fabrication</p> <p>Year 3. Integrated organ-on chip systems</p> <p>Year 4. Disease model validation through multiomic techniques</p>
<p>Innovative Aspects of the Project</p>	<p>The project will assimilate cutting edge life science and bioengineering tools to develop novel approaches in developing <i>in vitro</i> disease models through replicating natural intricacies. Accumulated knowledge in induced pluripotent stem cell based organoid techniques facilitate better models emulating the native tissue. Merging multiple organoids to form assembloids is a novel access minimizing the limitations of organoid research. The project will also focus on bioengineering the microphysiological environment reinstating the natural stimulants on <i>in vitro</i> developed organ models. Finally, multiomics approaches will play substantial role in gathering all possible information from <i>in vitro</i> model and facilitate the identification of functional assets.</p>
<p>Training Opportunities of the Project</p>	<p>Candidate will be trained in well established groups formed with team members from different backgrounds. The training will be on site and under direct supervision. IBG core facilities are run by technical staff motivated in assisting researchers to achieve ultimate from the experimental material. Trainee will have chance to reach all resources within the network.</p>
<p>Interdisciplinary Aspects</p>	<p>The study will harmonize basic biological sciences, bioengineering, and bioinformatics.</p>

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<p>Intersectoral Mobility</p> <p><input checked="" type="checkbox"/> Short Visit</p> <p><input type="checkbox"/> Secondment</p>	<p><i>Host: Fujifilm VisualSonics</i></p> <p><i>Context of Mobility: In vivo molecular and diagnostic imaging, exploitation of research results, and ethics</i></p>												
<p>Intersectoral Mobility</p> <p><input checked="" type="checkbox"/> Short Visit</p> <p><input type="checkbox"/> Secondment</p>	<p><i>Host: Istanbul Health Industry Cluster (ISEK)</i></p> <p><i>Context of Mobility: Entrepreneurship Training, Thematic Pre-incubation Program</i></p>												
<p>International Academic Secondment</p>	<p><i>Host Supervisor: Dr. Jo Huiqing Zhou</i></p> <p><i>Host Institution: Radboud University, Nijmegen, Netherlands</i></p> <p><i>Host Department: Molecular Developmental Biology Department</i></p> <p><i>Duration: 6 months</i></p> <p><i>Estimated Time of Mobility: 4th year</i></p>												
<p>Main Supervisor</p>													
<p>Brief CV</p>	<p>Assoc. Prof. Sinan Güven</p> <p>E-mail: sinan.guven@ibg.edu.tr</p> <p>ACADEMIC DEGREES</p> <table border="0"> <tr> <td>Ph.D.</td> <td>Biomedicine</td> <td>University of Basel, Switzerland</td> <td>2011</td> </tr> <tr> <td>M.Sc.</td> <td>Biotechnology</td> <td>Middle East Technical University, Turkey</td> <td>2006</td> </tr> <tr> <td>B.Sc.</td> <td>Chemistry</td> <td>Middle East Technical University, Turkey</td> <td>2003</td> </tr> </table> <p>Google Scholar: https://scholar.google.com/citations?hl=en&user=AAW4wtsAAAAJ https://orcid.org/0000-0001-5212-5516</p>	Ph.D.	Biomedicine	University of Basel, Switzerland	2011	M.Sc.	Biotechnology	Middle East Technical University, Turkey	2006	B.Sc.	Chemistry	Middle East Technical University, Turkey	2003
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<p>Brief CV</p>	<p>Assoc. Prof. Bora Garipcan</p> <p>E-mail: bora.garipcan@iyte.edu.tr</p> <p>ACADEMIC DEGREES</p> <table border="0"> <tr> <td>Ph.D.</td> <td>Bioengineering</td> <td>Hacettepe University, Turkey</td> <td>2008</td> </tr> <tr> <td>M.Sc.</td> <td>Chemistry/Biochemistry</td> <td>Hacettepe University, Turkey</td> <td>2001</td> </tr> <tr> <td>B.Sc.</td> <td>Chemistry</td> <td>Hacettepe University, Turkey</td> <td>1999</td> </tr> </table> <p>Google Scholar: https://scholar.google.com/citations?user=hmzDqY8AAAAJ&hl https://orcid.org/0000-0002-1773-5607</p>	Ph.D.	Bioengineering	Hacettepe University, Turkey	2008	M.Sc.	Chemistry/Biochemistry	Hacettepe University, Turkey	2001	B.Sc.	Chemistry	Hacettepe University, Turkey	1999
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Brief CV	<p>Assoc. Prof. Cumhur Tekin</p> <p>E-mail: cumhurtekin@iyte.edu.tr</p> <p>ACADEMIC DEGREES</p> <table><tr><td>Ph.D. Microsystems and Microelectronics</td><td>Ecole Polytechnique Fédérale de Lausanne</td><td>2012</td></tr><tr><td>M.Sc. Electrical and Electronics Engineering</td><td>Middle East Technical University, Turkey</td><td>2007</td></tr><tr><td>B.Sc. Electrical and Electronics Engineering</td><td>Middle East Technical University, Turkey</td><td>2005</td></tr></table> <p>Google Scholar: https://scholar.google.com/citations?hl=en&user=ml9NbuQAAAAJ https://orcid.org/0000-0002-5758-5439</p>	Ph.D. Microsystems and Microelectronics	Ecole Polytechnique Fédérale de Lausanne	2012	M.Sc. Electrical and Electronics Engineering	Middle East Technical University, Turkey	2007	B.Sc. Electrical and Electronics Engineering	Middle East Technical University, Turkey	2005
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