

## **CoE for Functional SURfaces and interfaces for Nano diagnostics (EFSUN)**



**Activity Report 2017-2018**

## Introduction

The Center of Excellence for Functional Surfaces and interfaces for Nano diagnostics (EFSUN) was established in September 2016. The Center aims at the discovery of efficient tools for an early, efficient accurate, cheap and on-site diagnosis of important health problems using nanotechnology tools. Highly qualified local researchers in various fields, including medicine, molecular biology, genetics, pathology, chemistry, physics, engineering, nanotechnology and electronics were brought together in the center in order to generate original, innovative and patentable knowledge and produce high impact research. Moreover, interdisciplinary nature of the center facilitates coordinated interactions between members from different fields to reach a common goal of generation of high-tech nano-based diagnostic devices. The advisory board consists of outstanding and experienced researchers from the best institutes and universities in the US and in Europe. EFSUN is now a center of attraction in the fields of nanotechnology and medical diagnostics in Turkey as well as in the region, and it always welcomes motivated researchers who would like to join forces to reach this goal.

The Center was founded by 5 scientists who were soon joined by more than 30 scientists, who are world-class experts in their respective fields. Contributing members are recipients of various prestigious national and international awards. Collaborations with the industry are ongoing. More than 40 Ph.D. students and 30 M.S. students as well as more than 10 Post Doctoral Research Associates are benefitting from the stimulating and collaborative environment of the Center.

Within a short time, the Center became a 'Research Powerhouse' at Sabanci University with exhaustive and collaborative efforts of the members. The research efforts and collaborations in the Center led to more than 100 journal publications in top journals between 2017-2018 (such as International Journal of Heat and Mass Transfer, Microfluidics and Nanofluidics, Applied Physics Letters, Nature Scientific Reports, Optics Express, etc.). 7 joint patents applications were made, and 4 joint patent grants were obtained. Significant large scale grants were also obtained from both national and international resources within a year (more than 5,000,000 Euro). Our Center is now seeking for TUBITAK (The Scientific and Technological Research Council of Turkey) 1004 Center of excellence Funding in collaborations with our outstanding centers in Turkey such as SUNUM (Sabanci University Nanotechnology and Applications Center). The members are self sustaining the Center and providing high impact outputs within the framework of the Center without any substantial support from Sabanci University.

We are happy to provide our contributions for organizing exciting events such as 'The Functional Surfaces and Interfaces Workshop' held at Sabanci University SUNUM building and 'Applied Nanotechnology Winter School' for High School students in collaboration with SUNUM.

This activity report is intended to provide a collection of the outputs of the center.

Ali Koşar      and      Burç Mısırlıoğlu- Co-Directors

Devrim Gözüağık- Vice Director

## Executive Board Members



Ali Koşar



Burç Mısırlıoğlu- Co-Directors



Devrim Gözüa ık- Vice Director



G zde  nce



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Murat Kaya Yapıcı



Funda Acar Ya cı

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## Advisory Board Members



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Director, Nano-Tumor Center,  
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Mehmet Toner <https://hst.mit.edu/users/mehmettonerhms Harvard.edu>  
Professor of Bioengineering,  
Harvard Medical School



Yusuf Leblebici  
President,  
Sabanci University



Yoav Peles  
Mechanical Engineering Department Head,  
University of Central Florida



Pamir Alpay

Materials Science Engineering Department Head,  
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Zahra Zakeri <http://biology.qc.cuny.edu/people/faculty/zahra-zakeri/>

President of International Cell Death Society,  
Queens College of the City University of New York



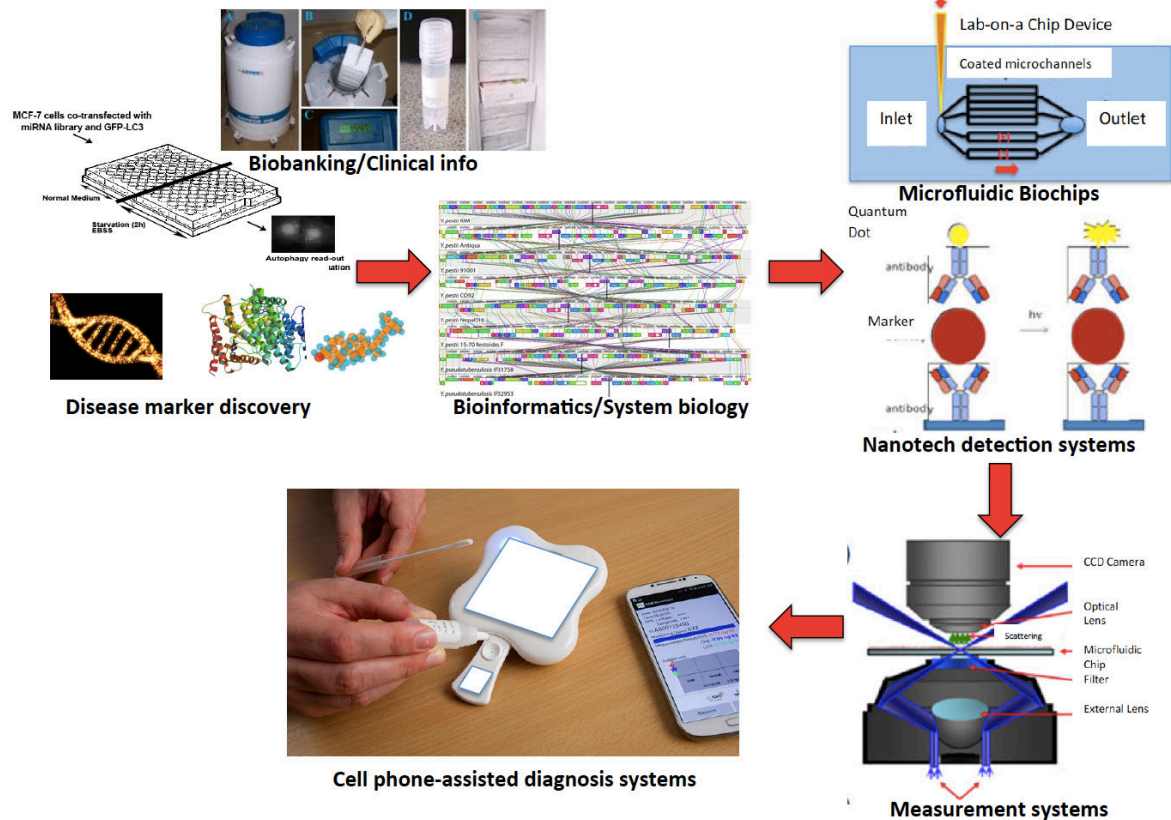
M. Pinar Mengüç

Director, Centre for Energy, Environment and Economy,  
Ozyegin University

## Research Activities in EFSUN

EFSUN - Center of Excellence on Nano Diagnostics (<http://efsun.sabanciuniv.edu>)

### Prototype Project Scheme



The Prototype Project Scheme: Collaborative efforts of EFSUN Researchers who are experts in their respective fields, will allow creation of a cell phone-assisted platform for quick, cheap and accurate on-site detection and diagnosis of diseases. Clinical materials (tumors, various tissues, blood, urine, saliva etc) that are collected by clinical medical doctors, are analyzed using molecular tools (omics approaches, molecular biology, genetics, cell biology, biochemistry) and novel disease markers are discovered. Experts of bioinformatics and computational biology analyze the results of high-throughput omics approaches. Currently at least 5 protein and 5 RNA new and patentable markers of cancer were already discovered by EFSUN researchers, others are in the pipeline. Innovative microfluidic biochips are used in order to enrich, purify or separate cells and biomolecules in clinical materials. Using home-made antibodies, specially designed and functionalized nanoparticles and innovative physico-chemical detection approaches, EFSUN researchers are able to detect femto to subfemtomolar concentrations of disease markers. Signal detection is achieved using a home-made and patentable detection devices that process information in a cell phone and Cloud-assisted manner, and operating with a custom-designed application. Therefore, all components and parts of EFSUN Cell Phone-Assisted Diagnosis Systems are a result of cutting-edge science and technology.

*EFSUN Center of Excellence: Fascination of science and technology, excellence in surfaces , interfaces and diagnostics.*

## Members and Involved Institutions in EFSUN

### Sabancı University:



Ali Kosar



Burc Misirlioglu



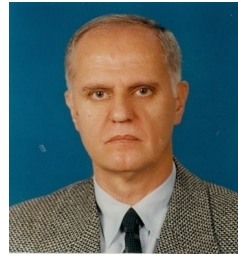
Devrim Gozuacik



Kursat Sendur



Gozde Ince



Asif Sabanovic



Huveyda Basaga



Ozlem Kutlu





Murat Kaya Yapici



Feray Bakan



Meltem Sezen



Emre Erdem



Canan Atılgan

#### Koç University:



Havva Funda Yağcı Acar



Alper Kiraz

#### Acibadem University:



Işın Doğan-Ekici

#### Hisar International Hospital:



Sinan Ekici

**TÜBİTAK-MAM:**



Koray Balcioglu



Berrin Erdag

**Kültür University:**



Elif Damla Arisan

**Gebze Technical University:**



Tunahan Cakir



Pinar Pir



Saliha Durmuş



Nurcan Doğan

**TR Forensic Medicine Institution:**



Arzu Akcay



Kubilay Kinoglu,

**Çukurova University:**



Hikmet Akkiz

**Marmara University:**



Tunc Lacin

**Hacettepe University:**



Serap Dokmeci (Emre)

**Yeni Yüzyıl University:**



Cenk Kig

**Middle East Technical University:**



Haluk Külâh

## Expertise Areas of EFSUN researchers

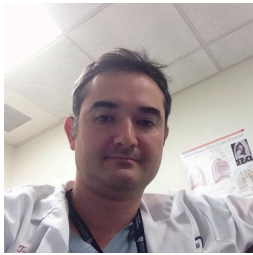
Surgery / Interventional Medicine:



Hikmet Akkiz (Gastroenterology)



Sinan Ekici (Urology)



Tunc Lacin (Thoracic Surgery)



Kubilay Kinoglu (Forensic Medicine)

Pathology:



Işın Dogan Ekici (Clinical Pathology)



Arzu Akcay (Forensic Pathology)

Molecular Biology, Genetics, Biochemistry:



Devrim Gozuacik (Molecular Medicine, Cell Biology, Biochemistry)



Huveyda Basaga (Molecular Biology, Cell Biology)



Ozlem Kutlu (Molecular Biology and Genetics of Disease)



Cenk Kig (Cell Biology, Biochemistry)



Serap Dokmeci (Medical Genetics)

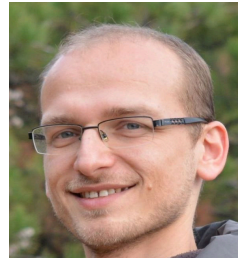


Elif Damla Arisan (Molecular Cell Biology, Cancer Biology, Drug Resistance)

Bioinformatics and Computational Biology:



Koray Balcioglu (Antibody Design and Production)



Tunahan Cakir (Systems Biology)



Berrin Erdag (Antibody Design and Production)



Pinar Pir (Systems Biology, Mathematical Modeling)





Saliha Durmuş (Systems Biology, Bioinformatics Tool Design)



Emre Erdem (Physics of Materials, Thin Film Batteries)

Chemistry / Material Science:



Havva Funda Yagci Acar (Nano particle design)



Burc Misirlioglu (Interfaces, phase transitions, microstructural Properties)



Nurcan Doğan (Nano particle Design)



Canan Atilgan (Polymers and Protein Dynamics)



Gozde Ince (Polymers, Thin Films)



Ali Kosar (Microfluidics, Heat Transfer, Cavitation)



Kursat Sendur (Nano-optics, Plasmon Resonance, Electromagnetics)



Alper Kiraz (Optofluidics, Photonics, Single Molecule Microscopy)



Asif Sabanovic (Robotics, Control, Micromanipulation)



Haluk Kùlah (Microelectromechanical Systems)

Electrics /Electronics:



Murat Kaya Yapici (Microelectromechanical Systems)

## Publications:

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**Patents:**

## Granted Patents:

- 1- Sendur, K., Kosar, A., and Menguc, M. P., "Nanoplasmonic device with nanoscale cooling," International Patent. JP5883938 B2, KR101719886 B1.
- 2- Kosar, A., Perk, O.Y., "Pharmaceutical Drug Delivery System," International Patent. EP2918263 B1.
3. Gozuacik D and Korkmaz G. Use of miRNAs for the diagnosis, propylaxis, treatment and follow-up of diseases involving macroautophagy abnormalities. International Patent. EP10777121.4.
4. Gozuacik D. Usage of CT-1 for cancer diagnosis and treatment. International Patent. EP3067422.

## Patent Applications:

- 1- Kosar, A., "An Energy Harvesting Device" International Patent. PCT/TR2016/050281.
- 2- Kosar, A., Gözüaık, D., Sadaghiani, A.K., Akko, Y., and Motezakker, A. R., "Heat Exchanger with Enhanced Heat Transfer Surfaces," International Patent. TR 2017/05596.
- 3- Kosar, A., Sendur, K., and Menguc, M. P., "Flow System Avoiding Particle Agglomeration," International Patent. WO2017069712 A1.
- 4- Cho YK, Bathany C, Kim JY, Gozuacik D. Device and method for single cell screening-based on inter-cellular communication. International Patent. WO2016099207.
- 5- Acar, H.F.Y., Gözüaık, D., Kosar, A., Ünal, Ö., Koak, M., Züvin, M., Akko, Y., and Motezakker, A. R., "Therapeutic Nanoparticles for MicroRNA Delivery" International Patent. PCT/TR2018/050094.
- 6- Kosar, A., Gözüaık, D., Sadaghiani, A.K., Akko, Y., and Motezakker, A. R., "Heat Exchanger with Enhanced Heat Transfer Surfaces," International Patent. PCT/TR 2017/05596.
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## Projects:

- TÜBİTAK 1001 'Development and Fabrication of Ferroelectric Polymer Thin Films with Multilayers and Gradient Compositions for Improved Control of their Dielectric Properties', 2017-2019
- TÜBİTAK 1001 'Investigation of links and crosstalk between autophagy and stress responses', 2017-2020
- TÜBİTAK (Korea Bilateral Cooperation Program Support, 'Turkey-Korean international collaboration on the controlled bubble dynamics in magnetic nanofluids for the heat transfer enhancement '2017-2019
- TÜBİTAK (British Council Bilateral Newton Katip Celebi Cooperation Program Support) 'Evaporated drop analysis, 2017-2019
- TÜBİTAK 1003 'Bioinformatic analysis of transcriptome data and cellular networks for Parkinson's Disease: Identification of novel drug targets and drugs', 2017-2020,(Project Code: 315S302)
- TÜBİTAK 1003 'Non-small cell lung cancer, investigation of its pathogenesis via omics approaches', 2017-2020
- TÜBİTAK Bilateral Cooperation Project with Pakistan, 'Constraint-based and Structure-based Analysis of Metabolic Pathways to Identify Potential Drug Targets against the Lethal Infectious Diseases originating from K. pneumoniae and S. enterica' 2017-2020
- TÜBİTAK Entrepreneurship program (1512), 'The development of miRNA profiling kit for milk and milk products, a new generation food tagging prototype'.
- TÜBİTAK 'The synthesis of GHRH blocking aptamers through SELEX method and characterization biological effect of selected aptamers in prostate, breast, colon and cervical cells', 2017-2020
- TÜBİTAK 'Targeting AMPKa with orlistat through 2D-DIGE method in PC3 and PNT1A prostate cancer cells'
- TÜBİTAK European Molecular Biology Organization (EMBO) Networking Grant for COST-GENiE BM1408
- TÜBİTAK 'The investigation of epibrassinolide-induced cell death mechanism related to ER stress in colon cancer cells'
- TÜBİTAK 'The therapeutic efficiency of Curcumin related to autocrine growth hormone signaling cascade in different breast cancer cells'
- TÜBİTAK 'Milk contamination sensor based on optical fiber cavity ring down spectroscopy'
- TÜBİTAK 1001, "Dielektrik özelliklerin kontrolü amacıyla Bileşim Gradyanlı ve Çok Katmanlı Ferroelektrik Polimer İnce Filmlerin Tasarımı ve Üretimi"
- TÜBİTAK 3501 Kariyer Geliştirme Projesi, Katı Oksit Yakıt Hücrelerinde Nanokompozit Katot Mikroyapısının Elektrokimyasal Performansa Etkisinin Araştırılması
- TÜBİTAK 1003 Öncelikli Alanlar Projesi, Düşük Sıcaklıkta Yüksek Performans ve Kararlılıkta Çalışan Katı Oksit Yakıt Hücrelerinin Geliştirilmesi
- TÜBİTAK 1001, Creation of non-small cell lung cancer models and investigation of its etiopathogenesis using omics methods.
- TÜBİTAK 1001, Investigation of connections and crosstalk between autophagy and DNA damage responses.
- TÜBİTAK 1005, Dolaşımdaki Tümör Hücrelerinin Etkin Ayrıştırılmasına Yönelik Hibrit Yapıda Bir Biyosensör Çipi Geliştirilmesi
- TÜBİTAK 3001, Farklı Geometrik Ve Yüzey Özelliklerine Sahip Kavite Akışının Karakterizasyonunda Kullanılan Mikro/Nanoakışkan Cihaz
- TÜBİTAK 1003, Hidrodinamik Kaviteye Dayanan Medikal Uygulamalar İçin Kullanılacak Ulusal Endoskopik Cihaz Prototipinin Ürüne Dönüştürülmesi



- Energy Harvesting in Small Scale with Small Bubble Collapse and Blast for Fulfilment of Personal Energy Need (01.09.2018- 01.09.2019), Sabancı University Internal Research Project
- Discovery of tumor-stroma crosstalk mediators in hepatocellular carcinoma. Scheme: Cukurova University SRP.
- Structural and Chemical Analysis of Nanostructured Solid Oxide Fuel Cell Electrodes (01.01.2017- 01.01.2018), Sabancı University Internal Research Project – Su-GTU Bilateral
- Analysis for early diagnosis and follow-up of bladder cancer. Scheme: Newton-Katip Celebi Fund.
- Royal Academy of Engineering, 'Multiphase Flows and Heat Transfer in Micro scale'
- 'The investigation of molecular targets of Epibrassinolide and/or roscovitine as potential GSK3b inhibitors in Caenorhabditis elegans model organism'
- TEYDEB-1505, Isi Değiřtirgeçleri İin Biyokaplamalar Geliřtirilmesi Fizibilite alıřması,(2018-2019)

## EVENTS

- Project Team Building Event (04.02.2017)
- General Meeting and Iftar Dinner (20.06.2017)
- The 'Functional Surfaces and Interfaces Workshop' of EFSUN on the 25th November 2017:  
<https://efsun.sabanciuniv.edu/functional-surfaces-and-interfaces-workshop-was-held-sabanci-university-sunum>
- Some high impact research outputs in 2017-2018:  
Ozturk DG, Kocak M , Akcay A, Kinoglu K, Kara E, Buyuk Y, Kazan H and Gozuacik D. MITF/MIR211 axis is a novel autophagy amplifier system during cellular stress. Autophagy, 2018.  
O. Mohammadmoradi, C. Sen, G. A. Ibanescu, L. Pintilie and I. B. Misirlioglu, "Strong composition dependence of resistive switching in Ba<sub>1-x</sub>Sr<sub>x</sub>TiO<sub>3</sub> thin films on semiconducting substrates and its thermodynamic analysis", Acta Materialia, 2018.  
Ghorbani, M. Chen, H., Villanueva, L.G., Grishenkov, D. and Koşar, A., "Intensifying Cavitating Flows in Microfluidic Devices with Poly(vinyl alcohol) (PVA) Microbubbles," Physics of Fluids, 2018, 30(10).  
Motezakker, A.R, Sadaghiani, A.K., Akkoç, Y. Parapari, S.S., Gozaucik, D., and Kosar, A.," Surface modifications for phase change cooling applications via crenarchaeon Sulfolobus solfataricus P2 bio-coatings," Scientific Reports, 7, Article number: 17891, 2017.
- Some accomplishments:  
Devrim Gozuacik will serve as an International Board Member of an NIH-Supported Center of Excellence  
Ali Kosar has been named a top reviewer in Publons' global Peer Review Awards.  
SUTAB team receives the METU (Middle East Technical University) Prof. Mustafa N. Parlar Foundation 2017 Technology Incentive

[https://efsun.sabanciuniv.edu/sites/efsun.sabanciuniv.edu/files/efsun\\_catalogue-2018\\_0.pdf](https://efsun.sabanciuniv.edu/sites/efsun.sabanciuniv.edu/files/efsun_catalogue-2018_0.pdf)Award.

Tunahan Çakır receives the METU (Middle East Technical University) Prof. Mustafa N. Parlar Foundation 2017 Technology Incentive Award.

Authors of the article in the 50 Most Downloaded Articles List in the IEEE Reviews in Biomedical Engineering

- EFSUN and SUNUM will organize an Applied Winter School for High School students between 28 January and 1 February 2019:  
[https://efsun.sabanciuniv.edu/sites/efsun.sabanciuniv.edu/files/fvs\\_sunum-efsun-uygulamali\\_nanoteknoloji\\_lise\\_kis\\_okulu-detayli\\_program\\_finalv2.pdf](https://efsun.sabanciuniv.edu/sites/efsun.sabanciuniv.edu/files/fvs_sunum-efsun-uygulamali_nanoteknoloji_lise_kis_okulu-detayli_program_finalv2.pdf)
- 2018 Research Catalog of the Center is available:  
[https://efsun.sabanciuniv.edu/sites/efsun.sabanciuniv.edu/files/efsun\\_catalogue-2018\\_0.pdf](https://efsun.sabanciuniv.edu/sites/efsun.sabanciuniv.edu/files/efsun_catalogue-2018_0.pdf)
- EFSUN members had the general meeting and traditional Iftar dinner on the 17.05.2018 with the participations of Prof. Dr. Sirin Tekinay and Prof. Dr. Fazilet Vardar
- EFSUN team had a Brain Storming Event on the 17th February 2018 and on the 1st September 2018



## Job Openings

- EFSUN invites applications for Ph.D. students, post-doctoral positions and technical staff.
- Candidates having experience on biology of diseases, microfluidics/nanofluidics, material fundamentals, surface and interface interactions, energy harvesting along with targeted device design are welcome.
- Please send a curriculum vitae, publication list, names and e-mail addresses of at least three referees and a motivation letter electronically to:

Professor Ali Kosar ([kosara@sabanciuniv.edu](mailto:kosara@sabanciuniv.edu))

Professor Burc Misirlioglu, ([burc@sabanciuniv.edu](mailto:burc@sabanciuniv.edu))

Professor Devrim Gozuacik ([dgozuacik@sabanciuniv.edu](mailto:dgozuacik@sabanciuniv.edu))