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RESEARCH
PROJECT

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Examples of Undergraduate
Research Projects supported
by AdımODTÜ in 2020

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A joint project of the Corporate Communications Office and METU Development Foundation, AdımODTÜ is a communication-sharing-action platform where everyone can provide financial support to the scientific research and community service projects of our students and faculty members, contribute to the announcement of the projects and even take part in projects on a voluntary basis.

Research at METU starts in undergraduate years!

AdımODTÜ has created a fund to support the research efforts of undergraduate students through donations. In this booklet, examples of undergraduate projects that have applied to AdımODTÜ are presented. These projects are either fully or partially supported by AdımODTÜ.

To support AdımODTÜ Undergraduate Research Project please visit:
https://adimodtu.org.tr/proje/lisans-arastirmalari-projesi

Field of Research: Power Electronics

Project Team Members: Emre Karabakla

Project Advisor: Assist. Prof. Dr. Ozan Keysan

Abstract:

Nowadays electrical devices can reach up to % 99 efficiency. For some DC-DC converter simple input and output power, measurement method can be applicable if well-calibrated measurement tools be used. However, there can be various reason that would affect the power measurement such as miss calculation of harmonics due to phase-errors or electromagnetic interference due to fast switching devices. In this project, we present the calorimetric efficiency measurement method which measures the power loss a device located inside. Our test trial with various dummy load proved that the designed calorimeter system can measure power loss with error up to 10%.

Calorimetric Measurement of High Efficient Devices

Name of the Project: Chronotype, Self-Compassion and Bedtime Procrastination Among College Students

Field of Research: Health Psychology

Project Team Member: Feyzanur Yön and Merve Timuroğulları

Project Supervisor: Prof. Dr. Özlem Bozo Özen

Abstract:

In the present project, the association between bedtime procrastination, chronotype and self-compassion, and also possible roles of their interactions among college students will be investigated. Data will be collected from 90 METU students, who do not have any diagnosed sleep disorder, through an online system, SONA by using three instruments and the results will be expected to reveal that students with morningness preference would engage in less bedtime procrastination whereas the ones with eveningness preference would have higher BP. Further, having higher self-compassion would be associated with lower BP whereas lower self-compassion would be associated with more BP. Another expected result is that morningness would be positively associated with self-compassion, whereas eveningness would be negatively associated with self-compassion.This study will be the one which sheds light on the possible components which could affect bedtime procrastination of the college student by examining chronotype, self-compassion and their interaction effect in this context.
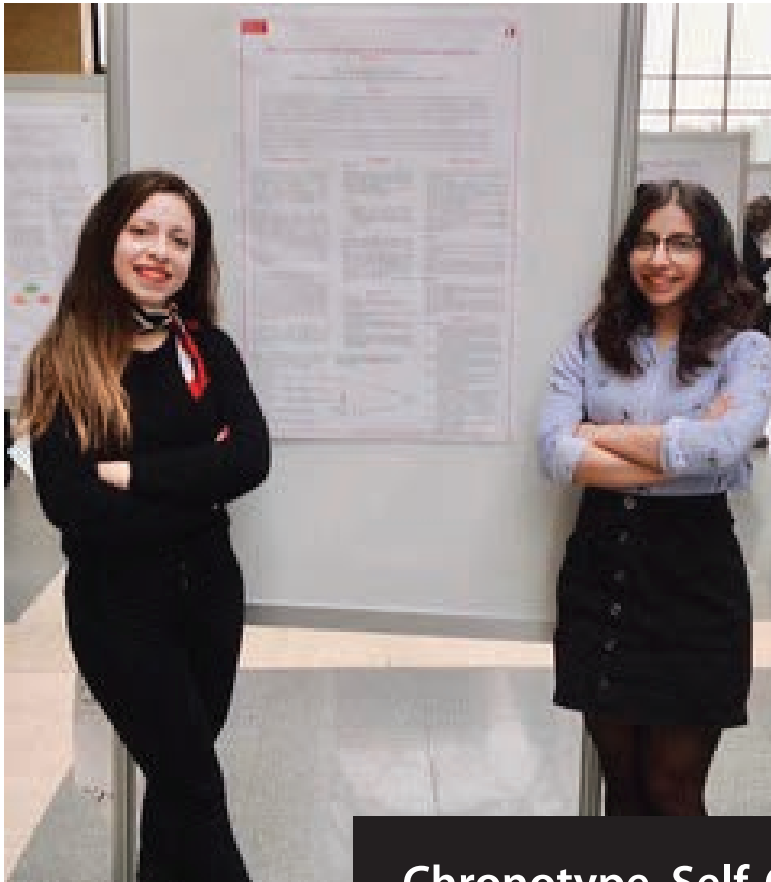
Chronotype, Self-Compassion and Bedtime Procrastination Among College Students

Name of the Project: Comparing the Mechanical Properties of 3D Printed Nylon Parts Produced by Selective Laser Sintering and Fused Deposition Modeling

**Field of Research:** Mechanical Engineering, 3D Printing, Materials Characterization

Project Team Members: Sabit Hasçelik and Ömer Taha Öztürk

Project Supervisor: Assoc. Prof. Dr. Sezer Özerinç

Abstract:

Additive manufacturing (AM) is a technology based on layer by layer production as opposed to conventional subtractive manufacturing. Fused Deposition Modeling (FDM) and Selective Laser Sintering (SLS) are AM methods that are commonly used because of their high reliability, capability to produce complex parts, and the availability of a wide range of materials. Furthermore, additive manufacturing technology gives faster results than traditional manufacturing methods especially in the case of low volumes and custom production. Among the AM materials, polyamide (nylon) is a popular choice that offers high strength, good flexibility and wear resistance properties. This study reports the mechanical properties of nylon specimens produced by fused deposition modeling and selective laser sintering. We investigated the effect of raster orientation and nozzle temperature on the mechanical properties of FDM-produced parts through tensile testing. The results show that these parameters have a direct influence on the mechanical performance. Therefore, process optimization is a critical aspect of FDM for the manufacturing of high-strength and high reliability components.
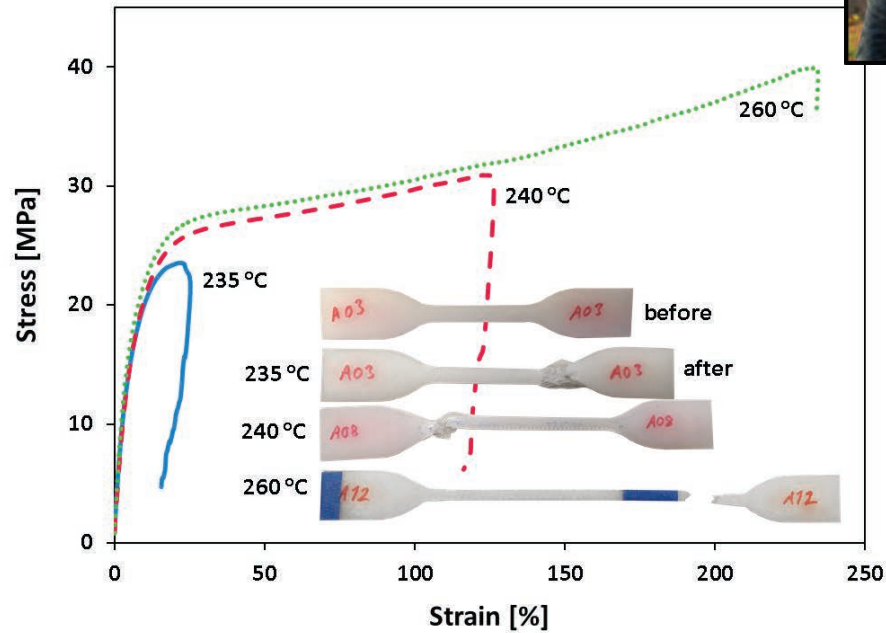
Comparing the Mechanical Properties of 3D Printed Nylon Parts Produced by Selective Laser Sintering and Fused Deposition Modeling

Name of the Project: Detection of Essential Phosphorylation Sites on the β2 Adrenergic Receptor (β2AR) for Binding of β Arrestin 2 to β2AR

Field of Research: Structural Biology, G-protein Coupled Receptor Activity

Project Team Members: Ali Akyol, Zeyneb Vildan Çakıl and Tolgahan Suat Sezen

Project Supervisor: Assoc. Prof. Çağdaş Devrim Son

Abstract:
The receptors are the machineries of cells to communicate with their environments, relaying the signal through downstream pathways. After transmission of the signal, the receptors are desensitized to stop the signal transduction. B2AR phosphorylation leads to desentization, thereafter, B-arrestin 2 binds to the receptor to facilitate desensitization with the help of other scaffold proteins. It is estimated that phosphorylation of four residues on C terminus of B2AR is fundamental for binding of arrestin. This research reveals that the phosphorylation of 355th and 356th Serine residues are more significant than the other residues. However, it is worth keeping in mind that is an ongoing research to finally define the exact pattern of phosphorylation.

Detection of Essential Phosphorylation Sites on the β2 Adrenergic Receptor (β2AR) for Binding of β Arrestin 2 to β2AR

Name of the Project: Development of Data Based Dashboard for Decision Making in Underground Mining Drilling Operations (DRILL-VISION)

Field of Research: Mining Engineering

Project Team Members: Artun Yıldız

Project Supervisor: Assist. Prof. Dr. Mustafa Erkayaoğlu

Abstract:

Natural resources are an essential part of sustainable development and shallow deposits started to become scarce, leading the mining industry towards underground mining. The equipment intensive mining activities such as drilling, generate data that plays a crucial role in management especially for consumables that are in direct relation with the overall production cost. In this project, a data-based approach for underground drilling operations to monitor drilling efficiency through rock tools is introduced. Since drilling operations can be considered as an initial stage of production like blasting, loading and haulage, development, support, and others, any inefficiency in this stage has major impact on the downstream processes. The potential fields affected by drilling in underground mines are ore dilution, final profiles of UG openings, and block creation. The main objective of the project is to collect operational data to develop a dashboard and create online reports including performance (service life and rate of penetration) results of the rock tools. These reports can be used for decision-making in mine management and tools for operation teams to increase the drilling efficiency.
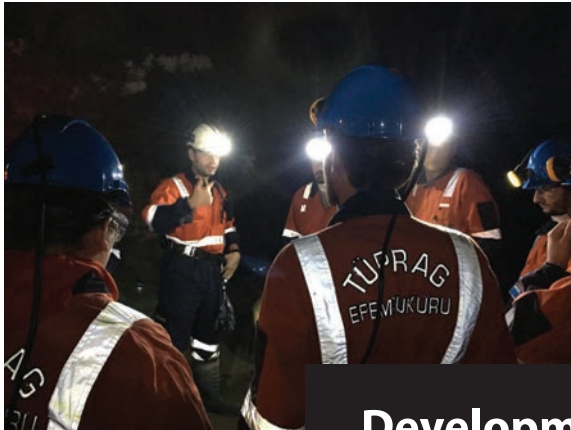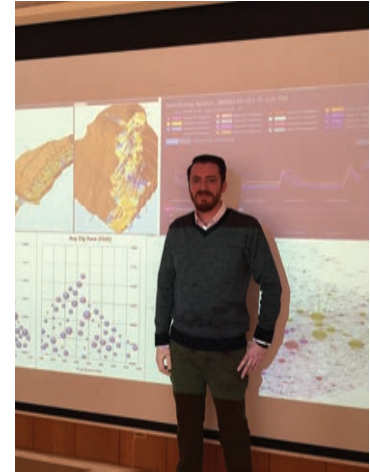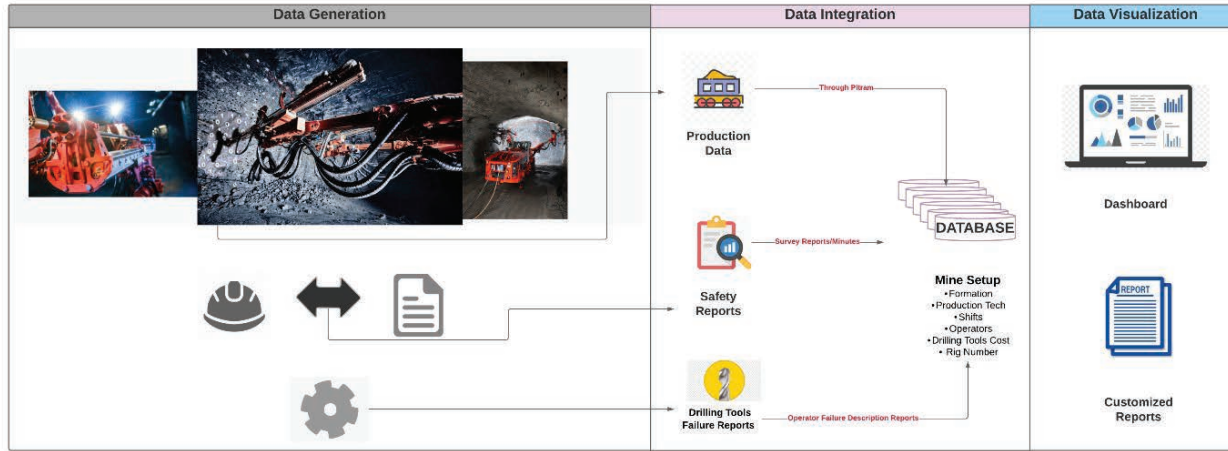
Development of Data Based Dashboard for Decision Making in Underground Mining Drilling Operations (DRILL-VISION)

Name of the Project: Development of Electrically Conductive Nano-patterned Silk Fibroin Membranes for Tissue Engineering Applications

Field of Research: Tissue Engineering

Project Team Members: Negar Moradi and Yiğithan Tufan

Project Supervisor: Assoc. Prof. Batur Ercan

Abstract:

Silk fibroin, a natural protein-based biomaterial, gained considerable attention for tissue engineering applications due to its biocompatibility, biodegradability, high strength and toughness, as well as the ability to be fabricated in different material forms. In this project, Bombyx mori silk fibroin was used as the matrix material for the membranes. Since electrically conductive platforms are required for various tissues, i.e. cardiac, neural, and muscle tissues, carbon nanofibers were incorporated into silk fibroin as a secondary phase to provide electrical conductivity and enhance mechanical properties. In addition, to enhance cellular interactions of the silk fibroin/CNF membranes, a surface nanophase topography was introduced using anodized aluminum templates having nanoporous oxide layer on their surfaces. Different sizes of nanophase topography on the membranes were obtained through optimization of pore size of the oxide layer. Currently, the influence of membrane surface topography and conductivity on fibroblast metabolic activity is being assessed.
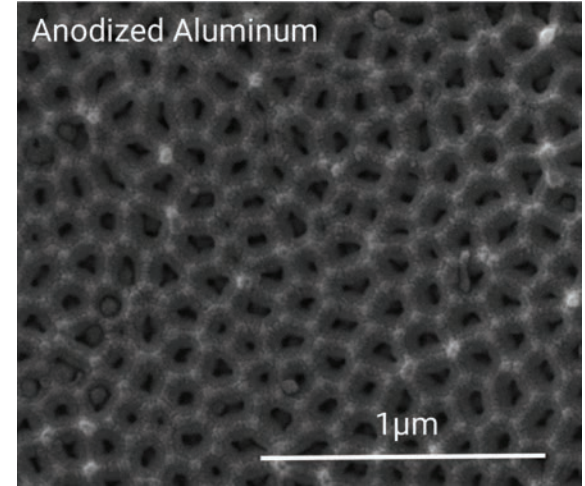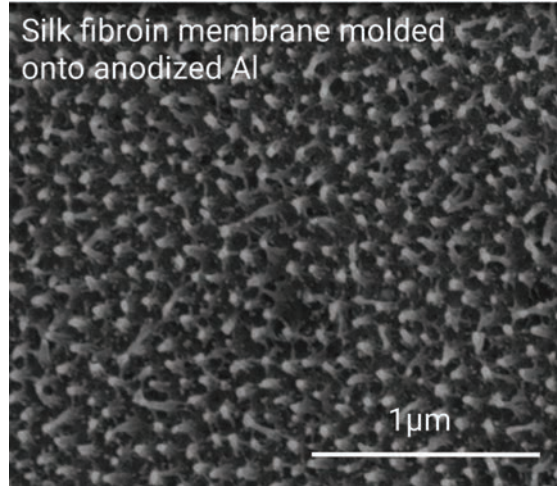
Silk fibroin membrane molded onto anodized Al

1μm

Anodized Aluminum

1μm

Development of Electrically Conductive Nano-patterned Silk Fibroin Membranes for Tissue Engineering Applications

Name of the Project: Effects of Climate, Geography, Genetic Properties of Honeybees, and Demographic Structure of Beekeepers on Bee Losses

Field of Research: Conservation Biology

Project Team Members: Selen Akçakoca, Selin Candır, Elif Dönmez, Merve Kahveci, İrem Harmancı, Nergis Bilge Karabulut, Nergis Yasav and Mert Kükrer

Project Supervisor: Prof. Dr. C. Can Bilgin

Abstract:

The honeybee (Apis mellifera L.) is a globally significant species of apparent economic and ecological importance due to its pollination services and bee products. It was thought that the bee losses were caused mainly by pathogens, pesticides, and parasites. That is true to a degree but those factors are almost always present across time and space but the losses usually occur regionally and unpredictably over the years. Here in this project we measure the relative effects of climate, geography, demographic structure of beekeepers, and genetic structure of honeybees on the colony losses observed. For this, we made use of the data collected over the past 3 years about wintering success as well as carrying out a survey for this year as well. A total of 392 beekeepers were called by phone and genetic tests on 100 new honey bee samples were performed.

Effects of Climate, Geography, Genetic Properties of Honeybees, and Demographic Structure of Beekeepers on Bee Losses

Name of the Project: Establishment of a Green Fluorescent Protein (GFP) Reporter System for Real-Time Imaging of Cellular Autophagy

Field of Research: Cancer Biology

Project Team Members: Ekin Su Erdem, Ezgi June Olgaç and İsmail Güderer

Project Supervisor: Prof. Dr. Sreeparna BANERJEE

Abstract:

Autophagy is a catabolic mechanism involving the degradation of defective proteins and organelles in the maintenance of homeostasis, ultimately supplying substrates for metabolic pathways. Nutrient starvation is known to trigger autophagy in cancer cells. Autophagy is known to be preferred in cancer cells as it can enable the cells to survive nutrient stress because of its ability to provide additional energy to the cell. Nutrient stress leads to an increase in the cellular AMP/ATP ratio, which can trigger the phosphorylation and activation of a protein called AMPK. Activation of AMPK triggers a signaling cascade in the cells, culminating in the formation of a double membrane that can encircle the organelles or macromolecules that need to be degraded. Formation of the double membrane is orchestrated by a protein called microtubule-associated protein 1A/1B lightchain 3B (LC3), which can get lipidated and lead to the formation of the autophagosome. The autophagosome subsequently fuses with lysosomes, leading to the degradation of its contents. This generation of autophagosome and its subsequent degradation is terms as autophagic flux, which can be detected in cells using fluorescently labeled LC3 protein.
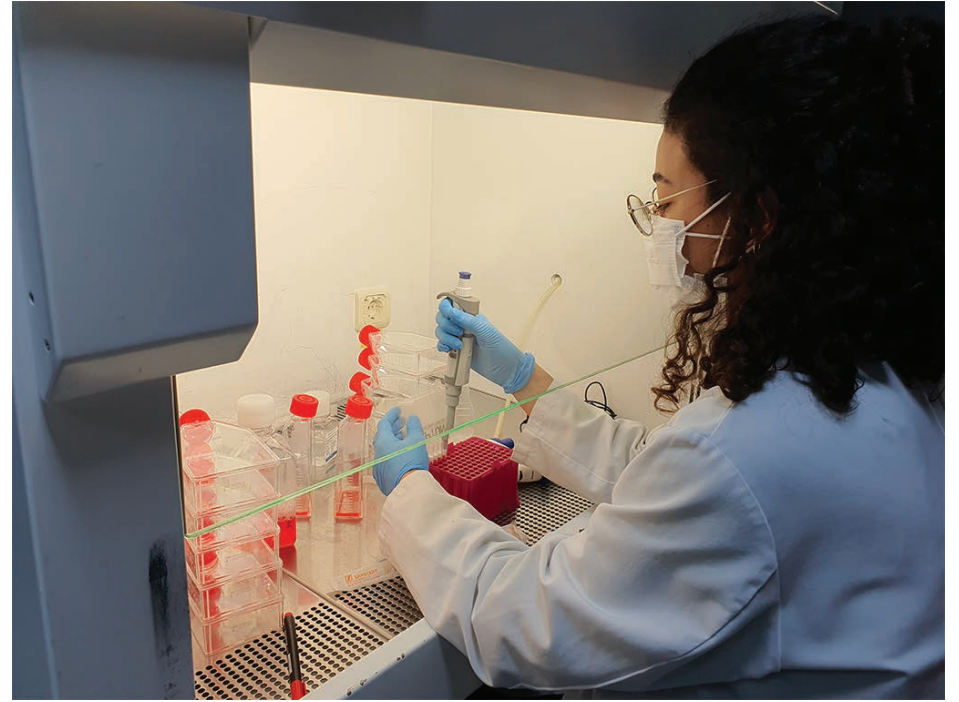
Establishment of a Green Fluorescent Protein (GFP) Reporter System for Real-Time Imaging of Cellular Autophagy
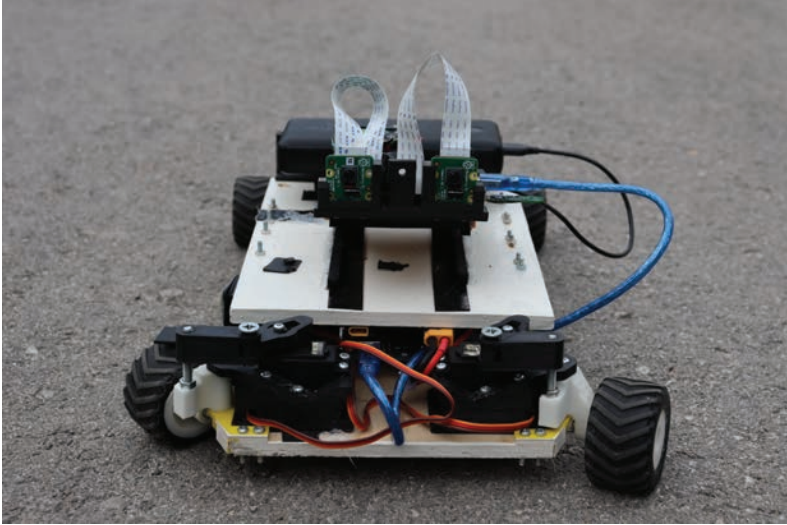
Name of the Project: FENER

Field of Research: Image Processing, Deep Neural Network, Self Driving Vehicle, Mapping, Stabilization Systems

Project Team Members: Şevval Belkıs Dikkaya, Volkan Arslan and Muhammed Sezer

Project Supervisor: Prof. Dr. Klaus Werner Schmidt

Abstract:

In this project, our purpose was to design a self driving vehicle which can follow a target object and carry load. To be able to track an object, it is necessary to determine the position of the object and move vehicle accordingly. We labeled 15,000 images to locate the object and used them to train on JetsonNano. We calibrated the images coming from the stereo camera, and with object detection and template matching, we also found the object in 2 different frames. Using the coordinates of these objects on images, we determined the angle and position of the object. As a result of a mapping made according to this data, we calculated the distance the vehicle should travel and we drove the vehicle via Arduino. In addition, this poster includes important mechanical works on the vehicle. These are studies to prevent vibration and increase the durability of the vehicle.

FENER

Name of the Project: Flexible Cognitive Science Research Front-end (FlexCog)

Field of Research: Biological Sciences

Project Team Members: Faruk Eroğlu

**Supervisor:** Assoc. Prof. Müslüm İlgü

Abstract:

Even though electroencephalography (EEG) is commonly used for cognitive science research, it's still far from being accessible outside laboratories with high amount of resources, due to the high cost of research-grade EEG hardware and time required to prepare a test subject. FlexCog aims to be an accessible platform for all researchers across the world, with low-cost research-grade EEG hardware, reusable dry electrodes and easy-to-use software.
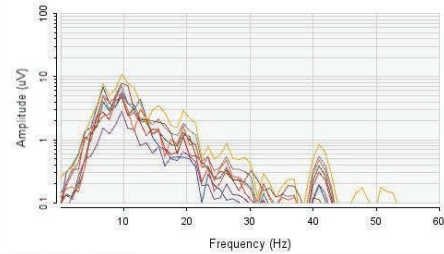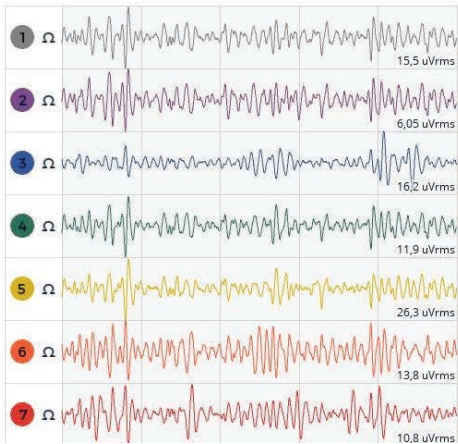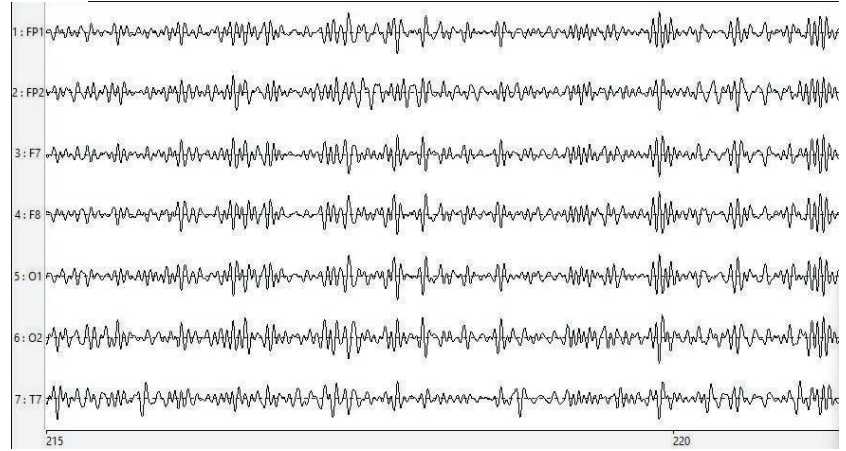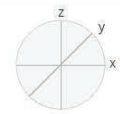
Flexible Cognitive Science Research Front-end (FlexCog)

Name of the Project: Forecasting the Effect of Climate Change in Turkey over the Years

Field of Research: Statistics

Project Team Members: Eda Yıldırım, İrem Üstek and Mertcan Yükselsin

Project Supervisor: Assoc. Prof. Dr. Ceylan Yozgatlıgil and Assist. Prof. Dr. Fulya Gökalp Yavuz

Abstract:
One of the most critical and controversial issues of today is climate change. Climate change is the overall name of a long-term change in the Earth's climate. Also, air pollution is another vital issue in today's world. This project aims to investigate the changes in these main fields by using statistical methods and machine learning techniques. This project consists of several steps starting from the data manipulation to the analysis of multiple parameters causing climate change and air pollution over the years. Then, investigating whether there is a relationship between these parameters. Additionally, we aim to estimate air pollution in the future using forecasting methods. At the end of the project, we expect to raise awareness on that vital issue with some suggestions on a specific website launched by the team.

Forecasting the Effect of Climate Change in Turkey over the

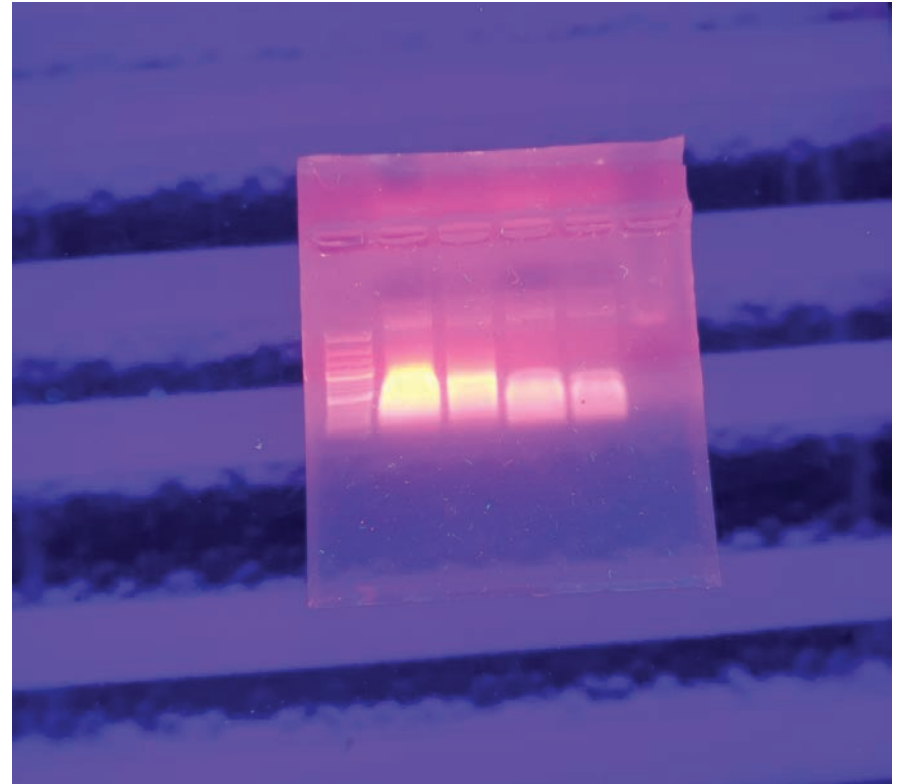## Name of the Project: Identification of Potential Proteins in the Ubiquitination/Deubiquitination of CXXC5

Field of Research: : Cancer Biology

Project Team Member: Hazal Ayten and Pelin Toker

Research Advisor: Prof. Dr. Mesut Muyan

Abstract:

In our laboratory CXXC5 was identified as a transcription and epigenetic factor involved in cellular growth in ER-positive breast cancer cell lines. We observed that CXXC5 synthesis and degradation occur in a cell-cycle dependent manner and critical for the proliferation of cells. Furthermore, CXXC5 contributes to the initiation and progression of breast cancer. Our in-silico studies suggest that CXXC5 protein is subjected to ubiquitination which as one critical post-translational modification, primarily affecting protein half-life consequently protein function. In our studies aiming at the identification of putative CXXC5 protein partners using Proximity-Dependent Biotin Identification (BioID) assay found that CXXC5 may interact with TRIM25, TRIM33, USP15, and UBAP2L proteins, which are responsible in the processes of ubiquitination and deubiquitination of the proteins. To verify that TRIM25, TRIM33, USP15, and UBAP2L proteins are indeed involved in the ubiquitination/deubiqutination of CXXC5, we aimed here to clone open reading frames (ORFs) of these proteins to use them in the co-immunoprecipitation assay and investigate the putative interactions with the CXXC5.

Identification of Potential Proteins in the Ubiquitination/Deubiquitination of CXXC5

Name of the Project: Implementation of Peak Age of Information Control on IoT Networks

Field of Research: Communication Networks

Project Team Members: Anıl Kaya and İlhan Can Avcu

Project Supervisor: Prof. Dr. Elif Uysal

Abstract:

There are multiple ways to determine the freshness of the data in Internet of Things (IoT) networks. One of the most recent and mathematically tractable metrics for data freshness is Age of Information (AoI). AoI is the time elapsed since the generation of the latest generated packet currently present in the receiver. In this work, we realized a Peak AoI control algorithm on a physical IoT network in real-time. We have realized our control algorithm using MQTT protocol which is used frequently in IoT networks. This control mechanism allows the user to change the Peak Age of Information (PAoI) of the network before and during the data transmission operation. Thus, even devices like ESP8266 which suffers from high queuing delay in sampling periods under 50ms can be controlled to provide a data transmission with PAoI below 50ms.
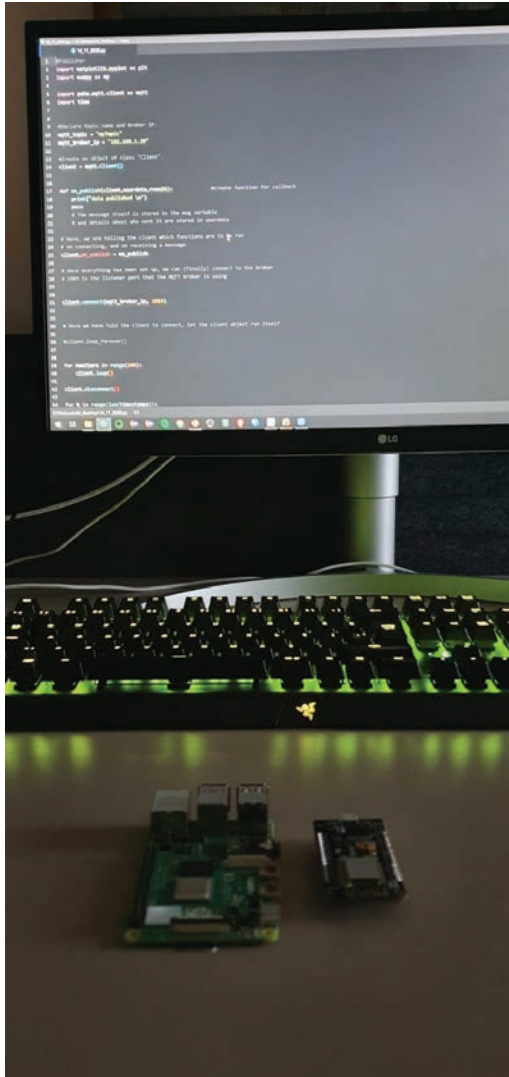
**Implementation of Peak Age of
Information Control on IoT Networks**

Name of the Project: Language Shift & Language Death: The Case of Crimean Tatar Language

Field of Research: Linguistics, Eco-linguistics, Ethnolinguistics

Project Team Members: Yiğit Can Akbay and İrem Naz Akkuş

Project Supervisor: Assist. Prof. Dr. Müge Gündüz

Abstract:

The study aims to examine discourses connected with the use of the Crimean Tatar language which is considered as an endangered language by UNESCO. Recently, the research interest in endangered languages have grown among researchers and many studies conducted to present what has been done and could be done to contribute to the maintenance of dying or disappearing languages. The study collected both quantitative and qualitative data from a diverse population (n=150). The research reflected on participants' opinions on the issue of language death and language maintenance. The study also revealed the extent that Crimean Tatar language is used as a means of communication in various social settings.

Language Shift and Language Death: Crimean Tatar Example

METU · adım ODTÜ

İrem Naz Akkuş, Yiğit Akbay, Assist. Prof. Dr. Müge GÜNDÜZ

December 24, 2020

ABSTRACT

The study aims to investigate the issue of language maintenance and the possibilities of language death prevention. Furthermore, we attempt to examine discourses connected with the use of the Crimean Tatar language which is considered as an endangered language by UNESCO. In the research, the age diversity of the participants will be taken into consideration. It is aimed to reach 150 participants from varying parts of Turkey. We want to focus on the attitudes of people towards the Crimean Tatar language. We want to investigate the potential of the Crimean Tatar language to be used as an effective tool in various areas of life. It is aimed to discuss the steps that need to be taken to protect the language's vitality.

Experimental Procedure

The first method of our project is the questionnaire. The questions in the questionnaire is prepared in the light of SEVQ (Subjective Ethnolinguistic Vitality Questionnaire). We are planning to reach 150 participants for the questionnaire. The second method is the semi-structured individual interviews planned to be done with Crimean Tatars and their institutions (like their associations). We want to learn our participants' ideas by conducting face-to-face interviews without channeling the participants to any particular answer. The questions we are planning to ask in the interview will be open-ended questions prepared in accordance with the steps of the EGIDS (Extended Graded Intergenerational Disruption Scale) method. As a result of this interview, we are planning to learn the Crimean Tatar participants' attitudes and its organizations to the Crimean Tatar language. At the same time, by learning which usage areas the language mostly used, the language stage will be tried to be determined according to the EGIDS method. We are planning to reach at least 15 participants for the interview. The other activity of our project is focus group discussions. By using these three methods, we try to gather in-depth information. We want to have a focus group discussion with participants from different age groups bacause we think that different generations' attitudes to the Crimean Tatar language will change. By

Results and Conclusions

Sixty-five participants have completed the questionnaire so far. There are equal participants of all age groups. In light of the information we have reached, no impressive age-based difference could be observed. Until now, ten people have been interviewed, and participants from all age groups have been reached, and no difference based on age has been observed.

As a result of the surveys and interviews conducted, it is concluded that the upper generations use the language frequently in their daily lives and most of them speak the Crimean Tatar language more than Turkish. On the contrary, the same cannot be said for younger generations and middle age group. Although most of them have no difficulty in understanding, they are limited to a few words in terms of using the language. In addition, some participants stated that although they used the language with their relatives or other Crimean Tatar friends, they did not use it effectively in daily life. The number of people who think that the Crimean Tatar language is endangered is quite high. When we asked the reason, they stated the following reasons: after the forced migration in 1944, Crimean Tatars were scattered over vast geography, the Crimean Tatar language is not used in cultural and scientific studies, and they tend to use Turkish. When asked in which areas the language was used, we obtained the following results: it was never used in commerce, health, shopping, or official institutions. Therefore, it was only spoken at home. Furthermore, participants were asked whether the Crimean Tatar language reminded an ethnic community's heritage identity, all participants perceive their language and culture as a heritage and as a result, more than a symbolic competence.
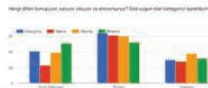
When the participants were asked how well they knew the Crimean Tatar language based on their perception, the results show that the majority did not have any difficulties understanding the language, and a similar number of them did not have trouble speaking. However, it can be said that fewer participants have mastered the Crimean Tatar language in reading and writing. This deficiency can be shown as learning the language by hearing from their own families at home, not receiving education in this language in any institution. In the interview, it was observed that most of the participants did not have problems understanding the language, but more than half of them could not go beyond a few words while speaking and writing the language. When asked the reason for this, they stated that they did not have the opportunity to speak after learning the language at home and that they were not exposed to the language sufficiently. Besides, they stated that although some families encourage speaking the Crimean Tatar language at home, many families deliberately kept away their children from the Crimean Tatar language to avoid having difficulties in education because the language of education is

level has not been reached yet. As a result of the interviews with several associations, it was seen that the associations opened their own courses in order to compensate for this deficiency and even continue their education online during the pandemic process.

Figure 2 shows whether Crimean Tatar language is taught in schools

As seen in Figure 3, the participants find the use of the Crimean Tatar language in the media insufficient. The results of the interviews support this argument. In response to the question of how often do you use Crimean Tatar media organs, the participants stated that the number of radio, television or magazines to follow has decreased. Besides, publications lack the original content and they fall into repetition. Many people said that they became distanced from the Crimean Tatar language and culture for this reason.

Figure 3 shows how well the Crimean Tatar language again represented through media

In this study, the endangered Crimean Tatar language is examined in terms of how the speakers of the language perceive their language. The data is analyzed in the light of ecolinguistics with the help of concepts such as; endangered languages, language death, ethnolinguistics vitality, and language maintenance. The paper mainly focused on the attitudes of the people towards the Crimean Tatar language. In light of the questionnaire and interviews conducted so far, it can be said that the Crimean Tatar language has faced many obstacles in the transfer of the older generations to the younger generation. The fact that the language is not used in education, official institutions, and business shows that the language is stuck at home. Most people, with the exception of the upper generation, speak the Crimean Tatar language only with their relatives or Crimean Tatar friends, and many of their conversations are only limited to a few words. In addition, the decrease in the number of media sources made in the Crimean Tatar language over time can be shown among the reasons for the endangerment of the language. Their perspective on their own identity and culture shows that they embrace their Crimean Tatar identity. Although

İrem Naz Akkuş · Yiğit Can AKBAY
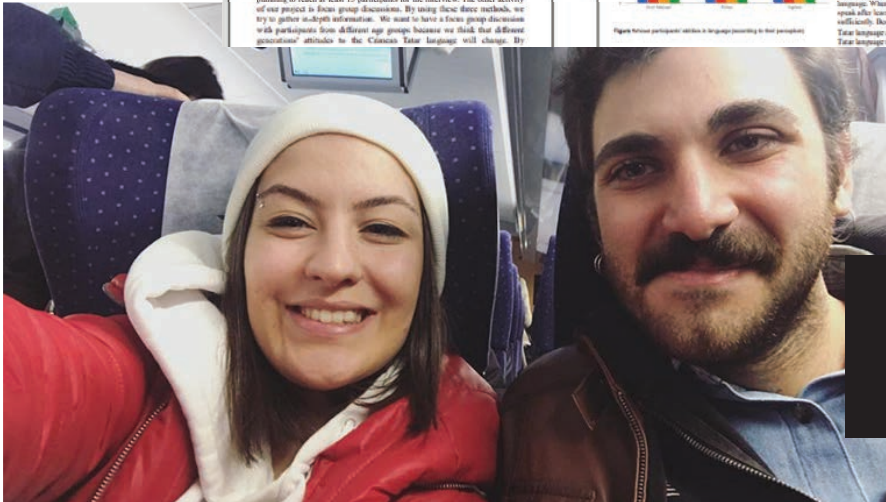
Language Shift & Language Death: The Case of Crimean Tatar Language

Name of the Project: Local and Targeted Drug Delivery Systems for the Treatment of Glioblastoma

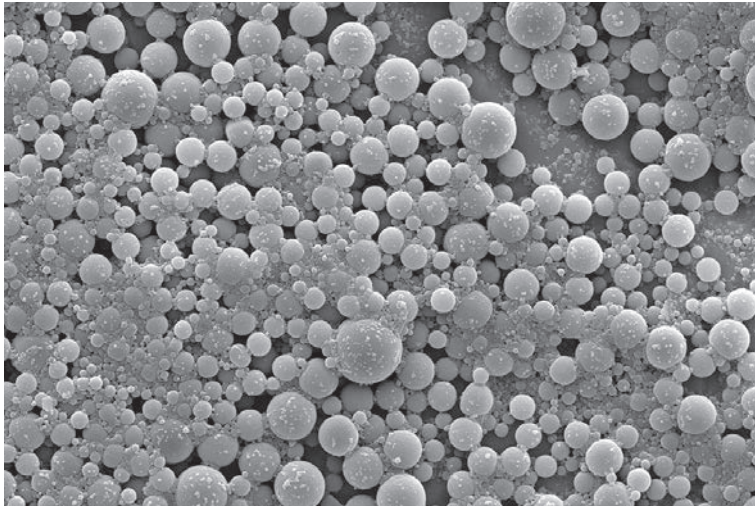**Field of Research:** Biotechnology, Tissue Engineering and Biomaterials

Project Team Members: Özlem Neyişci and Gülce Işıl Gökçe

**Project Supervisor:** Prof. Dr. Vasıf Hasırcı and Dr. Tuğba Dursun Usal

Abstract:

Glioblastoma multiforme (GBM) is a type of primary brain tumor that is the most common, aggressive spread among adults and causes critical decreases in life span. The most preferred treatment method for this type of tumor is to take the mass formed by surgical intervention followed by chemotherapy. However, in these types of treatments, many side effects are observed in the patient from both the lesion and the systemic side effects of the chemotherapy drugs used. This project aims to create a targeted and local drug delivery system based on improving the existing treatment routes and prevent the side effects of the most common treatments. For this purpose, a PLGA (LA: GA molar ratio 82:18) sponge embedded with PLGA nanospheres will be used as the local delivery system. The nanospheres will encapsulate an anticancer drug, Temozolomide (TMZ) and will be tagged with nuclear localization signal (NLS) to target tumor cells.
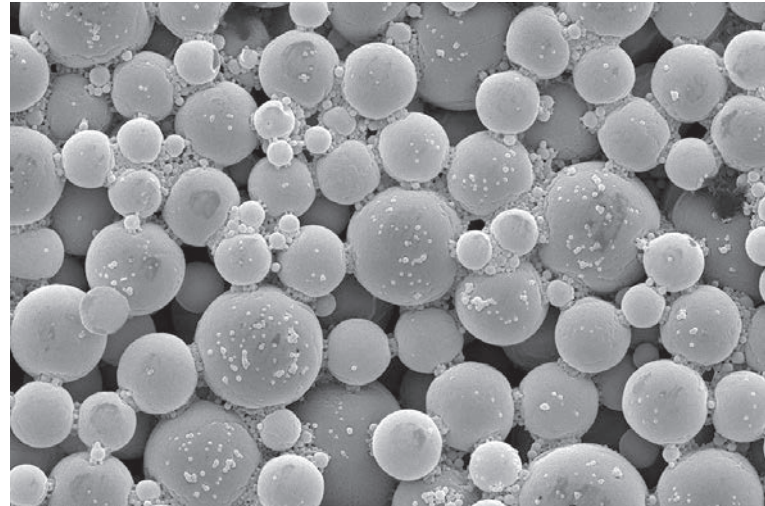
Local and Targeted Drug Delivery Systems for the Treatment of Glioblastoma
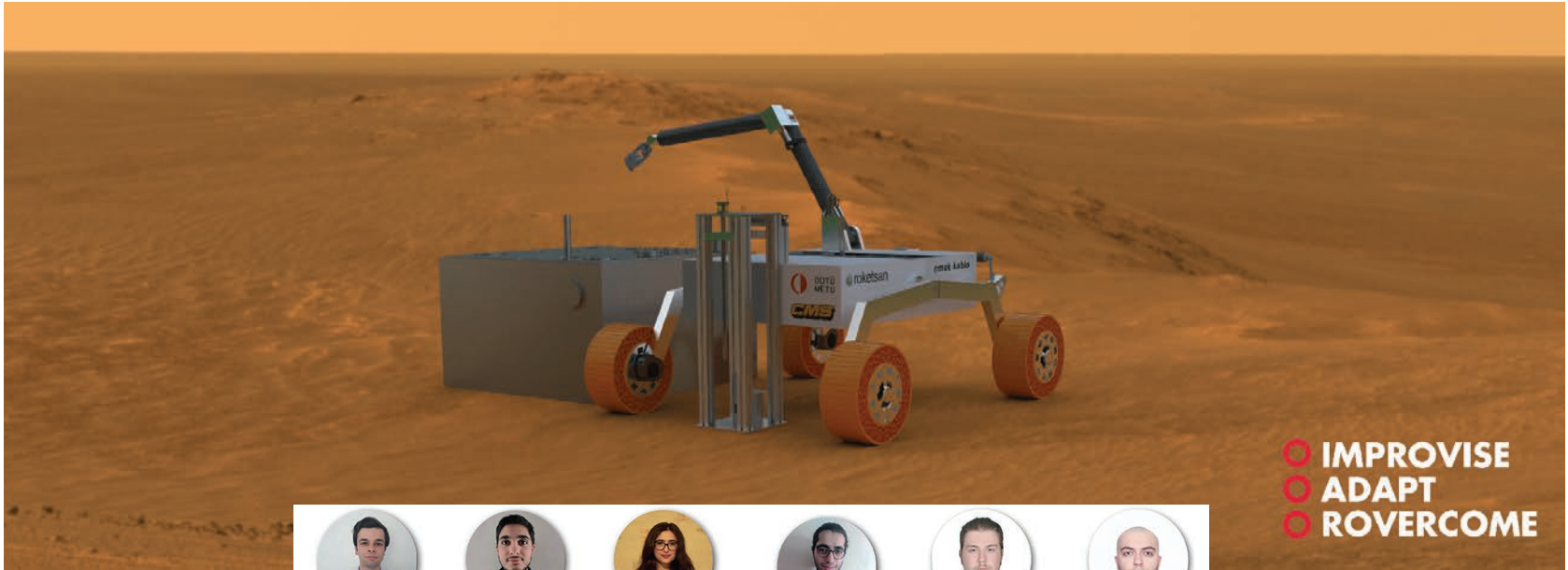
Name of the Project: METU ROVER

Field of Research: Space and Robotics

Project Team Members: Arda Özarslan, Güven Öner, Alptuğ Öztaşkın, Ahmet Altuğ Çiçekdağı, Furkan Kaan Çelik, Mahmut Bahadır Özbek, Arda Kaya, Öykü Çise Şahintaş, Rufat Bayramov, Evren Uçar, Taha Tolga Saadet, Abdulkadir Sarıtepe, Rabia Öztopal, Onur Karakoç, Adnan Harun Doğan, Cafer Selli, Mert Saadet, Tayyip Öztürk, Yusuf Onat Yılmaz, Alev Ayaz, Aysima Beril Baydar, Kaan Dere, Ceren Yıldız, Evrim Tunç Topuz, Bartu Yaman, Berk Ünlü and Ceren Özüçelik

Project Supervisor: Assoc. Prof. Ahmet Buğra Koku

Abstract:

In this project, a planetary exploration vehicle which has the capability of taking soil sample and analyzing sample onboard, performing maintenance operations on an electric panel, geo-locating and navigating autonomously, collecting and delivering predefined objects from the ground is to be designed and manufactured. The workload is divided into five sub-teams regarding the field of study of the competition tasks, and the working plan consists of five steps which are plan/research, design, manufacture, integrate, and test. As a result of these studies, the project team aims to compete in international rover challenges held in various countries.

IMPROVISE
ADAPT
ROVERCOME

METU
ROVER

METU ROVER

Name of the Project: Optimization of Transparent ZincOxide Electron Transport Layer on Lead Selenide Nanorods Based Solar Cells

Field of Research: Chemistry

Project Team Members: Bensu Balıkoğlu and Firdevs Aydın

Project Supervisor: Assist. Prof. Dr. Demet Asil Alptekin

Abstract:

Artificial atoms (Quantum dots) are being investigated because of their beneficial optical and electrical properties such as band gap tunability, multiple exciton generation (MEG) and strong absorption over a broad wavelength range. Quantum dot solar cells are being developed with the aim of harnessing solar energy in a more efficient manner than silicon solar cells by exceeding the Shockley- Queisser limit which is 33 % power conversion efficiency (PCE) at 1 sun condition. Advances in quantum dot based solar cells in the last 5 to 10 years have led to a rapid increase in PCE. Up to now, researches have reached 12% PCE by optimizing the cell architecture, electron/hole transport layer or the absorbing quantum dot layer. In this most efficient cell architecture, transparent zinc oxide (ZnO) nanoparticles (NP) were used as an electron transport layer (ETL). In this project, using QDs advantages provides to exceed the theoretical limits by optimizing the ZnO ETL in quantum dot solar cells with various cell architectures. Throughout the project the plan is optimizing the synthesis conditions for ZnO nanoparticles, obtain thin films with correct morphology and conductivity.
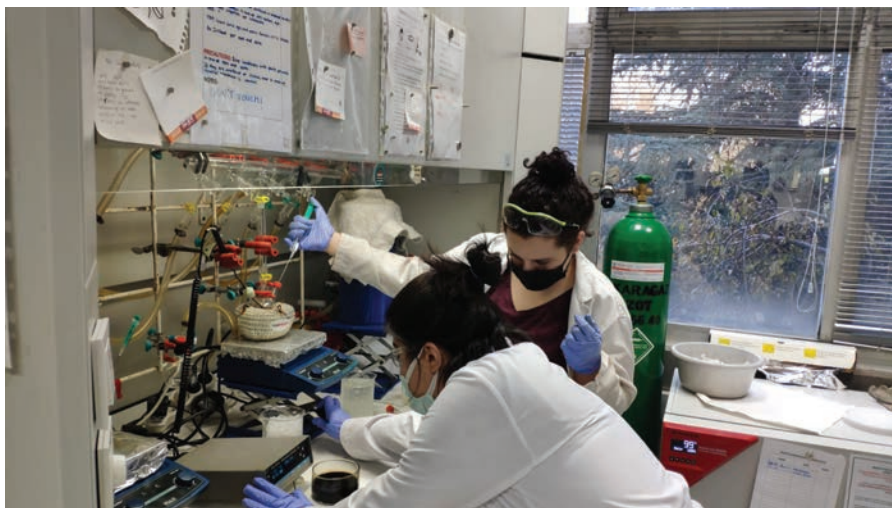
Optimization of Transparent ZincOxide Electron Transport Layer on Lead Selenide Nanorods Based Solar Cells

Name of the Project: Regenerated Cellulose Membranes for Organic Solvent Nanofiltration

Field of Research: Membrane Science and Technology, Chemical Engineering

Project Team Members: Onur Kaan Aydın

Project Supervisor: Assoc. Prof. Dr. Pınar Zeynep Çulfaz Emecen

Abstract:

Nanofiltration is a membrane filtration process where the fluid is forced through a membrane with extremely fine pores. Non-thermal solvent recovery and purification is possible with this method, where the crude or contaminated solvent is filtered through a suitable membrane. The two main advantages are: no heating or cooling is required which saves a lot of energy and makes nanofiltration cost effective; large volumes can be continuously processed to yield streams of products. For nanofiltration of organic solvents, the membrane material has to be insoluble in the solvent. Our material choice is cellulose, the most abundant and perhaps the most studied polymer. Cellulose membranes are made by hydrolyzing membranes cast from cellulose acetate. In our previous experiments we saw that the nanofiltration performance declined during the hydrolysis step. In this project reasons for this decline were addressed and the hydrolysis step was modified accordingly to yield high performance membranes.
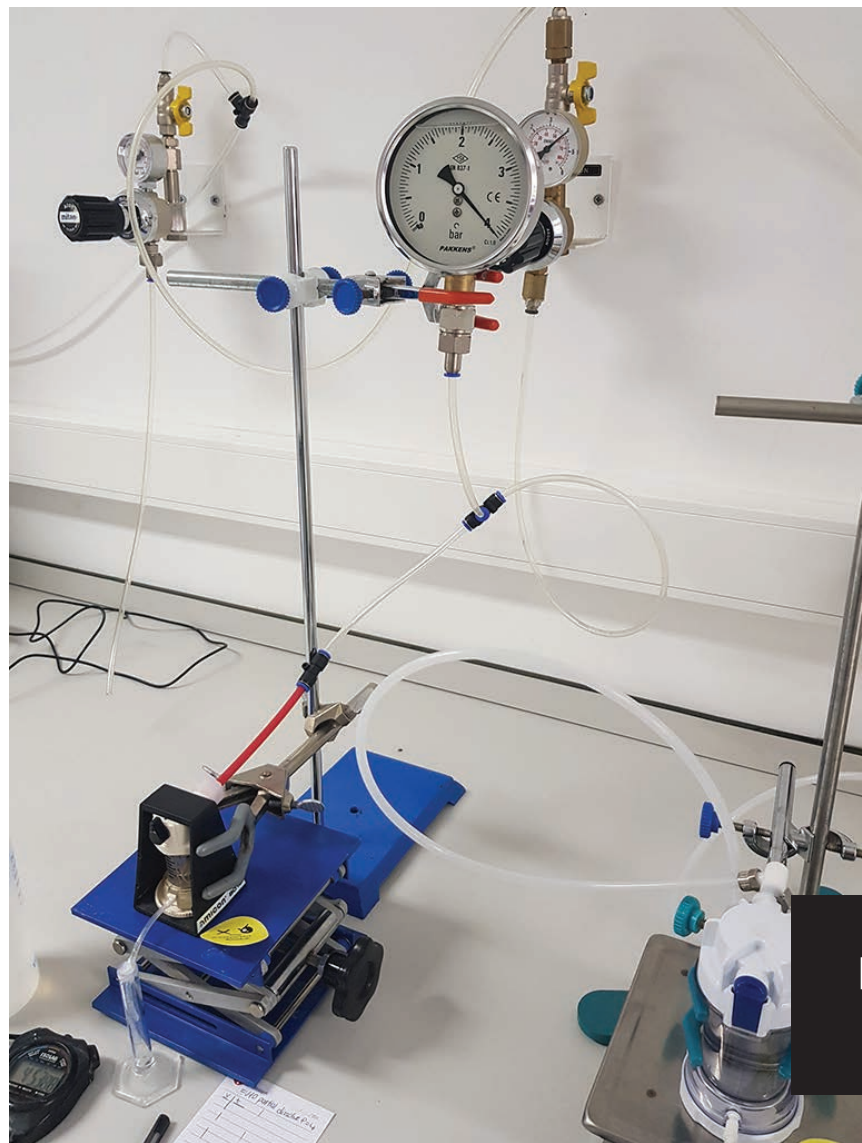
Regenerated Cellulose Membranes for Organic Solvent Nanofiltration

Name of the Project: Synthesis of Near-IR Absorbing Selenophe Containing Bodipy Derivative as Mitochondria Targeted Photodynamic Therapy Agent

Field of Research: Chemistry

Project Team Members: Çağlayan Kızıleniş and Osman Karaman

Project Supervisor: Assoc. Prof. Dr. Görkem Günbaş

Abstract:

Novel, selenophene-containing, mitochondria-targeting and water soluble BODIPY derivative is desgined for efficient PDT activity. It was envisioned that the introduction of 2-acetylselenophene ring to BODIPY core would shift the absorption maxima to near-IR (NIR) more than the halogen introduced analogue does, and also it would provide efficient singlet oxygen generation due to high spin orbit coupling constant of selenium atom. In addition, with offering an extra site for halogenation, selenophene derivatives have the potential to enhance singlet oxygen generation. Besides high singlet oxygen generation at red/NIR region, proper drug delivery to tumor cells and organelle targeting were considered. Overcoming both issues with one single modification is aimed.

Synthesis of Near-IR Absorbing Selenophe Containing Bodipy Derivative as Mitochondria Targeted Photodynamic Therapy Agent

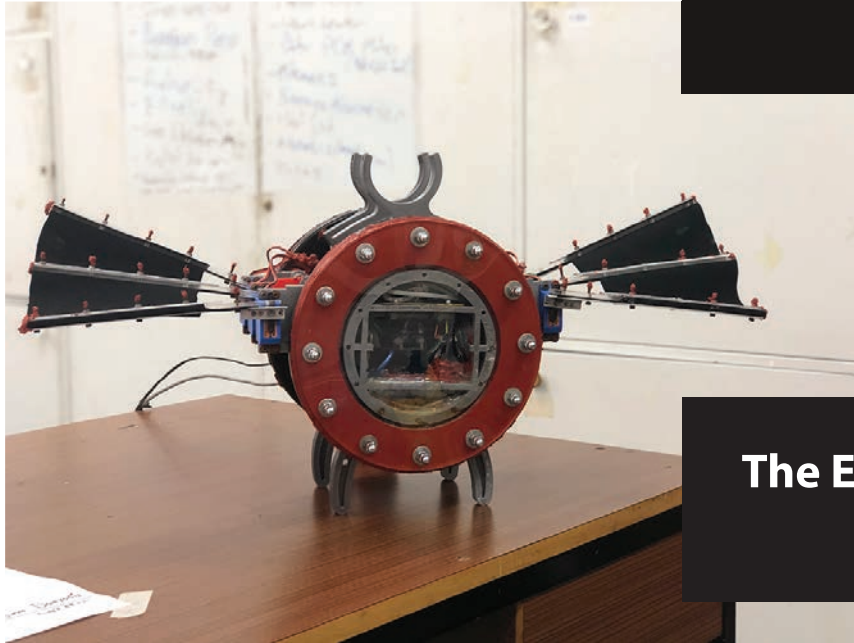## Name of the Project: The Effects of Mutually Opposing Forces on Propulsion of Underwater Vehicles

Field of Research: Bioinspired Robotics

Project Team Members: Atakan Durmaz, Furkan Kazanç, Firdevs Su Aydın, Mustafa Akbaba, Merve Nur Zembil, Aybars Ağaya, Berkay Kılıç, Ecem Layra Görk, Selin Ezgi Özcan, Bengisu Deniz, Enes Ata Ünsal, Adem Deniz Pişkin, Ahmet Bedirhan Şen, Demet Tangolar and Altay Ateş

Project Supervisor: Assist. Prof. Dr. Mustafa Mert Ankaralı

Abstract:
In this project, it is aimed to examine the effect of mutually opposing forces on propulsion of underwater vehicles. Moreover, a robot, which can perform simple but time-consuming tasks hard to performed by divers, will set an example for academic resources in our country. This robot will also be a security system for solo divers, which will protect the distance with the diver and give alarm to surface in an emergency case. Nautilius, whose mechanical structure is found out, is expected to become more autonomous with mapping and object avoidance techniques soon.
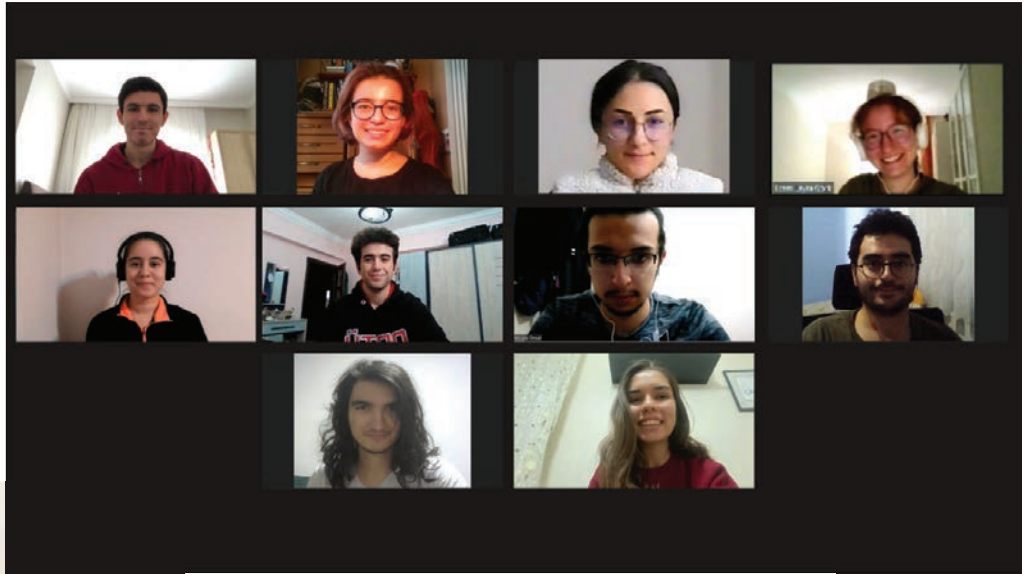
The Effects of Mutually Opposing Forces on Propulsion of Underwater Vehicles

Name of the Project: Treatment of Domestic Wastewater with an Anaerobic Fluidized Bed Membrane Bioreactor (AFMBR)

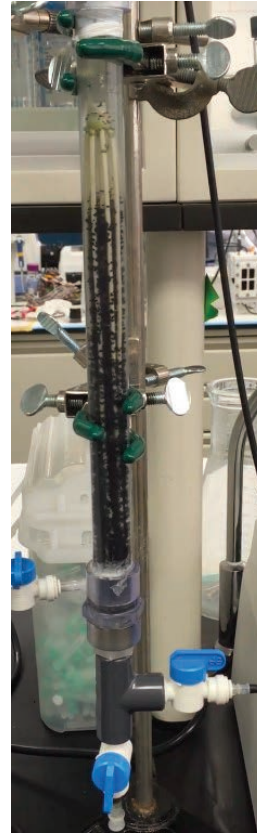**Field of Research:** Wastewater Treatment Technologies

Project Team Members: Yeşim Kutluata, Berivan Tunca, Feride Ece Kutlar and Mustafa Yavuz Taş

Project Supervisor: Assist. Prof. Dr. Yasemin Dilşad Yılmazel Tokel

Abstract:

In order to bring a new sustainable perspective to wastewater treatment, anaerobic systems were developed. For make it possible to treat low strength wastewaters with anaerobic systems which has many advantageous over aerobic one a novel anaerobic fluidized bed membrane bioreactor (AFMBR) has been introduced. AFMBR is a system that combines anaerobic treatment with membrane bioreactor, with such reactor configuration, washout problems are solved and effluents with high quality that can be used for irrigation purposes even under low temperatures as 10⬚ can be obtained. In this study, treatment of domestic wastewater in terms of COD and TSS removal under room temperature will be investigated. To prevent membrane fouling, GAC particles are used as fluidization medium which also provides a surface for microorganisms to acclimate on.

Treatment of Domestic Wastewater with an Anaerobic Fluidized Bed Membrane Bioreactor (AFMBR)

Name of the Project: TULPAR UAV

Field of Research: Unmanned Air Vehicles

Project Team Members: Enfal Çabuk, Barış Akış, Eren Tekelioğlu and Mehmet Utku Düzen

Project Supervisor: Assist. Prof. Dr. Ali Türker Kutay

Abstract:

As Tulpar UAV Team, our primary mission and motivation is to develop UAV's which can be modified easily, thus can adapt to different environments. We want our UAV's to be fully autonomous. In order to achieve that, we are focusing on cutting-edge autonomous flight and computer vision technologies. We are trying to develop a UAV that both can be used with mapping and object tracking purposes as our latest model: ATMACA. To design ATMACA, we developed different prototypes and observed their effectiveness. We examined different professional models as well. For computer vision, we used Python/OpenCV platforms and the YOLO-V3 algorithm. We collected our own dataset and trained our ML model. We are using the PX4 flight computer and the ArduPilot software.

TULPAR UAV

We would like to express out deep gratitude for all METU alumni and
friends for their valuable support.

https://adimodtu.org.tr/projeler

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