Developing Serum Protein Biosensors for Tumor Monitoring in Thyroid Carcinoma

Bozan, Melek Ceyda (School: Sehit Prof. Dr. Ilhan Varank Bilim ve Sanat Merkezi)
Orencik, Aytunc (School: Sehit Prof. Dr. Ilhan Varank Bilim ve Sanat Merkezi)

Thyroid cancer (TC) is the fastest-growing cancer worldwide, with non-cancerous thyroid tumors affecting 60% of the population. Current methods for detecting TC are often radioactive or highly invasive and, due to the thyroid's critical location and the nature of the cancerous follicular cells, have a staggering error margin. In hopes of reversing this, the use of serum protein markers to assess tumor malignancy and progression is gaining attention, yet their role in treatment is not well established. Therefore, this study aims to develop a biosensor for robustly detecting gal-3 as a new biomarker to enhance the validity of existing TC biomarkers like Tg and create a program for integrating gal-3 data with other serum proteins in tumor monitoring. For biosensor development, a molecularly imprinted carbon electrode was used. Its performance was tested first in standard solution and then on blood samples from cancer and non-cancerous patients using ELISA as a reference. Next, an AI-supported tool to assess cancer and progression was trained on the study sample's biosensor gal-3 and ELISA Tg values with existing patient datasets. At the end of the experiments, both a sensor that accurately measures a wide range of gal-3 concentrations and aligns with both ELISA and Tg data, and a program achieving >99% precision in distinguishing tumor malignancy and stages 1 and 2 cancer emerged. Ultimately, the research revealed promising outcomes for accessible and reliable tumor and treatment monitoring both in hospitals and at home, leading to a novel product design for the global biomedical market.

Awards Won: