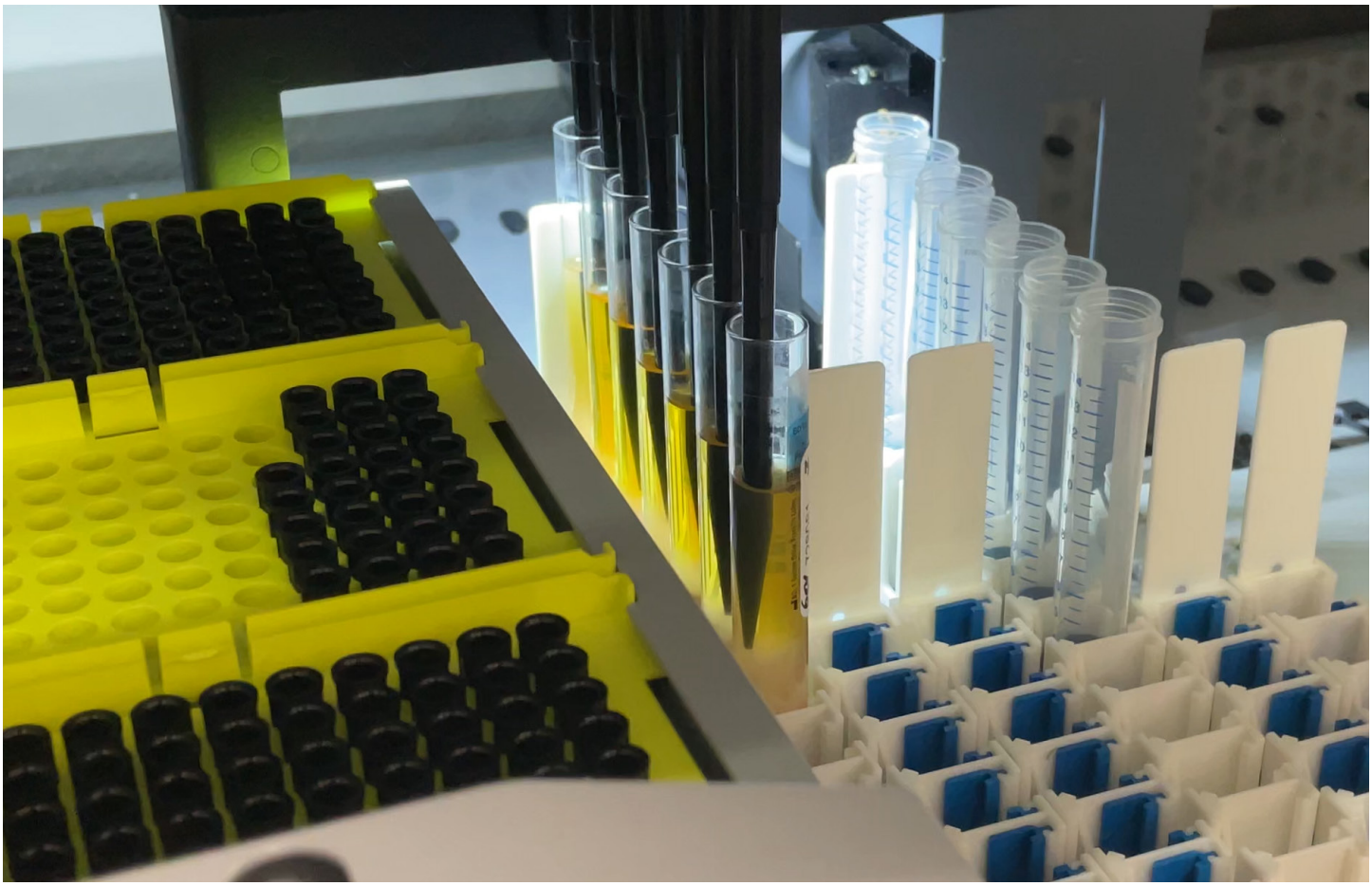
CASE STUDY: VIABLE PBMC ISOLATION USING TUBEEYE AT PROJECT 10K

Learn how an innovative study is automating blood sample processing for biobanking



Imaging & analysis of the CPT tubes takes approximately 2 seconds per tube

Project 10K is a long-term observational study designed to gather information on lifestyle and health in Israeli population. This study uses advanced and innovative techniques to personally characterize a unique group of 10,000 people in Israel.

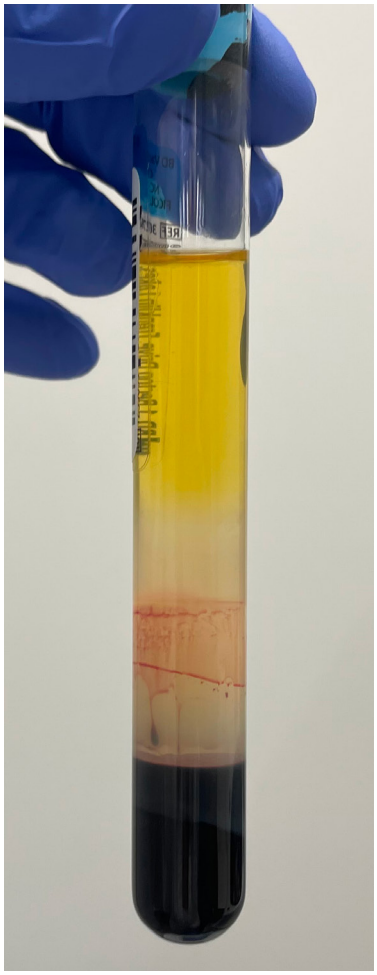
"We monitor the population of subjects over time in order to find a correlation between exposure to certain factors and the onset of diseases." explains Prof. Eran Segal from the Weizmann Institute of Science who is leading a team of interdisciplinary scientists with expertise in medicine, biology and artificial intelligence that are working on this project.

"A major challenge that we had to address was the need for accurate blood fractionation and extraction of PBMC, plasma and serum from the primary tubes. Peripheral blood mononuclear cells (PBMC) contain the adaptive B and T cells which are important to get a clear picture of the immune system of the subject. However, they comprise a small percentage of the white blood cells. Therefore, isolating PBMC and keeping them viable has been a major goal of the project and it was clear that an automated protocol had to be developed. In such biobank cohorts, automation is essential also for keeping the accuracy and reliability of sample tracking throughout the journey of the blood sample from the participant to the freezers" says Dr Adina Weinberger who leads the multi-omics efforts for Project 10K.

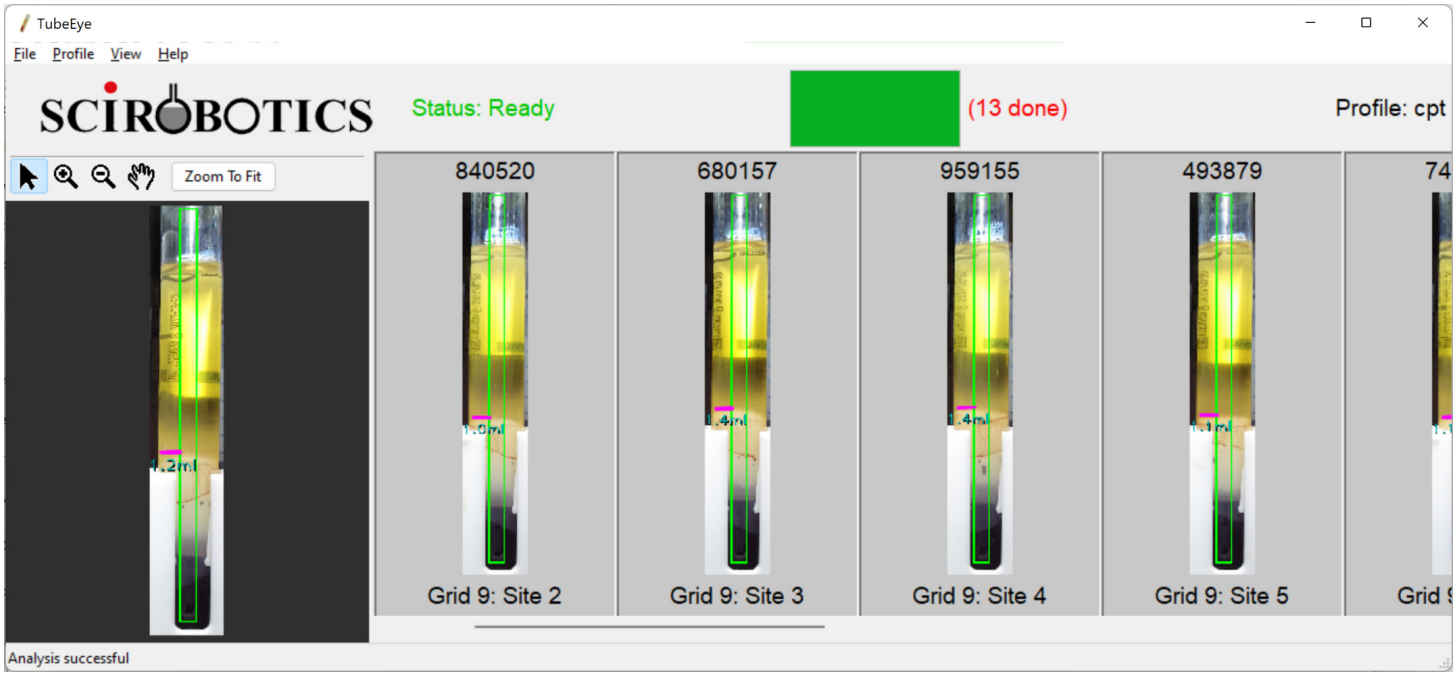
In order to automate blood samples processing Project 10K Lab is using a Tecan Evo liquid-handler equipped with SciRobotics TubeEye. TubeEye is a computer vision-based blood fractionation solution that enables automated PBMC, plasma and serum extraction. The Lab has been using the TubeEye solution for the last 2 years and has processed over 12K blood samples during this time. Moreover, testing shows viability of collected cells to be greater than 95% on average.

"We have selected the TubeEye solution as it provides the accuracy and flexibility to handle diverse types of tubes and extraction protocols."

For PBMC extraction the lab is using CPT tubes, which include a gel separation layer as well as a transparent Ficoll layer and anti-clot reagents. Following the addition of the raw blood sample, the CPT tubes are centrifuged, and the blood sample is separated into several layers. The red blood cells are at the bottom of the tube separated by the gel from the rest of the sample. Above the gel, we have the transparent layer of Ficoll in which the PBMC (white blood cells) forms a cloudy layer. Finally, at the top of the tube above the Ficoll, we have the plasma layer.



CPT tube after centrifugation. PBMC layer shows as a cloudy region below the plasma.



TubeEye identifies the height of the gel and uses that to calculate where to collect the PBMC

To process the tubes, they are placed on the Tecan EVO where they are imaged by the TubeEye camera. The software keeps a record of each tube, and the images are automatically analyzed by the software to identify the position and volume of each layer.

The user confirms the analysis, and the software then guides the liquid-handler pipette to extract the PBMC layer in a way that is adapted to each blood sample, increasing the yield and the viability of the collected fractions. Finally, the liquid handler also collects the plasma layer from the same CPT tube.

The lab also uses the CAT tubes to extract blood serum that includes other materials of interest. This type of tube has a different layer structure. "We use the TubeEye software to build the right image analysis profile for every type of tube we are using and thus easily automate the desired extraction process" explains Dr. Weinberger.

"Automation solutions such as the TubeEye and others enable us to streamline the experimental data collection on personal health status. We then perform multi-omics analysis such as serum metabolomics, antibodies profiling, and PBMCs transcriptomics on these samples and combine these data with a series of questionnaires and medical examinations of the participants. The entire data set is then processed using sophisticated artificial intelligence tools and we are looking forward to new scientific discoveries that will emerge from this project and eventually help to improve the quality of life and longevity of each and every one of us" summarizes Dr. Weinberger the vision of project 10K.