THERE WILL BE NO LABORATORIES IN THE FUTURE AS WE KNOW NOW

DR ÖMER GÜZEL

21 OCTOBER 2022

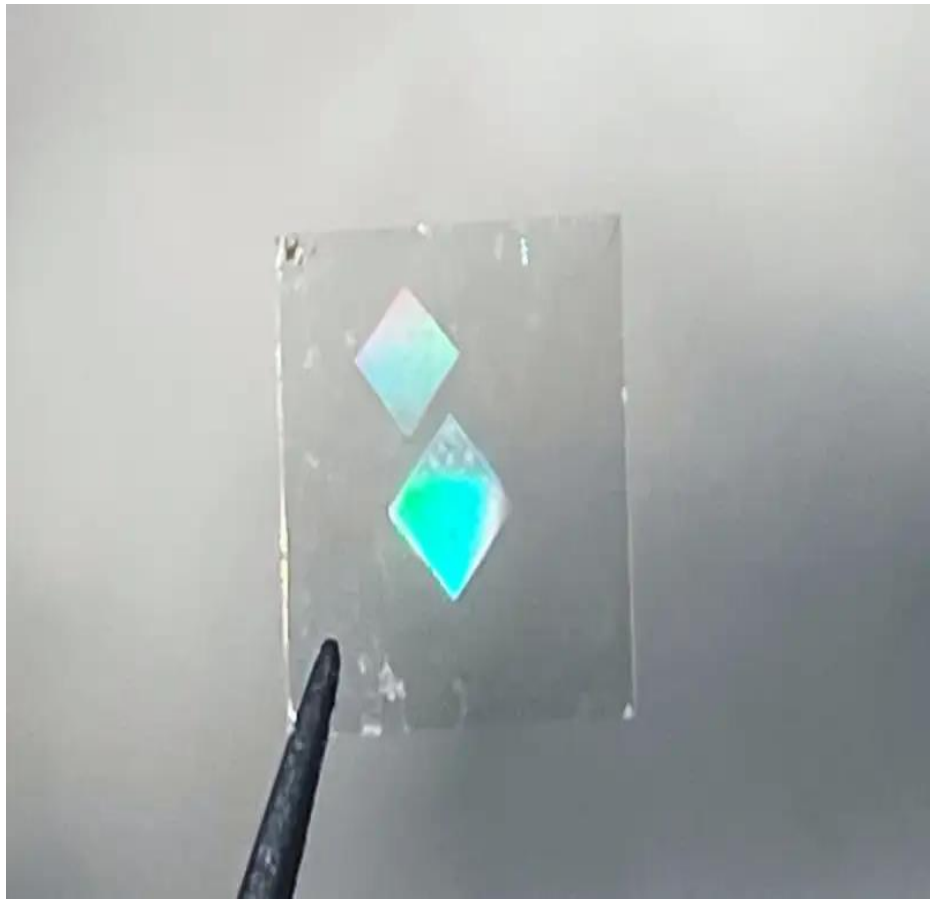
ISTANBUL

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories

Tiny chip can quickly identify hundreds of thousands of DNA sequences

.



A metamaterial that can detect a huge array of gene fragments within **5 minutes** could lead to devices for **medical diagnostics** or **environmental monitoring**

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories

Next-Generation Sequencing
Bioinformatics Pipelines

Next-generation sequencing (NGS)-based molecular tests have **revolutionized the practice of medicine** with the ability to **personalize diagnosis, risk assessment, and treatment of patients** with cancer and non-neoplastic disorders.

Given the vast amounts of quantitative and complex sequencing data generated by high-throughput sequencers, clinical laboratories rely on resource-intensive data processing pipelines to analyze data and identify genetic alterations of clinical relevance.

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories

Next-Generation Sequencing

Bioinformatics Pipelines

Bioinformatics, specifically in the context of genomics and molecular pathology, uses computational, mathematical, and statistical tools to collect, organize, and analyze large and complex genetic sequencing data and related biological data.

A set of bioinformatics **algorithms**, when executed in a predefined sequence to process NGS data, is collectively referred to as a bioinformatics pipeline .

NGS generates **several million to billion** short-read sequences of the DNA and RNA isolated from a sample.

Finally, the downstream bioinformatics analysis for DNA sequence variants involves queries across multiple genomic databases to extract meaningful information about gene and variant nomenclature, variant prevalence, functional impact, and assertion of clinical significance.

cloud computing and Cloud Laboratories

Cloud computing makes numerous IT resources available to a user, without the requirement for direct management or hosting by an operator. It also enables data transfer and storage without the need for human-to-human or human to-computer interaction

Centralized task force: If the cloud system is run inhouse, independent staff in each separate geographical laboratory/data storage location can be merged into one team to reduce IT spending in global companies.

Better accessibility and traceability of data:

Access and storage of large data sets: The physical storage of large amounts of data can be expensive. The cloud offers companies a large virtual data repository.

On-demand and scalable resources: Laboratories can purchase additional resources when needed, this can include end-user licenses, additional storage and features for applications.

Fast implementation: Installation of the cloud takes less time than on-site applications.

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories
turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

Automation

Automation helps manage bioinformatics resources and workflows and streamlines day-to-day bioinformatics operations.

The life-cycle of pipeline development, from testing and deployment to production infrastructure, is a complicated task.

A laboratory must revalidate any upgrades to its pipeline to prevent unintended effects on test results. This manual testing and validation is time-consuming and, in some instances, inconsistent. The advantages of automation include more thorough and consistent enforcement of validation policies, regular testing and validation of pipeline upgrades, standardized version control, codebase integration, and proper documentation of audit trails for regulatory compliance.

The Role of Conformity Assessment in the Digital Transformation:

Cybersecurity

Digital transformation and especially the dramatic rise of products and services connected to the Internet of Things raise the questions on how to deal with the increasing risks related to Privacy and Cybersecurity.

HIMSS (Healthcare Information and Management Systems Society)

Cybersecurity in healthcare involves the protecting of electronic information and assets from unauthorized access, use and disclosure. There are three goals of cybersecurity: **protecting the confidentiality, integrity and availability of information**

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories

Why We Need Cybersecurity Standards

Creating standards for cybersecurity is particularly important as the world becomes increasingly digitally connected

Manufacturers of Laboratory devices are responsible for ensuring that customer data stored on or transmitted by their devices.

- (1) interoperability between devices from different manufacturers,
- (2) ease-of-communication by developing a language for how to evaluate and measure device quality,
- (3) consumer protection by ensuring that people are able to use any device with the same minimum level of “safety, durability, and market equity,”

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories

Technology Trends in the Environmental Testing Laboratory

Environmental testing laboratories provide a critical service to **public health and our surrounding environment**.

Many different analyses can be performed, including **chemical, radiological, genetic and microbiological**, on a wide array of environmental samples and matrices

COVID-19, we have witnessed an unprecedented global effort to develop novel therapeutics as well as detection and monitoring protocols. This has highlighted the need for centralized data, to facilitate scientific collaboration and harness the power of **machine learning (ML)** and **artificial intelligence (AI)** .

Future technology trends shall enable testing laboratories

to adapt to predicted and unforeseen future issues.

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories

Artificial intelligence (AI) and Machine Learning (ML) in the lab

In laboratories around the world,
AI is being paired with **robotic** and **automated technologies** to expand the scope of science
ML and hypothesis generation to improve **experimental design and data analysis**.

AI produces **fewer errors and biases** than humans.

This has resulted in successful implementation into environmental testing protocols.

AI has been used in mineralogical composition prediction, which, combined with simple infrared spectrophotometry testing can reduce the testing to a fraction of the cost

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories

Coming soon:
Green New Deals

my green lab certification.

The first credential of its kind developed to offer scientists an opportunity to grow their knowledge and demonstrate their expertise in lab sustainability

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

CEEL

The Center for Energy Efficient Laboratories (CEEL) conducts research into energy-efficiency opportunities for laboratory equipment

green chemistry.

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories

Building a Global Culture of Sustainability

5 ways to make a laboratory more sustainable in the future

1. Reduce energy consumption and conserve resources
2. Improve waste management
3. Take care of equipment
4. Optimize processes
5. Incorporate sustainability in culture

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories

Near Future of Accreditation

- cloud laboratory
- bioinformatic pipelines
- digital transformation
- blockchain
- molecular testing
- automation
  - industry 4.0
  - dark laboratories; no working staff
- **unpredictable future**

eurolab aisbl
European Federation of National Associations of Measurement, Testing and Analytical Laboratories

turklab
Kalibrasyon ve Deney Laboratuvarları Derneği


Thank you