



SYSTEMS INTEGRATION AND POINT OF CARE DEVICES

INTRODUCTION

Human and animal health are currently in a transition, where evidence-based rapid therapeutic intervention and self-monitoring for lifestyle optimisation are on the rise. Diagnostic technology will be provided at the time and place where it is needed. The key driver for this development are point of care (POC) devices providing decentralized rapid testing. Those systems depend on miniaturised and automated processes with superior analytical performance, enabling earlier and more accurate disease detection and prevention. AIT has profound expertise in the whole analysis chain ranging from sample preparation, biomarkers, assays, biosensors, microfluidics, process control and data analysis towards the overall POC instrument. This system know-how enables us to develop single analysis modules, provide content for external POC platforms and to integrate all components into fully functional devices providing simple, fast and user-friendly operation. This will enable rapid diagnostic answers directly at the patient or animal and empower health professionals for better, targeted and personalised treatment. In addition, POC technology drives self-monitoring for lifestyle optimisation enabling early detection and prevention of disease. Overall the diagnostic knowledge will be democratised leading to significantly improved human and animal health.

RESEARCH SERVICES

- Development of POC-compatible sample preparation methods with minimal handling steps based on enzymatic, thermal, chemical, mechanical and electrical lysis
- POC-compatible assay design based on in-silico verification
- POC-compatible assay development and process definition providing:
 - // Rapid DNA, RNA, protein and metabolite analysis
 - // Simple operation protocols and minimal user intervention
 - // Reagent storage and small reaction volumes
 - // Compact dimensions of analysis cartridges and device
- Assay transfer to POC platforms including optimisation
- Integration of external technologies with AIT's know-how
 - // Combination of sample preparation, biosensors and biochemical assays
- Automation of analysis protocols with customised processing instruments
- Development of quality control concepts for: analyte extraction, process efficiency and measurement efficiency
- Development of point-of-care cartridges, systems and demonstrators
- Validation of POC systems (in cooperation with clinical partners in human and veterinary medicine)

CORE COMPETENCES AND TECHNOLOGIES

- Acceleration of existing sample preparation protocols based on enzymatic or mechanical methods
- Selective electrical cell lysis
- In-silico assay design for DNA/RNA-based pathogen detection and antimicrobial resistance testing
- Development and optimization of RNA, DNA, protein and metabolite assays towards POC-compatibility using qPCR/PCR, ELISA and enzymatic assay technologies
- Transfer of existing assays to POC platforms including adaptation and optimisation
- Reagent storage and handling on POC systems
- Process control and automation of extraction and measuring protocols
- Design and development of extraction and assay controls (e.g. extraction control with specifically selected microorganisms)
- Design and prototyping of microfluidic chips and cartridges in polymer substrates (micromilling)



POC APPLICATION EXAMPLES

- Infectious disease diagnostics and antibiotic resistance testing in human and veterinary field
- Metabolic monitoring
- Respiratory infection diagnostics for general practitioners
- Bedside immunmonitoring of inflammation markers
- Oral disease monitoring for dentists
- Monitoring of nutrition and stress parameters for individuals



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