"Smart, Active Micro-devices for Coordinating and Performing the Sample Workflow - Hyphenating the Technology"

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The task of coordinating and monitoring the progression of samples and sample processing through complex workflows commonly associated with life science platforms is daunting and highly error prone. The main issue is that there is frequently an open loop between a sample's location within the workflow and the workflow coordinator such as a human being or centralized database. This paper introduces smart, active micro-devices capable of coordinating, executing, and automating much of the workflow both within and across instruments, laboratories, and facilities. This is accomplished by placing sample awareness and process execution at the level of active, autonomous devices such as syringes which contain the sample itself. These smart devices actively usher the sample through its prescribed workflow as well as provide progress updates to central coordination systems at appropriate points along the execution path. Benefits derived from utilizing smart, active micro-devices in this manner include: much greater overall sample throughput via parallel execution paths, real-time workflow monitoring, greatly reduced sample processing errors, fewer surfaces contacting each sample, built-in fault tolerance and recovery, automatic audit trail recording, and built-in chain-of-custody verification. Examples of each benefit will be illustrated within an example workflow.

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