Multiplex platforms in diagnostics and bioanalytics

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In recent years, significant progress has been made in the field of multi-parameter analysis for diagnostics and bioanalytical applications. That is not only true for the technological approaches, which have been achieved; it is also the case with respect to new biomarkers available now for integration in multiplex systems providing a higher relevance of information. These efforts have already become important for laboratory medicine in terms of improved screening approaches as well as cost efficiency. This may prospectively also influence the opportunities for stratifying patient cohorts in personalized medicine.

The development of new platforms capable of multiplex analysis is a multidisciplinary process, including transduction principles, biofunctionalization, recognition elements, microfluidics, data processing, chemometrics,

etc. For example, biochip-based systems still provide a solid basis for such analysis of multiple parameters. However, the need for sample preparation and application—especially at the point of need—is often solved inadequately. Here, microfluidic systems offer simple and fast solutions to integrate sampling and transport to the place of analysis. This is also reflected in the current special paper collection of ABC.

In addition to standard methods like reading a fluorescent signal, readout of electrical signals becomes more and more interesting. There are promising developments in the field of micro-ring resonators, which combine optics, micro-electronics, and biology in an amazing technological cross-over approach. Through silicon-based technology, these resonators can be conveniently prepared in large batches and offer the possibility of carrying out several analyses—in parallel and even in smallest space.

However, any diagnostic or related bioanalytical technology also depends on the availability of robust and standardized biomarkers used for analysis. These must be sufficiently specific to minimize false-positive and false-negative results. The motto here is: a lot does not help much, especially according to the real demand of the clinical routine lab. The use of multiple biomarkers does not automatically increase specificity. This is particularly significant with the analysis of samples without sufficient initial suspicion, as seen in the screening of actually inconspicuous people. In this case, the probability of obtaining a false-positive result is much larger since the actual number of affected patients

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is significantly lower than in groups that are subjected to an examination because of a medically justified initial suspicion.

Besides the challenge of false-positive or false-negative results, with the screening for different diseases without initial suspicion, there also arises the question of what information is really needed from the medical point of view and what does the patient desire to know. Should only the requested test results be communicated, even if another disease has been diagnosed? A complex problem, which is increasingly relevant since multiplex-based genetic testing allows whole gene screenings to be performed. Technological efforts in multiplex testing and their application implicitly create ethical issues, which have to be answered in order to avoid restriction of the ongoing successful implementation of these techniques.

However, this topical issue “Multiplex Platforms in Diagnostics and Bioanalytics” cannot and will not answer all the questions associated with the application of multi-parameter analysis. But, it will give insights into the currently developed methods and technologies and will summarize the resulting findings. Without a doubt, further development of technical feasibility will truly open the way for new diagnostic systems, and will yield additional value to the health care system—and beyond, we may very likely expect new solutions for unmet needs in food and environmental analysis—this could probably be a possible focus of another ABC collection on “Multiplex Platforms”!

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