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On some trends

I would like to note a few trends in the development of analytical chemistry.

1. In the XVIII and XIX centuries, there were very few professional analysts; Swedish chemist T. Bergman (1735–1784) was, probably, the first one and later, in the XIX century, Germans H. Rose, K.R. Fresenius, K. Mohr and some others should be considered as professional analytical chemists. However, many chemists of wider profile also developed early analytical chemistry, e.g., A.L. Lavoisier or Yu. Liebich. In the XX century, separate analytical laboratories appeared and the number of professional analysts was quickly increased. At present, we have at least four groups of analysts: researchers and educators in universities; researchers and practical analysts in state services like EPA or FDA in the USA; workers in analytical laboratories in industry, agriculture and so on; developers of analytical instruments and other tools for analysis. We can think that, in the future, researchers, teachers and developers of instruments will be necessary in large numbers; as to practical analysts dealing with (routine) analyses, their numbers will decrease due to automation, wider use of continuously working sensors, and other factors.
2. Hybridization (hyphenation) of analytical methods and devices is one of the trends of modern analytical chemistry. The process is developing in several directions: combination of (1) separation and determination (chromatography, capillary electrophoresis); (2) sample preparation and determination (flow injection analysis and related techniques); (3) different determination methods (instruments for surface analysis combining various physical methods). Such combinations – without doubt – will be developed in the future.
3. Since alchemists times, chemical analysis was carried out in stationary laboratories. At present, there are a lot of needs for out-of-laboratory analysis, and possibilities for such analyses are increasing. Many important analyses are already performed without stationary laboratories: determination of methane in coal mines; detection of chemical weapons, explosives and narcotics in "field" conditions; estimation of carbon monoxide concentration in automobile gas wastes or ozone in high levels of atmosphere; determination of glucose in blood of diabetics and many others. Portable analyzers, chemical sensors, simple test kits are tools of such analysis; mobile laboratories occupy the intermediate position. It is clear that the scope of non-laboratory analysis will be only increased.
4. With "field" analysis (however not only with it), miniaturization of analytical tools and analysis in general is connected. During the last decades, analytical instruments have diminished in size, like computers. There are no doubts that this tendency will be retained, e.g., in the direction of microfluidic systems.
5. As to objects of analysis, substances and materials to be analysed, I think that the present understandable, reasonable boom connected with samples of molecular biology, biomedicine, biotechnology or pharmaceuticals should not lead to forgetting other significant areas. While we look through leading analytical journals we can conclude that certain analyses, e.g., geological or metallurgical materials, have practically disappeared! There are still problems in environmental analysis. For example, it is necessary to develop and practically use (in more widened scope) dual or three step systems of analysis, with the application of screening on the first step when biotests, chemical test kits, portable devices or mobile laboratories are used. Testing with using simple and cost effective tools allows us to do environmental analysis really widespread.
6. During a long period of time, methodologies of chemical analyses have been developed not only by chemists but also physicists, biochemists and other specialists. Therefore, the term analytical chemistry does not adequately characterize our science. It is why the wider use of terms Analytics (German: Analytik), Analytical Science, and others can be considered as reasonable. In fact, e.g., physicists–spectroscopists or, more often, specialists in nuclear methods of analysis, feel themselves uncomfortable under the label "Analytical Chemistry" (anyway in Russia).
7. On the education in analytical chemistry. When chemical methods of analysis predominated (XIX – the first half of XX centuries), teaching analytical chemistry was a natural part of the chemistry curriculum. In the present time, when the significant (or most important) portion of analyses is carried out by physical (spectrometric, mass-spectrometric, nuclear) or biochemical methods, in education of analytical chemistry, we need to find the balance, the compromise between Chemistry and Modern Methods of Analysis, which are not always based on chemistry. Chemical departments face this with difficulty, for instance, in Russia. This balancing will exist in the nearest future.
8. It seems to me that we should pay attention to popularization and propaganda, i.e., promoting, of analytical chemistry. In this direction, very few attempts were done, in spite of the

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importance of this for recruiting prospective young people and for funding research projects or even applied chemical analysis.

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