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DISCUSSION

of the Harper-Liebman paper, Intelligent Instrumentation

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There has been an instrumentation revolution in the chemical world which has changed the way both chemists and statisticians think. Instrumentation has lead chemists to multivariate data—much multivariate data. Gone are the days when the chemist takes three univariate measurements and discards the most outlying.

Faced with these large arrays of data the chemist can become somewhat lost in the large assemblage of multivariate methods available for the analysis of the data. It is extremely difficult for the chemist—and the statistician for that matter—to form hypotheses and develop answers about the chemical systems under investigation when faced with large amounts of multivariate chemical data.

Professor Harper proposes an intelligent instrument to solve the problem of the analysis and interpretation of the data. This machine will perform the experiments, formulate the hypotheses, and "understand" the chemical systems under investigation.

What impact will such an instrument have on both chemists and statisticians? For the chemist, such an instrument will allow more time for experimentation, more time to think about the chemical systems under investigation, a better understanding of the system, and better statistical and numerical analyses. There would be a chemometrician in every instrument! For the statistician, the instrument will mean the removal of outliers, trimmed data, automated regressions, and automated multivariate analyses. Most important, the entire model building process will be automated.

There are some things to worry about with intelligent instruments. Will the chemist know how the data have been reduced and the meaning of the analysis? Instruments made today do some data reduction, such as calibration and trimming, and the methods used in this reduction are seldom known by the chemist. With a totally automated system the chemist is likely to know less about the analysis than he does with the systems in use today.

The statistician when reading the paper of Professor Harper probably asks what is the role of the statistician in this process? Will the statistician be replaced with a microchip? *Can* the statistician be replaced with a microchip? In my view the statistician will be replaced by a microchip in instruments such as those discussed by Professor Harper. This will happen with or without the help of the statistician, but it is with the statistician's help that good statistical practices will be part of the intelligent instrument.

Professor Harper should be thanked for her view of the future chemical laboratory. This is an exciting time for both the chemist and the statistician to work and learn together.