# Bio-Medical

## Miniature Laboratory for Detecting Sparse Biomolecules

### Specimens would be concentrated and sorted before detection.

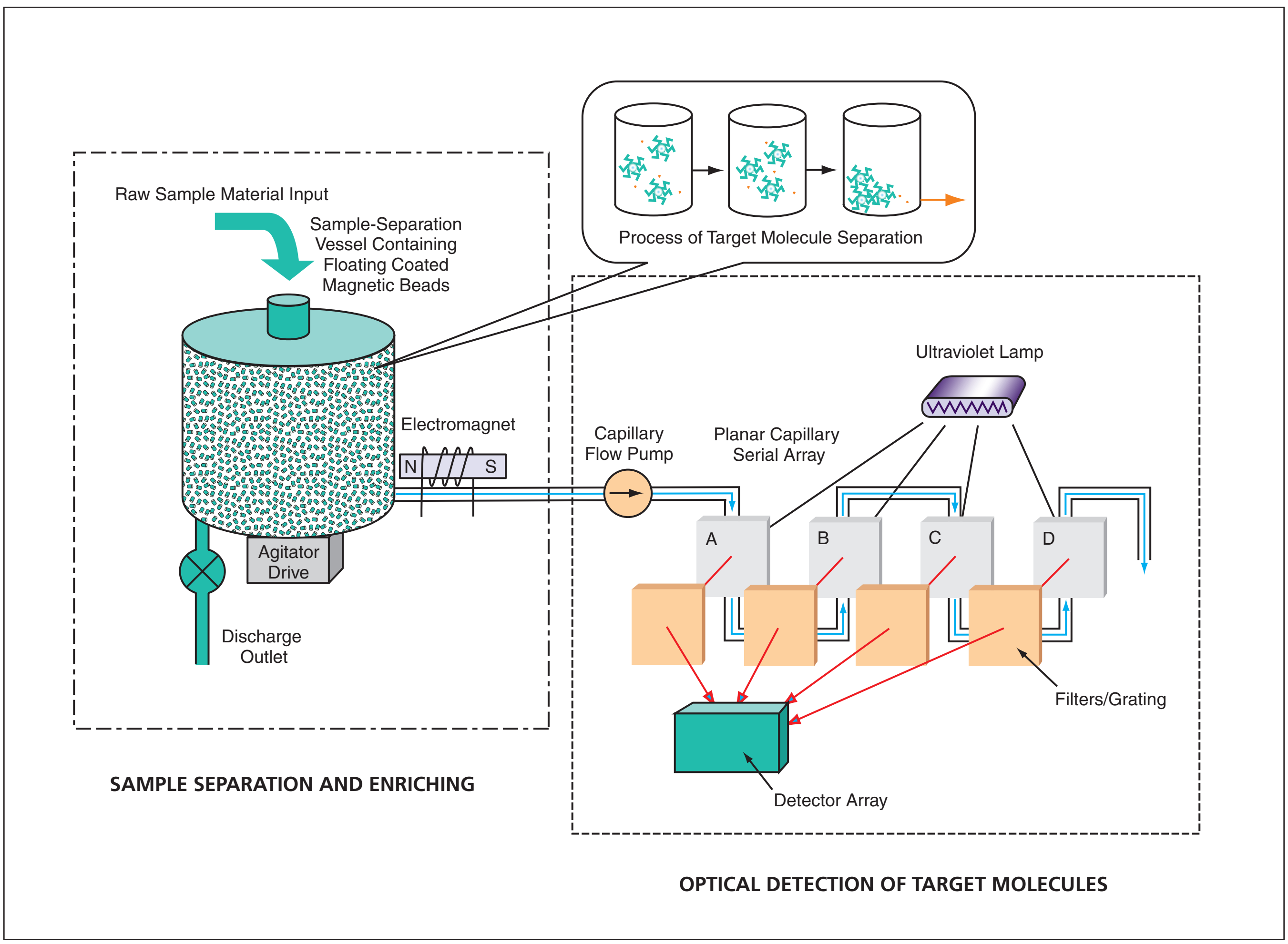
*NASA's Jet Propulsion Laboratory, Pasadena, California*

The figure schematically depicts a miniature laboratory system that has been proposed for use in the field to detect sparsely distributed biomolecules. By emphasizing concentration and sorting of specimens prior to detection, the underlying system concept would make it possible to attain high detection sensitivities without the need to develop ever more sensitive biosensors. The original purpose of the proposal is to aid the search for signs of life on a remote planet by enabling the detection of specimens as sparse as a few molecules or microbes in a large amount of soil, dust, rocks, water/ice, or other raw sample material. Some version of the system could prove useful on Earth for remote sensing of biological contamination, including agents of biological warfare.

Processing in this system would begin with dissolution of the raw sample material in a sample-separation vessel. The solution in the vessel would contain floating microscopic magnetic beads coated with substances that could engage in chemical reactions with various target functional groups that are parts of target molecules. The chemical reactions would cause the targeted molecules to be captured on the surfaces of the beads.

By use of a controlled magnetic field, the beads would be concentrated in a specified location in the vessel. Once the beads were thus concentrated, the rest of the solution would be discarded. This procedure would obviate the filtration steps and thereby also eliminate the filter-clogging difficulties of typical prior sample-concentration schemes. For ferrous dust/soil samples, the dissolution would be done first in a separate vessel before the solution is transferred to the microbead-containing vessel.

A small amount of a solvent solution would be used to elute the captured target molecules from the surfaces of the beads. The resulting solution would be made to flow through a se-




**Raw Sample Material Would Be Processed** to concentrate and sort specimens (specifically, target molecules), which would then be detected by optical or other means.

ries of capillary detection channels, which would be coated with probe molecules, each designed to capture a specific functional group. Once the flow had run its course, an instrument yet to be developed (perhaps an integrated optical spectrometer) would be used to detect and analyze molecules of interest that had accumulated in the channels. The outputs of the instrument would be used to construct a matrix of data from which the concentrations of the target molecules would be estimated.

*This work was done by Ying Lin and Nan Yu of Caltech for* **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1). NPO-40281*

# Multicompartment Liquid-Cooling/Warming Protective Garments

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Shortened, multicompartment liquid-cooling/warming garments (LCWGs) for protecting astronauts, firefighters, and others at risk of exposure to extremes of temperature are undergoing development. Unlike prior liquid-circulation thermal-protection suits that provide either cooling or warming but not both, an LCWG as envisioned would provide cooling at some body locations and/or heating at other locations, as needed: For example, sometimes there is a need to cool the body core and to heat the extremities simultaneously. An LCWG garment of the type to be developed is said to be shortened because the liquid-cooling and -heating zones would not cover the whole body and, instead, would cover reduced areas selected for maximum heating and cooling effectiveness. Physiological research is under way to provide a rational basis for selection of the liquid-cooling and -heating areas. In addition to enabling better (relative to prior liquid-circulation garments) balancing of heat among different body regions, the use of selective heating and cooling in zones would contribute to a reduction in the amount of energy needed to operate a thermal-protection suit.

*This work was done by Victor S. Koscheyev, Gloria R. Leon, and Michael J. Dancisak of the University of Minnesota for* **Johnson Space Center**.

*In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:*

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