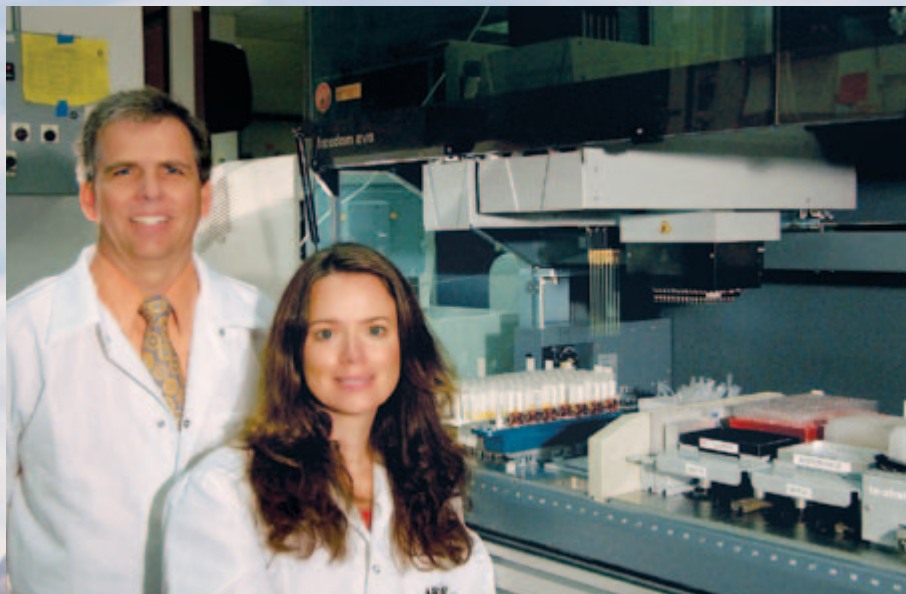


# ARUP Institute develops novel 104-well microplate

The ARUP Institute for Clinical and Experimental Pathology® (ARUP), based in Salt Lake City, USA, has chosen the Freedom EVO® liquid handling platform for automating RIA and ELISA assays, developing a novel 104-well microplate to increase sample throughput.



Mark Herrmann and Tanya Sandrock

The ARUP Institute for Clinical and Experimental Pathology, an enterprise of the University of Utah and its Department of Pathology, was established in 1996 to expand the quantity, quality, and utility of laboratory medicine. The Institute aims to be at the forefront of innovative research and development in clinical and experimental laboratory medicine and covers four broad project areas; development of new laboratory tests, improvement of current clinical laboratory tests, evaluation and critique of tests, and conducting basic and clinical research projects.

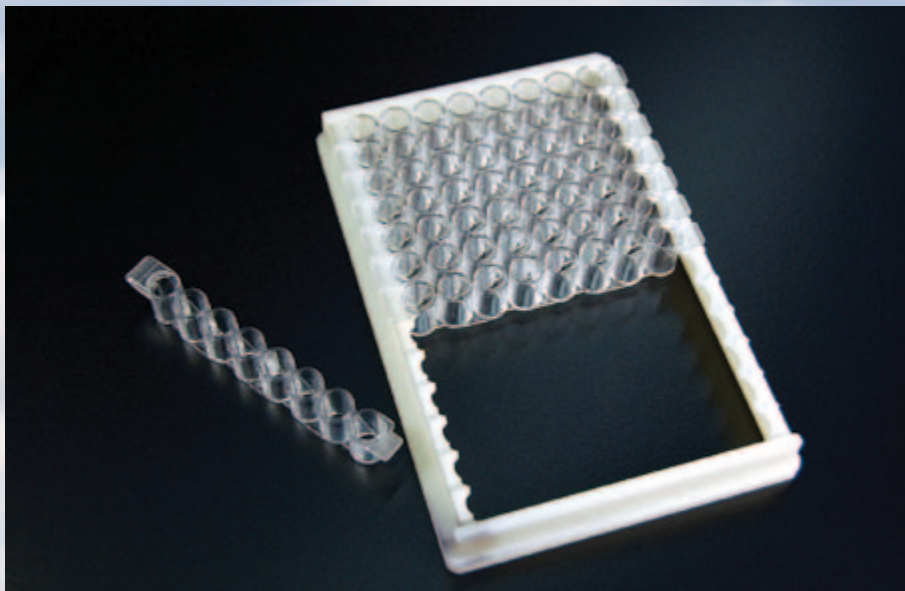
The development of a novel 104-well plate stemmed from a need for additional sample capacity when running radioimmunoassay (RIA). Mark Herrmann, Research Scientist, of ARUP's advanced technology group, explained: "The assay in question uses solid phase extraction, and involved transferring the extraction from 5 ml to 1 ml columns

so that it could be performed in a 96-well format. When we looked at the downstream procedure of the assay, we realized that after having extracted the full 96 samples we would need an additional two positions to accommodate the RIA control samples. The assay is always performed in duplicate, so the original master plate, consisting of 96 extracted samples, is split into two daughter plates for RIA. Once the controls are introduced, four plates are required. We had two options – either extract 94 samples instead of 96, or increase the complexity of manipulations downstream, and the potential for error, by using four plates."

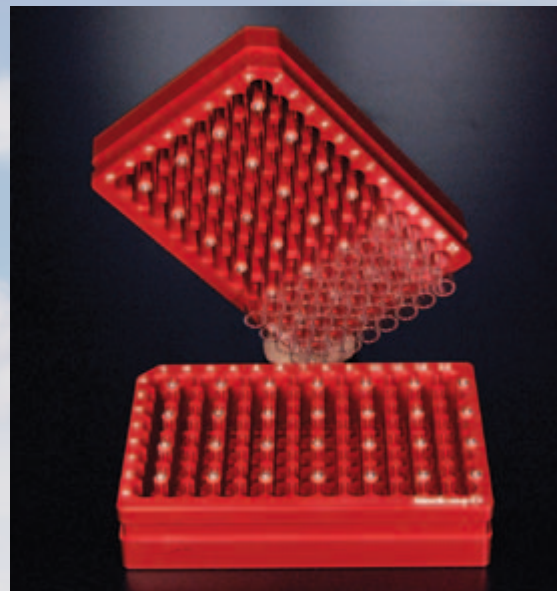
Tanya Sandrock, Research Scientist, of ARUP's endocrinology R&D department, continued: "This is a task that runs 24 hours a day, seven days a week, and is extremely labor intensive, so automation is very important. Using four plates is not practical as it is critical to have the controls on the

same plate as the samples." Mark added: "As we analyze around 20,000 samples a month, if we reduced sample numbers by two it would take almost a complete day's work to catch up, so this was not an option either."

ARUP's solution was to find a way to incorporate an extra column. Mark explained: "The RIA is performed in glass tubes, so we made custom hardware to accommodate the extra tubes. That allowed us to semi-automate the assay on the Freedom EVO, almost halving the time taken to run an assay. Manual pipetting, with its potential for errors, was eliminated and throughput significantly increased. We wanted to build on this success and wondered how the 104-well plate would work in a typical ELISA. The ELISA is run on Nunc Immuno Module strip plates, so we designed a frame, which matched SBS format dimensions so that it was compatible with automation, to house 13 of these 8-well strips, increasing capacity



104-well format frames can be used with tube racks or microplates



from 96-wells to a 104-well microplate.” Tanya commented: “The frames are very inexpensive and can be re-used, so it is very simple and cost effective.”

The 104-well microplate was evaluated using a Freedom EVO liquid handler equipped with LiHa and MCA™ 96 pipetting arms, a HydroFlex™ plate washer and a Safire2™ microplate reader. HydroControl™ V2.0 software controlled the HydroFlex, Magellan™ V6.4 controlled the Safire2, while integration of auxiliary devices and overall programming of the Freedom EVO was controlled by Freedom EVOware® V2.2. ARUP used Freedom EVOware to create a new plate definition for the 104-well frame and made minor programming adjustments to accommodate pipetting for the extra column of the microplate. HydroControl limits the HydroFlex washer’s motion range to 12 columns, even though mechanically it can access all 13, and this was overcome by

running two programs sequentially, while the Safire2 merely required new plate definitions.

Using the 104-well plate to automate the ELISA allowed ARUP to maintain the original 96-sample plate map by providing additional wells for standards and controls, yet minimal plate processing time was added to the assay. Comparison with assays performed on the traditional 96-well plate showed negligible difference in spectral readings, walkaway automation freed staff time for other tasks and sample throughput was increased. ARUP now plans to look at other assays to see where else the 104-well plate may be used to benefit the clinical laboratory.

Mark concluded: “The 96-well format has been around for many years and is an integral part of the laboratory, but sometimes a little bit more is needed and converting to two plates or 384-wells is

not practical or cost effective. The 104-well plate overcomes this problem, and it should also be possible to extend this to 416- and 1664-wells. Technology now is such that we have the flexibility to work within it if we open our minds. Tecan’s engineers were very open to this new challenge and worked with us to achieve our goal.” Tanya added: “It’s just a matter of having the idea in mind that these things are possible, so that instrumentation evolves in the future to adopt a wider platform.”

To find out more on Tecan’s Freedom EVO workstations, visit

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To find out more on ARUP, visit

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