Accelerating Drug Discovery

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Drug discovery is simply a process for evaluating or screening large numbers of candidate compounds against a model for therapeutic effect. The screening may be random, rational, or a combination of both. Designing innovative, valid screens and targets is essential—and screening the maximum number of potential compounds yields the greatest opportunity for success.

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The race for productivity began about 30 years ago with the introduction of the standard 96-well microplate format for immunoassays. The early commercial focus was routine clinical testing. Today's drug discovery relies on more complex assays performed by experienced scientists. Currently, automated screening techniques permit routine screening of up to millions of compounds per year. This increased productivity moves the rate limiting steps to designing new screens, enhancing compound libraries, and searching for new sources of compounds such as combinatorial techniques and new natural product sources.

Maximizing assay throughput requires three elements: high speed operation for rapid procedure execution; large capacity for long, unattended operation; and system flexibility to handle multiple and new assays. To ensure maximum system speed, microassay robotic technology uses multiple active automation modules and multitasking software to allow simultaneous or concurrent processing of several microplates. For example, sample transfer or plate duplication can be performed at one station while plate readings are being performed simultaneously at other stations. Achieving high throughput also requires on-table capacity to store enough samples and consumables to operate unattended for long periods of time. Special capabilities, such as the automated preparation of fresh reagents, may also be required for extended operation. Sample throughput is further increased by automating multiple assays from one day to the next without complex reprogramming or reconfiguration. Multiple assays can even be performed during long periods of unattended operation.

In evaluating the economics of discovery automation, the calculations are easy, but business judgments are crucial. The decision to automate should not only include the cost of justification calculations, but must also include a strategic evaluation of less-quantitative benefits such as more timely decisions, better quality results, improved precision, increased throughput, and better use of personnel. These strategic benefits, though less tangible than a bottom-line cost savings analysis, are, in my opinion, the most significant factors in deciding to employ discovery automation technology. Borrowing from the best-seller (and one of my favorite books) *The Seven Habits of Highly Effective People* (Stephen Covey, Simon & Schuster, 1989), the benefits of employing automation and robotics can be summarized as follows:

1. Increases capacity for significantly higher sample loads and more complex testing per sample.
2. Provides "just-in-time analysis" for faster new product introduction.
3. Enhances precision, documentation, and defensible audit trails.
4. Reduces analysis cost while routinely gathering all the data necessary to solve problems quickly, rather than waiting for more data.
5. Transfers valid analytical methods to multiple sites worldwide.
6. Improves motivation, reduces turn over, and enhances the effectiveness of a downsized workforce.
7. Utilizes valuable laboratory space more effectively.

Once experience is gained in the new technology, ongoing paybacks should be compelling. Precise return on investment (ROI) calculations, therefore, should not be necessary.

Begin by analyzing the costs per assay or assay batch for both manual and automation alternatives. If there are multiple assays, benchmark costs using a typical assay. Remember to use 24 hour assay capacity when calculating cost per assay for the automation alternatives. Then calculate ROI using the following models.

In the cost reduction model, the goal is to run the same number of assays as are run manually, but at the lowest cost. Calculate payback using the savings per assay or assay batch multiplied by the number of assays currently run. In the maximum capacity model, the goal is to run the maximum number of assays using the full capacity of the automation alternative. Calculate payback using the savings per assay or assay batch multiplied by the assay capacity of the automation alternative. In the value-added model, calculate an opportunity value for the assay or assay batch. The value will be higher than the savings per assay since it includes the cost savings, the value of more hits, faster time to market, freeing up skilled people for assay development, and improved assay consistency.

Leading biopharmaceutical companies know that drug discovery and high throughput screening are strategic priorities. Operating efficiency is essential to survival; developing innovative drugs is essential to winning in the future healthcare business. The value-added model recognizes both improved productivity and the strategic value of innovation. ///