logistical problem of supplying compounds to external collaborators, as it is, in practice, a lot of work.

Where do you think HTS will be in ten years time?

I think we will have probably solved the compound handling problems, but whether we will have solved it by retaining open-well microtiter formats or whether we will have gone to chips, I do not know. Chip-based systems are relatively new and, at the moment, are relatively limited in take-up. Although groups like Caliper Technologies have made big strides in this field, I cannot predict whether the closed architecture will be a common feature in ten years time. I think we will have certainly screened all the obvious families of targets (such as GPCRs, kinases and proteases), but I am not sure whether we will have leads or therapeutic utilities for all of these. We will then be looking to solve more intractable targets such as protein–protein interactions, which will offer a whole new range of pharmaceutical targets with their own problems in assay configuration and lead identification.

At your company, which well-plate size do you currently use the most?

Obviously we produce the 3456-well plate but we also do assays in 96- and 384-well plates for ion-channel work. However, we try to make all our assays suitable for the 3456-well plate format.

Who do you think has the most innovative products/ideas in the HTS field (other than your own company!)?

I think Scintillation Proximity Assays has changed the way a lot of radioactivity assays are being done. Also, the move to cell-based functional assays has had a large impact (e.g. FLIPR and reporter gene assays), as has the imaging of whole plates, various high-sensitivity detection systems, the use of fluorescence, and the ability to miniaturize.

Who do you think has most influenced your own career?

My post-doctoral supervisor, Ed Krebs (at the time at the University of California, CA, USA), was influential in my career as he introduced me to the areas of signal transduction and protein phosphorylation, which influenced what I did in academia and, to some extent, in industry. What probably influenced me most in terms of moving into screening was the signing of the deal between SB and Human Genome Sciences when I was at SB. This alerted SB to the need to have HTS as a centralized function rather than a small number of disparate groups working on their own separate targets. It also prompted the recognition that, with all the new targets, the only way to get leads was by having an HTS group.

Do you miss working at the bench?

I used to miss working at the bench very much as I did benchwork until my early 40s when I was in academia. Once I came into industry, I started to do less until, after three years, I did not have the time. However, I have always been very close to the science and have always looked at data and technologies and helped plan the research projects. I do not think I could go back to the bench now and run a research project as the techniques and the lab practices haved moved on too much. However, I have always tried very hard to see my job as a scientific manager rather than just a manager.

What would you like to have achieved by the end of your career?

I would like to have developed the careers of a lot of people by mentoring them and guiding them. I would also like to have contributed successfully to drug discovery, not just in screening but in general.

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How would you respond to the claim that 'HTS is a waste of time as no successful leads have yet been produced'?

I think they need to talk to people who have produced successful leads. Several talks at the industry conferences reported leads produced by HTS, in fact faster than without HTS. So I cannot imagine how it can be a waste of time when you can get your lead faster and in a more cost-efficient way.

Do you think further miniaturization is the way to go in the future?

I think that miniaturization at 3–8 μl per data point is probably a very significant enabling step and this is a step I believe will be broadly applicable – there should not be any biological limitations that will prevent you from running an assay at this level. If you go beyond that into the nanoscale, you start coming across limitations. However, that is not to say that there could not be good applications

for nanotechnology, as I believe that the fact that you can run an assay on a nanoscale could offer a significant advantage in some cases. However, so far, it is hard to see how it could be broadly applicable to all applications.

What do you think is the main problem with HTS at the moment and how would you resolve it?

I think that last year the problem was how to accelerate the throughput and how to get to the proverbial '100,000 data points per day' and run an assay in 10 μl or less. These problems have now been solved. I think the next problem is how to transfer the assays from assay development so you do not waste time waiting for assay conversion and validation, and I think this is going to become an increasing problem. One way to solve this is to push some of the screening into assay development by implementing screening workstation products that are designed to run a few, but important types of assays. Another way to solve it is to standardize throughout the enterprise, so that the technologies used in assay development are the same as those being used in HTS.

Do you think the benefits of HTS equal the level of financial input required?

I think if you are talking about a system that costs $15 million to $50 million to implement then I do not know if the benefits equal the input. However, if you are talking about a system that costs $500,000–$1,000,000 to implement, customers have reported that the savings from the reagent costs alone are enough to justify using this kind of a system.

Do you feel HTS is essential to advance fields such as genomics?

I think high-throughput is essential for genomics, and the drivers in genomics are going to be the same as in screening, i.e. that you need to get more data points at a lower cost per data point.

Do you think outsourcing of HTS is an essential part of pharma strategy or should it all be kept in-house?

That is one of my favorite questions and I am afraid I have a biased view on that. I remember when I was working in a large company in the early 1980s and I used to outsource my computerization needs. I could not afford my own personal computer, but the moment I could, I stopped outsourcing because it is much better to do things in-house. When companies outsource, they do it out of necessity. However, if they can apply products that enable them to do the screening in-house then they almost always can do it faster, better and cheaper themselves. It is therefore up to companies that supply technologies to make them available in a user-friendly way, to 'productize' them such that they can be routinely used by any end-users and do not require the help of the technology's inventor to run them.

Where do you think HTS will be in ten years time?

I think the general direction of the industry, driven by the needs for time- and cost-efficiency, is that people will be looking more towards integrated screening solutions that will include the hardware, the reagents, the plates and the software, all designed from the ground up to run smoothly together. You could unpack such a product from the box, plug it in, place your compounds in it and screen. One should be able to implement these compact, cost-efficient desktop stations across many functions, such as distributing them in all therapeutic areas, creating parallel processes, similar to the way personal computers enabled distributed computing and vastly improved productivity.

At your company, which well-plate size do you currently use the most?

We make systems that use all well-plate sizes from 96 to 1536-well plates. People are generally gravitating towards the 384-well format. I think people are also moving towards the 1536-well plate format, although it is not an overwhelming format right now.

Who do you think has the most innovative products/ideas in the HTS field (other than your own company!)?

I think ABP has some good products – they always have been very creative in what they do, and also Applied Biosystems. I admire these two companies.

Who do you think has most influenced your own career?

I have been fortunate to have a number of people who became my mentors informally – there are probably a dozen people so I would be hesitant to single anyone out.

Do you miss working at the bench?

My background is engineering, and I did work at the bench as an engineer. I do not really miss working at the bench – I changed my interests over time from pure technology to more strategic interests. This is not to say that one is better than the other – strategy without technology is worth nothing – but technology applied well is a lot of fun and that is where I see myself.

What would you like to have achieved by the end of your career?

My goal is to make everybody who I associate with successful and what I would like is to have a large number of people who say that 'I worked with Lev and that was the best thing I ever did in my career'.