

Targeted treatments and the prospects for pharmaceuticals



An Economist Intelligence Unit white paper
sponsored by Agilent Technologies



Preface

Targeted treatments and the prospects for pharmaceuticals is an Economist Intelligence Unit white paper, sponsored by Agilent Technologies. The Economist Intelligence Unit bears sole responsibility for this report. The Economist Intelligence Unit's editorial team executed the survey, conducted the interviews and wrote the report. The findings and views expressed in this report do not necessarily reflect the views of the sponsor. John du Pre Gauntt is the author of the report.

Our research drew on two main initiatives. We conducted a global online survey in December 2004 of 86 senior executives in the pharmaceutical industry on the topic of next generation drug discovery and development.

To supplement the survey results, we also conducted in-depth interviews with senior executives and regulators in the pharmaceutical industry. Our thanks are due to all survey respondents and interviewees for their time and insights.

January 2005



Executive summary

Fundamental changes are occurring in the way the pharmaceutical industry discovers and develops drugs, according to a new survey of 86 executives conducted by the Economist Intelligence Unit in co-operation with Agilent Technologies. Advances in genetic science have created the possibility of “targeted treatments” that address specific patient populations based upon their genetic profile. Grouped under the heading of pharmacogenomics, the intersection of pharmacology, biology and information technology offers the potential for targeting precisely the molecular basis of disease, with fewer side effects resulting from the process.

However, the business model for targeted treatments remains a work in progress. In addition to improvements in applied science for developing

products, targeted treatments require pharmaceutical companies to re-think the way they bring a drug to market. The survey and in-depth interviews revealed three major trends that will typify next-generation pharmaceuticals:

- Drug discovery and development will focus more on biology than on chemistry
- Drug markets will be more demand-led than supply-led
- The pharmaceutical industry will become more networked and horizontal

Between these three trends, survey participants and industry insiders expect pharmacogenomics to change how the pharmaceutical value chain is organised, how clinical trials are conducted and approvals are reached, and how the industry’s risks and rewards are evaluated.



Introduction

Fundamental changes are occurring in the way the pharmaceutical industry discovers and develops drugs, according to a new survey of 86 executives conducted by The Economist Intelligence Unit in co-operation with Agilent Technologies. Nearly five years after former US president, Bill Clinton, declared the human genome project to be the “most important, most wonderful map ever produced by humankind”, the survey and in-depth interviews revealed an industry still trying to assimilate massive change in its scientific and commercial underpinnings.

The human genome project brought into public view how the fusing of the biological and information technology revolutions have redefined medical research. New disciplines such as genomics (the structure and function of genes), proteomics (the structure and function of proteins), and

bioinformatics (information science applied to biology) have joined pharmacology, under the heading of *pharmacogenomics*, to describe the science behind next-generation pharmaceuticals (see “What is a targeted treatment?”).

Beyond the excitement of breaking new scientific ground, pharmacogenomics is a response to the fact that many drugs developed for the mass market do not work for a significant number of patients. For example, between 15% and 35% of all patients on standard blood-pressure medication receive little or no benefit, and anti-depressants have no effect on 20-50% of all users. A major reason for this disparity is the difference in genetic make-up that causes people to produce slight variations of certain proteins or enzymes that are affected by a given drug. As the human genome becomes better understood, the genetic basis for this variability will be correlated with

What is a targeted treatment?

Targeted treatments originated with cancer research, even though they are branching out to help cure other diseases. In the case of cancer, a targeted treatment hits the abnormal cell while preserving the surrounding normal cells. Hitting the right “target” requires detailed knowledge of the molecular basis of a disease (often called the “disease pathway”).

The only commercially available targeted treatment to date is Genentech’s breast cancer drug, Herceptin, which was approved in 1998. Technically, Herceptin is a monoclonal antibody (a substance that can locate and bind to cancer cells) aimed at a population of patients who over-express a specific receptor (a molecule inside or on a cell’s surface that binds to a

substance and causes a specific physiological effect) called HER-2. When Herceptin was first given to undifferentiated patients in clinical trials, the data were not encouraging. However, when the drug sponsors used a diagnostic test to pre-select patients who over-expressed HER-2, they recorded outstanding results. Herceptin comes paired with a diagnostic test that finds out if patients over-express HER-2, based upon their genes. If the patient does not have that characteristic, they are guided to other treatments. The payoff is two-fold. Those who qualify for Herceptin get clinical relief, whereas those who don’t qualify are not wasting precious time on a treatment that won’t help them.



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other factors, such as metabolism and toxicity, more accurately to predict how individual patients will respond to a drug in terms of safety and efficacy.

For drug companies, targeted treatments suggest that large-scale hit-or-miss clinical trials will be replaced by smaller trials for specific sub-groups of people. "If we can determine in early trials the genetic basis for the likely individual response, good and bad, to drugs being tested, we could then develop more clinically focused medicines", says Dr Allen Roses, senior vice president for Genetics Research at GlaxoSmithKline. "As a result, some of the trials may be smaller, but they may have a greater chance of success."

Improving the productivity of clinical trials is but one of several innovations sorely needed by the pharmaceutical industry (see "A lethal cocktail?"). Targeted treatments not only offer a different model for treating disease but a new business model for the

industry as a whole. However, the promised future of pharmacogenomics must mesh with the current reality of the drug market. Governments and private insurance companies are rebelling over the escalating cost of prescription drugs. These third parties are hopeful that targeted treatments will help patients and are equally committed to reducing the overall cost of drugs. Granted that major scientific, regulatory and commercial challenges remain, survey participants agree that a discovery and development paradigm based upon pharmacogenomics holds considerable promise. They identified three major trends that will typify pharmaceuticals in the genomic era:

- Drug discovery and development will focus more on biology than on chemistry
- Drug markets will be more demand-led than supply-led
- The pharmaceutical industry will become more networked and horizontal.



A lethal cocktail?

The Center for the Study of Drug Development (CSDD) at Tufts University estimates that the fully capitalised cost of a new drug, including post-approval expenses, hovers close to US\$948m in 2003 dollars. Additionally, it takes 10-15 years from the time a company files an Investigational New Drug (IND) application to reaching final regulatory approval. This huge investment for pharmaceutical companies comes at a time of lagging R&D productivity, imminent expiry of important patents, and higher reimbursement thresholds set by third-party payers.

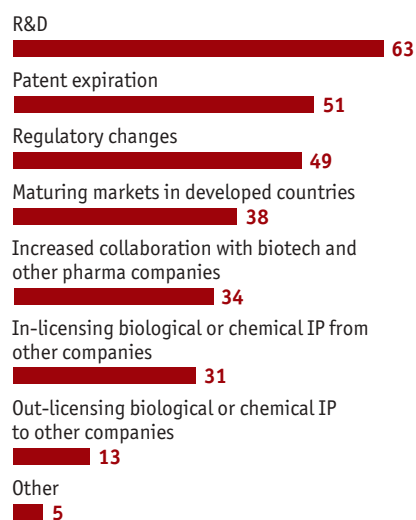
Observers on all sides agree that the pipeline for unique drug products has shrivelled since the 1990s. The US Food and Drug Administration (FDA) reported that the annual number of New Molecular Entities (NMEs)—drugs with a novel chemical structure—submitted for approval, dropped from 45 to 25 between 1995 and 2003, even though R&D

spending increased by two and half times.

The dearth of new compounds is coming at a time when pharmaceutical revenue is exposed to an unprecedented extent. Between 2002 and 2007, US patents will expire on 35 drugs with sales totalling more than US\$73bn. According to a pharmacy benefits manager, MedCo, it previously took a year or more for a drug to lose 70% of its market share following patent expiration. Now, a patented drug can lose 80-90% of market share in a few weeks, as insurance plans switch over to generic alternatives through mail-order and other delivery methods. Over half of our survey listed patent expiration after R&D as the factor that would most significantly affect business performance over the next three years.

Finally, there are fundamental changes in the US market for prescription drugs, which accounts for nearly half of global pharmaceutical sales. Managed care

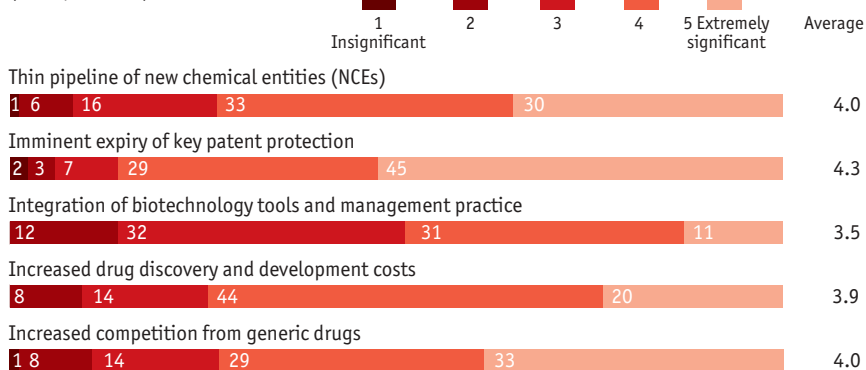
Which three factors will impact most significantly on your company's business performance over the next three years? Please choose up to three factors.
(% respondents)



organisations control more than 70% of the US retail market in both dollars and prescriptions, according to Goldman Sachs. Medicaid, and other US government programmes control another 13%.

Aside from using their buying power to negotiate large discounts, these payers are demanding proof that new products are genuinely better. Medco has set up "new product watch" initiatives to monitor the industry pipeline and regulatory approvals in order to predict which drugs will come on the market, to compare how these drugs perform against existing therapies and to develop prescribing guidelines before the drugs are launched.

How significant are these internal pressures on the pharmaceutical industry? Please rate on a scale of 1 to 5, where 1=Insignificant and 5=Extremely significant.
(% respondents)





Biology over chemistry

Conceptually, drug discovery is straightforward. Researchers first identify and validate a disease target (usually a protein or enzyme) and then screen compounds that block, promote or otherwise modify the target's biochemical activity. The main difficulty involves understanding the complicated biochemical pathways that lead in and out of the target in order to find the most appropriate intervention point, and then design a molecule that produces a desired clinical outcome. The historic business model behind pharmaceuticals is

straightforward as well. At nearly every major pharmaceutical company, the aim has been to develop a high-margin mass-market blockbuster drug with a long period of exclusivity to reap enormous profits to offset numerous failures along the way. Much of these profits are then ploughed back into the pipeline that is developing the next blockbuster drug. The survey showed great reliance on individual branded drugs for both annual revenue and profit. One-half of respondents reported that the best-selling branded drug accounted for more than 20% of annual revenue

Trial and error

Regulatory agencies around the world differ in degree more than in substance when it comes to drug approval. In Europe, market authorisation for drugs, previously a national procedure alone, is increasingly becoming the mandate of the European Agency for the Evaluation of Medicinal Products (EMA). EMA's centralised approval for new products requires acceptance in all member states and is mandatory for all biologically derived compounds.

Japan changed its basic law that regulated pharmaceuticals in 2003. The Pharmaceutical Affairs Law (PAL) introduced a new FDA-like regulatory body along with the introduction of priority reviews. These changes were institutionalised in April 2004 with the launch of the new Pharmaceutical and Medical Devices Agency (PMDA), which combined three separate organisations that historically covered things like product reviews and monitoring of side effects.

Notwithstanding greater centralisation and standardisation of regulatory agencies, obtaining approval of a new drug is not for the faint of heart. For every 5,000 candidate drug molecules, on average, only five are tested in clinical trials. Of these five candidates, only one is eventually approved for use. Here is an

overview of the general process in the US market, which provides a rough benchmark for procedures in the rest of the world:

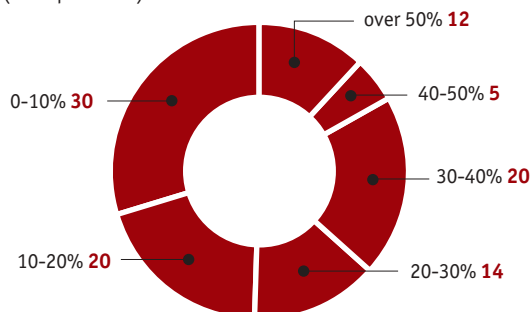
A New therapeutic molecules are created by drug sponsors, who will market the drug. The sponsor notifies the FDA of its intent to conduct trials on humans by filing an Investigational New Drug (IND) application. If approved, the IND permits the sponsor to conduct clinical trials, which typically involve three phases of study with a progressively larger number of human subjects.

B Phase-I trials usually involve healthy volunteers. These studies determine the pharmacokinetic (how the drug is absorbed, distributed, metabolised, and excreted by the body) and pharmacologic (how the drug affects the body) actions in humans. Phase I also looks at side effects associated with increasing doses, and any early evidence of effectiveness against a disease.

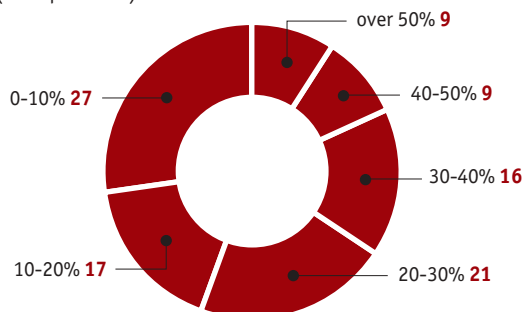
C Upon conclusion of Phase-I trials, the sponsor decides whether to pursue a Phase-II trial to determine the drug's therapeutic validity. Phase-II trials determine effectiveness of the drug along with com-



How much of your company's annual revenue is represented by its best-selling branded drug? (% respondents)



How much of your company's annual profit is represented by its best-selling branded drug? (% respondents)



as well as more than 20% of annual profit.

Drug companies' reliance on the fortunes of a single compound makes it critical to develop a pipeline of new medicines. Huge investments of capital and time are needed. Over half of the survey said that their companies invest more than 10% of sales in the R&D process. And two-thirds reported that, on average, it took their company more than six years to develop a

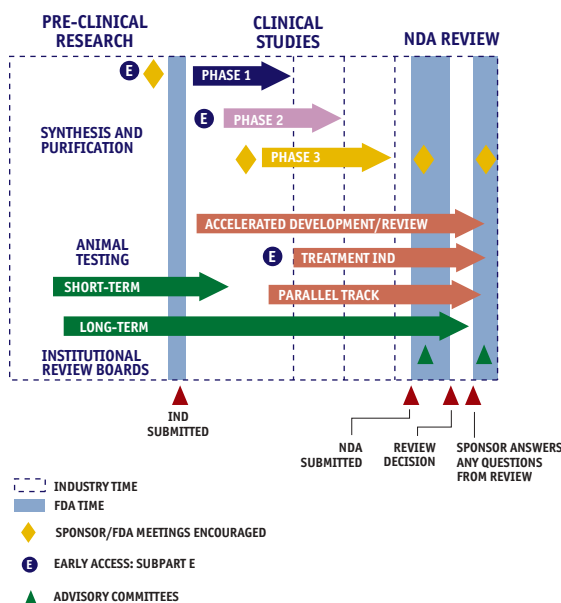
drug from laboratory to final approval (see "Trial and error"). However, many in the industry remark that the overall yield of approved products remains low. "About 8-10 years ago, the focus was on improving the yields of later-stage clinical trials, which were about 10%", says Chris van Ingen, president of Life Sciences and Chemical Analysis at Agilent. "There was a lot of investment and innovation targeted at pushing yields

mon side effects and associated risks. Phase-II trials are closely monitored and conducted with a relatively small number of patients. At this point, the sponsor again evaluates whether it should pursue further research. A positive decision will lead to Phase-III trials.

D Phase-III trials are controlled and uncontrolled clinical trials involving several hundred to several thousand people. They are conducted to gain additional data about effectiveness and safety needed to evaluate the benefits and risks of the drug for the general population. Results from Phase-III trials also yield data that eventually will be used to develop instructions to a prescribing physician.

E Based upon the results of Phase-III trials, the sponsor submits a New Drug Application (NDA) upon which the final approval of the regulator is based. The sponsor remains obligated to report adverse reactions or other pertinent data from the clinical community to FDA periodically for as long as the drug remains on the market.

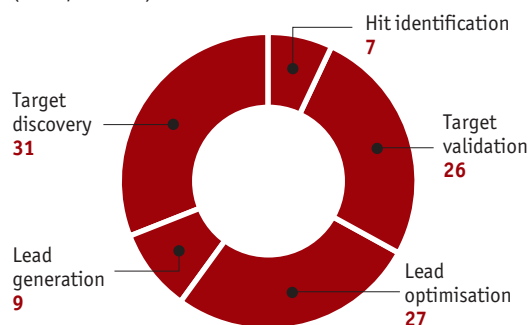
A schematic diagram from the FDA follows, below:





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In your opinion, which area is most important for increasing productivity in the drug-discovery process?
(% respondents)

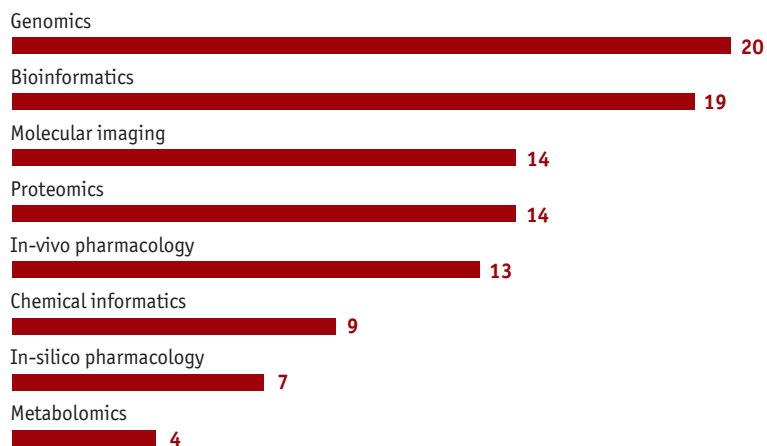


up to 25-30%, but the reality is that yields in drug discovery are still about the same [as a decade ago]."

Improving yields at the front end have heightened the importance for a biological understanding of disease. Survey participants noted that discovering and validating new targets (proteins that play important roles in the function of cells and that might be manipulated to treat disease) were most important for improving the productivity of drug discovery.

Mr van Ingen notes that genomic research has

Over the next three years, which area will play the most important role at your company in developing the pipeline for new drugs?
(% respondents)



provided pharmaceutical researchers with many more potential targets for new drugs. However, without being able to validate whether a target lends itself to drug intervention, it is difficult to predict the likely success of a candidate. "The problem is how to improve the predictability of the front end, so that when you go downstream in the value chain you can improve the yields of drug candidates that are going to make it to the market," he says. Mr van Ingen's concerns about optimising the front end of research are shared by regulators (see "Navigating the critical path").

Before the human genome was sequenced, pharmaceutical researchers used a list of around 500 or so proteins, enzymes or other biochemical compounds in the body that drugs are designed to target. Since 2000, the list has grown to nearly 10,000. Although many new targets will be disqualified for a variety of reasons, survey participants are employing a wide range of biological and computer techniques such as bioinformatics, genomics, proteomics and molecular imaging, to attack the expanded list of possibilities.

The impact of these new tools and disciplines goes beyond how they affect the drug-discovery process. They are helping the evolution of R&D and business cultures within pharmaceutical companies themselves. According to the global industry leader of IBM's Life Sciences and Pharmaceuticals Division, Dr Steve Arlington, drug research several decades back was driven by a chemistry-centric process of making and testing drug compounds. In that world, pharmaceutical chemists were the bosses because there were more of them than anyone else. "Since we've advanced further into the biological understanding and unravelling of disease, the importance of pharmaceutical chemists has not waned, but has been equalled by the contributions of geneticists, oncologists, bio-statisticians, and other disciplinary types not formerly associated with drug research" Dr Arlington says.



Navigating the critical path

In March 2004 the FDA attempted to address the disparity between major advances in the understanding of disease and the relative dearth of new pharmaceutical products. The agency determined that pharmaceutical product-development has not kept pace with scientific innovation. “The problem is, there is this huge investment in the discovery and basic-science side but not in the scientific infrastructure of product development”, according to Dr Janet

Which will be the top value-drivers for pharmaceuticals over the next three years? Please choose up to three drivers.
(% respondents)



Woodcock, the acting deputy commissioner for operations at the FDA. Survey participants agreed with Dr Woodcock that the top priorities for improving the drug pipeline would revolve around commercialisation. More than half of those surveyed stated that bringing drugs to market faster would be the top value-driver over the next three years.

Grouping its observations and recommendations under the concept of the Critical Path Initiative, FDA aims to identify and prioritise, firstly, the most pressing product development problems and, secondly, the areas that provide the greatest opportunities for rapid improvement and public health benefits. According to FDA and Dr Woodcock, the primary cause for failure to improve drug product-development concerns an inability to predict the likely success of a novel drug candidate. A new compound entering Phase-I trials in 2000 was no more likely to reach the market than one entering Phase-I trials in 1985, even though R&D investment had increased by several orders of magnitude. The agency’s analysis concluded that a crucial area to improve was the effectiveness of evaluative tools for drug development. “The tools that FDA and drug sponsors use to determine if a compound is safe, effective and can be mass-produced are often antique”, says Dr Woodcock. “For example, animal toxicology used for pre-

clinical work has been around for about 60 years and we haven’t improved on it very much.” In 2005 FDA plans to publish a Critical Path Opportunity List. The list will delineate three scientific and technical dimensions (safety, utility, industrialisation) to improve the development process.

These dimensions not only include new technical tools for evaluating the potential of a compound, but new regulatory procedures for interacting with sponsors and industry at earlier stages. Examples include more sharing of pre-commercial data about drug safety. Other efforts focus on standardising and sharing common, critical elements such as biomarkers (quantitative measurements used to predict toxicology, the progression of a disease, or effect of a drug) and conducting more efficient clinical trials.

The goals of better evaluative tools and regulatory processes are to shave time and cost from drug development while maintaining safety and efficacy. “The goals of Critical Path are more informative tools for product development”, Dr Woodcock says, “Companies will be able to get a much better idea much earlier in the process of whether or not their drug will succeed. For FDA, it means that when we approve a drug, we will know much more about it than before.”



Know the patient

Segmenting patient populations to ensure that the right patients receive the right medicines in the right amount underpins the targeted treatment model. However, the success of a targeted treatment involves numerous external factors that influence how sponsors develop new drugs. Survey participants noted that shareholder pressure to raise earnings and regulatory forces pressing to reduce the cost of pharmaceuticals were the most significant outside influences on the industry. Following a close third, were demands for lower prices from better-informed healthcare payers and consumers.

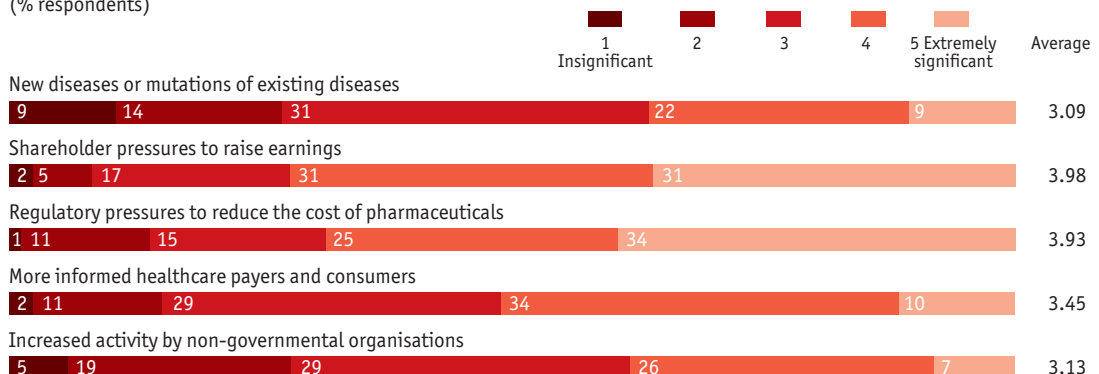
Satisfying shareholders, regulators, and healthcare payers hinges on new pricing schemes. Drug companies are counting on targeted treatments to realise premium or even super-premium prices for treatments that are produced in far smaller volumes. But this commercial imperative conflicts with the mandate for healthcare payers to provide equitable access to pharmaceuticals. “Our reason for being is to

ensure the viability of the pharmacy benefit” states Eric Elliot, vice-president of Pharmacy Management for Aetna, one of the world’s largest private insurers. “If people are getting medications they do not need, or if they are getting medications where a generic or more cost-effective drug could have been used, we are putting at risk the financial viability of the benefit.”

Mr Elliot is clear that he does not oppose targeted treatments. Indeed, the ability to select patient groups that will respond better to a treatment falls squarely within Aetna’s interest. “Let’s say that a new treatment for asthma comes on the market and the optimal population for whom this drug will really improve their condition is estimated at around 10,000. Let’s also imagine that the drug is a US\$5,000 product. Our challenge is to ensure that all 500,000 asthma sufferers on our books do not get this US\$5,000 drug but only the 10,000 who will respond positively” he says.

Deciding who gets which drug is not as simple as it seems. Many diseases, such as asthma, actually refer

How significant are these external pressures on the pharmaceutical industry?
Please rate on a scale of 1 to 5, where 1=Insignificant and 5=Extremely significant.
(% respondents)





to a set of sub-conditions (that is, allergic-reaction asthma, winter asthma, exercise-induced asthma, “smoker’s” asthma), yet they are conceived and treated as the same thing. This does not mean that an optimal situation would be one drug for one disease. Insurers are looking at targeted treatments as closely as drug companies. “As you become involved with these medications, you understand that they may be more expensive, but they are going to be significantly more effective”, says Mr Elliot. “Our task, as we develop coverage standards for these products, is to identify under which circumstances these products are the product to have.”

Historically, drugs were developed to reach the

mass-market using chemical, rather than biological, means. However, many in the industry remark that the low-hanging fruit has been taken. “The obvious clinical areas that can be addressed chemically for a mass market have pretty much been done”, observes Dr Arlington. Consequently, the future growth areas for pharmaceutical companies are shifting towards “lifestyle” medicines (that “make well people better”) or individualised drugs to treat catastrophic or chronic conditions, such as cancer or diabetes. Either way, drug companies are tailoring their products closer to specific patient groups, which, by definition, pulls pharmaceutical markets towards a more demand-led rather than supply-led focus.



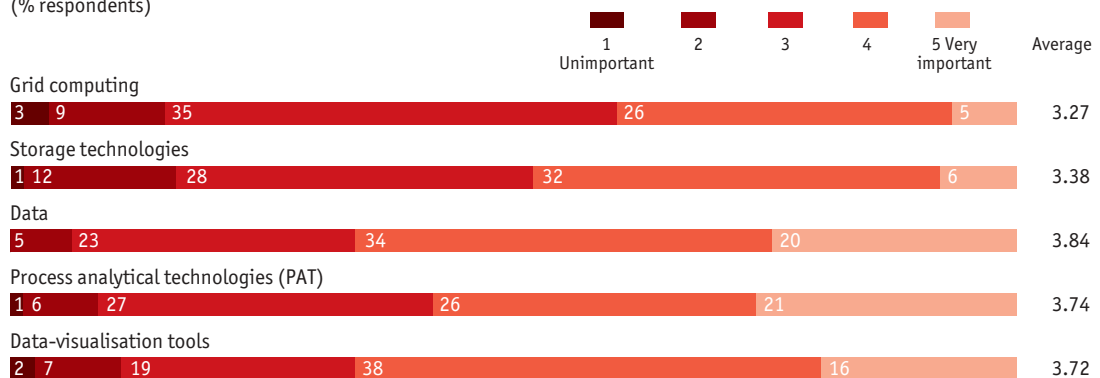
Networked and horizontal

During the race to sequence the human genome, J. Craig Venter proudly called Celera Genomics' IT system "the world's most powerful non-government supercomputing facility." One of the first people to recognise that the gene business is a data business, Venter remarked that enormous computing resources will be required to solve the biological problems of the 21st century. According to the survey, the use of information technology for drug discovery and development has become as important as biological and chemical competence. "The amount of data you need to manipulate in order to understand the biology of a disease just goes berserk", says Dr Arlington. "Massive computing power, algorithms, search engines, databases, all of that becomes crucial for finding that fabled needle in the haystack." Survey participants listed database, storage and process-analytic technology (IT systems used to optimise manufacturing) as crucial infrastructure for developing new drugs faster.

The survey then looked five years into the future to determine which specific technologies and disciplines would contribute most to drug discovery and manufacture. In the area of drug discovery, genomics stood head and shoulders above other research areas, such as bioinformatics and nanotechnology. Nearly one-third of survey participants tipped genomics as the best candidate for advancing drug discovery. Survey participants were more divided regarding their preferred choice for the technical area that would contribute most to manufacturing. They were split between those technologies that addressed specific problems in production (for example, formulation technologies and process analytic technologies) and those areas associated more with the pharmaceutical supply chain (for example, radio frequency identification devices (RFID) and supply-chain management technology).

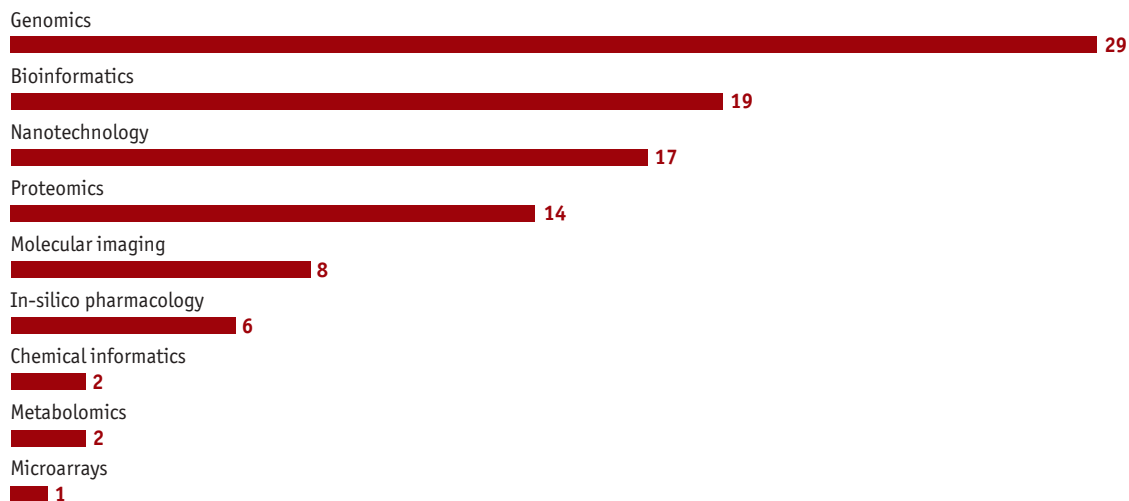
Such dependence upon IT infrastructure and new partnerships presents technical, managerial and security challenges to drug companies (see "Defence

How important are these information technologies to new drug discovery and development?
Please rank each on a scale of 1 to 5, where 1=Unimportant and 5=Very important.
(% respondents)





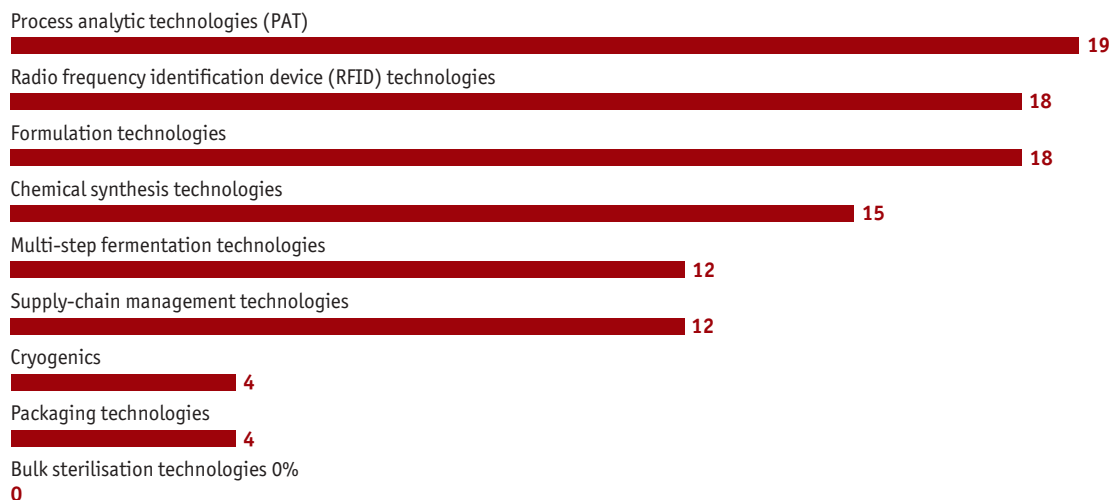
In your opinion, which technology area for drug discovery will experience the most dramatic progress over the next five years?
(% respondents)



in depth”) that are collaborating and sharing information as never before. The complexity of creating and developing targeted treatments is driving a division of labour between large and small pharmaceutical companies on a scale scarcely imagined a decade ago. “In pharma and biotech, a lot of the innovation is in biotech companies and

academic and research institutes”, according to Mr van Ingen. “These smaller players may have the intellectual property, but you still have to turn it into a commercial product, because about 80% of the money is spent on the back end. Actually, the back end may be where large pharma has the core competency. They know how to bring a drug to market and to navigate

In your opinion, which technology area for drug manufacture will experience the most dramatic progress over the next five years?
(% respondents)





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the regulatory process.”

Drug companies are also collaborating earlier in the process with clinicians in the field as well as healthcare regulators and payers. “I don’t think there is any way out for pharmaceutical companies to recognise that they are delivering a targeted treatment solution rather than being a purveyor of white powders or injectable compounds,” says Dr Arlington. “This means that they have to work hand-in-glove with the regulator and the payer-provider from the beginning.”

IT infrastructure and working across the value chain help to improve the productivity of pre-clinical research. However, the most pressing problem still involves human bodies, or rather the lack of them, for clinical trials. “At the end of the day, the bottleneck for drug development is not coming up with new compounds” says Nick Stamos, chief technical officer for Verdasys, a security-solutions provider for the pharmaceutical industry. “The bottleneck for drug development is coming up with valid clinical trials. There are only so many people and only so much time to do it.”

Defence in depth

Drug companies are faced with the dilemma of how to benefit from increased knowledge-sharing without losing their competitive edge. “The principal concern for pharma companies is not so much the protection of the IT infrastructure, but the protection of the intellectual content within R&D or the market projections within the business organisation”, says Allen Michels, chairman of Verdasys.

Developing targeted treatments has altered the security environment in two ways, according to Michels. The first difference stems from the fact that biological research involves far more people who must manipulate sensitive corporate data. “Because of the nature of this research, you’re going to have a vastly larger number of people who must

interact with the IP that forms the foundation of the business,” he says.

The second difference is the sheer volume of data produced by the research of disease pathways and subsequent clinical trials. Whereas data produced through internal research can be protected through various technologies and procedures, the torrent of clinical data generated through trials offers no such guarantee. “It is difficult enough to find doctors able to participate. For the doctors that do participate, they may be running multiple trials involving competitors where data is being entered into the same computer” says Nick Stamos, Verdasys’ chief technical officer.

Additionally, many pharmaceutical companies

outsource their crucial Phase-III trials to Contract Research Organisations (CROs). As such, pharmaceutical companies exchange data with third-party companies almost daily, balancing the risk of lost, corrupted or stolen trial information against the cost of conducting trials internally.

Although there are Clinical Data Management Systems (CDMS) that attempt to centralise control over trials, securing intellectual property will contend with more people manipulating more data at many more points of vulnerability. How pharmaceutical companies balance this risk against the gains realised through better co-ordination will prove to be one of the more important, although less visible, points of competitive differentiation among firms.



Designer drugs?

As the pharmaceutical industry shifts its focus to targeted treatments, it will have to change nearly every aspect of the way it does business. Observers predict that drug companies will no longer focus exclusively on products and instead will become providers of both goods and services. Experts say it is likely that a drug company will create and manage a core biochemical component where several derivatives cover 90% of a disease based upon the most common genetic profiles in a population and the remaining 10% is tailored for specific patients. The clinical diagnostics business, as a result, will play a pivotal role in enabling targeted treatments. “We are very concerned about diagnostics being a low-margin business. Proper diagnostics is the

foundation of everything going forward”, says Dr Woodcock of the FDA.

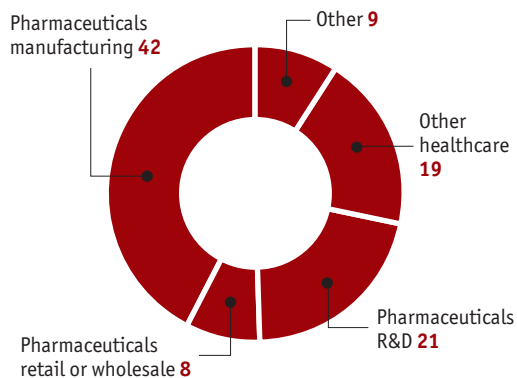
Between changes in drug development and patient selection, it is clear that pharmacogenomics is likely to shift the focus of the industry away from the blockbuster-drug business model. Yet, the challenges are daunting. “How do you build economies of scale for smaller markets?” asks Chris van Ingen. “And how do you conduct better research and clinical trials to make sure that you don’t have to do everything sequentially, but can do many things in parallel?” Notwithstanding such obstacles, major players up and down the value chain recognise the need to develop a sustainable scientific, regulatory and business model for targeted treatments. After all, it is a matter of life and death.



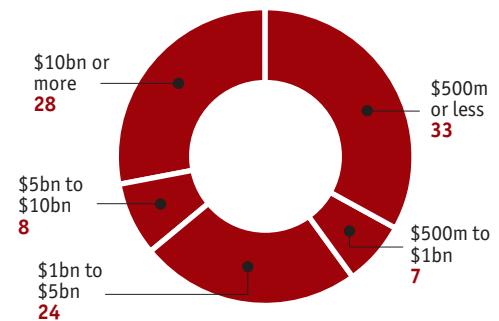
Appendix: Survey results

Responses received: 86. Please note that not all answers add up to 100, because of rounding or because respondents could give multiple answers to some questions.

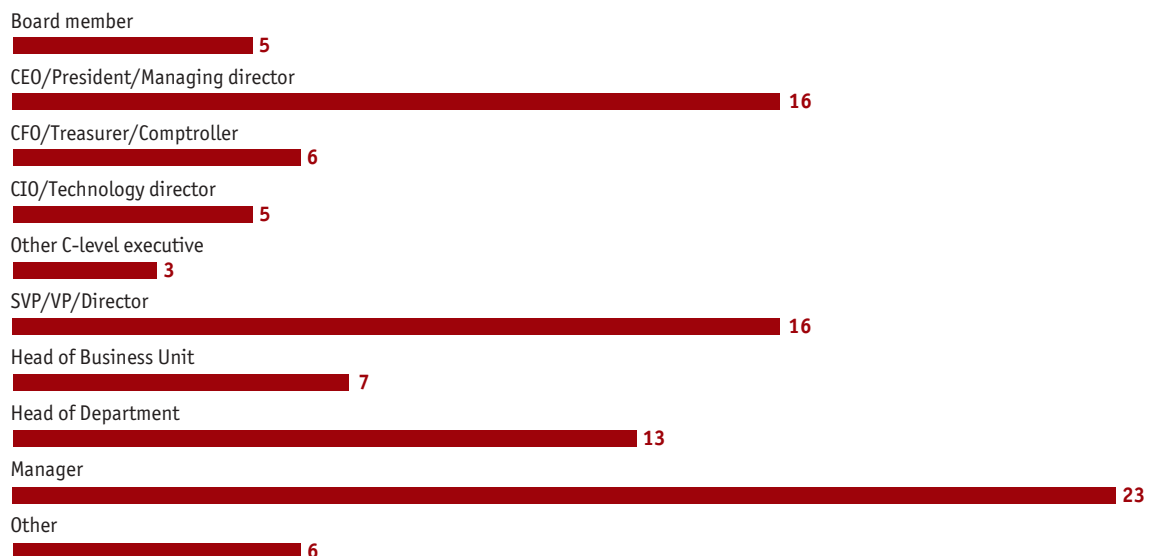
What is your industry?
(% respondents)



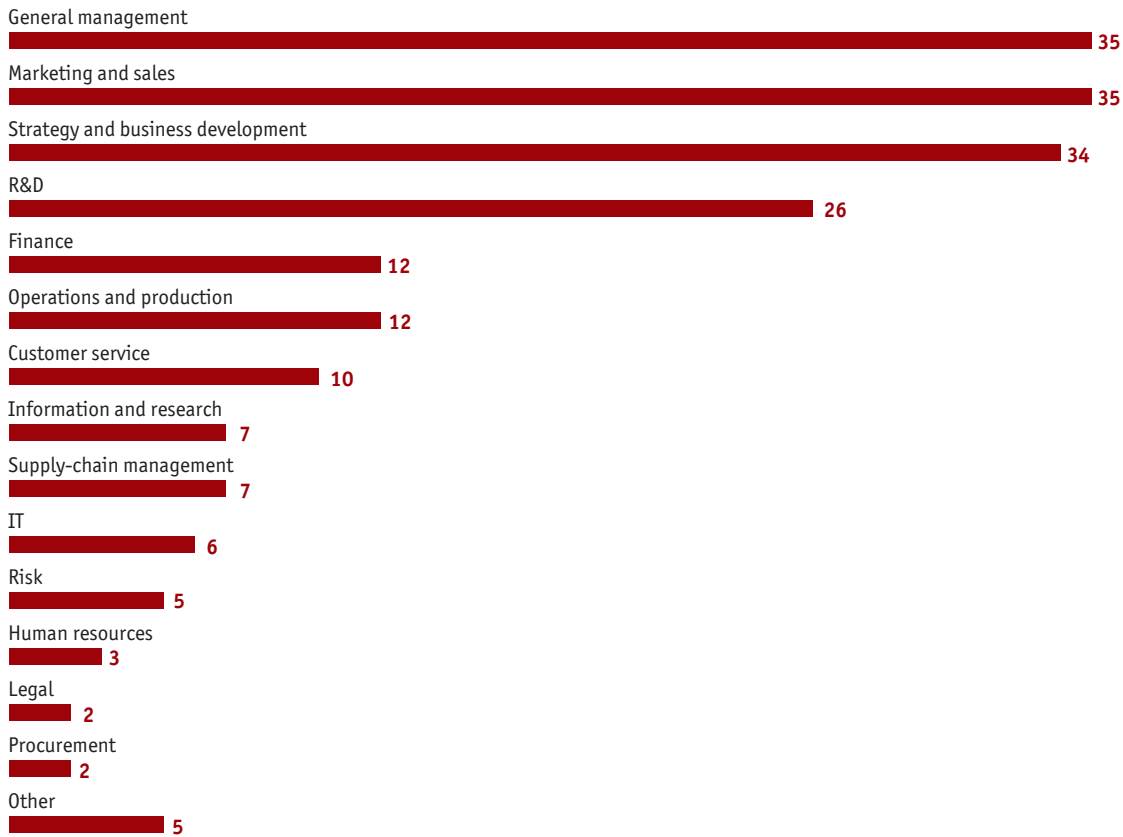
What is your organisation's global annual revenue?
(US dollars)



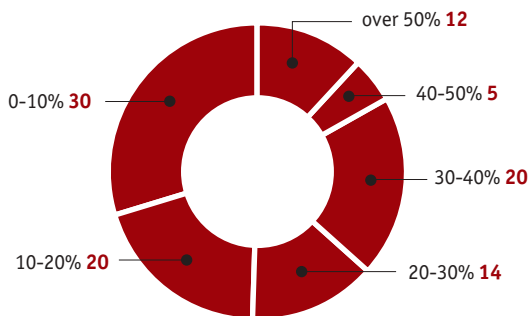
Which of the following best describes your job title?
(% respondents)



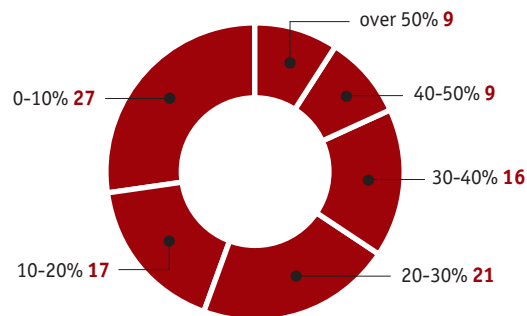
What are your main functional roles? Please choose no more than 3 functions.
(% respondents)



How much of your company's annual revenue is represented by its best-selling branded drug?
(% respondents)



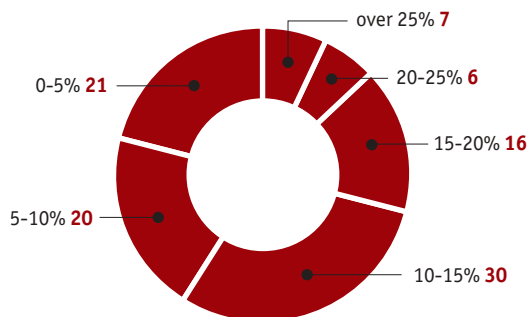
How much of your company's annual profit is represented by its best-selling branded drug?
(% respondents)



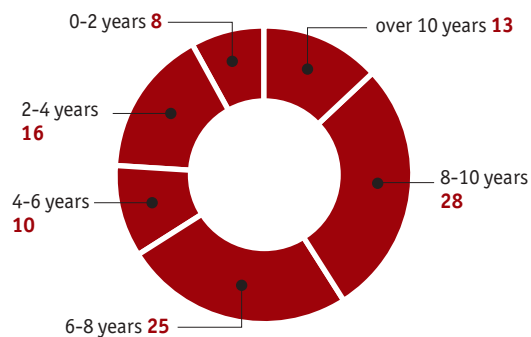
Appendix: Survey results

Targeted treatments and the prospects for pharmaceuticals

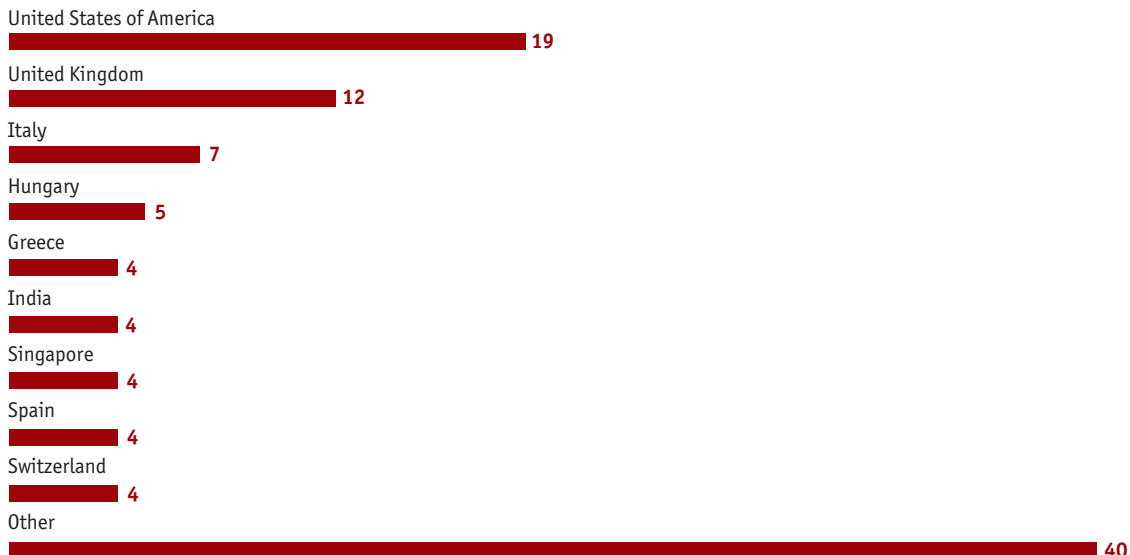
How much is invested annually in research and development (R&D) at your company, as a percentage of sales?
(% respondents)



How many years on average does it take your company to develop a drug from laboratory to market?
(% respondents)



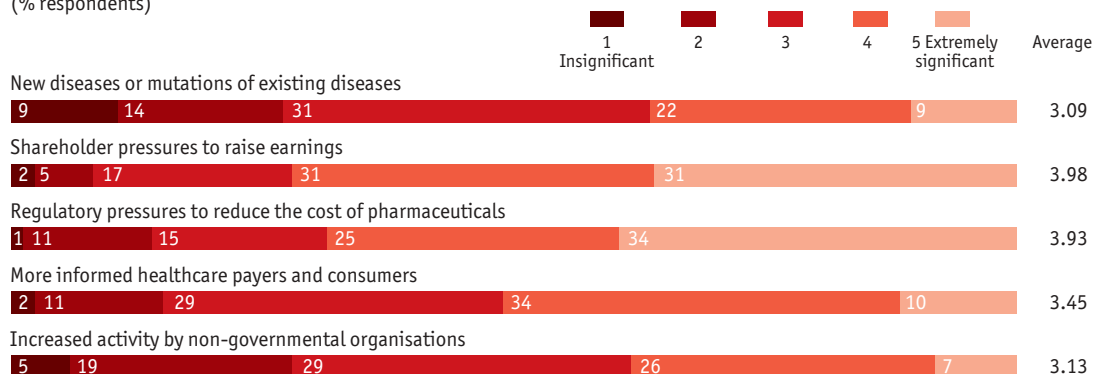
Country of origin.
(% respondents)



How significant are these external pressures on the pharmaceutical industry?

Please rate on a scale of 1 to 5, where 1=Insignificant and 5=Extremely significant.

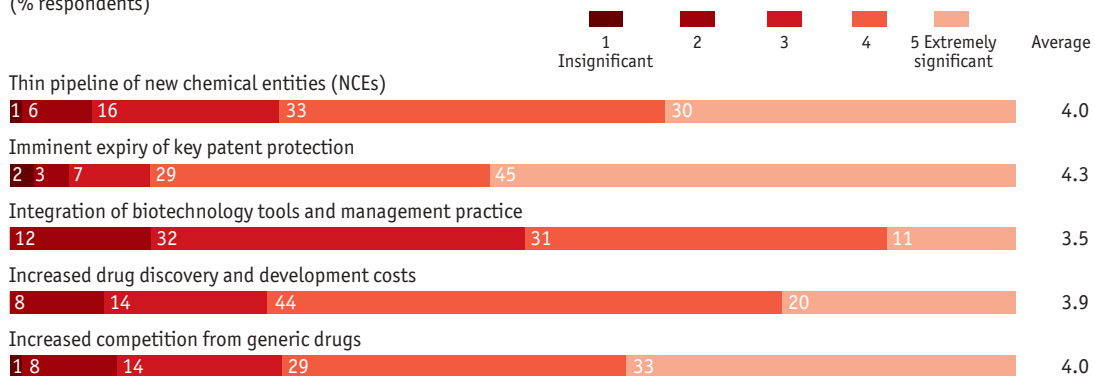
(% respondents)



How significant are these internal pressures on the pharmaceutical industry?

Please rate on a scale of 1 to 5, where 1=Insignificant and 5=Extremely significant.

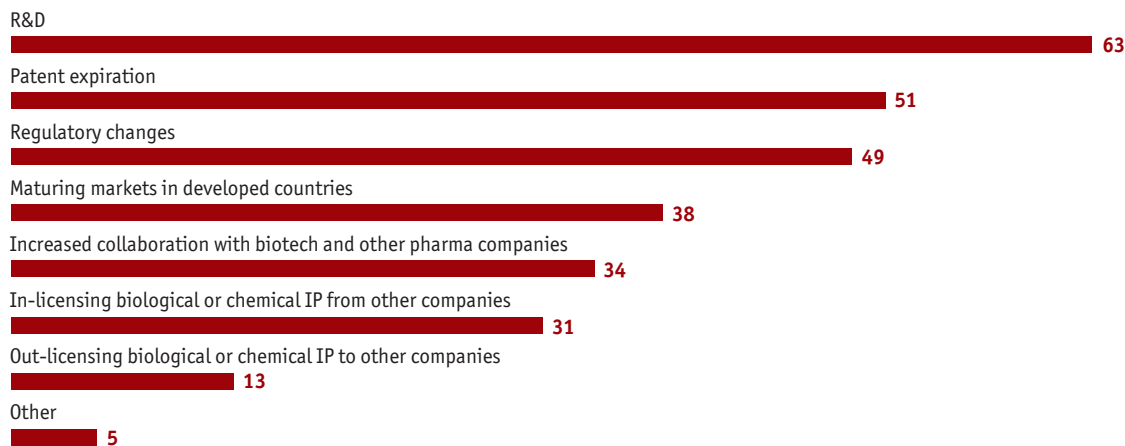
(% respondents)



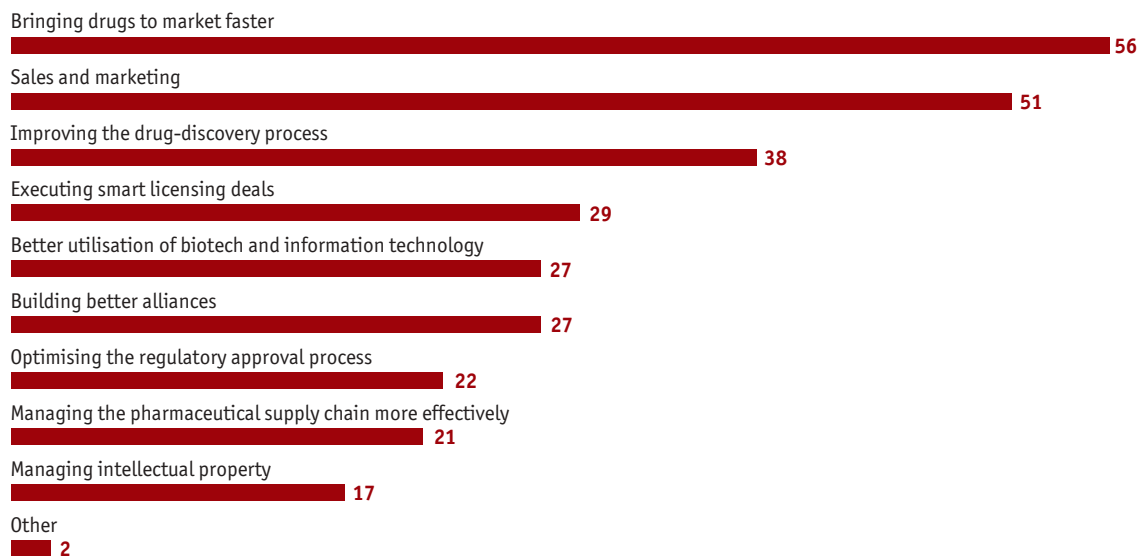
Appendix: Survey results

Targeted treatments and the prospects for pharmaceuticals

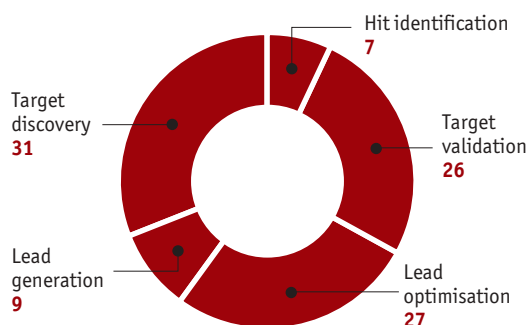
Which three factors will impact most significantly on your company's business performance over the next three years? Please choose up to three factors.
(% respondents)



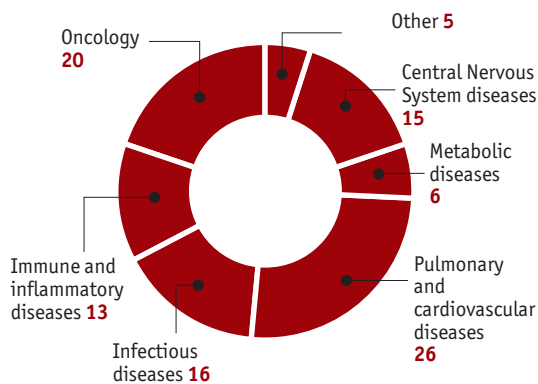
Which will be the top value-drivers for pharmaceuticals over the next three years? Please choose up to three drivers.
(% respondents)



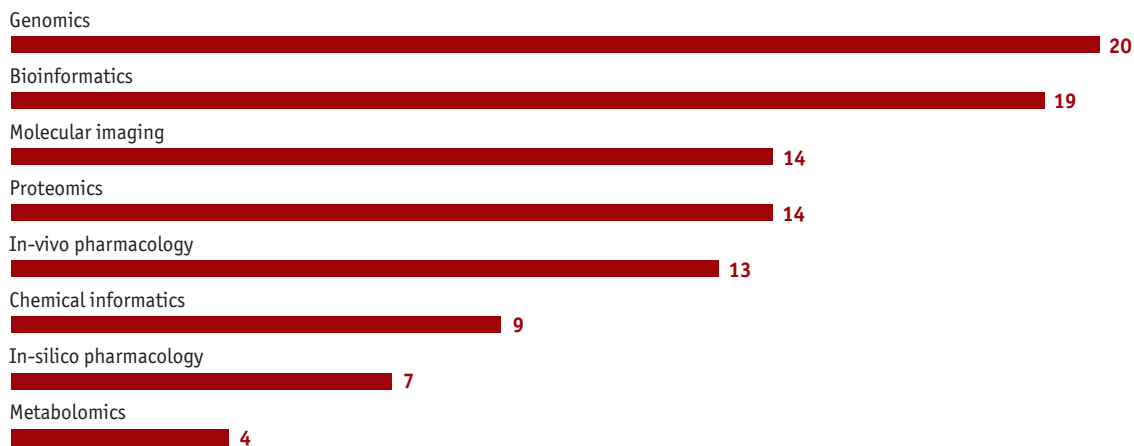
In your opinion, which area is most important for increasing productivity in the drug-discovery process?
(% respondents)



Which disease family receives the most investment by your company?
(% respondents)



Over the next three years, which area will play the most important role at your company in developing the pipeline for new drugs?
(% respondents)

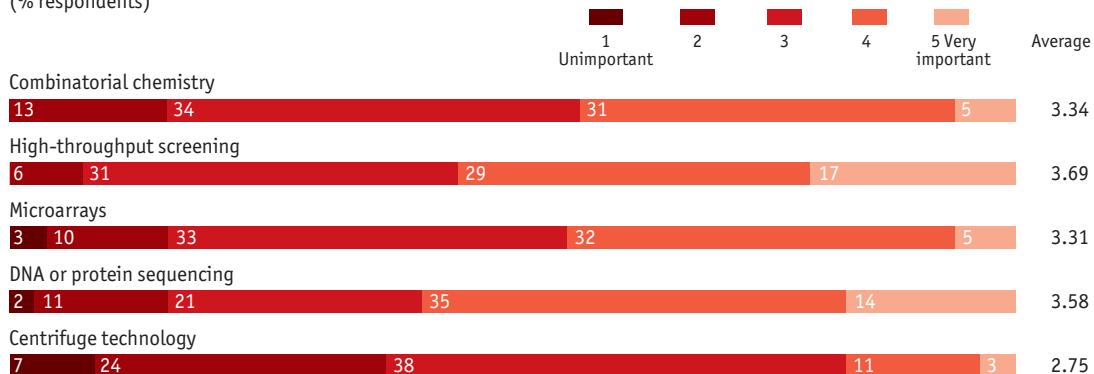


Appendix: Survey results

Targeted treatments and the prospects for pharmaceuticals

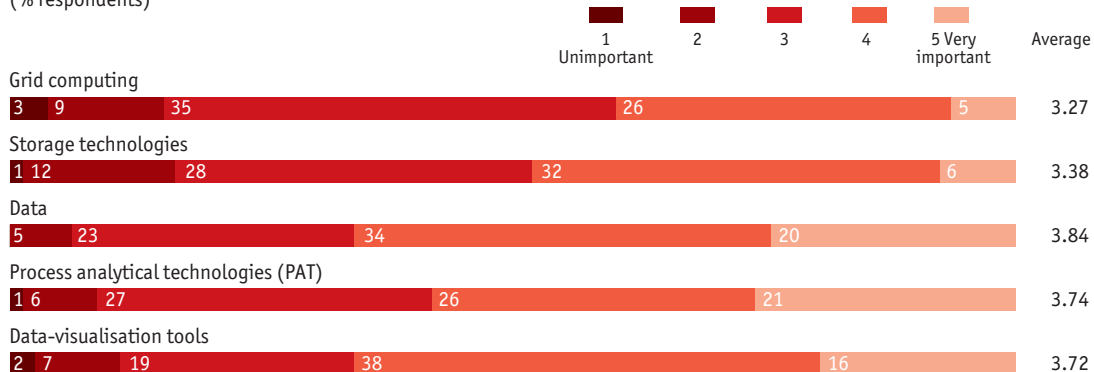
How important are these pharmaceutical technologies to new drug discovery and development?
Please rank each on a scale of 1 to 5, where 1=Unimportant and 5=Very important.

(% respondents)

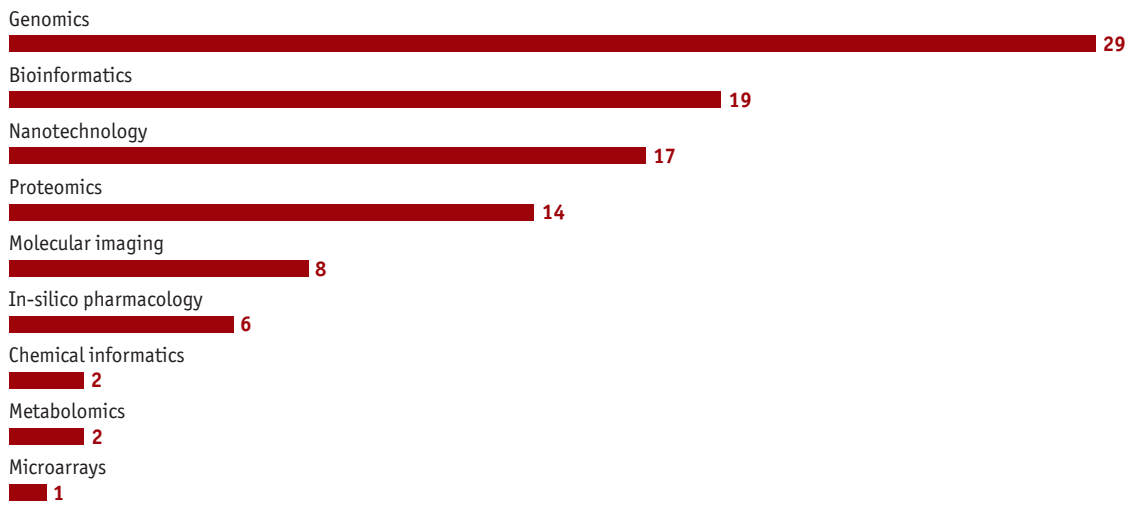


How important are these information technologies to new drug discovery and development?
Please rank each on a scale of 1 to 5, where 1=Unimportant and 5=Very important.

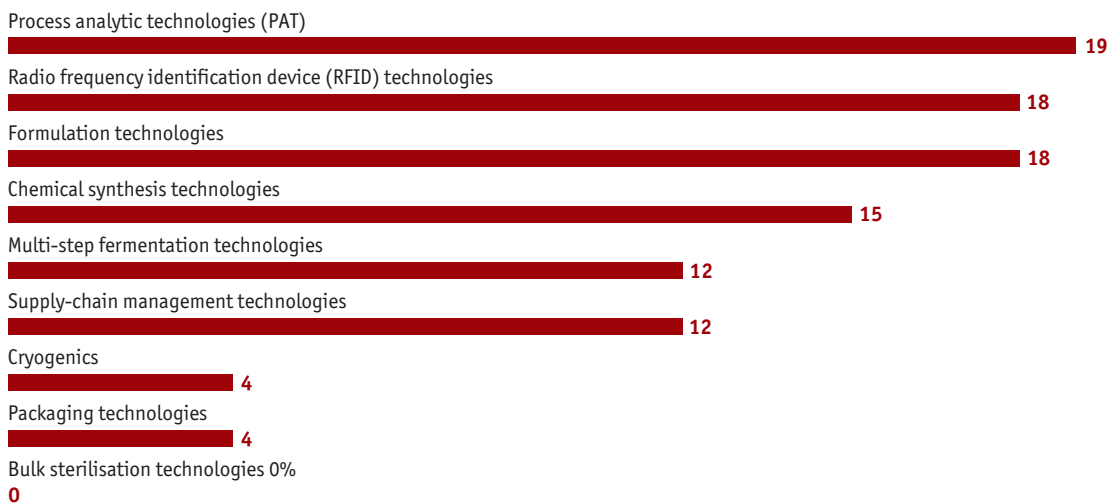
(% respondents)



In your opinion, which technology area for drug discovery will experience the most dramatic progress over the next five years?
(% respondents)



In your opinion, which technology area for drug manufacture will experience the most dramatic progress over the next five years?
(% respondents)



While every effort has been taken to verify the accuracy of this information, neither the Economist Intelligence Unit nor the sponsor of this report can accept any responsibility or liability for reliance by any person on this white paper or any of the information, opinions or conclusions set out in the white paper.

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