

# Falconbury

## Understanding the Pharmaceutical Industry

### Module 1

# Introduction to the Prescription Pharmaceutical Industry

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# INTRODUCTION TO THE PRESCRIPTION PHARMACEUTICAL INDUSTRY

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# 1. INTRODUCTION TO THE PRESCRIPTION PHARMACEUTICAL INDUSTRY

In order to succeed it is vital that as an individual working within the pharma sector you should develop not only the expert skills required, but also a broad understanding of the pharmaceutical industry. This distance learning programme offers the unique opportunity to develop this at your own pace, and in your own space, without the additional costs of travel and time away from work. It delivers a complete insider's guide to the pharmaceutical sector, its history and background, the process of discovery, clinical trials, taking a drug to market and the challenges and opportunities facing the industry currently and in the future.

It will concentrate on the pharmaceutical industry as it is in practice, with real-life examples. Experience has shown us that training participants are much more interested in the material relating directly to practice in the pharmaceutical industry than a less down to earth approach. This has governed the emphasis which we have given to the material in this course.

In this first Module we include a variety of different topics which are aimed to introduce basic aspects of the pharmaceutical industry.

## What is distinctive about the pharmaceutical industry?

The pharmaceutical industry is distinctive in a number of ways from other industries. It is important to get to grips with these because the way in which it has to operate is determined by these characteristics.

### ***Who is the customer?***

Although the patient consumes medicines, it is the doctor who prescribes them. This immediately introduces a disconnect between the (physical) consumer and the prescriber/immediate decision-maker. It also means that the primary, although not the only, target for pharmaceutical marketing is the doctor. Each doctor is primarily responsible for the prescribing of a very considerable quantity of often expensive pharmaceuticals each year.

Because the number of doctors in the general population is relatively limited, it is cost effective for pharmaceutical companies to promote their products very actively through salesforces and other promotional media targeted at doctors. We deal with marketing and sales in Module 5.

### ***Regulation***

Since the 1960s pharmaceuticals has become a highly regulated industry – probably more regulated than any other. Pharmaceutical products have to be shown to be safe and effective. Increasingly nowadays they also have to be shown to be cost-effective. Not only does this mean that it normally takes many years to generate the evidence to satisfy the regulatory authorities of the suitability of a new product for approval, it also means that there are also strict constraints on how an approved product may then be marketed.

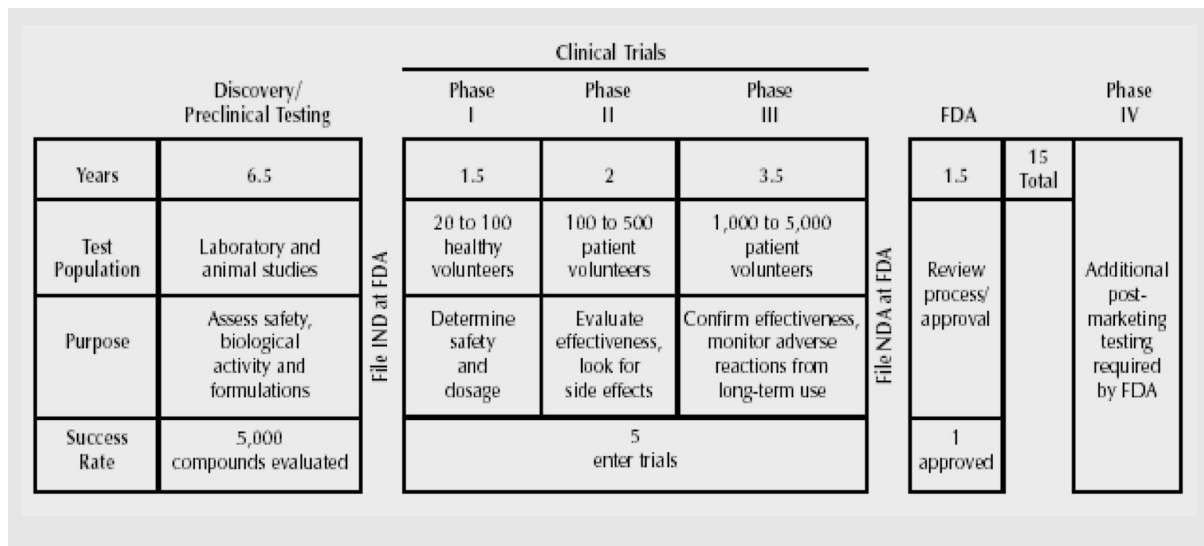
### **Intellectual property protection**

Several different types of intellectual property cover may apply to pharmaceutical products. The key type of intellectual property protection universally for pharmaceuticals is patent cover. Trademarking can be of some importance. But, unlike with consumer products, copyright is not often of great consequence in pharmaceuticals.

The standard patent term from filing is 20 years, though various forms of extension are available. Once all intellectual property protection has expired, then to most intents and purposes the life of the product as a marketed brand has passed. This is quite different from other industries, where brands can often be maintained from one century to the next. We deal with this important aspect of the pharmaceutical industry in more detail later in this Module.

### **Costs and timescales**

Let's look at *timescales* first. Firstly, let's consider R & D. The figure below shows that on average a new product takes 10-12 years to develop. We will discuss the whole process in Module 2.



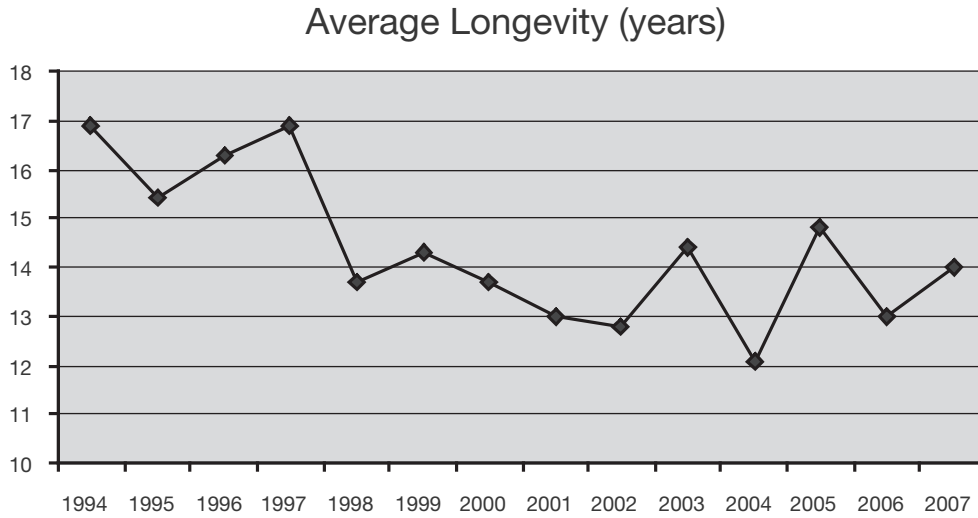
Source: Kelly, PhRMA web site

**Figure: The Drug Development and Approval Process**

The consequence of such a long development process for new products is that R & D costs are very high for pharmaceuticals in comparison with other industries' products.

Since the patent term for a pharmaceutical compound begins to run when the patent is filed, it might seem that not much time remains after a new product is launched before its patent expires. But, in reality, because subsequent patents of value can often be filed, and other types of intellectual property protection can apply, it means that on average global sales for a product only peak after it has been on the market for about 13 years.

Sales of the majority of products thereafter normally decline quite sharply as generic competitors erode their sales, so that effectively the active life of the original brand is over.



Source: John Ansell Consultancy

Figure: Average global longevity

This time to peak sales, termed longevity, has been stabilizing at around 13-14 years over the past few years.

Therefore, the life of a pharmaceutical product is in total about 25 years. It divides neatly into two roughly equal halves: the first half is taken up with developing the product to the point of regulatory approval and the second half is devoted to marketing it.

When we examine the cost structure for pharmaceuticals it is quite different from that of other industries. It is shown in the figure below:

R & D	16.5%
Cost of goods	13.2%
Sales & marketing	35.0%
General & administrative	8.0%
<b>Total</b>	<b>72.7%</b>
Margin	27.3%

Source: PharmaStrategy

Figure: Pharmaceutical cost structure (as percentage of sales)

**R & D costs**

R & D accounts on average for the equivalent of 16.5% of sales turnover. It reflects the long duration of the R & D process and the complex and demanding nature of regulatory requirements. 16.5% is the highest percentage for any industry, and very much higher than for most others; only a handful spend over 6% of their sales on R & D.

***Manufacturing costs***

Pharmaceutical manufacturing is not labour intensive as in many other industries and so manufacturing costs are typically only 10-15% of sales. For new products the figure is often well under 10%.

***Sales and marketing costs***

Across industries, marketing costs typically amount to 35-40% of a product's selling price. The figure of 35% for pharmaceuticals is very much in line with this.

***Net margin***

With general and administrative costs accounting for a further 8%, this means that net margins in the pharmaceutical industry are typically 25-30%. This is higher than for most other industries. But pharmaceuticals is also a relatively high risk industry: thus high risks and high gains apply.

***What counts most in pharmaceuticals?***

The consequence is that, crudely expressed, pharmaceutical success is much more about maximising revenue than reducing costs – because in pharmaceuticals the scope for the former is much greater than for the latter. For example, curbing manufacturing costs are an issue for most industries. But in pharmaceuticals they will not make or break the company – whereas how successful a newly launched product will be could do so.

Maximising revenue means above all that pharmaceutical companies must ensure that they have sufficient new products to survive and prosper – they are the lifeblood of the industry. Pharmaceutical companies therefore put immense efforts into developing new products through their own pipelines. And all today augment this through licensing: acquiring rights to products either already on the market or in development by third parties. For if they fail and patents run out on their existing products, there would be no future for the company.

**The structure of the pharmaceutical industry  
– and the international dimension**

The ways in which the pharmaceutical industry is distinctive, described above, help to determine its structure. And as we shall see, the international dimension is very important – and more so than for most other industries. Why should this be the case?

Firstly, today's enormous costs of R & D encourage pharmaceutical companies to maximise their returns from new products. One obvious way of achieving this is to maximise return internationally. Since most of the return from a drug is obtained from its commercialisation, it is important that pharmaceutical companies set up national subsidiaries wherever feasible in order to capitalise on their products.

Thus, rather than employ agents which pay a relatively modest royalty, as used to happen much more commonly 30 years ago, companies tend now in most countries to set up a wide international network of subsidiaries to market the product which they develop. As long as they have enough products for this to be viable, then it is normally much more profitable for them to do this.

Secondly, the nature of most disease is relatively uniform internationally. As developing countries become more developed, the degree of uniformity of disease and hence treatment increases. Until a little way past the middle of the twentieth century, the most important therapeutic area worldwide was infectious diseases. Then in the developed world cardiovascular disease became the most prominent therapeutic area. Now the cardiovascular area is dropping back somewhat and cancer is becoming the most important therapeutic area. As developing countries advance we see the same sequential progression. With fewer developing countries remaining, the extent of global uniformity of disease increases and the potential market for most types of actively marketed drug therapy therefore also increases. Whilst the pharmaceutical industry has been ahead of most other industries in the extent of its globalisation, nevertheless the extent is still increasing.

A consequence is that companies have to be capable of managing sophisticated international operations, which often demands high-level skills from their staff. This is in addition to the highly-educated and well qualified staff obviously required to run an R & D operation.

Also take another area which employs a substantial proportion of total staff: salesforces. Because of the technical nature of the product, a good standard of education is required to do the job effectively. For the past 25 years a first degree has been the standard qualification required for recruitment to a pharmaceutical salesforce.

Whilst, as we have explained, the nature of disease globally is becoming more uniform, there are still very many different types of disease which require treatment. This means that even major pharmaceutical companies each cover only a limited number of diseases.

This has the important consequence that compared with other industries, the pharmaceutical industry is only moderately concentrated, with the two largest pharmaceutical companies, Pfizer and GlaxoSmithKline, each accounting for only 6% of total global pharmaceutical sales. Companies ranked around No. 20, such as Genentech, Astellas and Novo Nordisk, account for only around 1%. This means that even a major pharmaceutical company only competes head-to-head with other pharmaceutical companies across a small proportion of its range of products.

### ***People***

Pharmaceuticals is a high-tech industry. This means that, compared with most other industries, it has to employ a relatively large proportion of highly educated and qualified people.

On the other hand, relative to most other industries, pharmaceuticals is not a labour-intensive industry. As we have previously discussed in this Module, manufacturing costs make up a much smaller share of total costs than is typical across all industries. The nature of pharmaceutical manufacturing means that relatively few people are employed. And, in comparison with other industries, very few labour disputes have ever occurred. Reflecting its lack of importance as an issue for pharmaceutical companies, the director responsible for manufacturing is not often a main board director in a pharmaceutical company.

Indeed, top management tends to come from two other main areas: the commercial area, until recently mostly former marketing management, and from R & D. A trend over the past 15 years is the rise from a relatively humble status of the licensing function (see also Module 5). Because of the declining number of products developed in-house, and the growing need to obtain rights to products from outside the company, pharmaceutical companies have had to expand their licensing and business development functions greatly. In recent years, those with licensing experience have tended for the first time to reach the top in pharmaceutical companies.

The pharmaceutical industry is sometimes criticised for being too insular. But there are good reasons to explain why it is rather set apart from other industries. Because of the particular characteristics of the pharmaceutical industry we have already described, pharmaceutical companies often want to recruit people who already have some pharmaceutical experience. It can, therefore, be difficult after more than a couple of years of non-pharmaceutical experience for potential employees to enter the pharmaceutical industry.

On the other hand, it can be difficult for people to get out of the industry, since their experience can be viewed by other industries as being too specialised. For example, a pharmaceutical marketeer will not gain experience of TV advertising (unless they happen to be based in the USA – see also Module 5). A consumer product company recruiting marketing people is likely to consider this gap in experience as a serious drawback.

The extent to which this inter-industry flow of employees is restricted in this way varies depending on management function. It is not, for example, such an issue for many accountancy or IT roles, but for many others it can be crucial. And as the demands placed on pharmaceutical companies have become more complex, the pharmaceutical industry has become more disinclined to recruit experienced people who lack pharmaceutical industry experience.

This means in turn that when people move companies, they tend to do so within the pharmaceutical industry or to companies serving the industry. Because skills and experience are readily transferable across companies it is therefore common for employees (once they have pharma company experience) to end up working for four or more pharmaceutical companies during the course of their career – but never to stray outside pharmaceuticals.

Whilst there are naturally confidentiality clauses that have to be adhered to in job contracts, the positive consequence is that ideas and techniques become quite rapidly disseminated throughout the pharmaceutical industry.

Because of this and the low intensity of head-to-head competition mentioned above, there is a culture of people from different companies communicating with each other – in industry conferences, for example. This is very different, for example, to the computer industry, or even the generics industry, where there is a much greater reluctance to do so. Furthermore, companies have become more dependent on each other because of the ever increasing importance of licensing already mentioned and have become used to communicating with each other more frequently than 20-30 years ago.

One result of this is a good level of respect in the main between companies at all levels. People are mindful of who they might end up having to deal with in the future! Thus, contracts tend to be honoured, payments are made, and companies are more mindful of their good name than is the case within most other industries.

We consider that the industry had benefited greatly from the healthy level of interaction between companies, even when taking into account the expense of perhaps higher recruitment budgets and the temporary disruption caused by staff movement.

## **A short history of the pharmaceutical industry**

In this short history we concentrate on landmark developments of the really effective pharmaceutical products which had most impact commercially as well as scientifically. Inevitably this means that we concentrate on the twentieth (and to some extent the nineteenth) century rather than on limited earlier progress that was made.

In contrast to conventional histories within each therapeutic area we feature the more recent, strikingly effective developments at the expenses of earlier developments if they actually made only a modest impact on disease (e.g. in cancer).

### ***The 19th century***

The following quotation from the medical historian Roy Porter in *'The Greatest Benefits to Mankind, A Medical History of Humanity'* emphasises the importance up until then of infectious diseases:

*“Throughout the 19th century, and well into the twentieth, patients were besieged by infections, commonly lethal to old and young alike – diphtheria, chickenpox, scarlet fever, rubella and a multitude of gastro-intestinal and dysenteric troubles claimed millions of infants. Being a family doctor in 1830 and even a century later meant being called out late at night to febrile patients, sweating copiously and hectic in their breathing, suffering from some infant fever or from pneumonia (called the ‘old man’s friend’ because it was often speedily fatal). Measles and the other epidemic diseases of childhood were still killers; tuberculosis, syphilis, diphtheria, meningitis, and post-partum sepsis were widely encountered.”*

Even by 1900 infectious diseases were still the major killer. Pneumonia and influenza were the leading causes of death in the United States, followed by tuberculosis and diarrhoea. Heart disease – which tops the chart today – was only the fifth most common cause of death, because infectious diseases killed many before they grew old enough to develop heart disease.

Before the 20th century doctors had few weapons to fight disease. The range of drugs of any efficacy available in the mid-to-late 19th century was very limited. It included:

- mercury for syphilis and ringworm
- digitalis and amyl nitrate for cardiac failure
- quinine for malaria
- anaesthetics, such as chloroform
- colchicum for gout
- plant-based purgatives.

In the second half of the 19th century, scientists such as Louis Pasteur and Robert Koch carried out the ground work for a revolutionary theory – that specific micro-organisms, or germs, cause disease. Both founded Institutes which proved important in further developing their original work.

In France, Pasteur showed that it was possible to protect fowl from cholera and sheep from anthrax by injecting them with attenuated strains of the causative bacteria. He found that some bacterial cultures lose their lethal character: they become attenuated. This knowledge led him to vaccinate a nine-year old boy who had been bitten by a rabid dog with attenuated rabies microbes. The boy survived unharmed.

In 1891 Emil von Behring and Shibasabuto Kitasato at the Koch Institute successfully treated a sick child with diphtheria antitoxin, signalling the eventual end of that disease. Also the developer of the first vaccine for tetanus, von Behring went on to found Behringwerke to market vaccines and serums. This stimulated companies in countries such as the US, France, Germany and the UK to produce other vaccines and antitoxins.

### ***The development of the modern pharmaceutical industry***

The development of the modern pharmaceutical industry only really began in the nineteenth century. Before that time empirical development by herbalists and the like had made slow gains in treatment.

However, there was an early and striking breakthrough in vaccination before that time. The development of vaccination, spurred by Edward Jenner at the turn of the eighteenth and nineteenth century, made major gains in the eradication initially of smallpox and then other diseases, first in the UK and then worldwide. Before vaccination, smallpox accounted for one in three deaths of all children.

In the second half of the nineteenth century, with the production of the first synthetic anti-inflammatory and pain-killing compounds, culminating in 1899 in the conversion of salicylic acid, originally derived from willow bark into acetylsalicylic acid, or aspirin, by Felix Hoffman at Bayer. Aspirin is still very widely used in these and more recent, cardiovascular indications.

Other branches of medical technology made progress during the 19th century. Anaesthetics (which can be regarded as pharmaceuticals) and antiseptics were first developed in the 19th century, opening up new possibilities for complex surgery. These included techniques of blood transfusion. Also, examination by X-rays, discovered in 1895, and radiotherapy began, following demonstration of the therapeutic effects of ultraviolet light in 1893.

### ***Anti-infectives to the fore***

By the end of the 19th century there had been some major breakthroughs, foremost from Germany, emanating from the dyeing industry.

In Germany in 1910 bacteriologists Sahachiro Hata, working for Paul Ehrlich, himself a former research assistant of Koch, formulated the first 'magic bullet', an arsenic compound, effective against syphilis. This was the first drug devised to overwhelm an invading micro-organism which did not also compromise the condition of the host. The medicine, Salvarsan (arsphenamine), was developed and marketed by Hoechst. It remained standard treatment for syphilis until the 1940s, when antibiotics replaced it.

A major attack on infection began in the late 1920s, when the German chemical giant I.G. Farben hired the young scientist Gerhard Domagk. In 1933, when experimenting with dyes, Domagk found that an orange-red dye called Prontosil killed bacteria in mice. A few weeks later, the substance saved the life of a baby dying of a bloodstream staphylococcal infection. Called 'sulfa' drugs after the active ingredient in the dye, these medicines were found to halt the growth and proliferation of bacteria while the body's natural defence fought off the infection.

In 1935 Ernest Fourneau's team at the Pasteur Institute in Paris discovered that Prontosil, a red dye developed by the German synthetic-dyestuff industry, was an effective drug against streptococcal infections. These infections lead to blood poisoning. The active ingredient was identified as being sulphanilamide – the first of the 'sulfa' drugs. Late in 1940, Fildes and Woods, at the Middlesex Hospital, London, identified the mechanism of action of sulphanilamide, which they termed 'competitive antagonism'.

Alexander Fleming discovered penicillin in 1928. But this did not then lead to a therapeutic drug being developed, partly because it proved very difficult to isolate the drug in a stable form from the mould in which it was formed.

Penicillins development in the UK from 1938, led by Florey, Chain and Heatley, was stimulated by World War II. This work first established that penicillin was less toxic than the sulphonamides, and was also active against staphylococci, against which sulphonamides had no effect. Fermentation production technologies were developed, and the first commercial production of penicillin began in 1941. By 1943, several US-based pharmaceutical companies were mass-producing a purified form. By 1944, sufficient penicillin was available to treat all severe battle wounds suffered by Allied troops in the D-Day Normandy landings.

In the 1950s, known as the decade of antibiotics, new breakthroughs followed to treat tuberculosis and other infections. Semi-synthetic penicillins began to be produced from the late 1950s; Penbritin (ampicillin) was a semi-synthetic penicillin developed by Beecham and first marketed in 1959. This highly successful drug was the first broad-spectrum antibiotic, active against Gram negative as well as Gram positive bacteria.

The most successful modern class of antibiotics are the cephalosporins. Cephalosporins were first isolated from cultures of *Cephalosporium acremonium* by Brotzu in 1948 from a sewer in Sardinia. The first cephalosporin antibiotic marketed by Eli Lilly was Cefalotin (cephalothin) launched in 1964. Many others have been marketed subsequently.

In the past 20 years there have been almost no novel classes of antibiotics marketed. Within the field of anti-infectives, it has instead been the anti-virals where the impressive breakthroughs have been made.

The first widely successful antiviral agent was Wellcome's Zovirax (acyclovir), for herpes simplex and zoster infections. This was launched in 1981. About this time HIV first emerged. Though next to no progress has proven possible in producing a suitable vaccine for AIDS, some 18 antiviral products for treating AIDS have reached the market since the first, Wellcome's Retrovir (zidovudine), in 1987.

### ***Vitamins***

The word vitamin was invented by a Polish chemist, Casimir Funk, in 1912. By the end of the 1930s most vitamins we know today had been isolated, their structures identified, and their chemical synthesis achieved.

Vitamin A is a generic term embracing substances with the biological activity of retinol and related substances, known as retinoids. Vitamin A deficiency is associated with ocular defects and an increased susceptibility to infections. It was discovered in 1917 but not synthesised until 1947, by two Dutch chemists, van Dorp and Ahrens.

Vitamin B, which plays important roles in cell metabolism, was originally thought to be one compound. It turned out to be no less than eight, including thiamine (B1), riboflavin (B2), nicotinamide (B3) and pyridoxine (B6).

Deficiency of Vitamin C (ascorbic acid) leads to scurvy. This was the first vitamin to be artificially synthesised in 1935. The process was devised by Tadeusz Reichstein of the Swiss Institute of Technology in Zurich.

Vitamin D to prevent rickets was produced in the UK by Glaxo. Previously a baby food manufacturer, this was its first venture into pharmaceuticals.

Vitamin K is necessary for the production of blood clotting factors and the normal calcification of bone. Adlebert and Dam both worked on its discovery in the late 1920s and received the Nobel Prize in 1943, the compound having been synthesised in 1939.

There was a tendency for original discoverers of vitamins to underestimate the complexity of vitamin deficiencies. This was true for the vitamin B complex. And vitamin K turned out eventually to be two different compounds.

With improving analytical techniques and the more immediate identification of compounds responsible for deficiencies, the need to use vitamin nomenclature declined and the era of new vitamin discovery did not stretch into the second half of the twentieth century.

### ***Hormones***

Diabetes mellitus is caused by a malfunctioning pancreas, which fails to produce insulin, the hormone that regulates blood sugar. For most of human history, diabetes meant death. In the late 19th century, scientists discovered the role of insulin in the pancreas in diabetes and attempted to isolate the hormone. But this took until 1921, when Canadians Frederick Banting and Charles Best of the University of Toronto isolated the hormone.

Lilly, a US company, which had a research affiliation with the University of Toronto where Banting did his research, acquired rights to manufacture and market insulin. Overcoming technical problems, Lilly perfected methods of large-scale collection of raw material extraction, purification, and mass production. Insulin was first marketed in 1923 and within a few years enough insulin was being produced internationally by Lilly and other pharmaceutical companies to meet the needs of diabetes patients around the world.

Much later, Lilly became the company to market the first biotechnology drug – human insulin, utilising recombinant DNA technology. This was marketed as Humulin in 1982.

Synthetic corticosteroid hormones such as hydrocortisone were first marketed from the middle of the 20th century, for a multitude of indications for their anti-inflammatory effect. They were particularly used, orally and parenterally, for the treatment of arthritis and asthma. Topical dermatological presentations were particularly used for eczema and dermatitis.

Corticosteroids became one of the important types of compound commercially in the late 1950s, and through the 1960s and 1970s, because they were used in these conditions which were all common ones. Their use became curbed because of serious side-effects. Only when the dose could be limited through targeting did this prove not to be an important limiting factor. (See also Respiratory section below.)

Along with insulin, sex hormones were extracted from offal from the 1930s. Meat companies such as Organon in Holland diversified into pharmaceuticals in this way. But in the early days none of the hormones extracted became major products.

The first really major development commercially for sex hormones was the development of the oral contraceptive Pill, first launched in 1960. Synthetic hormones needed to be developed in order to enable this: the most popular forms of the Pill have combined a synthetic oestrogen with a synthetic progestagen.

This again became one of the biggest markets commercially in the 1960s up until the 1980s but suffered from lack of real breakthroughs after the mid-1970s.

### ***Cardiovascular advances***

Until the middle of the twentieth century, with the principal exception of digitalis, there were very few drugs available to treat some of the underlying causes of cardiovascular disease, such as high blood pressure, stroke and high cholesterol (the latter not even being recognised as a danger at that time). When US President Franklin D. Roosevelt developed high blood pressure in the early 1940s, all his doctors prescribed were sedatives and a low-salt diet; he died of a stroke aged 63 in 1945.

In the cardiovascular field there have been tremendous advances over the past half century in treating high blood pressure and allied indications:

- The first agent successfully used to treat high blood pressure, reserpine, was extracted from the powdered root of the tropical plant *Rauwolfia serpentina*. It was developed by Merck & Co and approved in the US in the early 1950s.
- The first beta-blockers were developed by Sir James Black with ICI (now AstraZeneca) in the mid-1960s, notably Inderal (propranolol), for the treatment of angina and then high blood pressure.
- The first calcium channel blockers, such as verapamil (Securon, Knoll) and nifedipine (Adalat, Bayer) were launched in the mid-1970s.
- The first ACE (angiotensin converting enzyme) inhibitor, Capoten (captopril) was developed by Squibb (now Bristol-Myers Squibb) and launched in 1981.
- The first angiotensin II inhibitor, Cozaar (losartan), was developed by Merck & Co and launched in 1994.
- The first of an entirely novel class of antihypertensives, renin-inhibitors, Rasilez/Tekturna, was launched by Novartis in 2006. It is so far unclear whether this will be the commercial success that the earlier classes have proven.

Another major advance in cardiovascular medicine has been lowering of raised lipid levels. In the early 1970s, pharmaceutical company scientists searching for a drug for a disease of poultry, discovered an organism which inhibited an enzyme required for the synthesis of one of the building blocks of cholesterol. This serendipitous discovery led to a new class of drugs called statins.

The first statin launched was Zocor (simvastatin (Merck & Co) in 1989. Gradually more effective statins were developed, such as Lipitor (atorvastatin, Pfizer), which became the best-selling product globally in 2002 and still remains so, and the now up and coming Crestor (rosuvastatin, Shionogi/AstraZeneca). The use of statins, alongside the various drugs lowering blood pressure described above, has resulted in recent years in falling coronary death rates in developed countries.

Also in the cardiovascular field, tissue plasminogen activators TPAs, which are clot-dissolving drugs, were developed from the 1980s. TPAs are capable of stopping heart attacks in mid-stream before permanent damage to the heart is done.

### ***Respiratory***

From the 1970s there were major developments in the treatment of asthma and related diseases. Sir David Jack and his team at Allen & Hanbury's (which later became part of Glaxo and then GlaxoSmithKline) developed the first beta-agonist bronchodilator, salbutamol, which was first marketed in 1969 for asthma and became the enormously successful product Ventolin. Salbutamol was subsequently developed in formulations for