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Current and future prospects for the global biotechnology industry

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Abstract

The number of biotechnology compounds has been increasing steadily over the past 20 years, reflecting the key contribution that biotechnology is now making to healthcare. Recombinant DNA technology has been used to develop a number of therapeutic proteins, including antibodies, cytokines, hormones and vaccines for use in tackling and diagnosing a range of disorders. Worldwide there are more than 4,000 specialised biotechnology companies. The most well-known companies are located in the USA and Europe, but there are significant companies emerging in Canada, Australia, New Zealand and throughout Asia – particularly in Japan. Most of these companies are small in size and limited when it comes to finances and this has had an impact on the output of the industry in terms of new drugs.

DECLINING NEW DRUG OUTPUT

In 2002, only 28 new molecular entities (NMEs) were launched onto the global market, which represented the lowest number of new medicines launched in over 20 years.¹ The declining new drug

output represents a puzzling trend, given that many companies have been increasing their R&D spend on a regular basis over the past 10 years (Figure 1).

Some industry observers believe that there is an 'innovation deficit' in new drug development, and that many of the

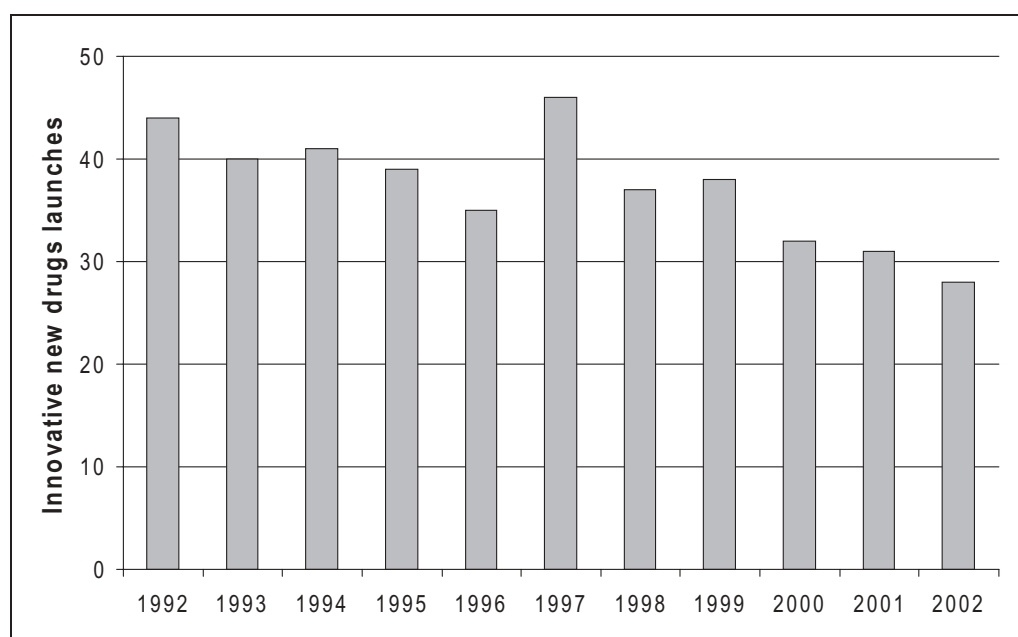


Figure 1: Number of innovative new drugs launched globally (1992–2002)
Source: CMR International^{1,3}

major companies involved lack new ideas and methodologies.² Critics within the general public believe that the industry is producing too many new drugs that are similar to each other and that offer little clinical advantage over those already on the global market.

As a result, many in the industry have looked to biotechnology to provide continuing innovation in R&D, which will lead to a new generation of medical treatments. Although the major pharmaceutical companies are involved in biotechnology research, most public attention has been focused on small biotechnology companies that have specifically dedicated themselves to this field. Although it is a relatively young sector, the biotechnology industry promises to deliver many benefits, such as medical treatment tailored to the individual patient's biological make-up.

THE EMPHASIS ON BIOTECHNOLOGY

The increasing emphasis on biotechnology research is illustrated by the fact that between 1990 and 1999, global biotechnology R&D increased by 262 per cent (Figure 2), whereas that for (non-biotechnology) pharmaceutical

R&D increased by 121 per cent.³ On a year-to-year basis there has been some fluctuation in the development of biotechnology compounds, but in general terms the number of biotechnology compounds has been increasing steadily over the past 20 years – reflecting the key contribution that biotechnology is making to healthcare.^{1,3}

Worldwide, there are now more than 350 biotechnology drug products and vaccines in clinical trials which are targeting more than 200 diseases, including various cancers, Alzheimer's disease, cardiovascular disease, diabetes, multiple sclerosis (MS), HIV and arthritis.⁴ The clinical impact that the current generation of biotechnology products have had for MS illustrates the exciting potential that biotechnology has to tackle disease.⁵ Before the advent of the interferon beta treatments, the condition had received inadequate attention, much to the disappointment of patients.⁵ Now it is seen as a growing therapeutic market by the pharmaceutical and biotechnology industries and a number of compounds are in development, aimed at modifying the disease.⁵

It should also be remembered that

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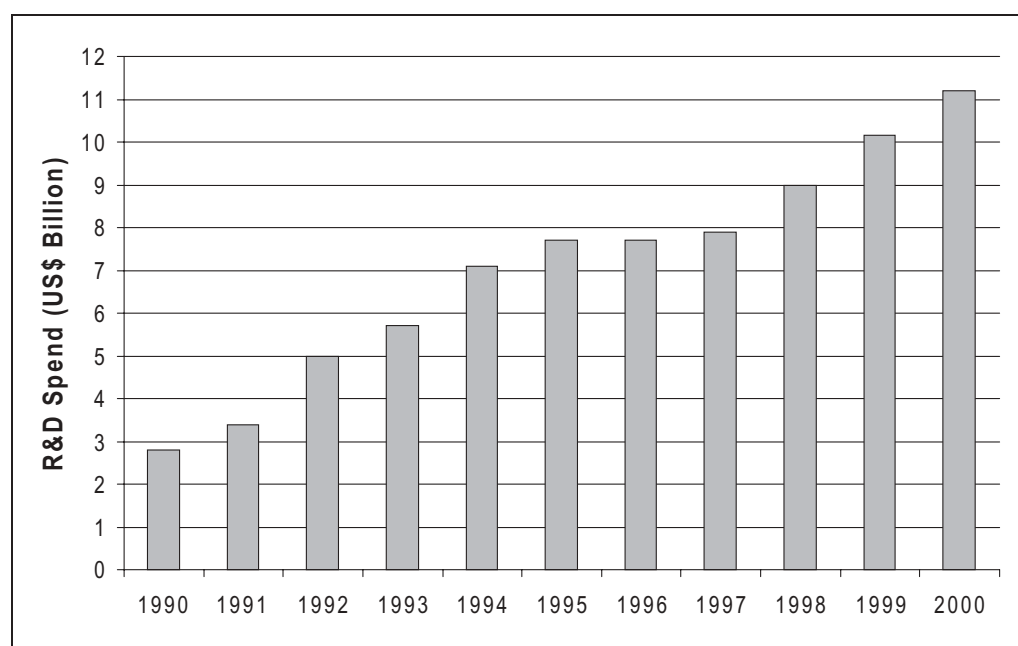


Figure 2: Global biotechnology R&D (1990–2000)
Source: CMR International,³ Ernst & Young⁶

Many biotech drugs are focused on difficult disease targets

Globally, there are more than 4,000 specialised biotech companies

Clinical trials are the most costly part of the R&D process

biotechnology is responsible for hundreds of medical diagnostic tests that detect medical conditions early enough to be successfully treated and keep the blood supply safe from various viruses.⁴ Home pregnancy tests are also biotechnology diagnostic products.

COMPANIES INVOLVED IN BIOTECHNOLOGY RESEARCH

Globally, there are more than 4,000 specialised biotechnology companies.⁶ The most well-known companies are located in the USA and Europe, but there are significant companies emerging in Canada, Australia, New Zealand and throughout Asia – particularly in Japan. Most of these companies are small in size and limited when it comes to finances and this has had an impact on the output of the industry in terms of new drugs.

As they are often younger, it has been suggested that the culture of the specialised biotechnology companies allows them to be more dynamic and risk-taking than their larger pharmaceutical counterparts. Large pharmaceutical companies have been criticised for being too corporate, too bureaucratic and too slow in their decision-making processes. However, biotechnology companies cannot rival the immense global marketing power that the large pharmaceutical companies wield. Thus, overall the major pharmaceutical companies have been in a better position to launch biotechnology products worldwide. Biotechnology companies that have been successful are those that have managed to maintain a consistent flow of financial support.

FINANCIAL AND STRATEGIC SUPPORT FOR BIOTECHNOLOGY R&D

The R&D process to produce new drugs involves a large investment of financial resources and time and in the face of considerable risk. At every stage, the company must evaluate the time, logistics, expense and expertise that it can allocate.

Thus the difficulty for companies involved in biotechnology research is that as the R&D process lengthens, so does the cost. Many biotechnology drugs are focused on difficult disease targets for under-served medical conditions and so the R&D process is expected to be lengthy.

If a small biotechnology company cannot get a drug to market on its own, there is the possibility of forging an alliance with a bigger pharmaceutical company. This will give the smaller company the finance to carry on with their R&D, and for the bigger company it will have the result of supplementing their new drug pipeline with an innovative product.

This approach has proved very successful and some of the major pharmaceutical companies have well-established programmes for collaborating with biotechnology companies. For example, Roche's deal with UK biotechnology firm Antisoma to buy exclusive worldwide rights to the company's portfolio of oncology drugs revitalised the biotechnology company's fortunes.⁷ The size and scope of the collaboration surprised many in the pharmaceutical and biotechnology industries but was viewed as advantageous by both parties. From Antisoma's perspective, if all its products were to reach the market, the company could earn US\$500m in revenues.⁷ The deal allows Roche to supplement its already impressive oncology portfolio, which already includes lymphoma treatment MabThera, breast cancer treatment Herceptin, and breast and colorectal cancer treatment Xeloda, with innovative products to tackle other types of cancer.⁷

Clinical trials are the most costly and time-consuming part of the R&D process and present the toughest challenge to biotechnology companies. More than 40 per cent of the overall costs may occur during clinical development³ and frequently biotechnology companies have little experience in this area. One way in which biotechnology companies can

By using a CRO biotech companies can retain overall control of their products

reduce these costs and also receive expert guidance is to outsource the clinical portion of their drug development to a contract research organisation (CRO) rather than looking to a pharmaceutical company. An added advantage is that by using a CRO (as opposed to a partnership with a pharmaceutical company) the biotechnology company can retain overall control of its product.

An experienced CRO can advise the biotechnology company on a suitable clinical trial strategy, and should also address the regulatory aspects of the proposed studies. The regulatory review stage of drug development is beyond the control of companies and yet it is the last hurdle to overcome before a drug reaches the market. The outcomes of such regulatory reviews cannot be predicted, but by planning ahead, biotechnology companies can be better prepared. Regulatory guidance is extremely important as different regions continue to have different regulatory requirements for biotechnology products. Thus a partnership with a CRO may provide biotechnology companies with a useful strategy to get their drug successfully to market in a number of countries.

Interestingly, Dr John Stageman,

Global Vice-President of Enabling Technologies at AstraZeneca, recently concluded that if AstraZeneca could 'turn the clock back' it would be far more proactive in outsourcing areas of its R&D.⁸ Furthermore, these statements were made in a panel discussion on whether biotechnology companies should emulate big pharma in the way they approach drug development.

With these financial and R&D challenges in mind, it is interesting to see how biotechnology companies have fared in the major drug development regions of the USA, Europe and Japan.

BIOTECHNOLOGY IN THE USA

There is little doubt that the USA has a better environment for biotechnology companies to flourish than other geographical regions of the world (Figure 3) and this is clearly illustrated by the level of general funding available for businesses. Thanks to the availability of such funding, the number of biotechnology companies in the USA has steadily been growing. In 1992, there were 1,231 companies with 79,000 employees, but by 2001 this had risen to 1,457 companies with 191,000 employees.^{4,6} The US biotechnology industry spent US\$15.6bn on R&D in 2001, which greatly exceeded the amount spent by foreign biotechnology industries.⁶ Given that US companies are responsible for 72 per cent of global biotechnology revenues, this commitment to R&D has paid off.⁶

US companies such as Genentech, Amgen, Biogen, Chiron and Genzyme have demonstrated impressive growth over the past 20 years and have brought to market important products, which counters the view that biotechnology companies cannot balance their scientific flair with commercial awareness (Figure 4).

In the USA, the trend of most biotechnology companies has been to follow the 'location is key' rule by clustering in the same geographical areas. Regions such as the San Francisco Bay

The USA has the best environment for biotech companies to flourish

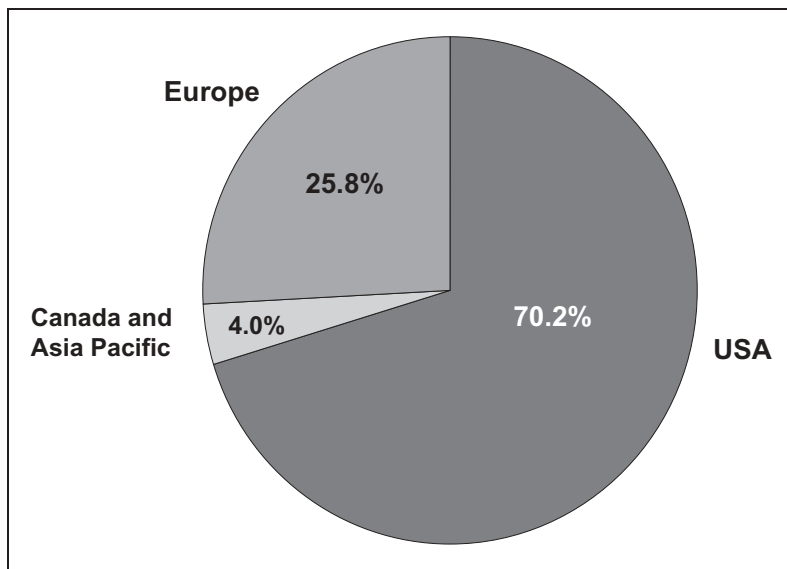
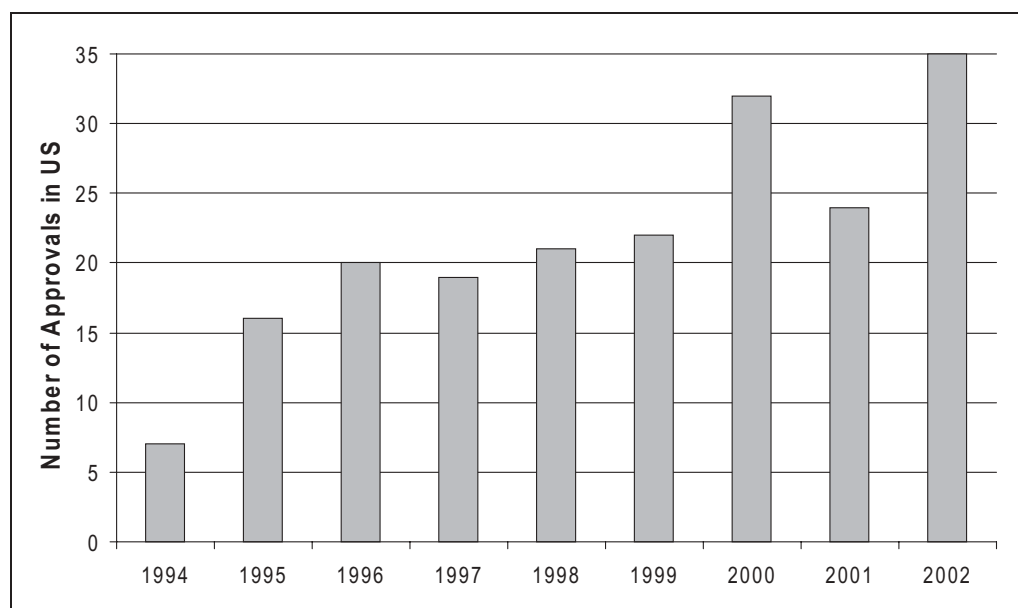


Figure 3: Global split of biotechnology R&D
Source: Ernst & Young⁶

Figure 4: New biotechnology drug and vaccine approvals/new indication approvals by year in the USA
Source: Biotechnology Industry Organization



California has 31 per cent of the biotech companies in the USA

Area, San Diego, Seattle and Boston have combined the availability of appropriate scientific expertise with venture capital backing, thereby stimulating the formation of companies often in biotechnology clusters. For example, California has 31 per cent of the biotechnology companies in the USA.⁹

The USA has also been much more proactive than other countries in encouraging its biotechnology sector. For example, in July 2003, the US House of Representatives introduced the Biotechnology Future Investment Expansion (BIOFIX) Act (H.R. 2968) Act, a piece of legislation designed to change the US tax code in order to encourage further investment and innovation in the biotechnology industry.¹⁰ The legislation has been enthusiastically welcomed by the Biotechnology Industry Organization (BIO) on behalf of its member companies.¹⁰ The BIO represents more than 1,000 US biotechnology companies.⁴

BIOTECHNOLOGY IN EUROPE

One of the problems for European biotechnology companies in emulating their US rivals has been the availability of

funding. For example, although there is considerable venture capital investment in Europe, it is dwarfed by the level in the USA. In 2001, European institutions allocated US\$23bn to private equity, but in the USA the corresponding figure was over US\$200bn.⁶

European authorities are acutely aware of the funding and productivity gap between their biotechnology sector and that of the USA. The European Commission recently launched its sixth framework programme to encourage scientific research. The European Commission framework programme has a budget of €16,270m (US\$16,400m) aimed at supporting R&D in areas such as the life sciences, for projects with an eventual commercial objective.¹¹ It is hoped that these initiatives will encourage small European companies to seek funding, as in the past they have been somewhat discouraged by the apparent bureaucracy in obtaining funding via such schemes.

In 2001, EuropaBio (the European Bioindustry Association) conducted a study examining issues that affected the competitiveness and development of small and medium sized biotechnology companies.¹² The project involved experts from ten different EU member

European companies have limited funding opportunities

states and was co-funded by the European Commission. According to the survey respondents, the single most important limiting factor on the development of the European biotechnology industry was the lack of availability of skilled technical and scientific staff.¹² Next was the lack of financial resources for R&D, difficulties in patenting biotechnology discoveries and a lack of tax incentives for start-ups.¹²

Nevertheless, there are some positive signs for the future of the European biotechnology industry. There are now 1,879 biotechnology companies in Europe, with most of these being located in the UK, Germany, Switzerland, France, Denmark and Sweden (Figure 5). At present, Europe accounts for 22 per cent of global biotechnology revenues.⁶ Furthermore, the European Commission has created the Biotechnology Innovation Scoreboard (BIS), which is a benchmarking exercise that examines the performance strengths and weaknesses of the EU member states in biotechnology innovation relative to the USA, Japan and Canada.¹³ This will enable Europe to monitor the progress of its biotechnology sector in the future.

According to Ernst & Young, Europe's biotechnology sector attracted US\$1.4bn in private equity in 2001, compared with US\$1.2bn in 2000.⁶ This is a positive sign for the industry, given that overall

investing by European venture capitalists has dropped following the failure of others in the technology sector such as the dot.com companies. In fact, the current uneasiness regarding the telecom and Internet businesses might encourage those with a technology focus to consider investing in biotechnology companies. Of particular interest are companies that are more product-focused rather than technology platform-focused.

IMPROVING CONDITIONS FOR JAPANESE BIOTECHNOLOGY

Japanese biopharmaceutical companies have played an important part in new drug innovation. Some of the world's leading drugs, such as Bristol-Myers Squibb's pravastatin for high cholesterol, TAP's lansoprazole and Daiichi's levofloxacin were discovered in Japanese laboratories.¹⁴ With this history of important drug research there is keen interest in biotechnology, but Japanese biotechnology companies have not fared as well as their US and European counterparts. Yet all this could change as efforts are being made to improve the environment for Japanese biotechnology research.

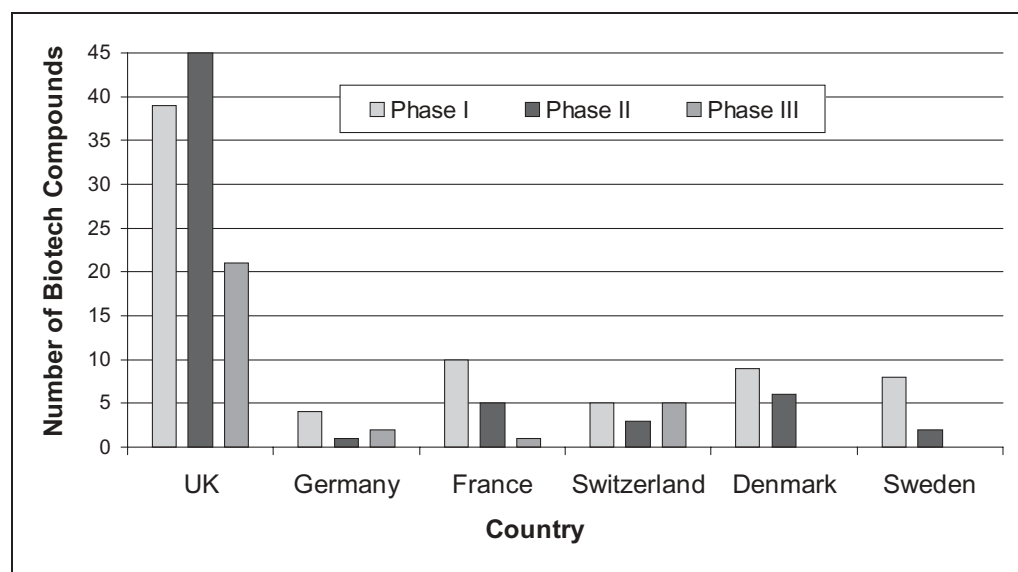
According to Ernst & Young, the Japanese biotechnology sector should experience strong growth in the next few

There are now over 1,800 biotech companies in Europe

In 2001, Europe's biotech sector attracted US\$1.4bn in private equity

The Japanese biotech sector should experience strong growth in the next few years

Figure 5: Number of biotechnology compounds in clinical development in Europe
Source: Ernst & Young⁶



The number of biotech companies in the USA is 25 times that of Japan

years, partly because of increasing support from the government.⁶ For example, the government selected genetic research as one of the key areas in its eight Millennium Projects. These are joint industry–academia–government projects and have around US\$1bn in funding allocation.⁶ Despite this focus, the biotechnology industry has some way to go. Current estimates suggest that the number of biotechnology companies in the USA is 25 times the number in Japan.⁶

Another interesting development is a recent change in the law that allows faculty members at national universities to serve simultaneously as corporate executives in start-ups.¹⁵ This will be a major boost to the concept of the start-up company and should lead to an increased focus on biotechnology in Japanese new drug development.

Partnerships with foreign companies will drive the growth of the Japanese biotech sector

Partnerships with foreign companies will also drive the growth of the Japanese biotechnology sector. For example, the Japan External Trade Organisation (JETRO) runs programmes whereby it matches US companies with their Japanese counterparts. Several US biotechnology firms are in talks with companies in Japan about possible alliances with the purpose of entering the Asian market.¹⁶ Established in the 1950s as a government-funded non-profit, JETRO's original mission was to promote Japanese exports overseas to aid in the development of Japan's post-war economy. Having met that goal, JETRO, with seven US offices and 80 overseas offices, changed its mission completely and is now trying to promote imports into Japan. To accomplish the new goal, JETRO sponsors study programmes for US companies, carrying them overseas at no expense and lining up the kind of 'pressed-suit' meetings small biotechnology businesses have difficulty obtaining.¹⁶

The overall trends for the global biotech industry are positive

THE FUTURE OF BIOTECHNOLOGY

As with most sectors affected by the current state of the world economy, the

biotechnology industry is experiencing funding difficulties. Capital to finance new ventures has become less certain, and biotechnology's entrepreneurs (who are both businessmen *and* scientists) find themselves stuck between the desire to make money and the desire to find treatments for diseases.

However, along with high risks, biotechnology companies can achieve high rewards. For those drugs that do make it through the final trial phase and regulatory approval, the potential demand is huge. After all, medical need does not depend on the economy and there remain disease areas where the current therapies are less than ideal. Although the biotechnology industry has endured several slumps over its 20-year history, the overall trends have been positive by many important measures: number of companies, number of approved products, market capitalisation and revenues. It is these positive factors that should help companies with the right scientific and commercial strategies to prosper in the future.

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