



Learning from giants: Early exposure to advance markets in the growth and internationalisation of Spanish health care corporations in the twentieth century

Paloma Fernández Pérez, Nuria Puig, Esteban García-Canal & Mauro F. Guillén

To cite this article: Paloma Fernández Pérez, Nuria Puig, Esteban García-Canal & Mauro F. Guillén (2019) Learning from giants: Early exposure to advance markets in the growth and internationalisation of Spanish health care corporations in the twentieth century, *Business History*, 61:3, 404-428, DOI: [10.1080/00076791.2017.1369528](https://doi.org/10.1080/00076791.2017.1369528)

To link to this article: <https://doi.org/10.1080/00076791.2017.1369528>



Published online: 02 Oct 2017.



Submit your article to this journal [↗](#)



Article views: 236



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 1 View citing articles [↗](#)



Learning from giants: Early exposure to advance markets in the growth and internationalisation of Spanish health care corporations in the twentieth century

Paloma Fernández Pérez^a, Nuria Puig^b, Esteban García-Canal^c and Mauro F. Guillén^d

^aDepartment of Economic History, Institutions, and World Politics and Economy, Universitat de Barcelona, Barcelona, Spain; ^bDepartment of Economic History, Universidad Complutense de Madrid, Madrid, Spain; ^cDepartment of Business Administration, Universidad de Oviedo, Oviedo, Spain; ^dThe Wharton School, University of Pennsylvania, Philadelphia, PA, USA

ABSTRACT

This article examines the influence of early exposure to advanced markets of the United States and Germany in the growth and internationalization of health care firms from Spain, a late industrialised country. Based on the case studies of the Spanish corporations Grifols and Ferrer, the study shows that early exposure to advanced markets helped them grow in their national markets, and in the world health care industry. It shows further that the specific capabilities developed by both firms were determined by path-dependent networks with scientists and institutions, on the one hand; and strategic alliances, acquisitions and mergers with German and US corporations on the other.

KEYWORDS

Multinationals; Spain; Biotechnology; Pharmaceutical Industry

Introduction

Over the last four decades accelerated growth and globalisation have shaped the health care industries in Europe, the United States and Japan.¹ Their technological and scientific innovations have contributed significantly to increase life expectancy at birth worldwide.²

The successful development of American multinationals, the globalisation of old European groups after World War II, and the oligopolistic structure of the health care industry have influenced our perception of this industry in general and the growth and internationalisation of the first movers in particular.³ According to Alfred D. Chandler Jr, a relatively small number of first movers in the most developed countries defined one century ago the evolving pathways of learning in the pharmaceutical industry, creating barriers to entry, strategic boundaries and limits to growth. The barriers set by first movers would have been so high that, according to Chandler after the 1920s, in the group of the 30 largest pharmaceutical companies he identified in the most developed markets, no new pharmaceutical enterprise was able successfully to enter their industry.⁴ The first movers grew in scale and scope, and their size and their control of new learning bases in the industry, therefore, allowed them to

dominate global health care markets for a century, and contributed to prevent new challengers, and new scientific findings, changing the bases of the industry.⁵

Small players from late industrialised countries would have therefore faced huge disadvantages that may have hampered their opportunities to challenge the supremacy of traditional global leaders from the most developed markets. And yet there are some examples of firms from these countries that, somehow, have been able to thrive in this environment, climbing to leadership positions. Obviously, the rise of global leaders from emerging and middle-income countries is not a phenomenon exclusive to health care, but to all industries.⁶ However, the huge internal path-dependent differences in capabilities for growth and internationalisation within the health care industries, as compared to other industries, as demonstrated for the case of the pharmaceutical industry,⁷ make the study of the mechanisms of entry of small players from latecomer markets in the health care industries extremely interesting.

There is a wealth of published research about how innovative small firms become big firms in developed countries, but not much about this process in developing economies.⁸ Following this line of thought, this article seeks to contribute to the scarce literature that exists, in the business history research field, about how knowledge-intensive small companies from the periphery can become global leaders.⁹ Our research aims to shed new light on the growth and globalisation of small players in the health care industries born in late industrialised countries, asking how small companies in this environment, with weak or unstable institutional support, have been able to enter the major league of the health care industries, and rise to the top levels. Our hypothesis is that, in the health care industries, early exposure to advanced markets, and alliances with first movers, may provide these firms with capabilities to grow and cross entry barriers in developed markets.

We use in-depth case studies to test this hypothesis and provide arguments which future research may extend to understand the globalisation of knowledge-intensive small firms in other developing economies. We examine in this article, more specifically, the long-term transformation of two small Spanish companies into global players: Grifols and Ferrer. Both companies were selected in order to test the hypothesis because they operated in different specialised branches of the health care industries, but until the 1990s in a similar institutional local environment.

Grifols ranks third among the top corporations in the world plasma industry, and Ferrer ranks fifth in Spain and 65th in Europe in the pharmaceutical industry. The Grifols family started a clinical institute in 1910, and a clinical laboratory in 1940. Ferrer started activities in 1925, and a pharmaceutical firm in 1953. The plasma industry's key asset is the ownership of high-quality raw material and manufacturing and distribution processes, whereas the pharmaceutical industry's key asset is the ownership of brands, licences, and patents of a vast portfolio of products and processes.

The analysis of their growth and internationalisation strategies in the second half of the twentieth century in this article concludes that despite the differences in specialisation, their early exposure to pioneering and leading corporations helped organize their firms in a way that allowed them to be leaders in their industries from the very beginning. This helped them take long-term strategic decisions to, helping them take strategic decisions to: first, achieve scale and scope; second, develop their own learning bases to innovate; and third, change their management to cross entry barriers into the global health care markets.

The empirical analysis of this process also provided evidence, as indicated before, about the usefulness of Chandler's proposed chronology of the dynamics of the growth and

modernisation of the first movers in the most developed markets, in the pharmaceutical and chemical industries, in the twentieth century. With a different environment, size and organisational complexity, the small labs in Spain studied for this article, as we will see, seemed to replicate, on a smaller scale, and for different reasons, the key chronological periods and major changes indicated by Chandler to explain the shaping of modern leaders in the Western European and US chemical and pharmaceutical corporations. According to Chandler, between the late nineteenth century and early 1920s firms created their integrated learning bases in production and marketing; in the inter-war years and during World War II companies strengthened their capabilities and grew in parallel with the 'therapeutic revolution' and the cascade of discoveries linked to penicillin, sulfa drugs, and other health care products developed in wartime. In the 1960s and 1970s the most enduring companies concentrated in their core businesses to expand production and sales at home and abroad. Their growth set entry barriers in their industries and markets to new challengers. After the 1970s new scientific findings in molecular biology and medical engineering, together with new managerial approaches, created a new wave of new startups, building new learning basis and entry barriers.¹⁰

There is no comprehensive study about the modernisation of the health care industries in developing economies comparable to the one published by Chandler about chemical and pharma corporations in the developed economies of the world. There is, therefore, no such comprehensive analysis about the history of the growth and internationalisation of Spanish health care industries, only fragmented historical case studies or sectoral studies, with few resources like a recent database about the international operations of the Spanish pharmaceutical corporations since the late 1980s.¹¹ This database shows that, as observed in other latecomer multinationals, in the last decades the most dynamic ones seem to have followed a dual path in their international expansion. On the one hand, they expanded into more developed countries with the aim of upgrading their capabilities and catching up with their more advanced competitors. On the other hand, they looked for less developed countries to exploit their experience and intangible assets. For the last three decades, for Spanish pharma companies, entering into an advanced country was associated with being a more active player in the international arena than those not entering into these countries.¹² Not only would firms investing in advanced countries have undertaken more international operations; they would have also had a higher propensity to expand aggressively (i.e. without partners) than the firms not entering into these countries.

This article provides archival evidence from in-depth case studies which suggest that this dual path of growth is not only a contemporary trend of dynamic Spanish pharmaceutical corporations, as believed, but also a century-old feature of some dynamic Spanish health care corporations that include pharmaceutical and also biomedical, clinical and hospital equipment manufacturing and sales. The article argues that networks and alliances with health care leaders of pioneering German and US corporations encouraged early imprinting of strategic capabilities needed to grow and be a global firm, particularly scientific, organisational and market knowledge.

The evidence presented in this article indicates that this was not a straightforward process, and that there were many difficulties within the firms, and in the relationship of the firms with the external institutional environment and their competitors. The history of the international expansion of Grifols and Ferrer in advanced markets shows that it was preceded by a decades-long process of networking, technology transfer and capability building.

In the following sections we first provide a synthetic view of the long-term evolution of the Spanish health care industries, within the historical framework proposed by Alfred D.

Chandler.¹³ Then we examine the processes of imprinting and internationalisation of Grifols and Ferrer in each of the three ‘Chandlerian’ stages (1880s–1920s, 1930s–1980s, 1990–present). Finally, a concluding section summarises the main findings of our comparative exercise.

Dynamics of the health care industries in the twentieth century for small firms: The case of Spain

From a technological and institutional perspective, the foundations of the health care industries are more than a century old. Chandler identified three big waves of technological and scientific therapeutic revolutions under the lead of a handful of corporations from the United States and Western Europe: the first movers. These waves are briefly characterised in Figure 1. How did firms raised outside the historical core of large and innovative corporations build their capabilities and go international?

Recent studies on the pharmaceutical and biomedical industries in peripheral markets suggest that neutrality during the two world wars and the technological convergence that took place during the golden age accelerated the transfer of old and new scientific and technological innovations to the rest of the world.¹⁴ The demographic growth was a particularly good opportunity to invest in innovation and growth. There was a rapid demographic growth in developing economies in the mid 1960s, and the institutional conditions protected the access of the population to health care products and services through public and private insurance and medical companies.

There was, however, an unfavourable context for the growth of small firms in the health care industries in Spain between the mid-1930s and the late 1970s. After the end of the Spanish Civil War in 1939 the state changed the rules of the game for the health care industries in the country until the late 1970s. During those decades the various governments created: (1) a new mandatory public health insurance for all Spaniards in 1942 (the Seguro Obligatorio de Enfermedad); (2) new central public agencies like the Instituto Nacional de Previsión or the Ministerio de Sanidad to regulate medical and pharmaceutical services and products that increased public health spending (with the construction of new large centralised hospitals); (3) regulations fixing the number of new pharmacies that could open in the market; and (4) regulations fixing pharmaceutical profits, by keeping the cost of many old

Stages	First movers’ main growth strategies
Stage 1 (1880s–1920s)	Pioneering firms from Western Europe establish new scientific and organizational bases. US and Japanese firms catch up after WWI. Full exploitation of economies of scale and scope.
Stage 2 (1930s–1980s)	First movers continue to exploit economies of scale and scope and increase international activity. They build entry barriers yet the emergence of a post WWII international technological market facilitate technological transfer and strategic alliances within and outside advanced economies.
Stage 3 (1990s–present)	First movers meet growing industrial, financial and regulatory challenges by either strengthening core business or diversifying into other businesses.

Figure 1. Growth strategies of the first movers.

drugs almost unchanged at 1963 prices, and allowing relatively free pricing for new products not regulated between 1963 and 1975.¹⁵ This situation led to large profits, and incentives for innovation and investments in health care firms, including pharmaceutical firms, health insurance companies, engineering and construction firms (to build or renovate large central hospitals), and manufacturers and distributors of hospital products. Forces from the demand and supply side grew together in a favourable regulatory context. Until the late 1970s, the health care market became concentrated in the hands of a few big national producers and large foreign US and Western European multinationals.¹⁶

Small firms in the 1950s and 1960s lacked scale and scope, and capabilities to influence regulatory public agencies, to be competitive in the public bids in Spain, and take advantage of the expanding demand for health care. Many remained small despite the incentives in the market. However, some innovative firms had room for growth. The comparison of the two Spanish laboratories Grifols and Ferrer shows that two key mechanisms for growth among small knowledge-intensive firms in this context were: specialisation in new products and technologies and, if they had entrepreneurial vision and ambition and networks abroad, the establishment of alliances with giants from developed markets. Some small and medium-size health care firms in Spain borrowed extensively and learnt from the first movers, particularly from the two countries that were leading the second wave of industrialisation (Germany and US) between the 1880s and 1980s, through four major channels: foreign trade; Spanish subsidiaries and joint venture links with research centres; and the post-World War II cooperative environment and US technical assistance.¹⁷

These four channels helped build bridges and networks in both directions with the most advanced health care corporations in developed economies. The connection was first established to import goods and knowledge which was very scarce and expensive to obtain in Spain from the end of the nineteenth century until the late 1980s.¹⁸ The professionalisation of the management of the small laboratories took place in the 1980s, closely following German and US models of management of large corporations in leading health care corporations, which helped imprint the managerial knowledge necessary to achieve scale and scope, and the globalisation, of both corporations between the 1980s and the first years of the twenty-first century. Foreign multinationals did not aim to transfer strategic knowledge that allowed for the import substitution strategies of their Spanish partners, but the accumulation of knowledge and networks inevitably provided such knowledge, particularly when the results were profitable to both sides, as it was the case in the history of Grifols and Ferrer.¹⁹ This is the process analysed in the following sections, and summarised in Figure 2, that follows the Chandlerian chronology of the evolution of modern pharmaceutical and chemical corporations from leading economies. The important finding, that maybe future research will help expand to other case studies and developing countries, is that small firms exposed from the late nineteenth century to advanced markets were able to develop the learning bases of the new scientific and engineering knowledge, by combining the resources obtained from local and regional systems of innovation with capabilities provided through alliances and networks established with first movers from Germany and the United States.

Grifols and Ferrer are good examples of this process. They were two typical small labs that followed this path of growth to become global firms. They were family businesses in the mid-twentieth century, small firms at a disadvantage in the Spanish health care market of the Francoist state. Foreign currency to pay for imported raw materials or equipment was not easily available to them until the late 1960s, and public bids for the construction or

Stages	Grifols and Ferrer
Stage 1 (1880s-1920s)	Company founders develop learning scientific and organizational bases by combining resources from existing local networks (in the Barcelona area) and first movers' Spanish subsidiaries and import agreements. Spanish neutrality during WWI and rising living standards improve business environment.
Stage 2 (1930s-1980s)	Heirs engage in knowledge transfer from leading centers through personal relations and trips, business alliances (Grifols-Dade-AHS) and acquisitions (Ferrer-Trommsdorff). Growth goes hand in hand with sound reorganization, professionalization and internationalization.
Stage 3 (1990s-present)	Subsequent generations seize worldwide opportunities to become global leader in the plasma industry (Grifols) and increase international activity (Ferrer). Whereas Grifols resorts to acquisitions to integrate backwards and adopts global organization, Ferrer consolidates worldwide commercial network based on regulatory knowhow, licencing in and out and cooperative research, keeping corporate and research base in Barcelona.

Figure 2. Growing outside the historical oligopoly.

supply of the new large hospitals were often won by larger domestic companies with privileged connections in Madrid, the centre of regulating agencies. Both were founded in Barcelona, in close connection with the local Faculties of Medicine and Pharmacy that had traditional links with leading researchers and centres in Germany, France, the United Kingdom, Switzerland, Italy and the Scandinavian countries. They were different, though. Grifols specialised in blood products and in hospital and clinical equipment, and Ferrer in pharmaceutical drugs that were usually sold under medical prescription. Whereas the plasma industry depends on stable and large supplies of high-quality raw materials, the pharmaceutical industry needs to invest heavily in marketing and patented/licensed innovation.²⁰ For these reasons, in the last 25 years Grifols has relied on mergers and acquisitions in its internationalisation process far more than Ferrer, which has resorted to strategic alliances in the research and marketing areas.

The resources and skills both companies used to expand abroad had a long history of creation, and originated in a similar environment, which fits broadly speaking Chandler's proposed chronology of the evolution of modern corporations in other more advanced economies.

The early exposure to advance markets in Barcelona and the early imprinting of strategic capabilities, 1880s–1920s

The Spanish health system experienced remarkable progress in the early decades of the twentieth century, laying the foundation of modern public health policy and institutions.²¹ This modernisation effort was supported by knowledge originating in the advanced European nations as well as by the International Health Board of the Rockefeller Foundation, among others.²² Barcelona was a city where demographic, industrial and scientific changes had combined to create an advanced health care district in Spain between the 1880s and the early 1930s. In this favourable local context small enterprises in the clinical analysis activity, in the production of pharmaceutical drugs, and in private surgical activity appeared and flourished, led by professionals from the local Medical and Pharmaceutical Faculties.²³

Our two firms participated in this dynamic environment in different ways. Grifols in the creation of outward-looking clinical laboratories (in 1910 and 1940) and the first civil Spanish blood bank (1945); Ferrer in the creation of outward-looking pharmaceutical laboratories (1925).

The Grifols archive preserves newspapers, books and conference papers from the late 1920s and early 1930s and 1940s which show the persistent activity of learning updated news of German, French, Italian and British scientists in the field of clinical analysis. Josep Antoni Grifols Morera graduated in Medicine from the University of Barcelona in 1889, and his son, José Antonio Grifols Roig, would study Medicine too. Upon his graduation in 1909, he worked in Danzig and Munich, where he specialised in pathology and lab practice. Back in his home town, he founded a small clinical laboratory – Instituto Central de Análisis Clínicos – with colleagues from the Faculty, doctors Celis, Moragas and Gordan. The German imprinting and transfer of scientific knowledge and clinical practice continued in the small Grifols firm until the 1950s, with German staff arriving in 1925 (Helmut Hempel) and with them German scientific journals and clinical know-how. The two sons of Grifols Roig, Victor and above all José Antonio Grifols Lucas, read and spoke German and French and were avid consumers of scientific publications obtained through friends and contacts. With their private collection they organised a private library for consultation in their lab, with specialised newspapers, conference reports and books. Aware that ‘no man is an island’, they decided to share news with the profession, and created a newsletter and specialised courses distributed for free, upon request, among physicians and clinical practitioners in Spain, thus increasing the reputation and good name of the family lab, in the difficult times of scarcity after the Spanish Civil War, between the 1930s and the 1950s.²⁴

In contrast with the ‘Germanic’ Grifols lab, the origins of Ferrer provide an example of a firm more locally embedded into the commercial and industrial atmosphere of Barcelona. Medir, Ferrer y Cía, Ferrer’s forerunner, was founded in 1925.²⁵ It was one of the many partnerships established at the time to seize the opportunities of importing drugs from the most advanced countries and serving the growing Spanish urban population. International networking and modern marketing were to play a relevant role in the development of Ferrer International.

At this stage both small labs were run by outward-looking entrepreneurs with scientific education, fluent in foreign languages, and with an embedded strategy of keeping informed about news from leading centres and companies in their different market niches of clinical analysis and pharmaceutical over-the-counter drugs.

New organisational and commercial knowledge from the United States and Germany and growth in scale and scope, 1930s–1990s

In this second stage both labs had to adapt to a cycle of collapse and slow reconstruction and late international integration in their traditional activities in their home markets due to the Spanish Civil War (1936–1939), Franco’s dictatorship (1940–1975) and the international orientation of the new democratic governments after 1975, which imposed a long period of strict limitations to foreign trade and knowledge transfer, and therefore a common framework of difficulties to maintain former links with European firms. After World War II both labs struggled to maintain contacts with European firms and scientific institutes and congresses, and would focus their scarce resources on importing knowledge, and establishing alliances,

with firms and centres from the three economies that seemed to be dominating innovation and world markets in the most knowledge-intensive products and processes: Germany, the United States and Japan.

The changing environment, and the new contacts, required organisational changes in both labs, in order to develop and design new strategies for internationalisation. In the case of Grifols, during World War II a German Jewish doctor, Dr Oppenheimer, who had escaped from Nazi Germany, came to work at the Grifols laboratory. The German staff continued to help Grifols keep up to date with the latest discoveries in microbiology and blood testing. Using Chandler's terminology, Grifols would have pioneered the biological drive of the health care industries in Spain following the German influence, in contrast with other local labs concentrated in the manufacturing and sale of old nutritional products and simple pharmaceutical remedies and vaccines in the pre-penicillin and sulphur era. The civil war in Spain (1936–1939) provided the Grifols family with a new and unexpected learning experience. The sons of Grifols Roig, Victor and José Antonio Grifols Lucas, students of Medicine and Pharmacy, had to become soldiers in the civil war, and in the midst of the disaster, had the fortune to work in the battlefield with the Spanish pioneer in blood transfusion and collection Dr Duran Reynolds, learning new methods of blood preservation for transfusion. Back home, the young sons convinced their father to start leaving aside the old business of nutritional products created by their grandfather Grifols Morera in 1910, due to scarcities in raw materials, and concentrate the core business on the new field of blood transfusion, collection and later manufacturing of blood derivatives. Laboratorios Grifols was founded in 1940 with Grifols Roig and his wife, to be joined soon by their two sons and their daughter and after 1946 by a local businessman (Alfons Brasó) completely unrelated to the family business but with much-needed money in times of scarcity.²⁶In 1946 Grifols Roig's son Victor Grifols Lucas went to England to study penicillin production and visit two of his father's exiled Catalan friends, Dr Trueta in Oxford and Dr Duran in Manchester. His main goal was to meet executives from the British subsidiary of a US multinational to invite them to consider the Grifols project of a joint partnership, intended to establish a factory to produce penicillin in Spain, at a time when there was expanding demand and no major penicillin producer in the country. The proposal was rejected by the US multinational, due to lack of financial resources of Grifols, which at the time had a good reputation but was only a very small firm with little money to invest.

Despite the unsuccessful attempt at their first joint venture with a US corporation, 1946 must be considered a major historical landmark. It was the first time the small family firm showed that they had abandoned Germany as their source of innovation and knowledge transfer after World War II, and demonstrated their excellent information about where the future of the health care industries was pointing, towards the other side of the Atlantic, to the United States of America. Grifols had no tangible resources to consolidate a joint venture with US corporations in 1946, but started negotiations with them, and in this process an early exposure to US styles of doing businesses in the health care industries was integrated and embedded in the small family firm, that would remain for decades, until the present.²⁷

The relative opening of the Spanish economy to the US multinationals in the 1950s seemed the right time to try again to find British and US partners. Grifols Lucas found it first in Dr Robert Race of the Lister Institute (established in London in 1891). Race, who had established the structure of the human chromosome related to the RH system, was invited

to Barcelona and he agreed to cooperate with Grifols on analysis-related matters. Grifols sought to enter the specialised market niche of plasma fractionation, which they achieved in 1956. Given Spain's poor international reputation, it was very difficult for Grifols to sell plasma outside the Spanish market. The company found a way: selling it under the customer's brand. Swiss, Swedish and German firms bought small volumes of plasma from Grifols sent in small glass containers by airplane. Through the attendance of Grifols at international conferences the Spanish lab had a good international reputation and foreign firms trusted the quality procedures. Payments were made through bank transfers.²⁸ Sales within Europe in the 1950s and 1960s were basically of the same type as they had been within Spain in the late 1940s and early 1950s, *maquila* style: Grifols sold to other labs with prestigious names (vaccines and penicillin to Sociedad General de Farmacia and gamma globulin to Hubber in Spain, blood to the Swiss Red Cross, gamma globulin to the Swedish Kabi), and those labs added their brand names to the products before they reached the final client. During the mid-1950s, and particularly after the association with Dade Reagents and with the American Hospital Supply Corporation, exports of plasma to the United States followed strict transparency rules which allowed for greater visibility of the Grifols brand and products in the US market, and in the Food and Drugs Administration. This increased sales, and reputation.

For serums and reagents, friendship with a Barcelona pharmacist, Dr Roca Vinyals, helped connect Laboratorios Grifols and their Blood Bank with the North American company Dade Reagents Inc., to export plasma and import their reagents. Dade Reagents had been established in Miami in 1949 by John Elliott, one of the pioneers in blood banking and the business of blood derivatives in the United States. Grifols established contact with the managers through previous commercial contacts maintained with them by the Barcelona pharmacist Roca Vinyals.²⁹ In January 1958 J.M. Potts, Dade Reagents' Vice President, sent a letter to J.A. Grifols Lucas, Director of Grifols Blood Bank. In that letter Potts said that Dade Reagents needed to buy human plasma to make tissues, and that they were interested in buying plasma from the Grifols Blood Bank if their price was 'more reasonable' than the price of the plasma available in the United States. Potts said they needed 20–25 monthly units of 250 c.c. per unit of sterilised human plasma of any blood group. For him, the price was the most important determining factor to close the deal. Correspondence with Dade Reagents in 1958 and 1959 in the Grifols Archive show they reached that deal, with a price per unit of US\$7.80.³⁰ Again, as in the 1946 trip to London, this time the most important thing for the future was, again, that the negotiation involved in how to prepare the product, how to send it and how to pay for it, and how to be in continuous communication in another language with the US client, represented a learning process, and an early exposure to US models of management of international operations. The process was not easy for Grifols; the correspondence shows they had to adjust and adapt administrative, financial and organisational routines. But they did a good job, and provided a good product on a satisfactory basis, and this paved the way for their first successful alliance with a US corporation. Dade's president and vice president Dr Griffiths and Mr Potts suggested incorporating a joint venture company, Dade Grifols, half owned by Dade Reagents, and half owned by Roca de Vinyals and the Grifols family. Negotiations started in 1959 and the company was registered in 1960, despite the sudden death of Roca de Vinyals. Without sons, the widow and niece of Roca de Vinyals would remain very active in the new company, along with the Grifols family. Dade Grifols, whose archive was almost completely lost when Baxter bought Dade Reagents in the 1980s, became the

most profitable company of the Grifols informal business group composed of Laboratorios Grifols, Grifols Blood Bank, Gri-Cel and Dade Grifols. New products much in demand in the Spanish health system (cardiovascular products and lab equipment particularly), with the new capital and managerial advice contributed by the North American partners, and on-site training at the North American factories opened up a new period in the history of the labs.³¹ Three women would play a very relevant role in launching initiatives that would consolidate the scientific reputation of Dade Grifols: María Cristina Cadira (co-manager of Dade Grifols, sister of Roca de Vinyals' widow), Julia Mas (director of the immunohaematology lab) and Montserrat Vinyals (chemistry graduate, technical director of Dade-Grifols, and wife of Grifols' top commercial manager between the 1950s and the 1970s, Antonio Ruiz).³² It was the beginning of new times, the alliance in 1960 of a small biopharmaceutical company of Barcelona with a North American pioneering giant in the clinical laboratories industries. Grifols imported reagents and exported plasma, and adjusted internal organisational routines to the requirements of the US client. In this way the small firm learnt by doing and introduced incremental organisational innovations that prepared the way for future alliances and more ambitious projects with US firms and markets.

The mid-1950s until the early 1980s were therefore decades of fruitful cooperation of the small Grifols lab with North American partners, first Dade Reagents (1957/1960–1965) and, when Dade was absorbed by American Hospital Supply Corporation, with American Hospital Supply Corporation (1966–1982). A prestigious Cuban doctor specialised in clinical diagnosis of tropical diseases and quality control methods, named Guillermo Anido, who, with his family, went into exile in Miami after the Cuban revolution in 1961, had started working in the innovation department of Dade in 1961, the same year Victor Grifols travelled for the first time to Miami after the constitution of Dade Grifols in 1960, to meet the new partners and see their manufacturing installations and routines. Anido and Grifols were the only two Spanish-speaking persons in Dade Reagents in 1961, and both they and their families became close friends. The friendship of two Spanish-speaking scientists helped the transfer of US routines from Dade, and later from American Hospital Supply, to the Spanish family firm.

New products, new routines in manufacturing, administration and organisation, played key roles in the survival of the Grifols family firm, when the Spanish state decreed the prohibition of blood exports (1965), and Dade Grifols (50% shares owned by AHS and 50% by the Grifols group) helped the Grifols shareholders diversify into the expanding business of the distribution of (US) hospital supplies to the new large Spanish centralised hospitals. In 1965, the Spanish government prohibited the export of blood, to 'nationalise' and protect the Spanish plasma manufacturing industry. Plasma exports collapsed. Grifols' exports sharply declined from 3.3 million Spanish pesetas in 1965 to 917,000 pesetas in 1966. The domestic market had to be the solution to survive, in a compulsory reconquest of Spanish markets, with sales increasing from 875,000 pesetas in 1965 to 2.2 million pesetas in 1966. The US partnership Dade Grifols decisively helped in this reconquest, providing new exclusive products for hospital consumption, and training in US managerial practices typical of a large Chandlerian corporation. Sales and profits account for the great support provided by the joint partnership. Quantitatively speaking, in 1966 the sales (59.2 million Spanish pesetas) of this joint partnership with a US corporation were approximately 30 times bigger than the sales of the other two firms in the Grifols group, Laboratorios Grifols (2.2 million pesetas) and Gri-Cel (less than 1 million), that same year.³³

Grifols not only survived, but increased sales. The profits helped the company reinvest and self-finance with its own resources growth in the former core business of blood products, by integrating forward the manufacturing of plasma derivatives with its own Grifols brand, thus substituting imports and developing plasma manufacturing capabilities.³⁴ Grifols felt confident enough to send its own patents to be considered for exploitation in the US market, and to export plasma and plasma technology to the United States.³⁵ Profits of Dade Grifols were around three to eight times the average profits of Laboratorios Grifols and Gri-Cel during the first three years of the 1970s, the only ones for which information is available after the loss of the Dade Grifols archive when it merged with Baxter Travenol in the mid-1980s.³⁶

There were a few weaknesses during the years of transformation of the small lab and blood bank into an industrial holding, between the mid-1950s and the mid-1970s. On the productive side: lack of productivity; accumulation of stocks for lack of coordination between production and the commercial network of sales agents; expenses and costs to train technical staff in labs and in the sales network; lack of security in infrastructure (a fire in September 1967 in the chemistry lab); informal supply of machinery and other elements needed to maintain the buildings and organise post-sales service. On the distribution side: lack of specialised and standardised training of the sales network; difficulties of planning sales abroad due to changes in the regulatory framework (prohibition of blood exports in 1965, regulation of prices by the Spanish Ministry of Health in the 1970s–1990s); lack of internal sales statistics to coordinate with production departments and avoid accumulation of stocks. In management: a disorganised sales network and lack of experience in coordinating production departments and the sales network.³⁷ The external context of rampant inflation in the country during the 1970s increased expenses in human resources, raw materials, services and reduced profit margins on the sales. Some products had constant losses but were maintained to preserve reputation and avoid losing clients. The excellent development of the sales was, therefore, not a good indicator of what was going inside the company in these years of growth.³⁸

The solution came with scale and scope following US factory models. The Grifols family decided to build a brand-new US-style factory in Parets del Vallés (land was bought in 1966, a factory was built in 1970) with plenty of space to create a large standardised building that met all the requirements of the US Food and Drug Administration in order to be a manufacturing centre whose products could one day be registered in the US market, to compete with US corporations. It was an ambitious dream, and it would be American Hospital Supply Corporation, a pioneering company in hospital equipment, with which Dade Reagents merged in the mid-1960s, that would help Grifols with an alliance. From the mid-1960s until the mid-1980s AHS Corp. was to be not just a commercial partner for the Grifols firms, but also a business school of good practices in the health industries in order to learn how the best corporations produced and sold in the US and the global markets. AHS staff would greatly help in the planning, design, construction and layout of the new building. Several trips to the different centres of AHS in the United States followed: to Miami in 1961 by Victor Grifols Lucas, Victor Grifols Roura in 1974 and other technical managers travelled in 1978 to Miami, Houston, Chicago, Evanston, Philadelphia and Washington.³⁹ The partnership with AHS allowed the Grifols company to learn about new layouts, new financial and technical practices, and establish contacts with relevant authorities, like the Secretary of Health Mr O'Keffe in March 1978. Sales and profits multiplied as well. Profits rose from €7.3 million in

1975 to €286 million in 1986, the golden age of the partnership of Grifols with AHS Corp. Americans had helped the Spaniards to acquire the strategic resources in terms of creation, and management, of a large corporation in the health industries, and also the long-term, stable capital that the Grifols needed to overcome the serious weaknesses the lab had had during the 1950s and 1960s.

A new generation participated in the new times. Victor Grifols Roura had joined the company's commercial department in 1973, and learnt from AHS, and from his father and the technical staff, how to run the US-style Parets factory. He had been travelling to the United States and supervised the launch of the internationalisation of the company, with the establishment of exports to China in 1983–1985, the first subsidiaries in Portugal in 1988, and in Argentina, Chile and Mexico in the early 1990s. He was well acquainted with the problems of the global health industries, and trained in business administration at high-quality local institutions. Grifols Roura, as the internal bulletins testify, was a tough manager who was determined to impose the highest standards of quality and professionalism at all levels of the group, in close coordination with the North American, Japanese and Spanish shareholders and staff. When in December of 1985 he joined the Board, taking on all the responsibilities formerly held by his father, he was well prepared to start a long period of complex and ambitious acquisitions in Europe, Asia and above all the United States.⁴⁰

Like Grifols, Ferrer had its beginnings in the industrial and scientific milieu of early twentieth-century Barcelona and was strongly influenced by the talents, background and social networks of its founders and managers, basing its growth on alliances with leading international companies. The company's origins in the commercialisation of imported chemical and pharmaceutical products would determine the focus and capabilities of Ferrer. The Ferrer family had seized control of Medir, Ferrer y Cía SRC at the death of the senior partner, and created two new companies, Manuel y Francisco Ferrer SL (1940) and Laboratorios Ferrer SL (1953), to take advantage of post-war Spain's nationalistic industrial policy. By then the second generation, second cousins Carlos Ferrer Salat and Jordi Ferrer Batlles, a chemical engineer and a pharmacist respectively, had taken over. The company continued to manufacture under foreign licences and to represent foreign multinationals, but it also diversified into the food industry.⁴¹ From the 1960s Ferrer Salat became deeply involved in the modernisation of the Spanish economy, playing a major role in the democratisation of Spanish employers' associations, and lobbying for Spain's full integration into Europe and the dissemination of free market economics and social dialogue in post-Franco Spain.⁴²

The growth and internationalisation of Ferrer would be nurtured by this context. The most decisive change took place in the 1970s.⁴³ Jordi Ferrer sold his share of the company (40%). Lacking sufficient purchasing power himself, Ferrer Salat turned to another cousin, the financier Josep Vilarasau, to the new local industrial banks (Banco Industrial de Cataluña, founded in 1968, and Banco Catalan de Desarrollo, founded in 1964), and to a few private investors, all of them connected with Ferrer Salat's institutional initiatives. This type of investment network had been common in Catalonia since the beginning of industrialisation.

In 1974, Ferrer Salat asked Rafael Foguet to replace him as CEO. Foguet was a chemist whose entire career had been spent with a leading Spanish chemical group, Cros. His experience at Cros had been highly formative: in the building of an industrial group and in the lessons he learned from Cros' international partners Hoechst, Wacker Chemie, Occidental-Hooker, Standard Oil, Shell, ICI, Dupont and Progil⁴⁴: German and North American know-how about organisation and international operations. As in Grifols, these partners transferred

much more than products, they transferred managerial and organisational models of production, commercialisation typical of large pioneering corporations in knowledge-intensive industries.

At Cros, Foguet had relentlessly promoted the diversification characteristic of industrial groups through the acquisition of firms working in more technologically advanced fields and the establishment of three research centres. Foguet demanded abundant financial resources and a hierarchical organisation. It was no easy task. Foguet found himself saddled with a family-run firm that was still digesting the recent acquisition of another family-run firm, Robert, and 'a daring mini-presence abroad' in three countries: Peru and Mexico, where Ferrer had established subsidiaries (dedicated mainly to product packaging under the brand name Novag) in 1961 and 1967, respectively; and Germany, where Ferrer had just acquired the pharmaceutical laboratory Trommsdorff.⁴⁵ In terms of research, Ferrer had little more than 'a laboratory of incremental R&D that had achieved some recognition for producing esters and salts that improved the therapeutic properties of certain active ingredients'.⁴⁶

As in the case of Grifols, transforming Ferrer into an industrial group and promoting innovation called for the exploitation of synergies and modernisation of the company's laboratories and production facilities.⁴⁷ The new CEO replaced the existing, very informal, structure with a pyramidal and centralised model, with himself in control of the areas of finance, human resources and research, with periodic meetings with the department heads. The new structure required a legal change (incorporation), a new name (Ferrer Internacional) and the long-term objective of consolidation, something that would not be achieved until 1996. Between 1975 and 1996, Ferrer Internacional experienced exponential growth based on new products of chemical and pharmaceutical research, developed individually or jointly; new process and product technology; the adaptation of products to international norms; advances in safety and environmental issues; internationalisation; diversification of activities into similar or complementary areas; and the training of management staff by area. In 1978 Ferrer had become a group in technical, legal and administrative terms. By closely controlling research from the top, Foguet had subordinated innovation to commercialisation. Diversification would involve the acquisition of companies working in fine chemistry, diagnostics, food products, dermopharmacy, nutraceuticals and specialities. New activities such as food, aromas and diagnostics required their own facilities and development laboratories, as well as specific methods of production, control and distribution. Diversification reached the research area, which was structured into six specific R&D centres, five of them in the Barcelona area.

Acquisitions provided organisational knowledge for the renewal of the production facilities, and the management organisation, but also commercial platforms for global markets, as in Grifols. The purchase of Trommsdorff by Ferrer was a great opportunity identified by Ferrer Salat during one of his many international trips. Founded in 1795 in Erfurt and rebuilt in Aachen after World War II, Trommsdorff was a small yet highly respected company. In 1970 Trommsdorff was controlled by the Fossen and Hüllen families, who were coping with falling sales (from 20 million to 3–4 million DM) due to the recent discovery of negative side effects in its leading product, the stomach protector *Rabro*. Ferrer Salat purchased 50% of Trommsdorff in exchange for 20% of Ferrer. As Trommsdorff's financial situation continued to worsen, Ferrer, already an active board member, set the stage for Ferrer's 100% acquisition

of the German firm. In less than a decade, Ferrer had engaged in a dual path of internationalisation. According to Foguet, Ferrer aimed to integrate Trommsdorff into the group's new structure as a means of achieving internationalisation in markets which were more demanding, but also more stable, than those of Latin America.

As with Grifols, Spain's poor international reputation and country image posed a problem. The company decided to 'hide' its Spanish background behind a German brand, but hired Spanish managers at Trommsdorff. Trommsdorff experienced remarkable growth, doubling its staff to around 250 and increasing its productivity to twice that of Ferrer's Barcelona facilities. The German subsidiary became focused on four therapeutic areas: cardiovascular, anti-bacterial, dermatological and pneumological. Although Trommsdorff's research centre was small and more oriented toward development than research, Ferrer sought from the very beginning to widen its activities by establishing collaborations with German research centres.

As in the case of Grifols' early exposure to German and US markets, Ferrer's early exposure to the German market provided valuable lessons for its international expansion over the next four decades.⁴⁸ Ferrer, like Grifols, learnt that advanced markets required dealing with regulatory, technical and commercial issues; that they might be difficult to enter, but were a safer bet in the long run. Further they learnt that industrial subsidiaries in countries such as Germany benefited from both their industrial tradition and the prestige of the country, which provided an export platform. Finally, as with Grifols, Ferrer realised that to maintain a uniform group strategy, foreign subsidiaries must be effectively controlled through the group CEO and the director of the international division. This is the model that Ferrer tried to implement in the over 20 international subsidiaries established before 1996. Having a German laboratory in the heart of Europe did allow Ferrer to create commercial subsidiaries all over the continent (Greece, Italy, Portugal, Belgium and Ireland), to gain access to the Austrian market, to establish a subsidiary in Hong Kong and, most crucially, to gain knowledge about advanced markets and acquire a solid global vision.

Concerted research, still unusual in Spain in the 1970s, replaced the traditional scheme of a sovereign researcher that had characterised Ferrer since the 1950s.⁴⁹ In addition, the new research centre, staffed by about 50 people, half of them university graduates, was kept separate from the factory and managed through a system of weekly meetings with the CEO and reports from each department of Ferrer Internacional. Foguet quickly sought to establish enduring relations with Spain's public and private research institutions and, in 1982, with the Massachusetts Institute of Technology (MIT).⁵⁰ A medical doctor by training, Dr Ortiz had worked for Sandoz and Hobson and Infar Natterman and helped design Spain's new regulatory framework before joining Ferrer.⁵¹

Over the next three decades, the size of the research centre tripled. Most projects would be conducted in cooperation with researchers specialised in clinical pharmacology or with hospitals to test particular drugs before obtaining their official medical registration.⁵² A familiarisation with foreign systems of research and registration did facilitate internationalisation in all of its dimensions (licensing in and out). The hierarchical organisational model implemented in 1975 included 'a precise, dynamic system of follow-up, with objective parameters and indicators and controlled by the company's decision-makers'.⁵³ Finally, since 1984 the Ferrer Research Foundation and the Severo Ochoa Award for Biomedical Research have helped to give visibility to Ferrer inside and outside Spain.⁵⁴

In both cases, the early imprinting of knowledge obtained in the first stage was maintained in the second stage of growth, but changed the scale and scope between the 1930s and 1990s. The growth of national and international demand of healthcare products unfolded in a common context of institutional change and strong foreign competition on the Spanish market. Both firms could have disappeared, as many other small labs did, in this second stage of development of their businesses, in face of the difficulties, but both labs had managers and owners who foresaw a possible option: alliance with foreign giants, instead of just surviving in increasingly smaller market niches in the national market. Their dialogue with German and US leaders interested in entering the Spanish market was negotiated in such a way that both labs used it to improve capabilities and competitiveness in their organisation, their structure and their strategies. They learnt from the world giants to become giants at home and slowly abroad in neighbouring markets like Portugal or France. This stage was, therefore, a period when the early imprinting of the previous period was carried on to a more grown up mature stage.

Expansion in developed markets after the 1990s: mergers and acquisitions (Grifols) and strategic alliances (Ferrer)

After the 1990s, Grifols and Ferrer were, like many other labs, able to grow by a range of new possibilities to buy abroad. It was a period of frenzy in mergers and acquisitions, which privileged investments in advanced markets in Western Europe and the United States.

From the 1990s Grifols' goal has been to integrate backwards and forward at a global scale, by controlling the global supply of its raw materials (high-quality plasma proteins), and in this way the most dynamic and profitable global markets in its market niche (plasma protein derivatives). With this strategy in mind, Grifols accelerated acquisitions in the United States in the early decades of the twentieth century.⁵⁵ The alliance with the Green Cross Corporation, the Japanese leader in plasma products, and with Alpha Therapeutic Corporation (GCC's North American subsidiary) provided a technological basis that increased sales in foreign markets to 25% of total income, and exports, multiplying by four since 1992. The subsidiaries provided further experience in international accounts, payments and the export of health and pharmaceutical products: Portugal was the first one in 1988, the Czech Republic in 1990, Slovakia 1999, the Miami Pexaco Intl Corp to distribute to Central and South America (except Brazil until 1998) in 1990, Chile in 1990, Argentina 1991, Mexico in 1993, Brazil in 1998. A qualitative step forward came with the opportunity to buy ATC's subsidiaries in Germany, Italy and the United Kingdom in mid-1997: safety problems had destroyed the financial future of these subsidiaries, and the Japanese GCC offered Grifols the option of purchase of its subsidiaries in these markets previously closed to Grifols by Alpha's commercial interests in Europe. The subsidiary in France came in 1999 and in 2003 the acquisition of Alpha's assets in the United States led Grifols to establish headquarters in the US in Los Angeles, where Alpha had had central offices and plants. The Singapore office opened in 2000, and the acquisition of Alpha's assets in 2003 led to merging with the subsidiaries in Malaysia and Thailand, serving 15 countries in Asia. In 2001 Grupo Santander Central Hispano became a shareholder of Grifols in order to help buy Seracare, a leading plasma supplier in the United States, in 2002. It was the first step in the acquisition of companies that had donation centres in the United States, to integrate horizontally, and control the quality of plasma in the manufacturing plants. The family Grifols retained 30%, and the corporation

became listed on the Spanish stock exchange in 2006. In 2005, three investment funds led by Morgan Stanley replaced Banco Santander Central Hispano and Deutsch Bank as the main financial partners. The third international expansion started with subsidiaries in Japan in 2006, in 2009 in China and Switzerland, and in the Nordic countries and Colombia in 2010. The core acquisitions after this year concentrated in the US market with Talecris and assets from Novartis Diagnostics in 2011 and 2014.⁵⁶ Today the most important market, and manufacturing plants, of the corporation are in the United States, and only 6% of sales go to the Spanish market. Grifols has more than 70% of its employees in the United States, where it has totalled investments for €6400 million (acquisitions and expansion of current installations combined), and of the €3935 million in sales in 2015 more than 60% were obtained in the North American market.⁵⁷

In the case of Ferrer, the group consolidated accounts and organisation in 1996, but maintained ownership and management under the Ferrer family, with a clear strategy of increasing its international presence in leading advanced markets. The preference was Western Europe, in contrast to Grifols' dominant strategy of acquisitions in the United States. After Carles Ferrer Salat's sudden death in 1998, his son Sergi took over. Two years later, Dr Ortiz was succeeded by Dr Joan Fanés as R&D director. As for Rafael Foguet, he maintained his central role until 2004, being replaced by Dr Jordi Ramentol. Forty years after its sound transformation, Ferrer is still a chemical, pharmaceutical and food product group which is vertically integrated, highly diversified and strongly commercial (licensing in and out), but with a more centred R&D strategy and a more selective and stable system of alliances. To understand the group's growth strategy one has to pay special attention to Ferrer's four major partners as of 2016: Centro Nacional de Investigaciones Cardiovasculares (CNIC), Alexza, Histocell and Janus Developments.⁵⁸ Alexza is an American pharmaceutical company specialising in research, development and commercialisation of innovative products to treat acute and intermittent disorders such as asthma or schizophrenia. This alliance allows Ferrer to participate in the development and marketing of Staccato and Adasuve systems, owned by Alexza. As for Histocell, it is a Spanish biopharmaceutical company developing cell therapy and tissue engineering products for regenerative medicine.⁵⁹ This alliance has two ongoing projects. The first project, aimed at developing a new cell therapy medication for the treatment of traumatic spinal cord injuries, marks a completely new strategy for the use of adult stem cells. The second focuses on the development of a new drug from the patient's adult stem cells and a new biomaterial for clinical application in articular cartilage injuries. Janus Developments is an incubator for biotech start-ups that facilitates collaboration between academic research, industry and investors, created in 2009 with the support of Ferrer, Enantia and Caixa Manresa.⁶⁰ Finally, in September 2016 Ferrer launched an alliance with the public research centre IBEC/Instituto de Bioingeniería de Catalunya (Bioengineering Institute of Catalonia) and the private company Mind the Byte, both based in Barcelona, devoted to the computational development of therapeutic molecules to fight cancer metastasis.

Grifols and Ferrer Internacional remain deeply rooted in the biomedical and chemical-pharmaceutical cluster of Barcelona, with slight differences. Grifols has strong connections with the research centres of the city, but has concentrated most of the scientific staff outside Spain due to mergers and acquisitions in Europe, America and Asia and the concentration of donor centres and clients in the United States. On the other side, Ferrer has a strong marketing and commercial component located in Barcelona, and a very high percentage of

its team trained in Catalan universities. Ferrer preferably resorts to Spanish scientists to form scientific committees. Today Ferrer's international network, with 27 subsidiaries, is one of the most extensive of Spanish-funded laboratories, even though Ferrer has only two industrial subsidiaries, Mexico and Alsdorf. Their function is strictly instrumental: to provide support to and increase European and American sales of products which are developed in Barcelona. This is coherent with the company's historical trajectory and with the fact that sales are concentrated in Europe (66%) and Latin America (21%). Ferrer's international sales account for nearly 50% of the group's total sales. The R&D activity of the foreign subsidiaries is very modest. However early and daring, Ferrer's internationalisation remains essentially commercial in nature and, much as it was in the 1970s, a drive to widen markets in order to sustain innovation, which takes place in Barcelona. In Grifols, with 96% of its sales outside Spain, and sales and employment concentrated in the United States, the R&D of foreign subsidiaries is strategic and is concentrated in or around its extensive network of donor centres in the United States, and the connected factories. Grifols' internationalisation is essentially productive in nature, in search of very stable and large high-quality markets of raw materials derived from human plasma.

Both companies started small, but grew large in many ways because of their early ties with leading giants from Germany and the United States. The small companies from a backward country specialised in an industry which required initially high-quality knowledge and networks. Both firms accumulated this initial knowledge at home in the Barcelona cluster of biomedical scientists born in the late nineteenth century. Both firms were able to grow, following Chandler's chronology, after the 1930s, but for different reasons to those posited by Chandler: not by establishing barriers to competitors, but by establishing networks and alliances with giants who did not see the Spanish labs as a threat, but as a target. Once the alliance yielded results, in terms of scale and scope and internationalisation via foreign trade, the Spanish companies used organisational knowledge from those giants to launch, in a favourable period after the 1990s, their foreign direct investment into the US or Germany, where old labs were being sold, or were near bankruptcy. In this way, after a century of learning from giants, the small firms joined the reduced group of giants in their industry, and started to try to establish, as Chandler indicated, entry barriers for other potential followers.

Lessons from history: final remarks

The oligopolistic structure of the modern pharmaceutical industry did not stop small firms based in late industrialised countries from developing their own organisational and innovation capabilities throughout the twentieth century and going global since the 1990s. Early exposure to advanced markets, particularly Germany and the United States of America, accelerated a learning process and the imprinting of new capabilities in knowledge-intensive industries from advanced countries. Personal and institutional networks played a crucial role in the long and effective learning strategies of both multinationals.

Six conclusions emerge from our comparative exercise. First, both Grifols and Ferrer established early contacts with incumbents from more developed countries, contacts which provided knowledge, networks and entrepreneurial attitudes oriented to embed innovative strategies and structures in their small companies in the early twentieth century. The Grifols travelled, studied or worked in German clinical labs in the first three decades of the twentieth

century, keeping in touch in those early years with the most modern techniques to organise clinical labs for diagnosis that would develop in the world after World War II. Ferrer's internationalisation in pharmaceutical products started with a close link with German markets, also learning German organisational routines in the pharmaceutical industry in the 1960s. In both companies import activities and distribution of products of corporations from developed economies, leaders in innovation, contributed to their learning and training with international players. A large share of the profits of Grifols and Ferrer from the 1950s until the 1970s came from the import and distribution in Spain of specialities from advanced countries, a crucial activity to achieve and sustain international competitiveness over time.

Second, in both companies leading scientists of the founding family institutionalised innovative scientific routines in their companies before the 1970s, and in both companies a change took place after the 1970s when professional managers with a German and/or American background occupied CEO positions and led an accelerated era of foreign investments and exports: Victor Grifols Roura in Grifols and Rafael Foguet in Ferrer.

Third, both corporations made this transition from a science-managed firm to a business-oriented global corporation with culturally hybrid entrepreneurs and managers.⁶¹ Culturally hybrid entrepreneurs and managers possessed a rare, valuable intangible experience: they had a good command of how to combine organisational knowledge of late developed markets with organisational knowledge of developed markets. In Grifols there were several family members with this intangible asset difficult to find in Spain before the 1980s (the founder, the sons and the grandsons) and members of their social network (the Cuban-American Guillermo Anido innovation manager in the US Dade Reagents and American Hospital Supply Corp, and Hikosuke Yorihiro, the Japanese CEO of Alpha Therapeutic Corporation). In Ferrer, it was the founder Ferrer and Rafael Foguet. Grifols accumulated these networks and knowledge through travel, scientific conferences, and import activities with France and Germany before the 1940s, the United Kingdom in the second half of the 1940s, and above all with the US since the 1950s, and the US and Japan after the 1980s.

Fourth, the stage of development in which the transformation of a small lab into a vertically integrated industrial group took place had profound and lasting effects on corporate development and R&D. It is important to underline the relationship between internationalisation and innovation, with the former always serving the latter in the two cases. The long training received by Grifols during the alliances and joint ventures with three North American corporations between the late 1950s and 1998 was essential to understand the company's self-confidence and the speed of mergers and acquisitions in the world after the 1990s. Similarly, Ferrer's history of enduring strong embeddedness in the Barcelona biomedical cluster was and remains the key to the company's international competitiveness.

Fifth, investments in Europe, in the 1970s by Ferrer and the 1980s–1990s by Grifols, provided the two companies with organisational knowledge about international operations, a fundamental resource to increase industrial, commercial and regulatory capabilities within and outside Europe. Trommsdorff's acquisition served well the objective of allowing a modest Spanish pharmaceutical firm to access mature markets and increase its industrial, commercial and regulatory capabilities. Grifols' acquisition of the European subsidiaries of the North American Alpha Therapeutic Corporation transformed a Spanish-based company into a European corporation that became visible as a new global player in the plasma industry after the 1990s.

Sixth, private family ownership has not prevented Grifols and Ferrer from going international and innovating. Self-financing and strategic alliances have always played a major role in both since the mid-twentieth century, but Grifols resorted to the local bank Sabadell in the 1970s–1980s and to a variety of other Spanish and international banks, the stock market and international investors since the 1990s. In contrast, Ferrer, which remains a closely held group, resorted to three related local banks to fund its ambitious growth plans.

And finally, the accumulation of social networks useful to expand the market niche of the two case studies must be underlined to understand the long-term resilience of the two health care companies. Both companies were founded by Catalan entrepreneurs very connected to centres of scientific excellence at the local and international level from their early beginnings until today. Both created enduring social networks within their different market niches, without which the transformation of small labs into global corporations could not have taken place. Throughout the twentieth century Grifols formed close networks with the local and global scientific community in its two market niches. Ferrer led and participated actively in the creation of networks with the local and European elites. In both cases the leadership in the creation and participation of networks helped them to participate in the design of strategic rules of the game, in the Spanish pharmaceutical industry in the case of Ferrer, and in the global plasma industry in the case of Grifols.

Early exposure to advanced markets helped them grow outside, but in dialogue with, the oligopolistic structure of the world health care industry. It shows further that the specific capabilities developed by both firms were determined first of all by personal and institutional networks that linked them to advanced research centres since the 1920s; and, second, by their acquisitions, mergers and strategic alliances, which gave them access to advanced organisational and global commercial knowledge from leading German and American companies from the 1960s. Future research may help provide additional case studies that could expand the lessons from these two firms to other processes of modernisation of health care companies from developing economies.

Notes

1. CGCOM, *Informe sobre el sector farmacéutico*; OECD, Statistics 2016.
2. Prados de la Escosura, "World Human Development."
3. Galambos and Sewell, *Networks of Innovation*, pp; Galambos and Sturchio, "Pharmaceutical Firms"; Vagelos and Galambos, *Medicine, Science, and Merck*; and Chandler, *Shaping the Industrial Century*.
4. Chandler, *Shaping the Industrial Century*, 9.
5. Data from public health care corporations listed in Nasdaq, one of the leading world markets for these industries, show that at the end of 2016 the largest major pharmaceutical corporation in the US (Johnson and Johnson) has a market capitalisation which is six times the capitalisation of the next follower (Abbott Laboratories) in this subsector of the health care industries, see <https://www.nasdaq.com/screening/companies-by-industry.aspx?industry=Health%20Care&marketcap=Mega-cap#ixzz4TN36thM5Na>
6. Guillén and García-Canal, "American Model of the Multinational."
7. Chandler, *Shaping the Industrial Century*, 9.
8. Fernández Pérez and Colli, *Endurance of Family Business*; Guillén and García-Canal, *Emerging Markets Rule*; Fernández Pérez and Lluch, *Evolution of Family Businesses*.
9. Campins and Pfeiffer, "La importancia de las redes sociales" for the Argentinian pharmaceutical industry, and Fernández Pérez, "Laboratorios Andrómaco" for a case study of the US subsidiary of the Spanish pharmaceutical multinational Andrómaco between 1928 and 1946.

10. Chandler, *Shaping the Industrial Century*, 9.
11. Guillen and García-Canal, "La expansión internacional," 23–34. For the purposes of this research, the original database has been updated to 2014, following the same methodology of search and codification.
12. We consider advanced countries those hosting the headquarters of world leading firms in the industry, namely US, UK, France, Germany, Switzerland and Japan.
13. Guillén and García-Canal, "American Model of the Multinational."
14. Sjögren, "Family Capitalism"; Puig, "The Global Accommodation"; Puig, "Networks of Opportunity"; Chauveau, "Quelle histoire de l'hôpital"; Colli, "Patterns of Innovation"; Zamagni, "The Rise and Fall"; and Donzé, "Siemens and the Construction."
15. Pons and Vilar, *Seguro de salud privado y público*; Chaqués, "Políticas públicas y democracia en España."
16. Pons and Vilar, *Seguro de salud privado y público*; Chaqués, "Políticas públicas y democracia en España."
17. Puig and López, "Chemists, Engineers and Entrepreneurs," 345–59; Fernández Pérez, "Laboratorios Andrómaco," 266–75.
18. *Estadística del comercio exterior de España*. Madrid, Dirección General de Aduanas/Ministerio de Hacienda 1905–1980, and Ministerio de Economía y Competitividad for 2005.
19. Puig, *Constructores de la química Española*; Cilingiroglu, *Transfer of Technology*.
20. Grifols i Lucas, *Vivències d'un empresari de postguerra*; Grifols, *When a Dream Comes True*, pp.
21. Pérez Moreda, Reher, and Sanz, *La Conquista de la Salud*.
22. Rodríguez and Martínez, *Salud Pública en España*.
23. Catalán, "El círculo virtuoso"; and Fernández Pérez, "Laboratorios Andrómaco."
24. Historical Archive Museu Grifols in Barcelona. Library Catalog and Journals Catalog. Also Grifols i Lucas, *Amb un suro*; Grifols, *When a Dream Comes True*.
25. Cabana, *Carles Ferrer Salat*.
26. Historical Archive Museu Grifols in Barcelona. Actas Laboratorio Grifols 1940–1964 (Ref. 6864); and notarial documents of constitution and changes in the family firm (Escrituras de constitución y ampliación de capital).
27. Historical Archive Museu Grifols in Barcelona. "Memoria sobre el viaje a Inglaterra realizado por Victor Grifols del 12 de julio al 22 de Agosto de 1946." Ref. 05898. Grifols Lucas had an interview with an executive of the British subsidiary of the US firm Hayden looking for an agreement on technical cooperation and investment with them. Hayden replied that they would be positive provided Grifols guaranteed the joint firm would have exclusive rights of manufacturing of penicillin in Spain, strong protection against imports, and a joint investment of 10 million pesetas. He also met representatives of Burroughs Welcome and Co. and Ashe Laboratories Ltd for nutritional products. Grifols arranged with a Catalan contact in London named Pedro Gilabert to have an agent providing commercial and information services to Grifols. In 1948 the Spanish government regulated the monopoly of the production of penicillin in Spain, that would benefit two large business groups, and would mean a de facto exclusion of small entrepreneurs like Grifols that were working hard to contact leading penicillin producers to try to break in to the business of penicillin. This legal exclusion was the first one in the history of Grifols that made the company take the decision to diversify in order to survive. The other important legal landmark in this regard would come in 1965 with the legal prohibition on exporting blood in Spain, which de facto benefited once again a few large plasma manufacturers like Hubber that were integrating the business and needed to control Spanish raw materials for their new large firms, again damaging the interests of small labs like Grifols, which had been exporting blood to Scandinavian countries, Germany, Switzerland and the US, among others, in the first years of the 1960s. This prohibition, again, made Grifols diversify, going into the expanding business of the distribution of hospital equipment, for which they entered into an alliance and partnership with the leading US company, American Hospital Supply Corporation.
28. 'Spain had a poor reputation in the world and it was almost impossible to sell anything abroad ... we began to sell plasma to a German lab, but under its own brand' (Grifols i Lucas, *Amb un suro*, 110).

29. Interview with Alfonso Vidal Ribas Cadira, Roca Vinyal's nephew by the phone with Paloma Fernández, January 26, 2015. Roca Vinyals had no sons when he died in 1960, only nephews, and the widow María Dolores Cadira continued his businesses after he died.
30. Historical Archive Museu Grifols in Barcelona. Correspondence Hemobanco and Dade Reagents Inc., Ref. 2331 to 2374, 1958–1969.
31. Historical Archive Museu Grifols in Barcelona. Private correspondence and Notarial Records 1957–1966.
32. Historical Archive Museu Grifols in Barcelona. Agreement with American Hospital Supply Corporation; and Grifols 2011:113. On Antonio Ruiz and these three women, and Interview with Montserrat Vinyals Vallesta (Ruiz's wife) by Rosa Avella from the Grifols Archive on 4 May 1999 (transcript in the Grifols archive).
33. Historical Archive Museu Grifols Ref. 06316.
34. Historical Archive Museu Grifols in Barcelona. Interview with Guillermo Anido by Rosa Avella in 1999, transcript; Interview with Victor Grifols Roura by Paloma Fernández, February 13, 2015; and Shareholders Agreements and Notarial Constitution of Companies in Grifols Archive years 1960 to 1985.
35. Historical Archive Museu Grifols in Barcelona. Ref. 06316.
36. Historical Archive Grifols in Sant Cugat del Vallés. Ref 05878c and 05878b.
37. Historical Archive Museu Grifols in Barcelona. Ref. 2176 Actas Laboratorio Grifols Caja 92, June 15, 1965, Junta General ordinaria de accionistas, and Juntas for June 15, 1966, June 20, 1967, June 7, 1968, June 18, 1973, June 5, 1974.
38. Historical Archive Museu Grifols. Ref 2176. Actas Laboratorio Grifols 1965–1987.
39. Historical Archive Museu Grifols in Barcelona. Ref 05626 and Conference in Miami (1994) and Boletín Informativo Grupo Grifols May 1980 in Ref 05659.
40. Victor Grifols Roura, interviewed February 13, 2015.
41. Cercle d'Economia, *Cercle d'Economia 1958–1983*; Maluquer de Motes, *El Largo Camino a Europa*.
42. See note 5 above; and Ferrer Salat, *Europa y España*.
43. Ferrer Salat, "Hacia una Política Industrial."
44. Foguet, *Solemne discurso de investidura*.
45. Bank of Spain, Historical Archive, Deed of Conversion, 1975.
46. Historical Archive Museu Grifols in Barcelona Reference 05626; and Conference in Miami (1994) and Boletín Informativo Grupo Grifols May 1980 in Historical Archive Museu Grifols in Barcelona Reference 05659.
47. *Ibid.*, 128–9.
48. *Ibid.*, 138–9.
49. Foguet, *Investigación concertada*.
50. *Ibid.*, 134–5.
51. Accessed July 2016. <https://www.jaortiz.info/index.html>
52. Historical Archive of the Bank of Spain, IEME Files, Deed of Conversion, 1975.
53. See note 39 above, 135.
54. Accessed July 2016. <https://www.ferrer.com>
55. Acquisitions of Grifols in the US: <https://www.grifols.com/portal/es/grifols/origens>; [https://www.belinked.es/exito\(March2015\)](https://www.belinked.es/exito(March2015)); <https://openaccess.uoc.edu/webapps/o2/bitstream/10609/13101/1/GRIFOLS%20Factores%20Competitividad%20a%20Largo%20Plazo.pdf> (March 2015); https://www.elexportador.com/062003/digital/empresas_huellas.asp (about the Probitas operation, March 2015). Also Rich, "La historia de..."
56. Grifols, Historical Archive Grifols in Barcelona. Revista Cosmos; <http://www.grifols.com>.
57. Grifols, <http://www.grifols.com> and *La Vanguardia*, Saturday July 9, 2016.
58. Accessed September 2015. <http://www.Ferrer.com>
59. Accessed May 2016. <http://www.histocell.com>
60. Accessed May 2016. <http://www.spheriumbiomed.com>
61. Fernández Pérez, "Acerinox."

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by Fundación BBVA [I Ayudas a la Investigación en Socioeconomía FBB].

Notes on contributors

Paloma Fernández Pérez is Professor of International Business History and History of Family Businesses at the Universitat de Barcelona in Spain. She is a council member of the European Business History Association and a Trustee of the Business History Conference. Her research interests are family businesses, innovation, emerging markets, and currently she is studying the history of growth and innovation of modern Spanish laboratories and hospitals. Her most recent research focuses on the history of health care corporations in the plasma industry. She has recently published 'Acerinox: A Successful Joint-venture in Southern Europe' in *Entreprises et Histoire* (2015), and has coedited with Andrea Lluch *Evolution of Family Business. Continuity and Change in Latin America and Spain* (Cheltenham, 2016). She serves or has served on the editorial boards of *Investigaciones de Historia Económica*, *Business History*, *Anuario del Centro de Estudios Económicos de la Empresa y el Desarrollo* and the *Journal of Evolutionary Studies in Business*.

Nuria Puig is Professor of Economic History and Institutions at the Universidad Complutense de Madrid, Spain. Her research focuses on the long-term effects of foreign investment and the influence of business groups in twentieth-century Spain. She has published 'Globalization and the Organization of Family Philanthropy: A Case of Isomorphism?' in *Business History* (55, no. 1, 2013), and is principal investigator of two publicly funded research projects, BOLDE (Business Organization in Late Developing Economies) and FILT (Foreign Investment and Local Talent). She is member of the editorial boards of *Business History Review* and *Revista de Historia Industrial, Economía y Empresa*.

Esteban García-Canal is Professor of Management and International Business and Director of IUDE Business School at the University of Oviedo (Spain). His research interests are focused on the confluence between organisational economics, corporate strategy and international business. Author of more than 80 articles published in leading economics, management and international business journals. His most recent books are *The New Multinationals* (Cambridge University Press, 2010) and *Emerging Markets Rule* (McGraw Hill, 2013), both coauthored with Mauro Guillen. He currently is or has been member of the editorial boards of the *Journal of International Business Studies* (JIBS), *Journal of Management Studies*, *Management International Review*, *Global Strategy Journal*, *Management Research* and *Universia Business Review*.

Mauro F. Guillén is Zandman Professor of International Management and Director of the Joseph H. Lauder Institute of Management and International Studies at the Wharton School of the University of Pennsylvania. He is a member of the Global Agenda Council on Emerging Multinationals at the World Economic Forum, and a recipient of the Aspen Institute's Faculty Pioneer Award. He previously taught at the MIT Sloan School of Management. He received a PhD in sociology from Yale University and a Doctorate in political economy from the University of Oviedo in his native Spain. His research focuses on globalisation, corporate governance, and the diffusion of practices and innovations.

References

- Cabana, F. *Carles Ferrer Salat. Biografía*. Barcelona: RBA, 2015.
- Campins, M., and A. Pfeiffer. "La importancia de las redes sociales en los orígenes de la industria farmacéutica argentina. El caso de los catalanes en Argentina." *Revista de Historia Industrial* 47 (2011): 17–50.

- Catalan, J. "El círculo virtuoso de Grifols 1909-2013: I+D+i, éxito global desde el cluster médico farmacéutico de Barcelona." *Revista de Historia de la Economía y de la Empresa* 8 (2014): 27–64. Cercle d'Economia. *Cercle d'Economia 1958-1983. Una trajectòria de modernització i convivència*. Barcelona: Cercle d'Economia, 1983.
- CGCOM (Consejo General de Colegios Oficiales de Médicos de España)/ OMC (Organización Médica Colegial). *Informe sobre el sector farmacéutico*. Madrid: CGCOM, 2014. www.cgcom.es
- Chandler, A. D. *Shaping the Industrial Century: The Remarkable Story of the Evolution of the Modern Chemical and Pharmaceutical Industries*. Cambridge, MA: Harvard University Press, 2005.
- Chaqués, L. "Políticas públicas y democracia en España. La política farmacéutica del franquismo a la democracia." Unpublished doctoral dissertation, Universitat de Barcelona, 1999.
- Chauveau, S. "Quelle histoire de l'hôpital aux XX^e et XXI^e siècles ?" *Les Tribunes de la santé* 4, no. 33 (2011): 81–89.
- Cilingiroglu, A. *Transfer of Technology for Pharmaceutical Chemicals. Synthesis Report on the Experience of Five Industrialising Countries*. Paris: Organization for Economic Cooperation and Development, 1975.
- Colli, Andrea. "Patterns of Innovation, Strategies and Structures in the Italian Chemical Industry, 1973-2003." In *Innovation and Entrepreneurial Networks in Europe*, edited by P. Fernández Pérez and M. B. Rose, 99–117. New York, NY: Routledge, 2010.
- Donzé, P.-Y. "Siemens and the Construction of Hospitals in Latin America 1949-1964." *Business History Review* 89, no. 3 (2015): 475–502.
- Fernández Pérez, P. "Acerinox. A Successful Japanese Joint-Venture in Southern Europe in the Second Half of the Twentieth Century." *Entreprises et Sociétés* 80 (2015): 57–83.
- Fernández Pérez, P. "Laboratorios Andrómaco. Origins of the First Subsidiary of a Spanish Pharmaceutical Multinational in the United States (1928-1946)." *Journal of Evolutionary Studies in Business* 1, no. 2 (2016): 266–275.
- Fernández Pérez, Paloma, and Andrea Colli, eds. *The Endurance of Family Businesses. A Global Overview*. Cambridge: Cambridge University Press, 2013.
- Fernández Pérez, Paloma, and Andrea Lluich, eds. *Evolution of Family Businesses. Continuity and Change in Latin America and Spain*. UK.: Edward Elgar Publishers, 2016. Original version in Spanish published in 2015 as *Familias empresarias y grandes empresas familiares en América Latina y España*. Bilbao: FBBVA.
- Fernández Pérez, Paloma, and Nuria Puig. "Dynasties and Associations in Entrepreneurship: An Approach through the Catalan Case." In *The Determinants of Entrepreneurship: Leadership, Culture, Institutions*, edited by José L. García-Ruiz, and Pier A. Toninelli, 105–125. New York: Pickering & Chatto, 2010.
- Ferrer Salat, C. *Europa y España: La lucha por la integración*. Barcelona: Discurso de ingreso en la Real Academia de Ciencias Económicas y Financieras, 1993.
- Foguet, R. *Investigación concertada en el campo de la química fina y farmacéutica*. Barcelona: Boletín de la Sociedad Catalana de Ciencias Físicas, Químicas y Matemáticas, 1983.
- Foguet, R. *Solemne discurso de investidura Dr.H.C.* Barcelona: Univesitat de Barcelona, 2010.
- Galambos, L., and J. E. Sewell. *Networks of Innovation: Vaccine Development at Merck, Sharp&Dohme and Mulford, 1895–1995*. Cambridge: Cambridge University Press, 1995.
- Galambos, L., and J. L. Sturchio. "Pharmaceutical Firms and the Transition to Biotechnology: A Study in Strategic Innovation." *Business History Review* 72, no. 2 (1998): 250–278.
- García-Canal, E., M. Guillén, and A. Valdés. "La internacionalización de la empresa española. Perspectivas empíricas." *Papeles de Economía Española* 132 (2012): 64–81.
- Grifols. *When a Dream Come True*. Barcelona: Grifols, 2015.
- Grifols i Lucas, V. *Amb un suro i un cordill. Vivències d'un empresari de postguerra*. Barcelona: Grifols, 2009.
- Guillén, M., and E. García-Canal. "La expansión internacional de la empresa española: una nueva base de datos sistemática." *Información Comercial Española. Revista de Economía* 839 (2007): 23–34.
- Guillén, M. F., and E. García-Canal. "The American Model of the Multinational Firm and the "New" Multinationals from Emerging Economies." *Academy of Management Perspectives* 23, no. 2 (2009): 23–35.
- Guillén, M., and E. García-Canal. *Emerging Markets Rule: Growth Strategies of the New Global Giants*. New York: McGraw-Hill, 2012.

- Guillén, M., and E. García-Canal. *The Rise of the New Multinationals*. Bilbao: BBVA-OpenMind, 2015. <https://www.bbvaopenmind.com/wp-content/uploads/2015/04/BBVA-OpenMind-The-Rise-of-the-New-Multinationals-business-innovation.pdf>.
- Malerba, F., and L. Orsenigo. "The Evolution of the Pharmaceutical Industry." *Business History* 57, no. 5 (2015): 664–687.
- Maluquer de Motes, J. *El largo camino a Europa. Cincuenta años del Círculo de Economía 1958-2008*. Barcelona: Centro editor PDA, 2008.
- Pérez Moreda, V., D. Reher, and A. Sanz. *La conquista de la salud. Mortalidad y modernización en la España contemporánea*. Madrid: Marcial Pons, 2015.
- Pons, J., and M. Vilar. *El seguro de salud privado y público en España. Su análisis en perspectiva histórica*. Zaragoza: PUZ, 2014.
- Prados de la Escosura, L. "World Human Development 1870–2007." *Review of Income and Wealth* 61, no. 10 (2014): 220–247.
- Puig, N. *Constructores de la química española. Bayer, Cepsa, Puig, Repsol, Schering y La Seda*. Madrid: LID, 2003.
- Puig, N., and S. López. "Chemists, Engineers and Entrepreneurs. The Chemical Institute of Sarria's impact on Spanish Industry (1916-1922)." *History and Technology* 11 (1994): 345–359.
- Puig, Núria. "The Global Accommodation of a Latecomer: The Spanish Chemical Industry Since the Petrochemical Revolution." In *The Global Chemical Industry in the Age of the Petrochemical Revolution*, edited by Louis Galambos, Takashi Hikino and Vera Zamagni, 368–400. Cambridge: CUP, 2006.
- Puig, Núria. "Networks of Opportunity and the Spanish Pharmaceutical Industry." In *Innovation and Entrepreneurial Networks in Europe*, edited by Paloma Fernández and Mary Rose, 164–183. UK: Routledge, 2010.
- Rich, G. "La historia de ... Grifols en Estados Unidos." *Tribuna Norteamericana* 17 (Dec 2014): 1–16.
- Rodríguez Ocaña, E., and F. Martínez Navarro. *Salud pública en España. De la Edad Media al siglo XXI*. Sevilla: Junta de Andalucía, 2008.
- Sjögren, H. "Family Capitalism Within Big Business." *Scandinavian Economic History Review* 54, no. 2 (2006): 161–186.
- Vagelos, R., and L. Galambos. *Medicine, Science, and Merck*. Cambridge: Cambridge University Press, 2004.
- Zamagni, Vera. "The Rise and Fall of the Italian Chemical Industry, 1950s-1990s." In *The Global Chemical Industry in the Age of Petrochemical Revolution*, edited by Louis Galambos, Takashi Hikino and Vera Zamagni, 347–367. Cambridge: Cambridge University Press, 2006.

Archives

Museo Grifols, Barcelona. Historical Archive and Library.
 Grifols Corporation, Sant Cugat del Vallés, Barcelona.
 Archivo General de la Administración, Madrid.
 Banco de España (Madrid). Historical Archive and Library.

Websites

<https://www.ferrer.com>, accessed September 2015 and July 2016
www.grifols.com, accessed 2014, 2015 and 2016
<https://www.jaortiz.info/index.html>, accessed July 2016
www.histocell.com, accessed May 2016
www.spheriumbiomed.com, accessed May 2016

Interviews

Eduardo Herrero, 9 December 2013. By Paloma Fernández.

Rosa Avella, interviewed 2013-2015. By Paloma Fernández.
Nuria Pascual, various interviews 2013-2015. By Paloma Fernández.
Alfonso Vidal Ribas Cadira, 26 May 2015. By Paloma Fernández.
Victor Grifols Roura, 13 February 2015. By Paloma Fernández.
Francesc Cabana, 11 November 2015. By Nuria Puig.
Rafael Foguet, 14 December 2015. By Nuria Puig.