

**ANALYSIS OF
COLLABORATIVE
SCIENTIFIC
PRODUCTION
BETWEEN SPAIN
AND THE UNITED
KINGDOM.
2011-2020**



Data source: Elsevier,
Scival, from Scopus data.



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INTRODUCTION

International research collaboration has increased in terms of volume and importance, by way of a response to the expansion of higher education and the furthering of knowledge, and the increase in scientific professionalisation and specialisation. This collaboration, which goes beyond organisational, disciplinary and cultural confines, extends the potential of discovery. If this race of learning to secure new knowledge is to be successful, participation in interorganisational networks and links is a must, along with continuous communication and different kinds of collaboration.

As scientists increasingly work in teams, they need to meet, understand, cooperate and collaborate, and they do so for countless reasons. In a number of fields, research has become so complex that scientists working alone cannot produce any significant results without collaboration, a phenomenon known as the collaboration imperative. Elsewhere, shared infrastructures also facilitate

collaboration. Today's natural science and cultural publications represent the work of multiple researchers, often working in different organisational and cultural contexts. This collective move towards team work and the implicit division of work and specialisation ranges between essential research and the applied world of patents.

This is why driving the internationalisation of agents operating in the Spanish Science, Technology and Innovation System (SECTI) is one focus of the work of the Spanish Science, Technology and Innovation Strategy 2021-2027. With a view to boosting the SECTI system's human and institutional capacities, plans contemplate the need to work to improve the utilisation and impact of bilateral relations, determining geostrategically relevant scientific-technological areas and defining decision-making structures for public policies.

That is why this report has been drawn up to analyse scientific production by collaboration

INTRODUCTION

between Spain and the United Kingdom (hereinafter UK), the second of its kind produced by the FECYT - Spanish Foundation for Science and Technology, in association with the British Embassy in Spain.

17 January 2018 saw publication of the first report on the *Analysis of collaborative scientific production between Spain and the United Kingdom, 2005-2014*. For the first time the study included objective data of scientific collaboration between both countries through publications. The results of the report demonstrated that Spain and the UK are good scientific partners, because when both of them team up for research purposes, the impact and the scientific excellence of their joint publications surpasses that of the two countries in isolation. This is why both FECYT and the British Embassy in Spain considered it would be useful to update the contents of the aforementioned report, and

conduct an analysis of how this beneficial collaboration has developed in recent years.

This report provides a quantitative and qualitative analysis of the bibliometric indicators of scientific publications produced in collaboration between Spain and the UK during the 2011-2020 decade. The increase in the number of journals indexed in Elsevier's Scopus database, the source of these studies, updated the information in the report on the preceding four years (2011-2014) and also obtained new indicators from 2015 to 2020.

In terms of the document typology studied, as in the first round, work made use of the documents posted in scientific journals that had been reviewed by peers (papers, reviews and minutes of the main scientific conferences), with a list of authors featuring at least one Spanish institution and one British institution.

INTRODUCTION

The study is divided into the following five sections:

- 01 Spain and the UK in the international context
- 02 The UK's scientific production in international collaboration
- 03 Spain's scientific production in international collaboration
- 04 Main indicators of scientific collaboration between Spain and the UK
- 05 Thematic distribution of scientific collaboration between Spain and the UK

The appendices contain the fifteen main Spanish centres working with the UK and the fifteen main British centres working with Spain. There is also a list of the main Spanish institutions working with the UK and vice versa in scientific areas with greater citation of scientific production in collaboration.

EXECUTIVE SUMMARY

The data set out in this report show that Spain and the UK are good science partners. Bibliometric indicators of joint publications have continued to increase with respect to the indicators for 2005-2014 in the first report.

This study comprises an analysis of scientific production in collaboration between Spain and the UK during the **2011-2020 decade** on the basis of Scopus data. During this period the UK was ranked third worldwide in terms of numbers of documents published, while Spain was ranked tenth¹.

Both countries support a global approach to science, because approximately half their scientific production is carried out in collaboration with other countries. In general terms, during the period studied 46.8% of Spain's scientific production was published in collaboration with other countries, and the figure was 54.4% in the case of the UK.

Turning to scientific production in collaboration between the two countries from 2011 to 2020, the following may be observed:

- A total of **79,805 documents were published collaboratively between Spain and the UK**. 5,526 were published in 2011, and 10,595 in 2020, demonstrating that scientific production in collaboration between the two countries almost doubled in the space of 10 years. The compound annual growth rate² stands at 7.5%.
- 20% of Spain's scientific documents produced with international collaboration are published with UK institutions, and 8.7% of the UK's scientific documents produced with international collaboration are published with Spanish institutions. This makes the **UK Spain's second largest publishing partner**, while **Spain is the UK's eighth largest partner**.

1 In 2020, the UK was ranked third, and Spain eleventh.

2 Compound annual growth rate = $[(\text{final value}/\text{initial value})^{1/(\text{n}^\circ \text{ of years})}] - 1$

EXECUTIVE SUMMARY

- **The excellence rating³ of collaborative publications by the two countries is 33%**, much higher than the excellence ratings of Spain and of the UK individually over the same period, at 14.5% and 18.2% respectively. There is a case here for “*scientific profitability*” establishing a relationship between documents jointly produced by Spain and the UK and quotes from the documents, and so it may be said that it is extremely “profitable” for both countries to publish on a joint basis from the point of view of citations.
- **The Normalised Impact of collaborative publications between the two is 3.03**, well above the impact of both countries separately - 1.29 in the case of Spanish scientific production, and 1.59 for the UK’s scientific production. On other words, citations outstrip the world average (= 1) by 203%, indicating the advantages of scientific collaboration for the two countries.
- **78% of collaborative scientific production by Spain and the UK is published in the world’s leading journals** or in first-quartile publications, a figure which is also higher than the individual values of scientific production by each country separately, 55.6% for Spain, and 64.3% for the UK.
- In terms of **thematic distribution of collaborative scientific production by the UK and Spain by major areas of knowledge**, it may be observed that Medicine accounts for the greatest number of documents, followed by Physics and Astronomy and Biochemistry, Genetics and Molecular Biology. The areas in which Spanish/UK collaboration attains the greatest scientific excellence are (with the exception of multidisciplinary science) Medicine; Immunology and Microbiology and Biochemistry, Genetics and Molecular Biology.

3 Refers to publications forming part of the 10% of papers most quoted worldwide in a certain year or period.

EXECUTIVE SUMMARY

- If we deepen our examination and analyse the scientific disciplines which have achieved the greatest impact for the two countries over the last five-year period (2016-2020), these are: Cardiology and Cardiovascular Medicine; Oncology; Physics and Astronomy; Immunology; and Clinical Neurology.
- Here it should be pointed out that collaboration between the two countries also features the latest high-impact scientific tendencies, such as: COVID-19, SARS-CoV-2, Coronavirus; T-Lymphocytes, Neoplasms, Immunotherapy; Climate Models, Model, Rainfall; Algorithms, Computer Vision, Models; Graphene, Carbon Nanotubes, Nanotubes; among others.
- Finally, the **leading research bodies and the best universities in the two countries form part of the main institutions which**

are collaborating with each other. If we take a look at the leading producer institutions in Spain which collaborate with the UK and vice-versa, in the order of numbers of documents produced collaboratively with either country, we note the presence of leading research bodies and the best universities in each, such as the Spanish National Research Council (CSIC), University of Barcelona, Barcelona's Autónoma University, Madrid's Autónoma University, University of Valencia, Madrid's Universidad Complutense and the Biomedical Network Research Centre (Centro de Investigación Biomédica en Red - CIBER), and University College London, Imperial College London, University of Oxford, University of Cambridge and University of Manchester.

01



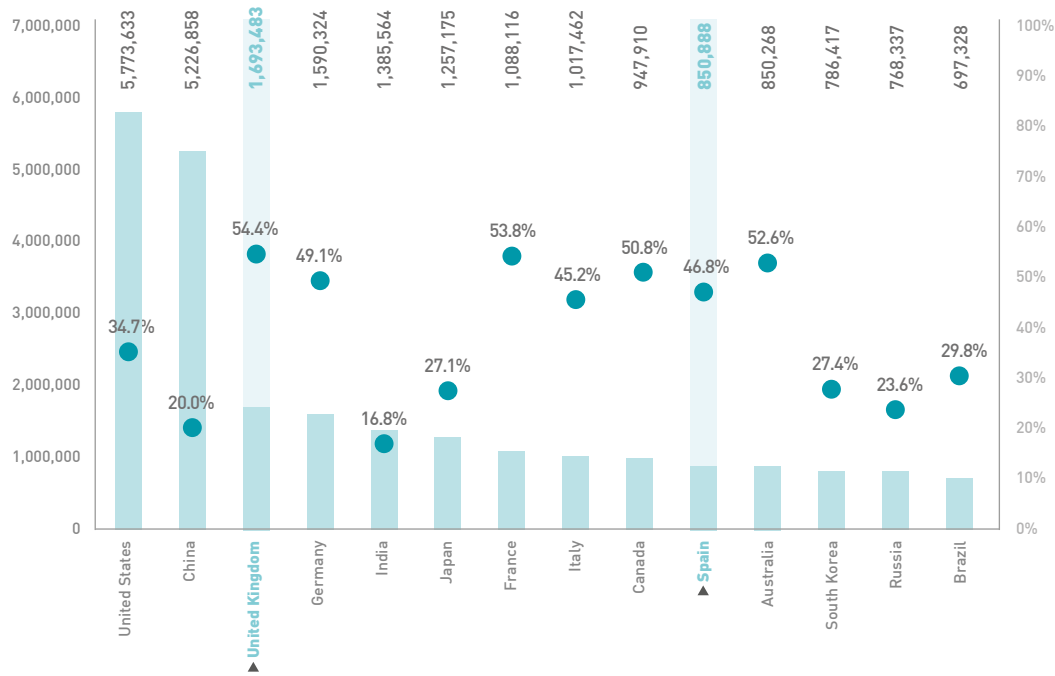
SPAIN AND THE UK IN THE
INTERNATIONAL CONTEXT

01 SPAIN AND THE UK IN THE INTERNATIONAL CONTEXT

During this period, the UK was ranked third worldwide in terms of numbers of documents published, while Spain was ranked tenth.


Turning to collaborative publications with other countries, 46.8% of scientific production in Spain was published as international collaboration, and 54.4% in the UK.

Main producing countries by NDOC and % international collaboration, 2011-2020



Number of documents ■
% International collaboration ●

02



THE UK'S SCIENTIFIC PRODUCTION
IN INTERNATIONAL COLLABORATION

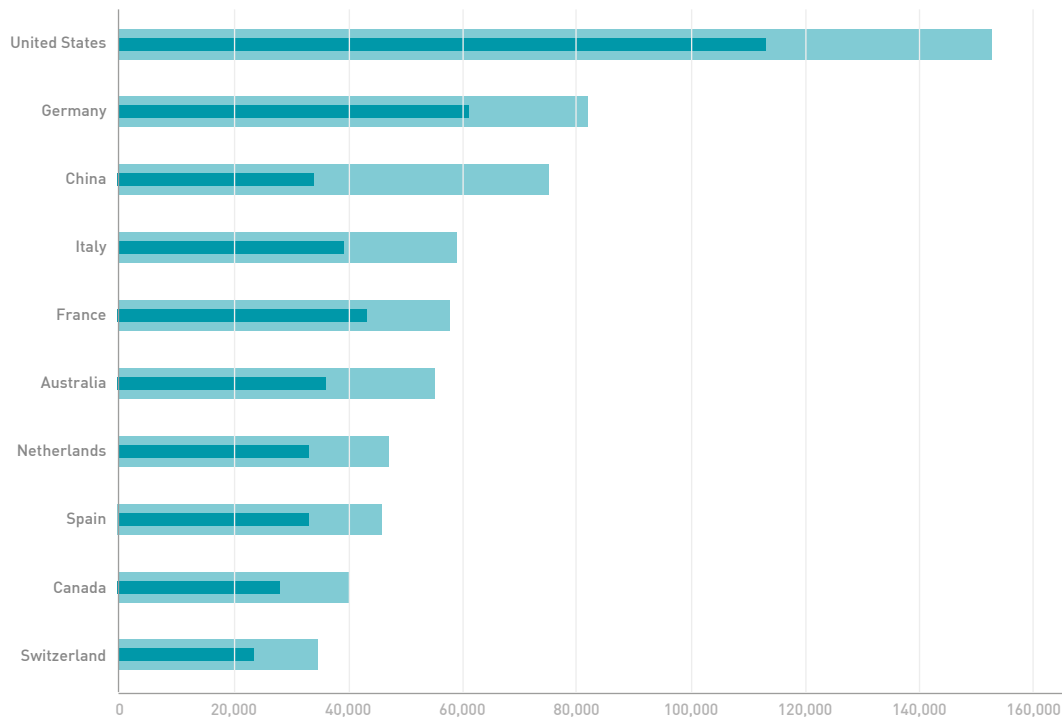
THE UK'S SCIENTIFIC PRODUCTION IN INTERNATIONAL COLLABORATION

A display is provided of the UK's 10 main collaboration countries, with a comparison of scientific production published in the two five-year periods studied.

The US is the UK's main collaborator, and Spain is its eighth most extensive collaborator.

It should be pointed out that China is quite important as a scientific partner to the UK, and the country doubled its collaboration with the UK during the second quinquennial.

Scientific production with collaboration between GBR and the 10 main collaborators. Number of documents



03



**SPAIN'S SCIENTIFIC PRODUCTION IN
INTERNATIONAL COLLABORATION**

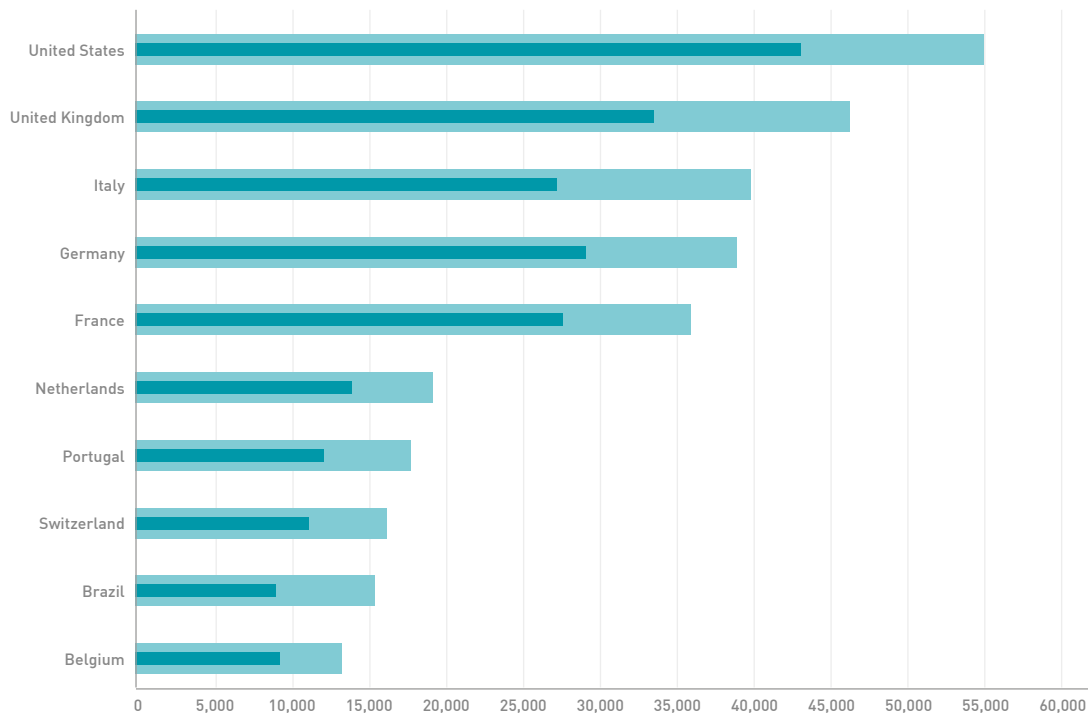
SPAIN'S SCIENTIFIC PRODUCTION IN INTERNATIONAL COLLABORATION

In terms of Spain's 10 major collaborators, the UK is one of our country's main scientific partners.

It is the second largest exponent of collaboration with Spanish science after the US.

2016-2020 ■
2011-2015 ■

Scientific production with collaboration between ESP and the 10 main collaborators. Number of documents



04



MAIN INDICATORS OF SCIENTIFIC
COLLABORATION BETWEEN
SPAIN AND THE UK

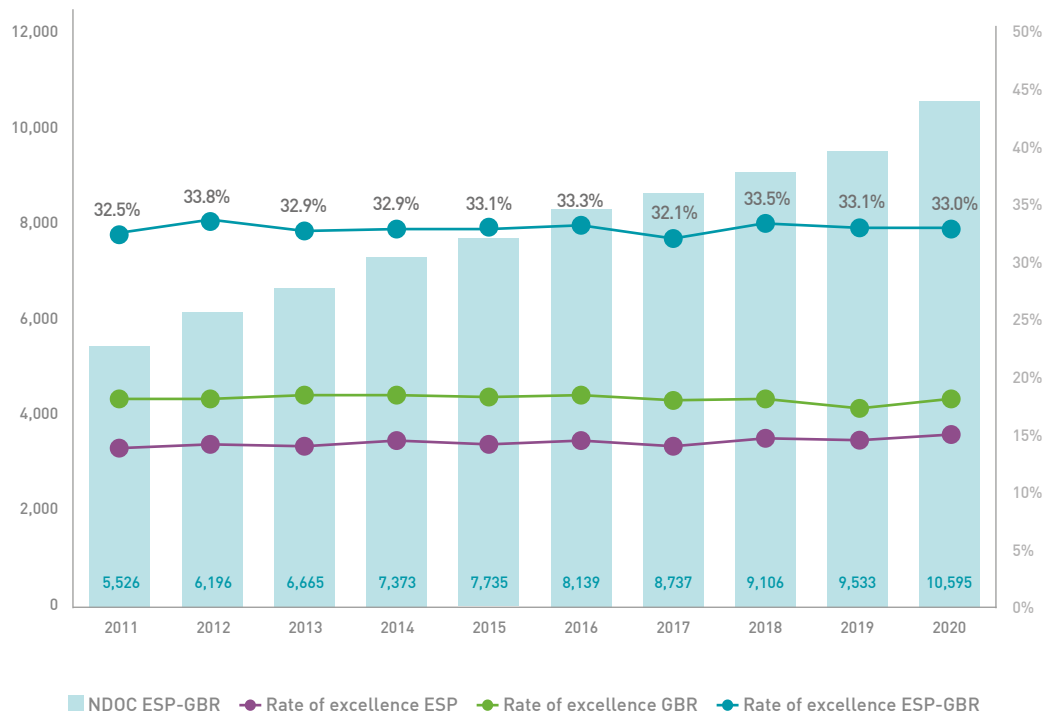
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MAIN INDICATORS OF SCIENTIFIC COLLABORATION BETWEEN SPAIN AND THE UK

Between 2011 and 2020, collaborative scientific production between the two countries almost doubled, with a compound annual growth rate of 7.5%. A total of 79,805 documents were published collaboratively between Spain and the UK during this period.

The excellence rating of collaborative publications by the two countries is 33% on average, much higher than the individual excellence ratings of Spain and of the UK over the same period, at 14.5% and 18.2% respectively.

Number of collaborative documents and the rate of excellence



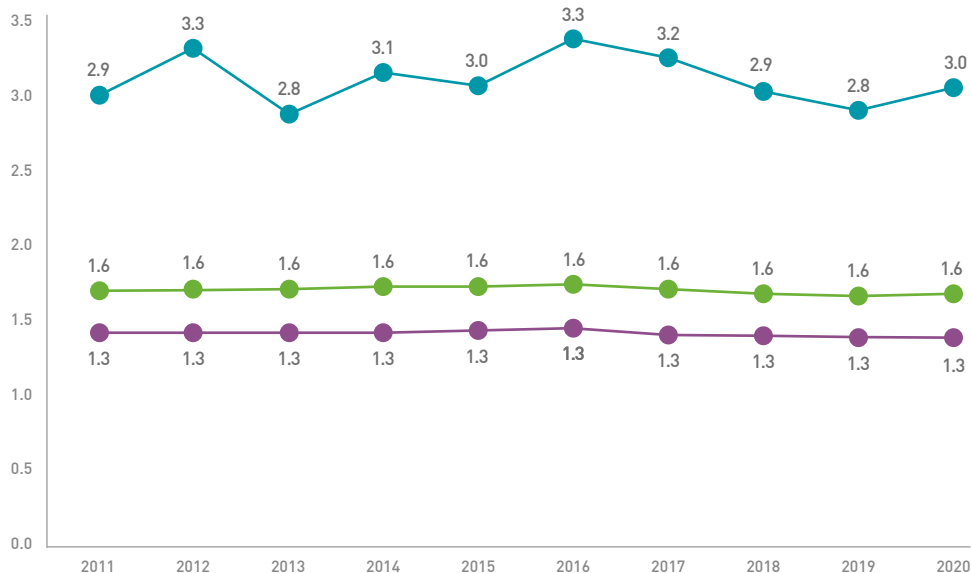
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MAIN INDICATORS OF SCIENTIFIC COLLABORATION BETWEEN SPAIN AND THE UK

The Normalised Impact of collaborative publications between the two is 3.03 on average compound annual growth rate, well above the impact of both countries separately - 1.29 in the case of Spanish scientific production, and 1.59 for the UK's scientific production.

This works out as 203% above the world average (= 1), demonstrating the advantages of scientific collaboration for both countries.

Normalised Impact (NI)

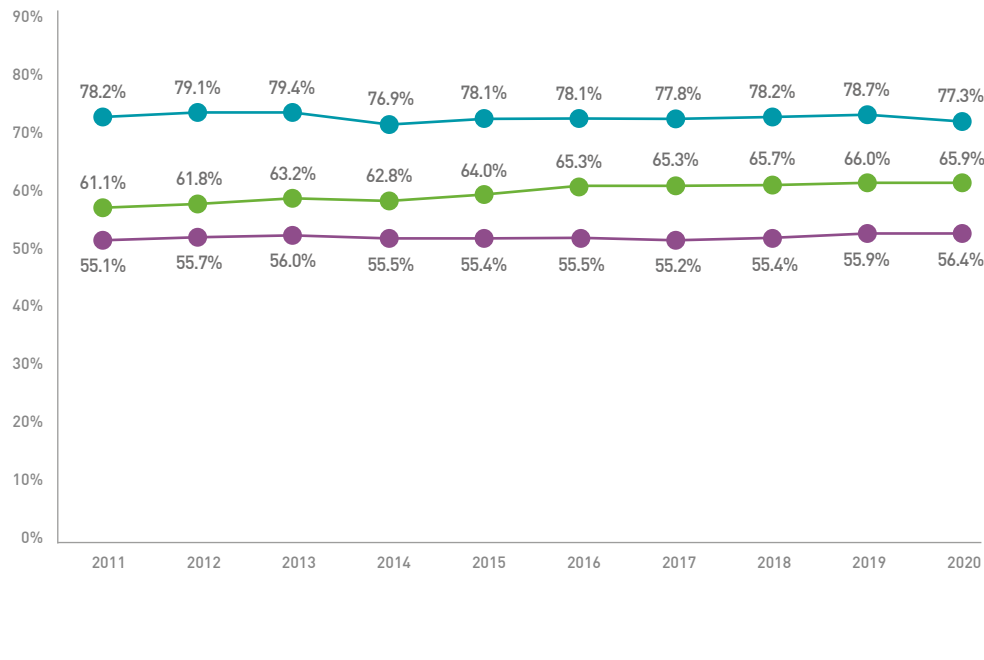


- NI_ESP-GBR ●
- NI_ESP ●
- NI_GBR ●

MAIN INDICATORS OF SCIENTIFIC COLLABORATION BETWEEN SPAIN AND THE UK

On average, 78% of collaborative scientific production by Spain and the UK is published in the world's leading journals or in first-quartile publications, a figure which is much higher than the individual values of scientific production by each country separately: 55.6% for Spain, and 64.3% for the UK.

Percentage of publications in the most significant reviews in the world of first quartile (Q1)



05



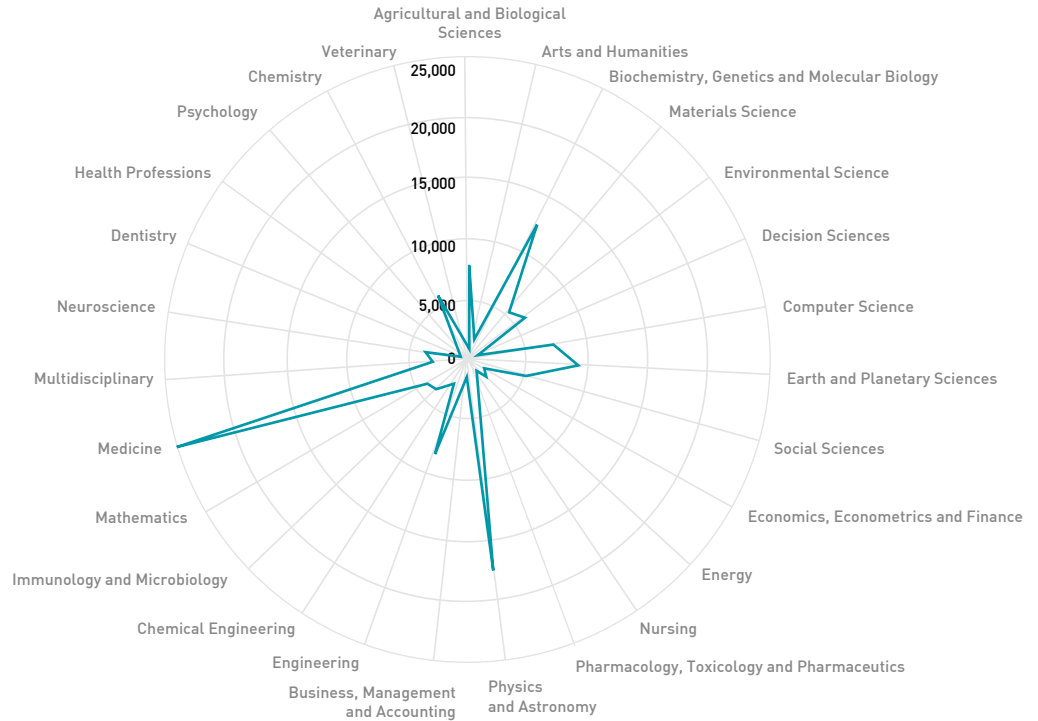
THEMATIC DISTRIBUTION OF
SCIENTIFIC COLLABORATION
BETWEEN SPAIN AND THE UK

05 THEMATIC DISTRIBUTION OF SCIENTIFIC COLLABORATION BETWEEN SPAIN AND THE UK

In terms of thematic distribution of collaborative scientific production by the UK and Spain by major areas of knowledge, Medicine emerges as the area that accounts for the greatest number of documents, followed by Physics and Astronomy and Biochemistry, Genetics and Molecular Biology.

ESP-GBR

Collaborative production between ESP and GBR by subject. 2011-2020. Number of documents



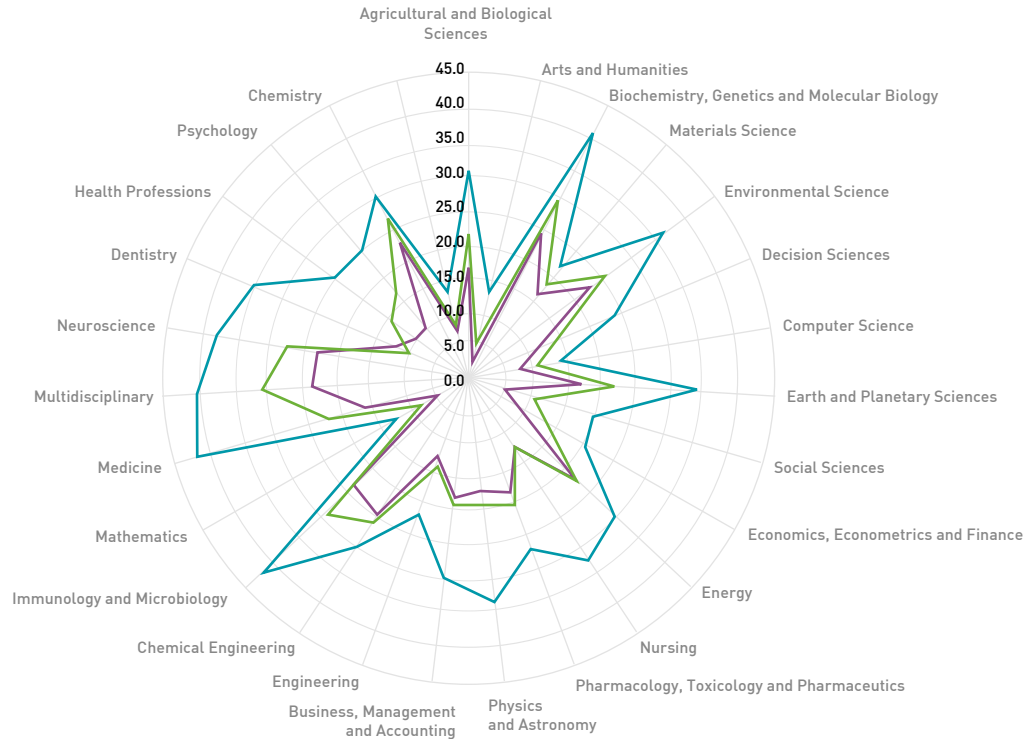
05 THEMATIC DISTRIBUTION OF SCIENTIFIC COLLABORATION BETWEEN SPAIN AND THE UK

The areas in which Spanish/UK collaboration attains the greatest scientific excellence are: Medicine; Immunology and Microbiology and Biochemistry, Genetics and Molecular Biology.

Establishing a relationship between documents jointly produced by Spain and the UK and quotes from the documents, it may be said that it is extremely "profitable" for both countries to publish on a joint basis from the point of view of citations.

ESP —
GBR —
ESP-GBR —

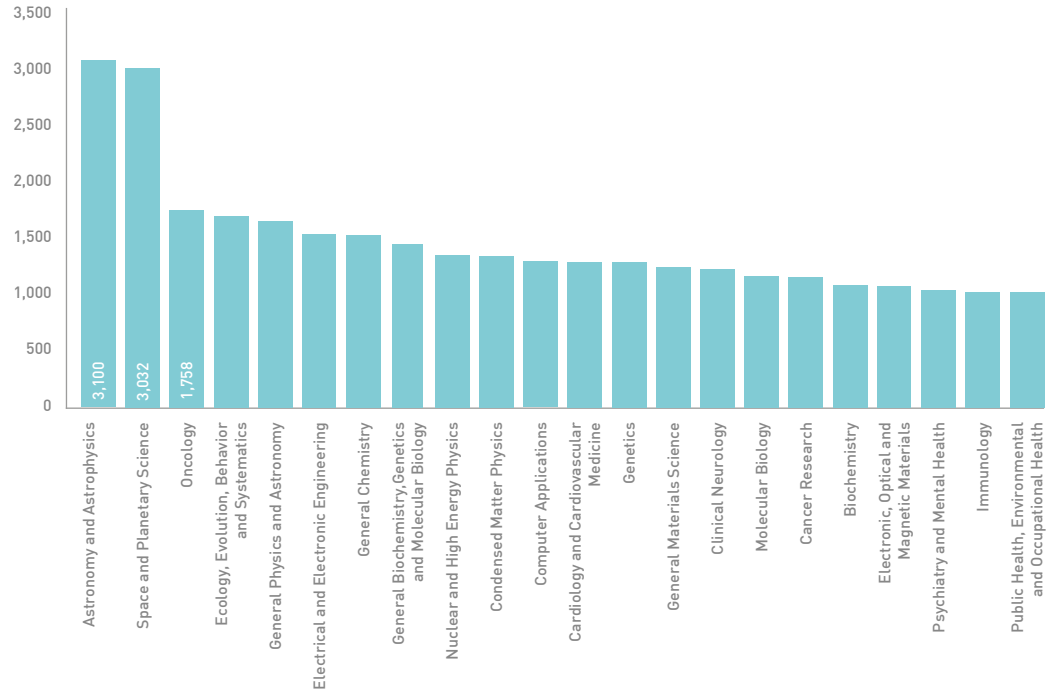
% Excellence by area of knowledge in collaboration between ESP and GBR. 2011-2020



05 THEMATIC DISTRIBUTION OF SCIENTIFIC COLLABORATION BETWEEN SPAIN AND THE UK

Examining areas of knowledge and the scientific disciplines they contain, analysing only the second five-year period between 2016 and 2020, here we have set out the scientific disciplines in which more than one thousand collaborative documents have been published during this time. The following are most noteworthy in terms of numbers of documents: Astronomy and Astrophysics, Spatial and Planetary Science, Evolution, Ecology, Systematics, General Physics and Astronomy, Electrical and Electronic Engineering, General Chemistry, General Biochemistry, Genetics and Molecular Biology, Nuclear and High Energy Physics, Condensed Matter Physics, Computer Applications, Cardiology and Cardiovascular Medicine, Genetics, General Materials Science, Clinical Neurology, Molecular Biology, Cancer Research, Biochemistry, Electronic, Optical and Magnetic Materials, Psychiatry and Mental Health, Immunology, Public Health, Environmental and Occupational Health

Main scientific disciplines with ESP-GBR collaboration, 2016-2020. Number of documents

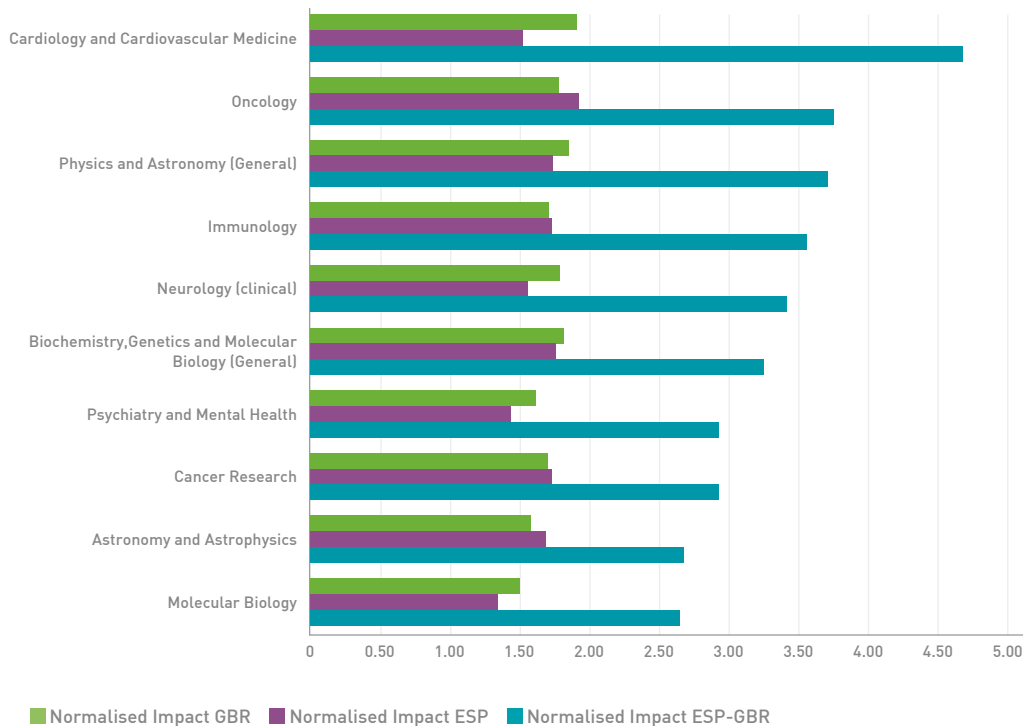


05 THEMATIC DISTRIBUTION OF SCIENTIFIC COLLABORATION BETWEEN SPAIN AND THE UK

There follows a list of the 10 scientific disciplines with the most impact in the two countries over the last 5 years (2016-2020): Cardiology and Cardiovascular Medicine, Oncology, Physics and Astronomy (General), Immunology, Neurology (clinical), Biochemistry, Genetics and Molecular Biology (General), Psychiatry and Mental Health, Cancer Research, Astronomy and Astrophysics, Molecular Biology.

The quality of the scientific production achieved collaboratively between Spain and the UK must serve to boost this joint cooperation even further.

Scientific disciplines with ESP-GBR collaboration 2016-2020 with the greatest Normalised Impact



THEMATIC DISTRIBUTION OF SCIENTIFIC COLLABORATION BETWEEN SPAIN AND THE UK


It should also be pointed out that the **latest scientific tendencies** with the greatest impact on worldwide research are also features of scientific collaboration between the two countries.

The table below shows the world's most salient research disciplines in comparison to other areas of research, arranged in order by prominence percentiles.

¹ Percentage relates the publication cites from each topic of global total citation

| GROUPING OF CURRENT AREAS OF RESEARCH WITH A SIGNIFICANT WORLWIDE SCIENTIFIC IMPACT | NUMBER OF DOCUMENTS | GROWTH IN 2011-2020 (%) | NORMALISED IMPACT | PROMINENCE PERCENTILE ¹ |
|---|---------------------|-------------------------|-------------------|------------------------------------|
| COVID-19; SARS-CoV-2; Coronavirus | 262 | - | 13.33 | 100.00 |
| Secondary Batteries; Electric Batteries; Lithium Alloys | 143 | 63.4 | 4.13 | 99.93 |
| Photocatalysis; Photocatalysts; Solar Cells | 200 | -15 | 3.25 | 99.87 |
| Algorithms; Computer Vision; Models | 399 | -11.6 | 2.77 | 99.80 |
| Graphene; Carbon Nanotubes; Nanotubes | 351 | -9.1 | 3 | 99.73 |
| T-Lymphocytes; Neoplasms; Immunotherapy | 383 | 147.1 | 14.84 | 99.67 |
| MicroRNAs; Long Untranslated RNA; Neoplasms | 179 | -27.3 | 6.13 | 99.60 |
| Plasmons; Metamaterials; Surface Plasmon Resonance | 311 | -56.8 | 1.87 | 99.53 |
| Catalysts; Zeolites; Hydrogenation | 276 | -1.5 | 1.48 | 99.47 |
| Catalysis; Synthesis (Chemical); Catalysts | 238 | 2.5 | 1.43 | 99.40 |
| Electric Power Transmission Networks; Wind Power; Electric Power Distribution | 159 | -38.3 | 2.12 | 99.33 |
| Electricity; Energy; Economics | 219 | 244.9 | 3.01 | 99.26 |
| Ligands; Crystal Structure; Organometallics | 350 | -46.8 | 2.1 | 99.20 |
| Climate Models; Model; Rainfall | 422 | 8.8 | 3.69 | 99.13 |
| Ozonization; Degradation; Wastewater Treatment | 123 | -33.2 | 2.41 | 99.06 |
| Industry; Innovation; Entrepreneurship | 392 | 80.1 | 2.95 | 99.00 |
| Metagenome; Probiotics; Bacteria | 147 | -50.8 | 7.91 | 98.93 |
| Industry; Research; Marketing | 198 | 57.5 | 2.56 | 98.86 |
| Microbial Fuel Cells; Anaerobic Digestion; Bioreactors | 92 | -16 | 1.32 | 98.80 |
| Obesity; Motor Activity; Child | 592 | 58.3 | 5 | 98.73 |
| Galaxies; Stars; Planets | 5192 | 40 | 2.77 | 98.66 |
| Organic Light Emitting Diodes (OLED); Solar Cells; Conjugated Polymers | 186 | -38.9 | 2.55 | 98.60 |
| Arabidopsis; Plants; Genes | 322 | -23.9 | 2.78 | 98.53 |

APPENDIX 1



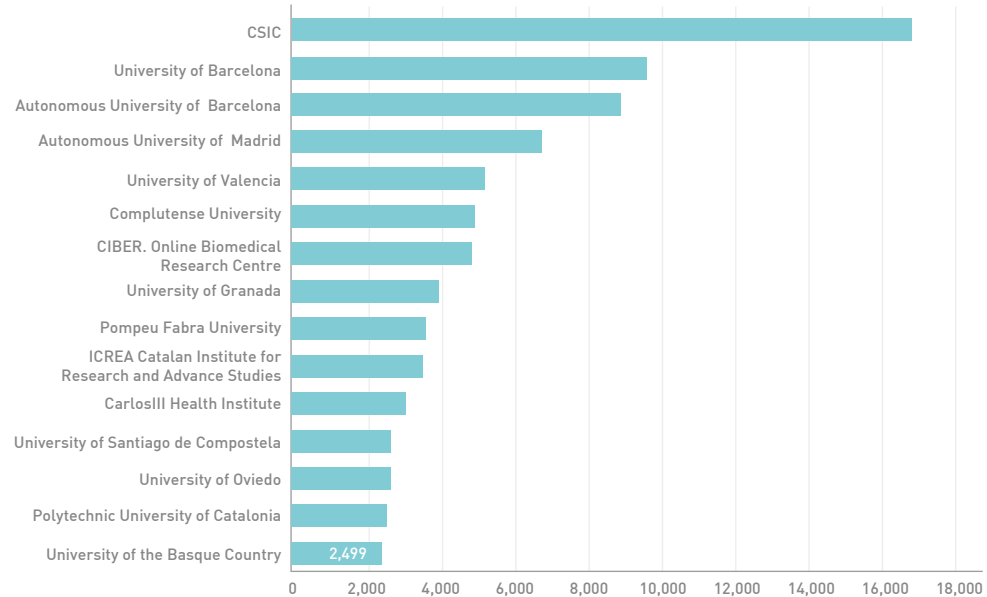
MAIN RESEARCH INSTITUTIONS
THAT COLLABORATE MOST
BETWEEN BOTH COUNTRIES

MAIN RESEARCH INSTITUTIONS THAT COLLABORATE MOST BETWEEN BOTH COUNTRIES

The main research organisations and the best universities in the two countries form part of the main institutions which are collaborating with each other.

In the case of Spain, in terms of the number of collaborative documents, the main exponents are: CSIC, University of Barcelona, Barcelona's Autònoma University, Madrid's Autònoma University, University of Valencia, Madrid's Universidad Complutense and the Biomedical Network Research Centre [Centro de Investigación Biomédica en Red - CIBER].

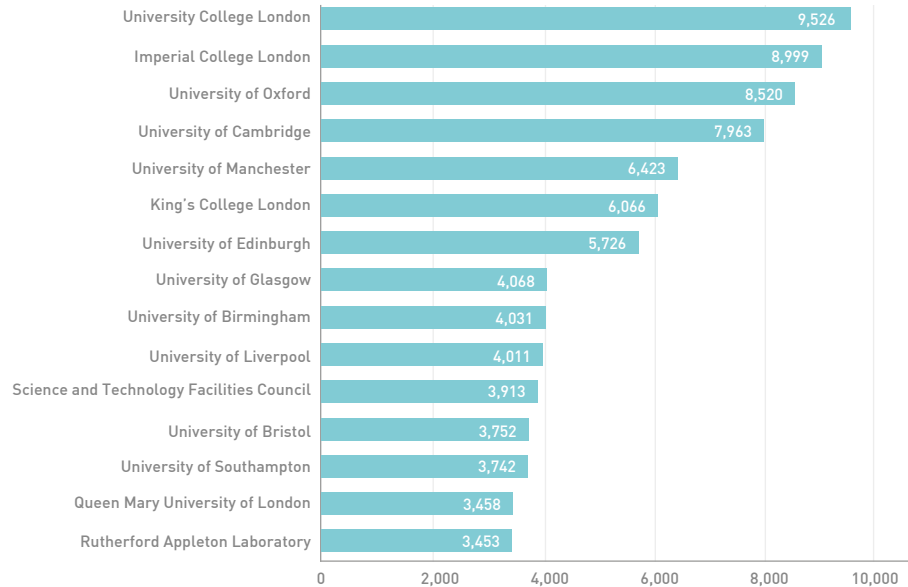
15 main institutions in ESP collaborating with GBR, 2011-2020.
Number of documents



15 main institutions in GBR collaborating with ESP, 2011–2020. Number of documents

MAIN RESEARCH INSTITUTIONS THAT COLLABORATE MOST BETWEEN BOTH COUNTRIES

The UK's primary producer institutions collaborating with Spain are as follows: University College London, Imperial College London and the Universities of Oxford, Cambridge and Manchester.



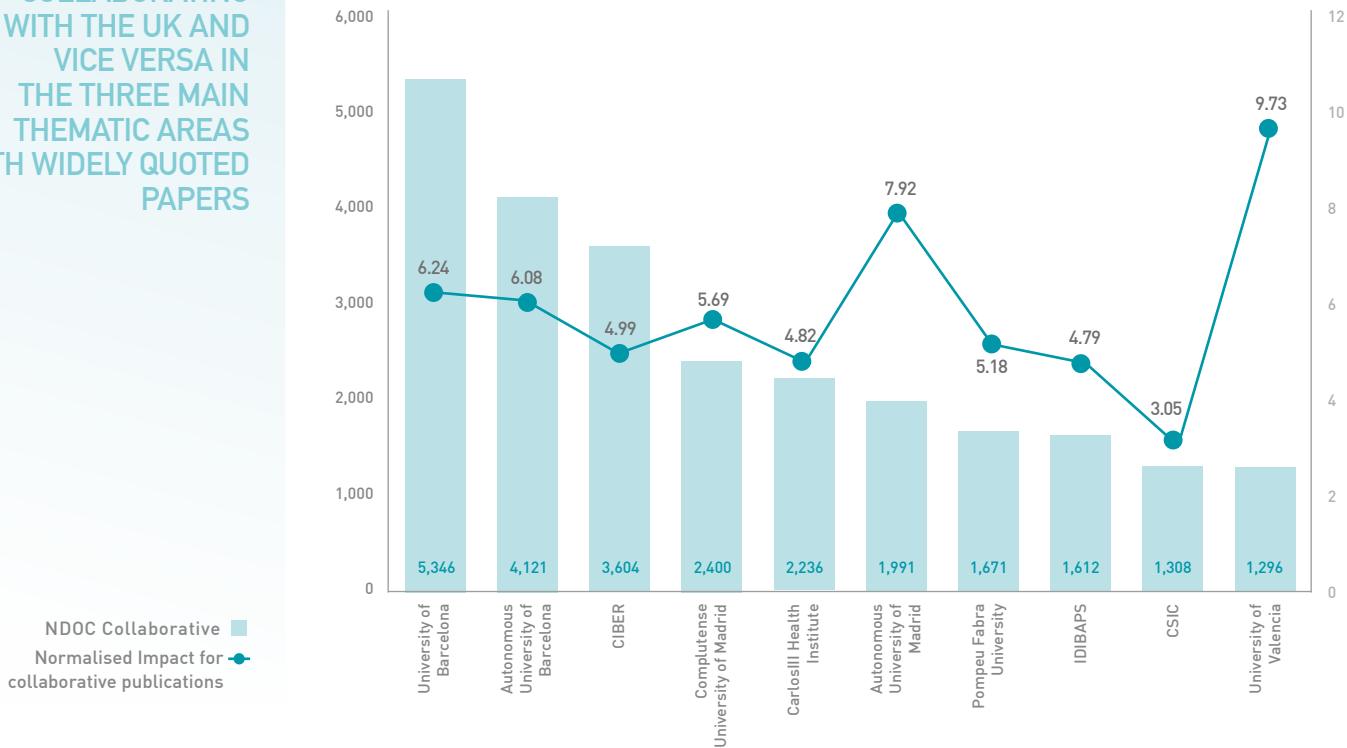


APPENDIX 2

SPANISH INSTITUTIONS
COLLABORATING WITH THE UK AND
VICE VERSA IN THE THREE MAIN
THEMATIC AREAS WITH WIDELY
QUOTED PAPERS

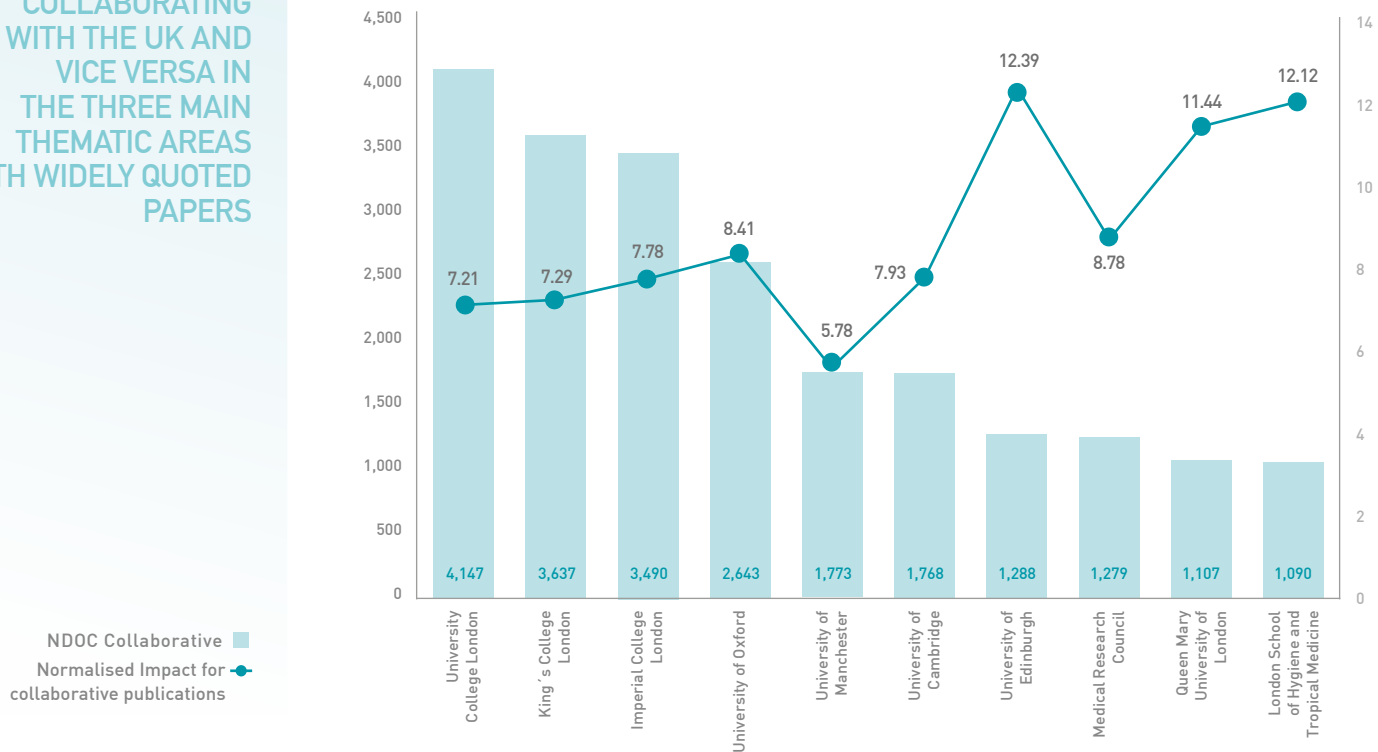
SPANISH INSTITUTIONS COLLABORATING WITH THE UK AND VICE VERSA IN THE THREE MAIN THEMATIC AREAS WITH WIDELY QUOTED PAPERS

10 main institutions in ESP collaborating with GBR in the field of Medicine and Normalised Impact for publications, 2011-2020



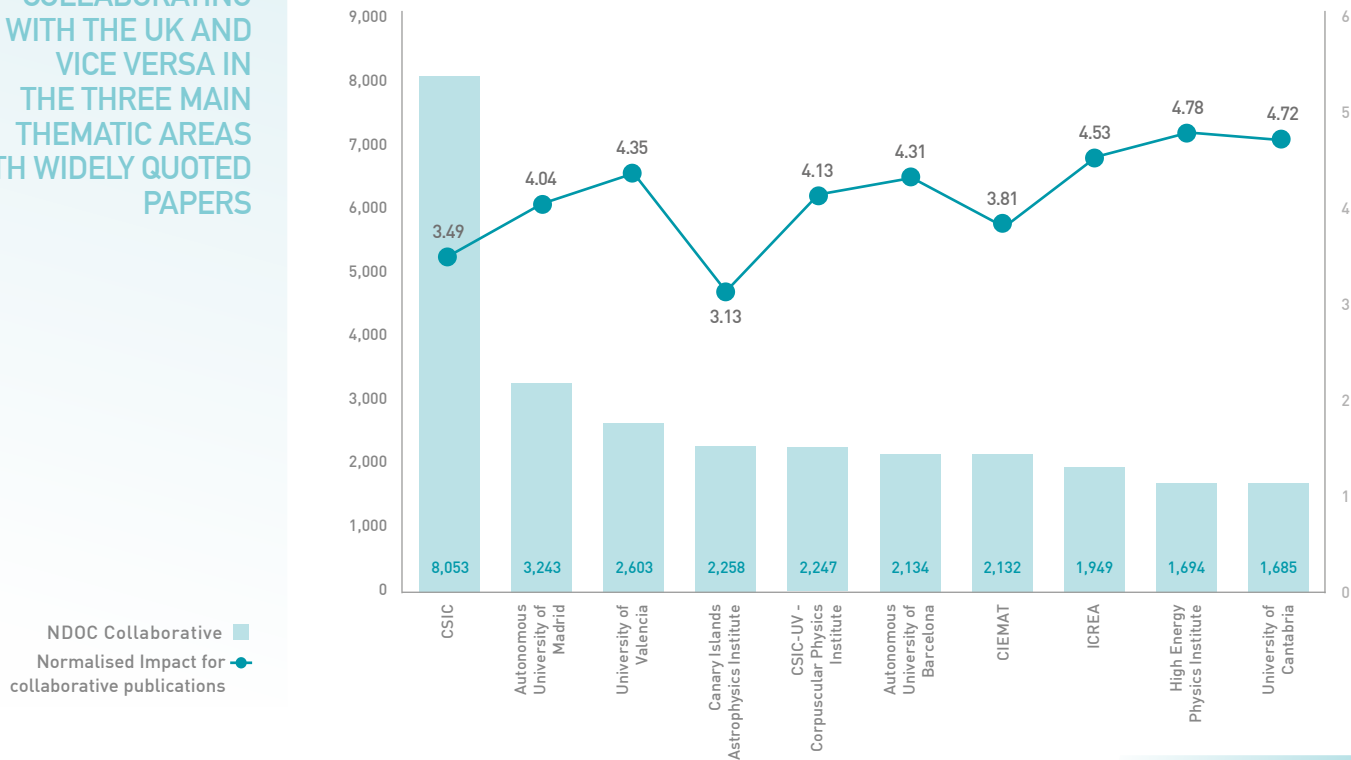
SPANISH INSTITUTIONS COLLABORATING WITH THE UK AND VICE VERSA IN THE THREE MAIN THEMATIC AREAS WITH WIDELY QUOTED PAPERS

10 main institutions in GBR collaborating with ESP in the field of MEDICINE (NDOC) and Normalised Impact for publications, 2011-2020



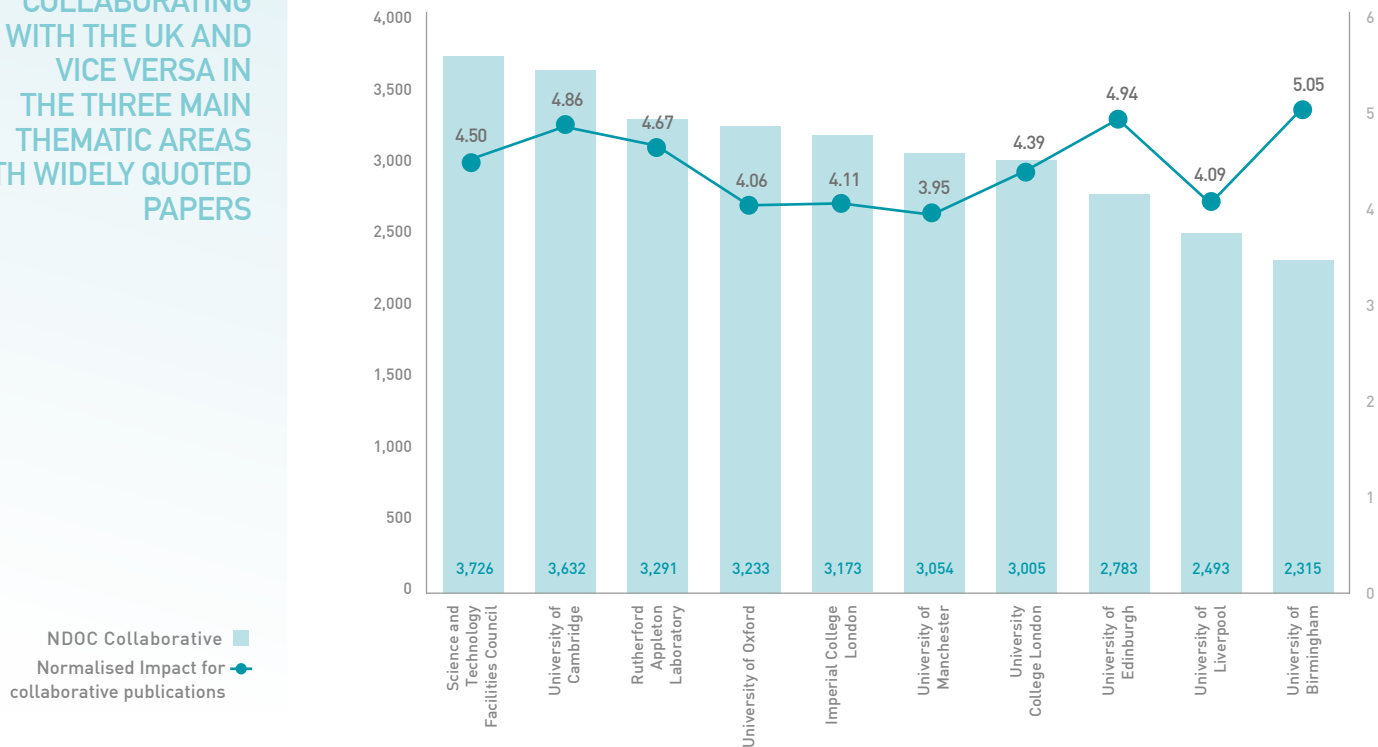
SPANISH INSTITUTIONS COLLABORATING WITH THE UK AND VICE VERSA IN THE THREE MAIN THEMATIC AREAS WITH WIDELY QUOTED PAPERS

10 main institutions in ESP collaborating with GBR in the field of PHYSICS & ASTRONOMY and Normalised Impact for publications, 2011-2020



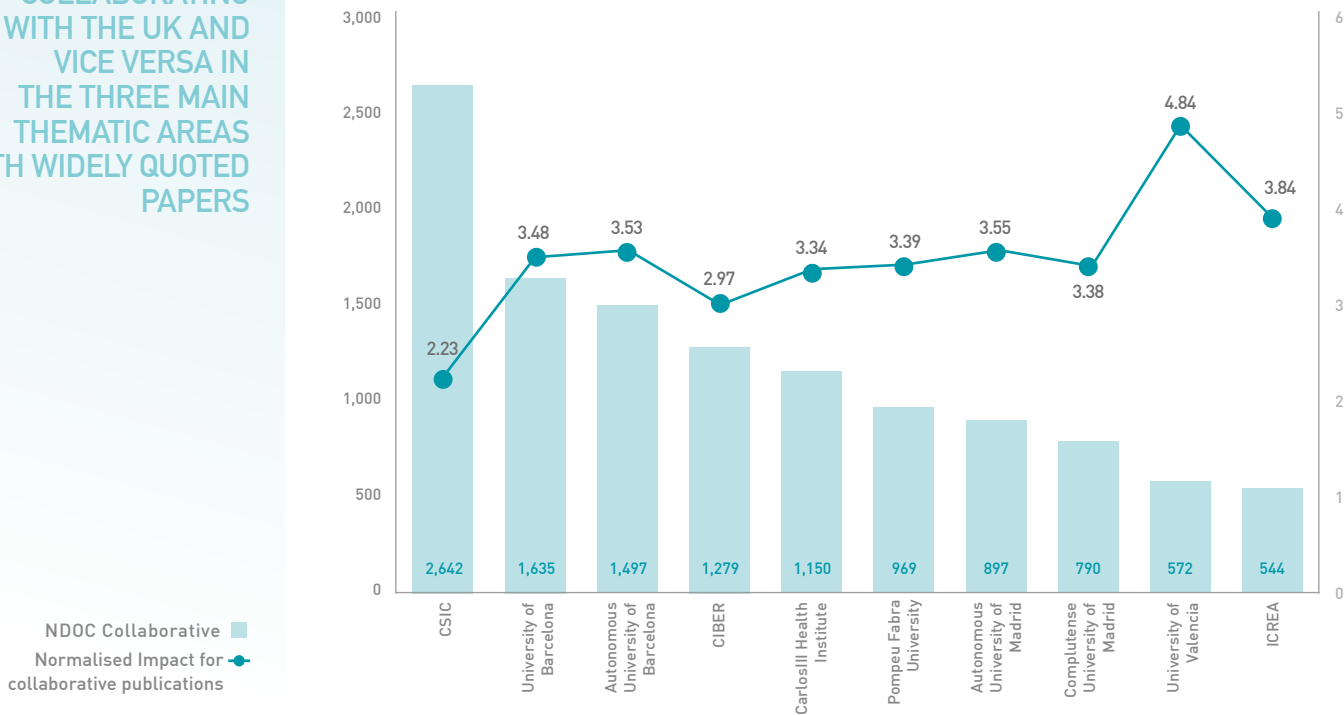
SPANISH INSTITUTIONS COLLABORATING WITH THE UK AND VICE VERSA IN THE THREE MAIN THEMATIC AREAS WITH WIDELY QUOTED PAPERS

10 main institutions in GBR collaborating with ESP in the field of PHYSICS & ASTRONOMY and Normalised Impact for publications, 2011-2020



SPANISH INSTITUTIONS COLLABORATING WITH THE UK AND VICE VERSA IN THE THREE MAIN THEMATIC AREAS WITH WIDELY QUOTED PAPERS

10 main institutions in ESP collaborating with GBR in the field of BIOCHEMISTRY, GENETICS & MOLECULAR BIOLOGY and Normalised Impact for publications, 2011-2020



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