

Veterinary Science in Catalonia: 1996-2002*

M.T. Paramio**

Universitat Autònoma de Barcelona, Bellaterra

Abbreviations

C	Number of accumulated citations	ISI	Institute for Scientific Information
C/D	Citations/documents ratio	MCT	Ministry of Science and Technology
CICYT	Spanish Commission for Science and Technology	MEC	Ministry of Education and Science
CIRIT	Catalan Interministerial Commission for Research and Technological Innovation	NC	Number of non-cited documents
CReSA	Animal Health Research Center	NCR	National Citation Report
D	Number of documents	NSI	National Science Indicators
DGR	General Directorate of Research	PETRI	Program for the Promotion of Research Results Transfer
DURSI	Ministry of Research, Universities, and Information Society	PIR	Acquisition of financial aid
ESAB	College of Agriculture of Barcelona	PRRS	Porcine reproductive and respiratory syndrome
FEDER	European Regional Development Fund	R+D+I	Research, development, and innovation
GRR	Ruminant Research Group	SCI	Science Citation Index
IC	Hired investigator	TC	Hired technician
ICREA	Catalan Institution for Research and Advanced Studies	TP	Staff technician
IEC	Institute for Catalan Studies	TSR	Research support technician
IP	Principal investigator	UAB	Autonomous University of Barcelona
IRTA	Institute for Food and Agricultural Research and Technology	UdL	University of Lleida
		UIC	International University of Catalonia
		UPC	Technical University of Catalonia
		UVic	University of Vic

Resum

La investigació de la veterinària a Catalunya pot considerar-se una activitat relativament recent perquè els principals organismes públics que s'hi dediquen s'han creat en les últimes dècades. L'any 1982 es va crear la Facultat de Veterinària de la Universitat Autònoma de Barcelona (UAB), el 1983 l'especialitat

Abstract

Research in veterinary science in Catalonia can be considered a relatively recent activity since the main public entities dedicated to it were developed during the last few decades. The Faculty of Veterinary Science at the Autonomous University of Barcelona (UAB) was created in 1982; the specialization animal

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** Author for correspondence: Maria Teresa Paramio, Departament de Ciència Animal i dels Aliments, Àrea de Producció Animal, Edifici V, Despatx V0/316, Campus de la UAB, 08193 Bellaterra, Universitat Autònoma de Barcelona. Tel. 34 935811456. Fax: 34 935811494. Email: Teresa.Paramio@uab.cat

de zootècnia a l'Escola d'Enginyers Agrònoms de la Universitat de Lleida (UdL) i el 1985 l'Institut de Recerca i Tecnologia Agroalimentàries (IRTA). Actualment, el concepte de ciències veterinàries comprèn, a més de la medicina i la sanitat dels animals, temàtiques més relacionades amb la importància econòmica dels animals i amb la qualitat i higiene dels aliments d'origen animal. L'informe s'ha realitzat classificant la veterinària en les diferents àrees temàtiques que la componen: «Sanitat animal», «Anatomia animal», «Medicina i cirurgia animal», «Producció animal», «Nutrició i bromatologia animal», «Farmacologia i fisiologia animal». La majoria d'aquestes àrees temàtiques s'aborden pels departaments que pertanyen a la Facultat de Veterinària de la UAB. L'àrea «Producció animal», per la importància econòmica d'aquesta activitat a Catalunya, és la temàtica a què es dediquen els organismes públics més grans (UAB, IRTA, UdL). Des de l'any 2000 hi ha en funcionament el Centre de Recerca en Sanitat Animal (CReSA), organisme autònom constituït per la UAB i l'IRTA. La metodologia que s'ha utilitzat per a la realització d'aquesta memòria s'ha basat majoritàriament en l'anàlisi de les dades aportades pels diferents organismes. Com que aquest informe aplega un nombre reduït d'organismes públics i un nombre reduït de persones, les dades s'han analitzat i classificat molt detalladament. Tots els indicadors de la recerca analitzats s'han desglossat per àrees temàtiques i per organismes involucrats. Finalment, sobre cada indicador es fa una anàlisi global per a totes les àrees i els organismes i es compara amb els resultats obtinguts en l'informe anterior, que comprenia els anys 1990-1995. Els indicadors analitzats, que han estat els recomanats per l'Institut d'Estudis Catalans (IEC), són els següents:

- a) el sistema de recerca. En aquest apartat es fa referència a les institucions públiques, els centres, els departaments i les unitats que desenvolupen la recerca veterinària a Catalunya;
- b) les línies de recerca. S'hi descriuen els diferents temes de recerca que es desenvolupen en les diferents àrees i organismes. S'hi han especificat els temes de recerca i els grups que la Direcció General de Recerca (DGR) considera com a grups de recerca consolidats. També en aquest apartat es fa una descripció dels serveis de recerca creats per les universitats i els centres d'investigació per donar suport a la recerca demandada tant pel sector privat com pel públic;
- c) recursos humans. El personal dedicat a la recerca es desglossa per a cada àrea i organisme i es classifica en investigador de plantilla, investigador contractat, personal tècnic de plantilla, personal tècnic contractat i becaris. Les noves figures d'investigadors dels programes Ramon y Cajal i ICREA s'especifiquen per a cada tema. Finalment es presenta un organigrama amb el total de personal en les diferents categories l'any 2002, del qual podem deduir que el 35 % són investigadors de plantilla; el 17 %, investigadors contractats; el 27 %, tècnics, i el 21 %, becaris. En relació amb el període 1990-1995, no s'observa una variació significativa del nombre d'investigadors i tècnics, només produeix un increment en el nombre de becaris;
- d) finançament de la recerca. El finançament de la recerca s'ha classificat en projectes competitiu o projectes sotmesos a avaluació científica i projectes no competitiu o convenis.

husbandry at the School of Agricultural Engineering of the University of Lleida (UdL), in 1983; and the Institute for Food and Agricultural Research and Technology (IRTA) in 1985.

Nowadays, the field of veterinary science includes, besides animal medicine and health, topics more related to the economic importance of animals and the hygiene and quality of animal-derived products. This report classifies veterinary science according to its different thematic areas: Animal Health, Animal Anatomy, Animal Medicine and Surgery, Animal Production, Animal Nutrition and Bromatology, and Animal Physiology and Pharmacology. Most of these areas are dealt with in the departments of the Faculty of Veterinary Science of the UAB. Given the economic importance of Animal Production in Catalonia, it has become the domain of the largest public entities (UAB, IRTA, and UdL). The Animal Health Research Center (CReSA)—an autonomous institution of the UAB and the IRTA—has operated since 2000.

The methodology used in this report was mostly based on the analysis of data obtained from these institutions. Since the report takes into account a small number of both public institutions and people, the data obtained were thoroughly analyzed and classified. All research indicators have been sorted by topic and by the institutions involved. Finally, for each indicator, a global analysis of all areas and organizations is made and compared to the results obtained in the previous report, which comprised the years 1990–1995. The analyzed indicators, recommended by the Institute for Catalan Studies (IEC), are the following:

- a) The research system. In this section, references to public institutions, centers, departments, and units that carry out veterinary science research in Catalonia are made.
- b) Lines of research. The different subjects of research that are in the focus of the different areas and institutes are described. The subjects of research and the groups that the General Directorate of Research (DGR) considers as *consolidated research groups* have been specified. This section also describes research services created by universities and investigation centers to support the research demands of the public and private sectors.
- c) Human resources. Personnel dedicated to research are classified for every area and institution according to: staff investigator, hired investigator, technical staff, hired technical staff, and intern. The new figures for researchers in the Ramon y Cajal and the Catalan Institute for Research and Advanced Studies (ICREA) programs are specified for every subject. Based on an organizational chart that lists all the personnel comprising the different categories for 2002, we can conclude that: 35% are staff researchers, 17% are hired researchers, 27% technical staff, and 21%, interns. Compared to the period 1990–1995, there was no significant variation in the number of technicians or researchers, only an increase in the number of interns.
- d) Research funding. This has been classified in competitive projects or projects subject to scientific evaluation, and agreements or non-competitive projects. The funding for competitive projects has been classified according to the

Entre els projectes competitiu s'ha desglossat el finançament segons si prové de programes europeus, estatals o de la Generalitat de Catalunya. Dins els convenis s'especifica si han estat encarregats pel sector privat o per institucions públiques. Sobre aquest apartat podem concloure que, per a totes les àrees i per a tots els organismes, la principal font de finançament és el sector privat, la qual cosa indica la forta projecció de la recerca veterinària en els diversos sectors productius. Pel que fa als projectes competitiu, el finançament més important ha estat el que prové de l'Estat. Si ho comparem amb el període 1990-1995, veiem que el finançament per a projectes competitiu en el període anterior va ser d'1,4 milions d'euros, i que en el període actual aquesta quantitat ha ascendit fins a 6,97 milions. El finançament per convenis en el període anterior va ser d'1,63 milions d'euros, i en el període actual ha ascendit a 13,11 milions, 9 dels quals van ser finançats pel sector privat;

e) producció científica. En aquest apartat s'han considerat exclusivament els resultats de recerca publicats en revistes científiques, llibres, informes i tesis. Els resultats obtinguts sobre transferència de tecnologia, serveis de recerca i altres resultats obtinguts per mitjà de convenis no s'hi han incorporat, tot i que som conscients que tenen una gran importància. L'evolució que han experimentat totes les àrees i els organismes ens assenyalen el creixent interès per la divulgació dels resultats en revistes pertanyents al registre ISI (Institute for Scientific Information) en comparació amb altres formats de divulgació. Així, de tot allò que es va publicar en el període estudiat, el 63,7 % van ser articles publicats en aquestes revistes, amb una tendència creixent. En comparació amb el període 1990-1995, s'ha passat de 265 articles del Science Citation Index (SCI) a 800.

Quan fem la comparació amb la productivitat científica del món, Espanya, Dinamarca i Holanda, s'arriba a les conclusions següents: en aquests temes l'aportació d'Espanya és del 4,3 % respecte al total mundial, i Catalunya representa el 18,7 % del total de l'Estat. En el període anterior aquestes xifres eren un 3,1 % i un 13,5 %, respectivament. En comparació amb Catalunya, a Holanda i Dinamarca es publica, respectivament, 4,3 i 2,6 vegades més que a Catalunya. Per comprovar la qualitat de les publicacions realitzades s'han analitzat el nombre de citacions rebudes pels articles publicats. La conclusió és que la mitjana de vegades que se citen els articles publicats a Catalunya és igual a la mitjana del món i a la d'Espanya, però és inferior a les citacions dels articles publicats a Holanda i Dinamarca. En conclusió, la recerca de la veterinària a Catalunya ha experimentat un fort increment en finançament, productivitat científica i formació de personal, encara que el personal investigador i tècnic no ha variat. Els equips de recerca s'han consolidat i s'han centrat en temes de recerca d'alt interès per als sectors productius. Com a conseqüència d'això, més de la meitat del finançament de la recerca prové dels convenis amb el sector privat. En comparació amb països com ara Dinamarca i Holanda, la productivitat i la qualitat científica és significativament menor. És possible que si s'incrementés el finançament públic per a projectes de recerca de temàtiques científicament més innovadores aquestes diferències es reduïssin.

source of the program: European, Spanish, or the Government of Catalonia. For non-competitive projects, it is specified whether they were commissioned by the private sector or by public institutions. From the information presented in this section, we can conclude that, for all areas and institutions, the main source of funding is the private sector, indicating a strong projection of veterinary science research in the various productive sectors. For competitive projects, the most important funding are public. If we compare it with the period 1990-1995, we see that the financing for competitive projects in the previous period came to 1.4 million Euros, and that in the current period this sum adds up to 6.47 million Euros. Financing for agreements in the previous period was 1.63 million Euros and during the current period this sum increased to 13.11 million, 9 of which were provided by the private sector.

e) Scientific output. This section exclusively considers research results published in scientific journals, books, reports, and theses. The results obtained regarding scientific transference and research services, and other results obtained through agreements have not been included, despite our awareness of their great importance. The development experienced by all areas and institutions indicates a growing interest in the dissemination of results through journals indexed at the ISI (Institute for Scientific Information) register rather than through other formats: 63.7% of the publications published during the period of study were articles that appeared in these journals –a trend that continues to grow. Compared to the period 1990-1995 period, the number of articles in the *Science Citation Index* (SCI) increased from 265 to 800.

When we compare the scientific output of the world, Spain, Denmark, and the Netherlands, the following conclusions can be drawn: Spain contributes 4.3% of worldwide output, and Catalonia represents 18.7% of the State's total. During the previous period, these figures were 3.1% and 13.5%, respectively. The Netherlands and Denmark, respectively, publish 4.3 and 2.6 times more than Catalonia. To verify the quality of the publications, the number of citations received by published articles was analyzed. The conclusion is that the average number of citations of articles published in Catalonia is equal to the average of the world and Spain, but lower than the number of citations of articles published in the Netherlands and Denmark.

In conclusion, veterinary science research in Catalonia has experienced a strong growth in funding, scientific output, and personnel training, despite the fact that the number of researchers and technicians has remained the same. Research teams have consolidated and have focused their efforts on those areas of research that are of greatest interest to the productive sector. This has resulted in more than half of research funding coming from agreements with the private sector. Compared to countries such as Denmark and the Netherlands, scientific output and quality in Catalonia are significantly lower. If public financing for innovative scientific research projects increased, surely these differences would in turn decrease.

Introduction

Veterinary science includes scientific areas related to animal medicine and health, the study of animals as an economic activity aimed at the production of animal-derived products, and the medical and scientific basis for regulating the quality of these food products for the consumer. Furthermore, there are basic or fundamental areas such as veterinary anatomy, veterinary pharmacology, and veterinary physiology. These were not analyzed either in the previous report (1990–1995) or in any of the previous reports on the interdisciplinary sciences that have been added to the current report, as they are fundamental to veterinary science and require no further consideration here.

The importance of veterinary research in Catalonia is due to: (1) the economic value that stockbreeding represents, around 60% of total agrarian production; (2) the population's growing awareness of the quality and safety of the food it consumes; and (3) an increase in the quality of life that is reflected by the increase in medical care for pets and the population's increasing sensitivity towards animals, their protection, and their welfare.

The main objective of this second report (1996–2002) on veterinary science research is to discuss its current situation in Catalonia, and to observe the evolution of the research indicators examined in the first report. In this way, the trends marked by the scientific indicators can be evaluated from a broader perspective, which allows more significant conclusions to be drawn.

It is interesting how working groups –diverse and dispersed during the years 1990–1995– have become established and consolidated. Nevertheless, the most interesting event during this last period has been the creation of new research centers, thanks to the collaboration of several institutions. This collaboration between institutions was established to tackle subjects of general interest and to optimize resources, and was one of the proposals and recommendations suggested in the first report.

During the current period, there have been changes in the structure of some university departments as well. In 2000, the Department of Animal Production and Pathology, of the Faculty of Veterinary Science at the UAB, was divided to give rise to three new departments: Department of Animal Medicine and Surgery, Department of Animal Health and Anatomy, and Department of Animal Science and Food. New research groups belonging to the IRTA have also been created at the UAB; in particular services to support research in veterinary sciences have been created and consolidated.

Since the inception of the Faculty of Veterinary Sciences (1982) and of studies in animal husbandry at the UdL (1983), more than 20 years have passed, and it has been 15 years since the creation of the IRTA (1985). This report intends to observe the evolution of these centers, their personnel, their lines of research, the source and quantity of their funding, and the scientific output obtained. In this way, we will be closer to reaching the main objective of this report, which is to analyze the data in order to devise recommendations for improving veterinary science research in Catalonia.

Methodology and data collection

This report is conducted following the IEC criteria for all thematic areas, thus facilitating comparison of information collected from them regarding research in Catalonia.

Veterinary science research is still considered a relatively new field in Catalonia and there are only a few institutions dedicated to it. The only Faculty of Veterinary Science in Catalonia is at the UAB and it is the center with the most researchers in this field. The UdL and the Technical University of Catalonia (UPC) also have departments with researchers working on Animal Production, which is also taught at the University of Girona (UdG), the University of Vic (UVic), and at the Tortosa campus of the International University of Catalonia (UIC). However, as it was not possible to obtain research information from these last three universities, they are not included in this report. The IRTA is the only center in Catalonia dedicated to Agricultural Food Sciences, including Animal Production. Due to the small number of institutions that could be studied, the data provided by the UAB, the UdL, the UPC, and the IRTA were submitted to a detailed analysis.

Given the relationship between veterinary science and the area of agricultural, forestry, and alimentary engineering, the present study was structured in coordination with that report. In order to prevent overlap in the analysis of the two fields, it was agreed that this report would include all topics related to Animal Production, except for the field of aquaculture, which is included in the Agricultural Engineering report. Thus, a detailed study of research in veterinary sciences comprises all scientific indicators analyzed for each of the scientific areas comprising veterinary science. These are: Animal Health, Animal Anatomy, Animal Medicine and Surgery, Animal Production, Nutrition and Bromatology, Veterinary Pharmacology, and Animal Physiology.

The outline adopted by this report is as follows:

Firstly, all organizations and public institutions that carry out research in Catalonia are described according to their departments, units of research, and geographical location.

All scientific areas classified under Veterinary Sciences, except Animal Production, are located in departments of the UAB's Faculty of Veterinary Science. For Animal Production, all scientific indicators have been broken down according to the different research organizations involved.

Secondly, the main lines of research in the different areas of veterinary science, as well as the different research organizations are described. In addition, the research services that the various centers and departments offer to the public and private sector to support further research have been included. In this section, the groups and fields of research accredited and recognized as such by the Government of Catalonia are highlighted.

The third section refers to research and technical personnel in charge of carrying out research in the areas of interest to this study. In both cases, it has been specified whether the personnel are staff members or are employed by the institution through a temporary contract. In this section, we have ignored the restriction that university professors cannot devote more than 80% of their time to research, since the rest must be allocated to teaching. Hired teachers are able to devote even less

time to research, since in most cases they are employed only on a part-time basis. Since the last report did not take this factor into consideration, it was not included in the present one, so that results could be compared. At any rate, it should be noted that most of the research staff in veterinary sciences are employed by universities, and that taking this into account would considerably reduce the amount of personnel data, consequently modifying the percentages regarding scientific output per investigator.

Fourthly, the economic resources employed or the funds received to develop research have been studied. Funding has been classified as either publicly granted projects, which are subject to previous evaluation, or projects without previous evaluation, such as agreements. Public and competitive projects are classified as state-owned, European, or granted by the Government of Catalonia. Non-competitive projects or agreements are classified as agreements with public or private institutions. Agreements with private institutions include service assistance, development of research topics, and consultancy. It was impossible to elaborate further on the types of agreements since each organization employs a different nomenclature. However, it would have been very interesting to know which agreements are specifically related to research, and which simply represent assistance or personal queries from professors, without repercussions for scientific output.

The projects financed by the Spanish Government include the following:

- Investigation projects of the National Plan concerning research+development+innovation (R+D+I) for the different thematic programs:
- Investigation projects from the Program for the Promotion of Research Results Transfer (PETRI)
- Scientific infrastructure aid
- Projects with the European Regional Development Fund (FEDER)
- Special actions from the Interministerial Commission for Science and Technology (CICYT).

The projects financed by the DGR of the Government of Catalonia include the following:

- Financing of consolidated investigation groups
- DGR infrastructure projects [acquisition of financial aid (PIR), improvement of benefits, and infrastructure replacement]
- FEDER infrastructure
- Infrastructure maintenance (Catalan Interministerial Commission of Research and Technological Innovation [CIRIT])
- Incorporation of UAB-DGR technical staff
- Mobilization actions: congresses and symposia
- Thematic networks

Intern fellowships, overseas stays of members of either the Ministry of Education and Science (MEC) or the Government of Catalonia, and financial help to visiting professors have been excluded from this section.

Fifth in our outline are research results, an analysis of which consisted of considering the quantity and quality of publications. They have been classified either as "SCI Register" (those published in journals included in the SCI) or "Others" (those published in other journals). Publications of a technical or popular nature are referred to as "Reports", and books simply as "Books". In this section we have also taken into account doctoral theses; although their results are most often published in the above-mentioned types of publications, they provide a rough idea of the level of preparation of new researchers.

Regarding scientific results published in SCI-registered journals, two different methodologies were employed: (1) articles published in journals included in the SCI were manually counted looking them up in the reference lists of research reports of the evaluated centers and departments. Due to collaboration between researchers in different centers and departments, we are aware that with this methodology some of the published articles were counted more than once. (2) In order to reduce the degree of error introduced, a second methodology was applied: using the Institute for Scientific Information (ISI) databases, journals pertaining to Animal Sciences and Veterinary Sciences (a list of these journals is included in Appendix 1) were selected. For articles published in these journals, we looked up how many times they were cited worldwide, in Spain, in the Netherlands, and in Denmark. The last two countries were chosen due to their similarities with Catalonia, and because they were also used as references in the last report. The objective of this analysis was to compare scientific output between countries and thus evaluate the existing level in Catalonia. The data were obtained from the IEC's documentation services.

In order to assess the quality of the scientific results, the number of times that an article was cited by other authors was noted. This information was obtained from the *National Citation Report* (NCR) databases and the *National Science Indicators* (NSI), both provided by the Department of Research, Universities, and Information Society (DURSI). The data were also obtained from the IEC's documentation service.

Scientific output valued only as results published in journals, books, or reports, does not reflect work carried out by researchers in its totality. The importance of technological transfer in the social sector, the collection and analysis of data supplied to public institutions, and the analytical services provided to the private sector are also communicated results of unquestionable significance. Nevertheless, given the difficulty of obtaining data for this type of analysis, we decided to refrain from analyzing these types of scientific output. It should be noted, however, that, in an eminently applied field such as veterinary science, they make up an important part of researchers' work.

Finally, the conclusions of the study and the recommendations we consider to be critical to improve the level of research in veterinary sciences in Catalonia are noted.

The research system

Research in the field of veterinary science in Catalonia is carried out by the Faculty of Veterinary Science of the UAB, the UdL,

the Technical School of Agricultural Engineering, the School of Agriculture of Barcelona (ESAB) of the UPC, and the IRTA (Table 1).

Joint IRTA-university centers:

- a) UdL-IRTA center: A research center in the form of a university institute at the UdL, with the corporate body of the IRTA. The researchers and the infrastructure of the UdL and the IRTA in Lleida work jointly and in combined units in the different fields of agrarian and food sciences. Since this center has the corporate body of the IRTA, the results and the indicators have been combined with those of the IRTA. The UdL-IRTA center's Animal Production unit has been included in this report.
- b) UAB-IRTA center: In this new report, the creation of the Animal Health Research Center (CReSA) is emphasized. This research center was set up at the UAB campus next to the Faculty of Veterinary Sciences. As a legal entity, it is a foundation based on the joint participation of the UAB and the IRTA. The CReSA began its activity in January 2000. According to its statutes, CReSA has the following functions:
 - Develop research programs in Animal Health
 - Transfer scientific advances to the appropriate sector, according to the outline and conditions established by the corresponding by-laws
 - Provide services in the fields of research and technological development by means of R+D programs established by agreements
 - Advise both companies in the agrarian and food sectors and the public administration, provide them with technological support in Animal Health
 - Organize scientific and technical training programs in the CReSA's area of competence, either alone or in collaboration with other public or private institutions
 - Support other activities established by mutual agreement between organizations associated with the CReSA.

Lines of research: subjects, consolidated groups, and research centers

In this second report, the lines of research related to the veterinary science areas previously mentioned are discussed. Lines of research are defined as broad-based research subjects comprising an array of projects from different disciplines. In addition, this section also describes research groups consolidated by the Government of Catalonia and research services created by the universities to satisfy the needs of the public and private sector in specific areas of veterinary science.

Animal Health: UAB and CReSA

Animal Health concentrates on the diagnosis and prevention of infectious and parasitic diseases in animals. The four groups or units that carry out lines of research in Animal Health are: (1) Epidemiology and Infectious Diseases, (2) Parasitic Diseases, (3) Mycology and Microbiology, and (4) in part, Pathological Anatomy.

Currently, two independent organizations collaborate in the field of Animal Health: the UAB's Department of Animal Anatomy and Health and the CReSA. Since 2000, many professors from the UAB together with researchers from the IRTA have incorporated to the CReSA.

a) Unit of Animal Health, from the Department of Animal Anatomy and Health, UAB

- Neosporosis: epidemiology, pathogenesis and diagnosis
- Tick-transmitted diseases: rickettsiosis, piroplasmiasis (babesiosis, theileriosis), taxonomy and ixodid control
- Mycosis: the study of *Malassezia* species in cats, dogs, and domestic ruminants
- Mycotoxicosis: Determination of mycological control techniques in fodder and raw materials; *Fusarium* mycotoxins in products for human and animal consumption; ochratoxin A and new producing species
- Microbiology: evaluation of natural compounds as an alternative to antibiotics

Table 1. Veterinary science centers and research units in Catalonia.

Centers	Research Units
UAB	Department of Animal and Food Science Department of Animal Medicine and Surgery Department of Animal Anatomy and Health Department of Pharmacology, Therapeutics and Toxicology Department of Cellular Biology, Physiology and Immunology
UdL	Department of Animal Production
UPC	Animal Production Group at the Department of Agriculture and Food Engineering and Biotechnology
IRTA	Department of Animal Nutrition, in Constantí, Reus
	Center of Porcine Control, in Monells, Girona Unit of Poultry Genetics, in Constantí, Reus Prat de Llobregat's, Barcelona Experimental Station Rabbit Breeding Unit (at the UAB campus) Ruminant Unit (at the UAB campus) Animal Production Area (UdL-IRTA center)

- Epidemiology: epidemiologic simulation models
- Avian pathology: swollen head syndrome (SHS) diagnosis in chicken, avian infectious bronchitis, Gumboro virus isolated in Spain
- Pathogenesis, diagnosis, and treatment of porcine infectious diseases: Aujeszky virus infection, porcine reproductive and respiratory syndrome (PRRS), porcine pleuropneumonia caused by *Actinobacillus pleuropneumoniae*
- New methods for the diagnosis of infectious disease in domestic and wild animals
- Study and characterization of an experimental murine model for the study of human asthma

Consolidated Research Group at the Department of Animal Anatomy and Health

The Veterinary Mycology Research Group focuses on the study of fungi as the causal agents of pathologic processes related to infectious diseases and mycotoxicoses that affect both animals and humans.

b) CReSA

As previously noted, research lines at CReSA are closely related to those at the UAB's Department of Animal Anatomy and Health. However, the CReSA's research focuses more on the sanitary problems of the Catalan productive sectors, particularly of the porcine and poultry subsectors:

- Pathogenesis of infection
- Immunity, and vaccine development
- Antibiotic therapy
- Epidemiology and disease control
- Pharmacological studies
- Disease-genetics relationships
- Disease-nutrition relationships

Animal Anatomy: UAB

A small number of professors –those in charge of teaching anatomy at the School of Veterinary Science– work in this area. The lines of research they develop are:

- Angiogenesis and vasculogenesis
- Analysis of vascular morphogenesis and molecular mechanisms of blood-vessel formation in embryos and transgenic mouse models
- Study of vascular alterations in metabolic pathologies
- Embryology and functional anatomy of female reproductive organs
- Cryopreservation and *in vitro* embryo production in cattle
- Ovarian regulation of reproductive function, and hormonal synchronization of heat in dairy cattle
- Reproductive characteristics of non-conventional breeding species

Animal Medicine and Surgery: UAB

Researchers working in this area are engaged in the study of companionship animals (domestic carnivores, horses, and other species). Their work differs from that carried out in Animal

Health in that they study the diseases of the individual animal (etiopathogenesis, diagnosis, treatment) and their possible consequences for humans. The main lines of research are:

- Traumatology and orthopedics of domestic carnivores
- Study of stress tests in equids
- Hemostasis in equids and dogs
- Allergy diagnosis in equids
- Electrolytic alterations and fluid therapy in equids
- Minimally invasive surgery
- Morphological and functional characterization of semen from different species, gamete cryopreservation
- Diagnosis of domestic carnivore neoplasias, search for markers
- Ecopathology of wild fauna
- Neuropathology
- Prion-induced disease in animals: pathogenesis of neuroinvasion and neurodegeneration
- Canine leishmaniasis

Consolidated Research Group at the Department of Animal Medicine and Surgery

The main research activity of the Animal Pathology Group: is the study of infectious diseases and neoplasias of different domestic species and laboratory animals, by means of microscopic morphological, immunocytochemical, and serologic techniques, in order to elucidate the pathogenesis of the lesions they induce.

Research Services

- Veterinary Pathology Diagnosis Service
- Wild Fauna Ecopathology Service
- Veterinary Hematology Service
- Equine Reproduction Service

Animal Production: UAB, UdL, UPC, IRTA

Animal Production research is characterized herein by incorporating all scientific disciplines involved in increasing, in quantity and quality, the production of animal-derived food products, taking into account the economic aspects of production, the welfare of animals, and the environment in which they are exploited. The scientific disciplines that traditionally comprise this research are: genetics, nutrition, reproduction, and exploitation management. The studies concentrate on porcine, bovine, ovine, caprine, avian, and rabbit species. As previously noted, aquaculture, a sector of great importance, is analyzed in the report on agrarian and alimentary engineering.

In Catalonia, of all the veterinary science specializations, Animal Production is the one covered by the largest number of organizations, centers, and departments. Given this area's importance in the country's economic productivity, it is the sector with the highest number of researchers and the most economic resources invested. The organizations and centers involved are university departments from the UAB, UdL, UPC, and the research departments of the IRTA.

The lines of research developed in the different research centers are the following:

a) Animal Production Unit of the Department of Animal and Food Sciences, UAB

The Department of Animal and Food Sciences is made up of two units: Animal Science, which incorporates all the professors of Animal Production, and Food Science, which incorporates professors of Nutrition and Bromatology and professors of Food Technology.

- In this department, professors teach the specialization of Animal Production and carry out research intimately related to their teaching activities. The diversity of scientific disciplines and the large number of animal species studied are the reasons behind the department's multiple lines of research, which are:
- Additives in animal nutrition and alternative compounds to growth-promoting antibiotics
- Lactation biology and milk production in ruminants
- Chemical composition, normal rabbit serum (NRS) analysis, and food nutrition evaluation
- Conservation and improvement of animal genetic resources
- Carbohydrate digestion and metabolism; influence on intestinal health and lipid metabolism
- Productive structure and costs of livestock exploitation
- Applied molecular genetics in veterinary science
- Animal electronic identification and tracing
- Improvement of the quality of lipid deposits in animal-derived foods
- Bovine alimentation and nutrition
- Natural resources, landscape, and ruminants
- *In vitro* embryo production

Consolidated Research Groups at the Department of Animal Science and Nutrition

- The group Molecular Genetics Improvement in Veterinary Science has worked in the field of applied genetic improvements in animal production since 1989. At that time, molecular genetics techniques were introduced to the Animal Production Unit (the current Animal Science Unit) of the Faculty of Veterinary Science to allow genetic characterization of autochthonous breeds and improve the management of animals' genetic resources. Results of the work done since 1992 include the establishment of an animal genetics diagnostic service –the Veterinary Service of Molecular Genetics– which initiated collaboration with the IRTA in order to detect porcine stress syndrome, and which subsequently widened the spectrum of species and characteristics analyzed. The exponential progress of these methods has led to the rapid growth of this service and its recognition by the Government of Catalonia as a member of the Technological Innovation Centers network. The group participates in the thematic areas of biodiversity, genomics, and proteomics.
- The Ruminant Research Group (GRR), whose main objective is research, development, transfer, and innovation related to milk (bovine, ovine, caprine) and meat (bovine and ovine) production by livestock ruminants.

Research Services

- The UAB Farms and Experimental Fields Service supports practical instruction and lines of research carried out by those departments and research institutions of the UAB involved in the development of assays and plant and animal experimentation. The service also assists agricultural and veterinary groups and organizations outside the UAB.

b) Department of Animal Production, UdL

Professors in this department teach undergraduate courses at the School of Agricultural Engineering and pursue the following lines of research:

- Ruminant nutrition
- Biology and reproduction techniques for dairy cattle
- Wild fauna
- Animal improvement and physiogenetics
- Avian and porcine production systems

Consolidated Research Groups at the Department of Animal Production, UdL

- Porcine Genetic Improvement and Administration System (in collaboration with the IRTA)

Research Services

- Lyophilization Service
- Facilities for animal experimentation

c) Animal Production at the College of Agriculture of Barcelona, UPC

- Hen genetics and melioration
- Ostrich genetics and manipulation
- Partridge genetics, nutrition, and manipulation
- Genetic improvement of Ripolles sheep

d) The Institute for Food and Agricultural Research and Technology (including the UdL-IRTA Center)

This institute is the only center in Catalonia exclusively dedicated to research in Agriculture and Animal Production. Its lines of research focus more than those of the universities on the needs of the Catalan productive sector:

- Porcine evaluation, selection, and genetic improvement
- Rabbit selection and genetic improvement
- Porcine selection, and economical and technical management through computerized systems
- Databases of Spanish swine (BDporc)
- Nutritional value of raw materials and grain for monogastric animals
- Lipid metabolisms in birds; dietary effects on the lipid content and quality of the food product
- Dietary effects on the intestinal health of birds and pigs
- Nutritional value of fodder and raw materials for ruminants
- Ruminant fermentation and metabolism

- Milk production by cattle
- Models and simulation of production mechanisms
- Animal metabolism

Consolidated Research Groups at the IRTA

- Animal nutrition
- Porcine genetic improvement and management systems (in collaboration with the UdL)

Research Services

- Porcine documentation
- Animal genetic markers
- Electronic access to reference databases of Spanish swine
- Terminal breeding of rabbits
- Rabbit insemination
- Rabbit breeding nests
- Choice avian breeds
- Porcine exploitation technical management program
- Ovine and caprine exploitation management program

Nutrition and Bromatology: UAB

Professors affiliated with the field of Nutrition and Bromatology, Department of Animal Science and Food, carry out research dedicated to food hygiene and sanitary inspection, both of which make up an essential part of veterinary science and are included in this report as well as in the agrarian engineering one.

The lines of research are:

- Emerging pathogenic microorganisms and their effect on food
- Development of rapid alimentary control techniques
- Surface hygiene
- Pathogenic microorganisms transferred through food, e.g., *Vibrio*, *Salmonella*, and *Listeria*

Research Services

- Food control, hygiene, and inspection services

Veterinary Pharmacology: UAB

Of the several lines of research pursued by the Department of Pharmacology, Therapeutics, and Toxicology of the UAB, this report focuses exclusively on that of Veterinary Pharmacology, which consists of:

- Inflammatory mediators
- Intradermal microdialysis in dogs
- Alimentary allergy; experimental sensitization of beagles
- Response of dogs hypersensitized to *Ascaris suum*
- Assessment of drug effectiveness in the control of allergic reactions
- Diagnosis and treatment (immunotherapy preparations) of canine atopic dermatitis

- Expression and regulation of pyroinflammatory molecules in a model of allergy-induced asthma in mice
- Characterization of the inflammatory process and the mechanisms of immune induction in a model of canine cutaneous allergy
- Importance of mastocyte activity in an alimentary allergy model in rats
- Epidemiology, immunology, and development of new drugs and vaccines against leishmaniasis.

Research Services

- Pharmaceutical Drug Analysis services pharmaceutical companies regarding the development and registration of new pharmaceutical products, vaccines, and diagnostic techniques, for their use in veterinary medicine.
- The Veterinary Diagnosis Service SL (UNIVET) is an R+D company set up in June of 2001 following the initiative of a group of dermatologists and clinical pharmacists at the UAB's Faculty of Veterinary Science. UNIVET specializes in the field of allergy and inflammation and targets veterinary clinics and the pharmaceutical industry.

Animal Physiology: UAB

Lines of research dedicated to veterinary science were selected from the UAB's departments of Cellular Biology, Physiology, and Immunology. Research groups study animal welfare, the handling of laboratory animals, and pet behavior. The departments' physiologists also analyze:

- Mechanisms involved in intestinal dysmotility
- Mastocytes of the intestinal epithelium: physiological and allergy-related functions
- Porcine stress indicators
- Effects of nutrition on animal welfare
- Effects of shock or stress on animal welfare and meat quality

Research Services

- Integrated services for laboratory animals, together with the Housing Service of the UAB.

Human resources: research staff, technical staff, and interns

Human resources have been defined as professors and principal researchers (IP), professors and hired researchers (IC), staff technicians (TP), hired technicians (TC), and predoctoral and postdoctoral interns. Due to the small number of postdoctoral interns, the last two have been considered as a single category. Doctors enrolled in the Ramón y Cajal Program and researchers of the Catalan Institution for Research and Advanced Studies (ICREA) are considered to be hired researchers. However, given that both these programs began in 2001, the figures cited in this report are limited. Nonetheless, the number of doctors involved in each of the research areas is specified due to the importance of these programs in the research capabilities of the departments.

Animal Health

a) Animal Health Unit of the Department of Animal Health and Anatomy, UAB

Table 2 shows the number of personnel dedicated to this area. Since 2000, some of the professors have joined the CReSA and thus were counted in both centers.

In this unit, the number of principal researchers has remained constant while those of associated hired researchers increased. However, associated professors carried out only a small percentage of the total amount of research, since their major function is to teach laboratory courses. The number of researchers and technicians remained the same as in the previous period (1990–1995).

Table 2. Evolution of IP, IC, TP, TC, and interns in Animal Health Unit of the Department of the and Anatomy, UAB

<i>Animal Health</i>	1996	1997	1998	1999	2000	2001	2002
IP	13	13	12	12	12	12	12
IC	9	9	11	9	9	14	14
TP	3	3	3	3	3	3	3
TC	0	0	0	0	0	0	0
Interns	2	2	2	3	3	3	3

b) CReSA

When CReSA began, in 2000, its staff consisted of one researcher and 14 associate researchers, three of them belonging to the IRTA and the remaining 11 to the UAB departments of Animal Health, Anatomy, and Animal Medicine and Surgery. During the same year, two laboratory technicians and an administrative assistant were hired.

In 2001, CReSA's personnel increased to: three researchers, 21 associated researchers, nine technicians and two interns.

In 2002, four researchers, 24 associate researchers, ten technicians, four interns and two doctors from the Ramon y Cajal Program were added.

Thus, there has been slow but constant growth, with more professors from the UAB's departments employed each year.

Animal Anatomy

Practically since the beginning, the number of Animal Anatomy researchers from the Faculty of Veterinary Science has been

Table 3. Evolution of IP, IC, TP, TC, and interns in Animal Anatomy, UAB

<i>Animal Health</i>	1996	1997	1998	1999	2000	2001	2002
IP	4	4	5	5	5	5	6
IC	4	4	4	4	4	4	3
TP	1	1	1	1	1	1	1
TC	0	0	0	0	0	0	0
Interns	2	2	2	3	3	3	3

stable or reduced compared to the previous period (Table 3). This group was not included in the previous report.

Animal Medicine and Surgery

The number of personnel comprising all categories of this group has remained constant. Their research is specifically focused on medicine and is carried out at the Clinical Veterinary Hospital of the Faculty of Veterinary Science. The number of resident predoctoral interns, whose objective is to obtain the degree of specialist from the European Veterinary Specialist College, has significantly increased. Resident veterinarians or those undergoing training in veterinary medicine were not included since their main objectives are not purely investigative. However, the number of resident veterinarians has greatly increased compared to the period covered in the previous report, when there were practically none.

Table 4. Evolution of IP, IC, TP, TC, and interns in the Department of Animal Medicine and Surgery, UAB

<i>Veterinary Medicine</i>	1996	1997	1998	1999	2000	2001	2002
IP	19	19	19	20	20	20	20
IC	17	21	21	19	18	18	18
TP	4	4	4	4	4	4	4
TC	0	0	0	0	0	0	0
Interns	5	5	5	5	5	4	4

Animal Production

The number of researchers in this area is higher than that of any of the other veterinary areas, since there are more centers pursuing these lines of research in Catalonia.

a) Animal Production Unit of the Department of Animal and Food Science, UAB

For the same reasons as stated above, there has not been an increase in the number of personnel in this department compared to the previous period (Table 5). Most of the interns for research staff training come from the General Department of Universities and the UAB. One of the hired researchers is from the Ramón y Cajal Program, while the rest are either associated or assistant professors.

Table 5. Evolution of IP, IC, TP, TC, and interns in the Production Unit of the Department of Animal and Food Science, UAB

<i>Animal Production</i>	1996	1997	1998	1999	2000	2001	2002
IP	17	17	17	16	16	17	17
IC	9	9	7	7	7	7	7
TP	4	4	4	4	4	4	4
TC	0	0	0	0	0	0	0
Interns	4	5	5	5	5	9	12

b) Animal Production Department, UdL

The university experienced a significant increase in the number of research staff whereas the number of hired personnel has decreased sharply since 1999 (Table 6).

Table 6. Evolution of IP, IC, TP, TC, and interns in the Animal Production Unit at the Animal Production Department, UdL

<i>Animal Production</i>	1996	1997	1998	1999	2000	2001	2002
IP	8	8	8	8	8	8	12
IC	9	9	9	19	9	9	5
TP	1	1	1	1	1	1	1
TC	0	0	0	1	1	1	1
Interns	2	1	1	1	2	2	1

c) Animal Production Department, UPC

There are only five researchers working in this department, and there are no data indicating that there are any technicians and interns. The figures are the same as those of the 1990–1995 report.

d) Animal Production, UdL-IRTA Center

This organization experienced the largest increase in the number of research and technical personnel compared to the previous report (Table 7).

Table 7. Evolution of IP, IC, TP, TC, and interns at the IRTA

<i>Animal Production</i>	1996	1997	1998	1999	2000	2001	2002
IP	13	13	13	17	14	18	21
IC	1	1	1	1	1	4	9
TP	29	29	29	40	45	43	43
TC	0	0	0	0	0	0	0
Interns	0	0	0	8	7	7	7

e) Personnel Dedicated to Research in Animal Production in Catalonia

The number of personnel dedicated to research in Animal Production is considerably higher than that of any of the other veterinary specialties (Table 8). As pointed out in the previous report, the proportion of researchers/technicians differs between

Table 8. Evolution of IP, IC, TP, TC, and interns in Animal Production in Catalonia

	1996	1997	1998	1999	2000	2001	2002
IP	43	43	43	46	43	48	55
IC	19	19	17	27	17	20	21
TP	34	34	34	45	49	48	48
TC	0	0	0	1	1	1	1
Interns	6	6	6	14	19	16	20

the university and the IRTA: whereas at the university there are more research staff than technicians, the opposite is true at the IRTA. Two researchers from the ICREA and three from the Ramón y Cajal program are included in this area.

Nutrition and Bromatology

There are very few researchers in this area, and there have been no changes in the figures compared to the previous period (Table 9).

Table 9. Evolution of IP, IC, TP, TC, and interns in Nutrition and Bromatology, UAB

<i>Nutrition</i>	1996	1997	1998	1999	2000	2001	2002
IP	3	3	3	3	4	4	4
IC	3	4	3	1	1	3	3
TP	1	1	1	1	1	1	1
TC	0	0	0	0	0	0	0
Interns	0	0	0	0	0	0	0

Veterinary Pharmacology

Pharmacological research benefits from the particular interest of public and private organizations in Catalonia. In Table 10, only personnel from the UAB's Pharmacology, Therapeutics, and Toxicology Department that are employed in veterinary pharmacology research are included.

Table 10. Evolution of IP, IC, TP, TC, and interns in Veterinary Pharmacology, UAB

<i>Pharmacology</i>	1996	1997	1998	1999	2000	2001
IP	3	3	3	3	4	4
IC	3	3	3	3	2	2
TP	2	2	2	2	2	3
TC	2	3	4	4	6	5
Interns	2	3	3	8	6	6

Animal Physiology

For this specialization, we have also included only those researchers employed in the field of veterinary physiology at the various departments of the UAB (Table 11).

Table 11. Evolution of IP, IC, TP, TC, and interns in Animal Physiology, UAB

<i>Physiology</i>	1996	1997	1998	1999	2000	2001	2002
IP	6	6	6	6	6	6	6
IC	0	0	0	0	0	0	0
TP	1	1	1	1	1	1	1
TC	0	0	0	0	0	0	0
Interns	6	6	6	11	12	12	10

Organizational Chart of Personnel Dedicated to Veterinary Science Research in Catalonia During 2002

In Catalonia, in 1995 there were 126 researchers in the two categories IP and IC, 47 technicians, and 35 interns working on Veterinary Science research. In 2002, the number of researchers increased to 130; 76 of whom worked exclusively in Animal Production. In the same year, of the 69 technicians and 54 interns, 48 and 20, respectively, were employed in Animal Production. If we take into account that this report includes areas not considered in the previous one, then there was no increase in the number of research personnel and only a slight increase in the number of technicians and interns.

Figure 1 shows the percentages of the different categories of employees during 2002. Contrary to the level expected for adequate operational research, there was a reduction in the number of technicians compared to research staff.

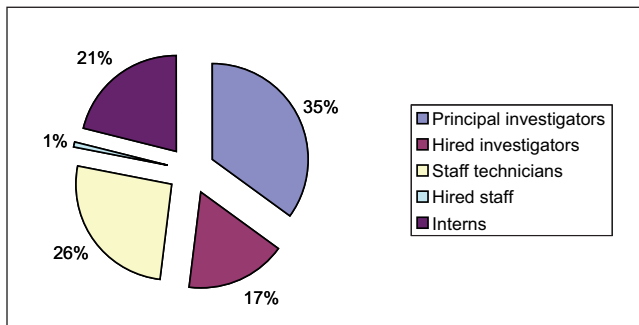


Figure. 1. Organizational chart according to the different professions of staff researchers dedicated to research in veterinary science during 2002.

Research funding: competitive projects (European Union, State-supported and of the government of Catalonia) and agreements (public and private)

Research in veterinary science is funded in two ways:

- 1) Competitive bidding (public competitions with other projects) for public financing
- 2) Non-competitive funding (through agreements made with public or private companies)

Competitive projects have been divided according to their origin: European, state-supported, or from an autonomous administration.

Animal Health

The importance placed on ruminant health in Catalonia is reflected by the high percentage of financing it receives from private agreements compared to the total amount of funding dedicated to research on animal health as a whole.

a) Animal Health Unit of the Department of Animal Anatomy and Health, UAB

There has been an important increase in financing of research in the field of Animal Health compared to the previous report, although since it has been irregular over the years, it is difficult to predict its evolution.

b) CReSA

CReSA has received an important amount of public and private financing (Table 13) compared to the departments at the UAB (Table 12).

Table 13. Source and evolution of financing for Animal Health research, CReSA (in €)

CReSA	2001	2002
European Union	–	–
State-supported	664,179	142,140
Autonomous government	18,228	224,092
Public agreements	–	–
Private agreements	426,917	375,083

This is a logical situation given that the center was set up recently with the support of the Government of Catalonia, and, as reflected by the contributions it has received from private agreements, to the remarkable involvement and interest of the productive sector in the center. Since the CReSA has only been in existence for a few years, it is difficult to predict its evolution, but if we analyze the center's figures for personnel and financial resources, and considering that there still is no office or laboratory infrastructure, the continued growth of the CReSA seems certain.

Animal Anatomy

There is a general lack of agreements with the private sector concerning research in Veterinary Anatomy (Table 14). Due to the nature of its research, this area has also faced difficulties in

Table 12. Source and evolution of financing for Animal Health research, UAB (in €)

	1996	1997	1998	1999	2000	2001	2002
European Union	53,710	0	97,922	379,095	14,337	0	0
State-supported	0	0	0	0	35,309	81,136	0
Autonomous government	0	0	4,816	42,484	16,909	3,741	32,661
Public agreements	0	0	10,282	0	0	5,893	4,482
Private agreements	32,523	25,190	101,381	96,372	32,986	125,267	63,937

obtaining financing from the National Plan of the Spanish Ministry of Science and Technology (MCT).

Animal Medicine and Surgery

Financing for research in veterinary medicine comes mostly from agreements and private funding (Table 15). There has been a continuous and progressive increase in funding, especially from agreements associated with the Clinical Veterinary Hospital. This is due to the fact that public research does not consider the lines of research in this discipline as a priority, but shows a great interest in private aspects, such as laboratories and veterinary clinics, and in the training of professionals of veterinary science.

A tendency towards increasing financing for state-supported competitive projects has also been observed over the last 2 years.

Animal Production

Animal production research is carried out by a very larger number of researchers. This, together with the great economic importance of this sector in Catalonia, implies that more resources will be devoted to this area of veterinary science.

a) Animal Production Unit of the Department of Animal and Food Science, UAB

Animal production at the UAB receives most of its resources from the MCT's Stockbreeding National Plan (Table 16). There has also been an important and progressive increase in private agreements, and on a smaller scale, of public ones.

b) Animal Production Department, UdL

Funds for research at the UdL essentially come from agreements with private companies. Until 1999, public funding went to projects at the UdL-IRTA Center and were designated specifically to the IRTA, independent of the institutional affiliation of the main researcher. From 1999 onwards, state-funded projects belonged to the UdL, a fact that explains the figures observed in Table 17.

c) IRTA (Including the UdL-IRTA Center)

The IRTA is dedicated to research and development in Animal Production. The institute receives most of the total financing (Table 18) and has the largest number of researchers. As in other university-dependent organizations, the center's prevailing source of funding comes from public and private agreements, rather than from competitive projects.

Table 14. Source and evolution of financing for Animal Anatomy research, (in €)

	1996	1997	1998	1999	2000	2001	2002
European Union	0	0	0	0	80,704	80,518	0
State-supported	0	0	0	0	0	0	0
Government of Catalonia	0	4,421	3,611	7,460	3,831	33,420	25,639
Public agreements	0	0	0	0	0	54,500	0
Private agreements	0	0	0	8,781	0	0	0

Table 15. Source and evolution of financing for animal medicine and surgery research, UAB (in €)

	1996	1997	1998	1999	2000	2001	2002
European Union	-	-	-	-	-	0	0
State-supported	0	0	0	0	0	122,918	172,000
Government of Catalonia	-	-	-	-	-	29,133	24,986
Public agreements	140,475	-	-	-	-	607,176	42,279
Private agreements	24,420	22,740	40,451	44,321	40,543	31,465	156,700

Table 16. Source and evolution of financing for Animal Production research, UAB (in €)

	1996	1997	1998	1999	2000	2001	2002
European Union	550,403	256,752	0	0	0	0	0
State-supported	137,571	88,721	98,080	194,877	311,172	270,190	432,706
Government of Catalonia	0	4,147	7,933	13,681	0	24,040	28,320
Public Agreements	39,803	67,516	379,779	110,511	68,112	245,183	135,676
Private Agreements	2,312	70,518	71,053	36,924	234,667	63,215	283,540

d) Total Financing for Animal Production Research in Catalonia

An analysis of total financing for Animal Production in Catalonia shows that agreements provide most of the funds for this area (Table 19). This is due to the economic importance of the productive sector and the dynamics when hiring R+D services. The maturity of the research teams is demonstrated by the increase in funds obtained from the MCT, most of which belong to the National Program of Agriculture and Food Technology's section for stockbreeding. Financing from the European Union is scarce and constantly decreasing. Funds coming from the Government of Catalonia, excluding financing of consolidated groups, have repercussions on the improvement of the cen-

ter's scientific infrastructure, since they do not include money for research projects.

Compared to 1900–1995, financing for Animal Production increased considerably, especially that from agreements with the private sector.

Nutrition and Bromatology

The main sources of financing for this area of research are public agreements (Table 20), most of which were signed with the Department of Health of the Government of Catalonia for the purpose of food analyses and editing of public health bulletins. Contracts signed with private companies were for food-quality controls.

Table 17. Source and evolution of financing for Animal Production research, UdL (in €)

	1996	1997	1998	1999	2000	2001	2002
European Union	–	–	–	–	–	–	–
State supported	–	–	–	38,200	65,680	42,161	78,064
Government of Catalonia	–	–	–	–	–	–	–
Public agreements	–	15,024	13,823	9,015	0	0	0
Private agreements	41,546	65,151	58,656	84,697	86,111	95,321	217,357

Table 18. Source and evolution of financing for Animal Production research, UdL and IRTA (in €)

	1996	1997	1998	1999	2000	2001	2002
European Union	18,607	–	47,231	45,245	17,541	28,464	41,704
State-supported	84,453	34,137	149,128	215,642	227,346	268,244	157,820
Government of Catalonia	6,731	16,227	27,469	19,382	10,756	16,421	12,771
Public agreements	33,022	–	359,621	165,574	212,753	190,541	317,744
Private agreements	777,032	–	645,870	966,546	906,166	767,942	906,597

Table 19. Source and evolution of financing for Animal Production research in Catalonia

	1996	1997	1998	1999	2000	2001	2002
European Union	569,010	266,975	47,231	45,245	17,541	28,464	41,704
State-supported	149,236	122,858	116,771	248,937	604,198	580,595	766,936
Government of Catalonia	6,731	20,374	35,402	33,063	10,756	40,461	100,565
Public agreements	114,371	82,540	753,223	285,100	280,865	435,724	453,420
Private agreements	820,890	135,669	775,579	1,088,167	1,226,944	926,478	1,407,494

Table 20. Source and evolution of financing for research in Nutrition and Bromatology, UAB (in €)

	1996	1997	1998	1999	2000	2001	2002
European Union	24,040	0	31,493	0	–	–	–
State-supported	–	–	–	–	–	–	–
Government of Catalonia	–	–	–	–	–	–	–
Public agreements	19,558	19,558	24,197	19,558	20,976	21,926	21,926
Private agreements	36,217	12,789	9,285	49,315	20,927	1,295	1,052

Veterinary Pharmacology

Financing for pharmacological research is covered by private agreements (Table 21), most of which are with the pharmaceutical industry for the analysis of new drugs.

Animal Physiology

The lines of research developed by this research group are financed mostly by the MCT (Table 23).

Total Financing of Veterinary Science Research in Catalonia

For the period comprising 1996–2002, the total amount of funds dedicated to veterinary science research in Catalonia was 20 092 225 Euros. The distribution, in percentages, is shown in Fig. 2. As can be seen from the chart, 46% of financing came from private agreements and 20% from public ones, which indicates that research is either contracted for or directed specifically to the needs of the private and public sectors.

Evolution of Research Financing

Table 23 and Fig. 3 show the increase in financing of veterinary science research in Catalonia, especially from agreements. Al-

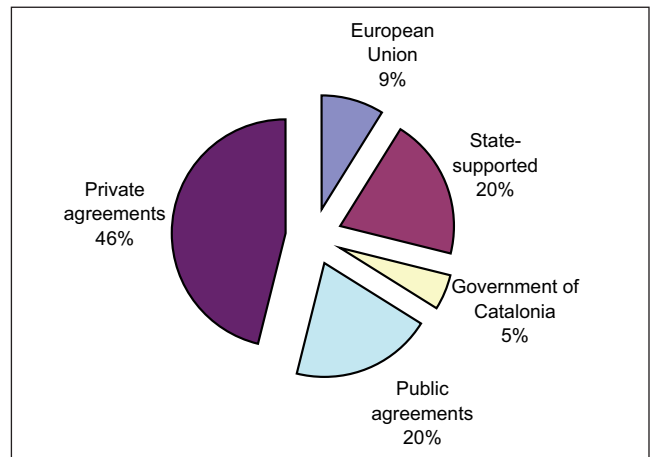


Figure 2. Organizational chart of the source of financing for veterinary science research in Catalonia, 1996–2002.

though there has been no change in the number of researchers, financing has increased, suggesting that research groups have consolidated and become more competitive in attracting public and, more importantly, private funding. Figure 4 shows the overall evolution of funds dedicated to veterinary science research, independent of the source.

Table 21. Source and evolution of financing for pharmacological research, UAB (in €)

	1996	1997	1998	1999	2000	2001	2002
European Union	-	-	-	-	-	-	-
State-supported	-	-	83,467	73,822	4,639	-	67,700
Government of Catalonia	-	-	16,227	4,207	21,035	114,146	-
Public agreements	-	25,963	-	15,025	10,722	25,107	57,355
Private agreements	65,390	134,367	15,297	151,711	237,197	300,810	517,584

Table 22. Source and evolution of financing for Animal Physiology research, UAB (in €)

	1996	1997	1998	1999	2000	2001	2002
European Union	-	-	-	-	-	-	-
State-supported	26,325	-	67,686	110,795	-	79,445	-
Government of Catalonia	-	-	-	-	-	-	-
Public agreements	-	-	-	-	-	-	-
Private agreements	-	-	-	13,823	13,855	-	7,950

Table 23. Origin and evolution of the source of financing for veterinary science research in Catalonia, 1996–2002 (in €)

	1996	1997	1998	1999	2000	2001	2002	TOTAL
European Union	646,760	266,975	176,646	424,340	112,582	108,982	41,704	1,777,989
State-supported	175,561	122,858	267,924	322,759	644,146	1,528,273	1,050,430	4,111,951
Government of Catalonia	6,731	24,795	60,056	87,214	42,218	469,129	395,172	1,085,315
Public agreements	274,404	102,098	813,665	319,683	291,587	1,128,400	1,154,319	4,084,156
Private agreements	979,440	330,755	941,993	1,452,490	1,572,452	1,812,232	1,931,945	9,021,307
TOTAL	2,084,892	849,478	2,262,282	2,608,485	2,664,985	5,067,017	2,388,823	20,080,718

During 1990–1995, total funding from competitive projects was 1.4 million Euros, while that received from agreements was 1.63 million Euros. Between 1996 and 2002, competitive financing was of 6 975 255 Euros, and non-competitive 13 116 970 Euros. The considerable increase of funds dedicated to research, taking into consideration the longer period of time, provides an impression of the significant increase of funds obtained by researchers.

The total number of researchers for 2002 was 130, including staff and hired personnel. Thus, we obtain the following proportions:

- 53.565 competitive projects per investigator and 7665 Euros per investigator, per year
- 100.900 agreements per investigator and 14 414 Euros per investigator, per year.

In short, the amount of funds from agreements received by researchers in Catalonia was twice that from competitive projects.

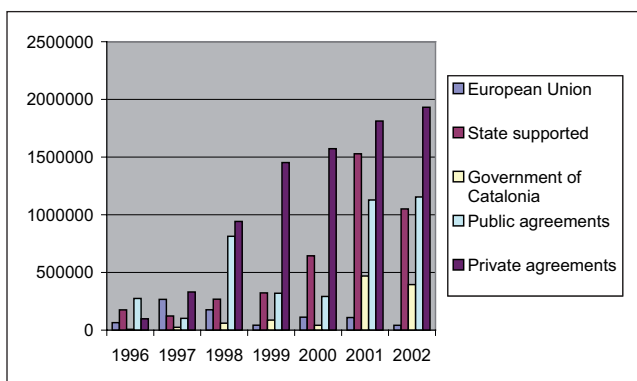


Figure 3. Evolution of the different sources of financing in veterinary science research.

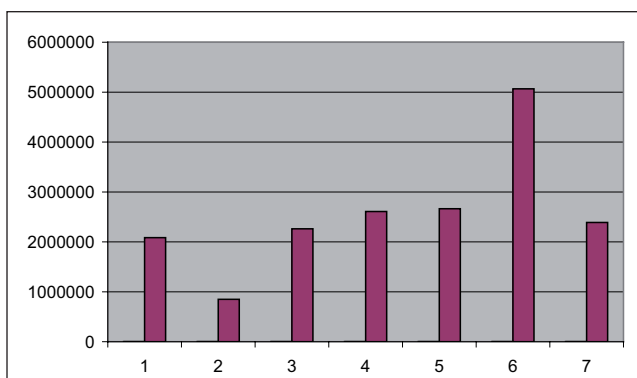


Figure 4. Evolution of the total funds destined to veterinary science research.

Scientific output (articles in sci-registered journals, other journals, reports, books, theses)

Scientific output is defined as the number of publications containing results obtained from the different lines of research. These publications have been classified as articles published in SCI-registered journals, other journals not belonging to this register, reports, books, and doctoral theses. The data were obtained directly from records of the different universities and research centers. All SCI journals have been considered, regardless of the thematic area they belong to, since some articles were not published in journals classified among the Animal Sciences or Veterinary Sciences groups.

Animal Health

a) Animal Health Unit of the Department of Animal Health and Anatomy, UAB

For this area, it is important to highlight the contribution made by the creation of CReSA. Since many professors work at both the Health Department and CReSA, several publications are enumerated in the respective tables (Tables 24, 25). Most of the Animal Health results are published in SCI journals, which indicates the quality of the results and the researchers' interest in announcing their results in international journals.

Animal Anatomy

Despite the low number of researchers and the limited financing of research, there has been a considerable increase in the number of publications in SCI journals (Table 26).

Table 25. Evolution of scientific output in Animal Health, CReSA

	2000	2001	2002
SCI-registered journals	–	19	34
Others	–	8	6
Reports	–	–	–
Books	–	3	7
Theses	0	1	–

Animal Medicine and Surgery

Most of the articles on Animal Medicine and Surgery are published in SCI journals, and there has been a remarkable increase output during the period of study (Table 27).

Table 24. Evolution of scientific output in Animal Health, Department of Animal Health and Anatomy, UAB

	1996	1997	1998	1999	2000	2001	2002
SCI-registered journals	–	31	27	23	27	25	37
Others	–	–	–	19	23	11	9
Reports	–	–	–	–	–	–	–
Books	–	1	–	3	–	–	7
Theses	2	4	1	2	3	1	4

Table 26. Evolution of scientific output in Animal Anatomy: Department of Animal Health and Anatomy, UAB

	1996	1997	1998	1999	2000	2001	2002
SCI-registered journals	–	8	7	5	4	10	14
Others	–	1	–	–	–	–	–
Reports	–	–	–	–	–	–	–
Books	–	–	3	1	–	5	3
Theses	1	1	1	0	0	2	0

Table 27. Evolution of scientific output in Animal Medicine and surgery, UAB

	1996	1997	1998	1999	2000	2001	2002
SCI-registered journals	1	6	23	15	19	12	17
Others	–	–	1	10	4	5	5
Reports	–	–	–	–	6	2	–
Books	–	–	–	–	6	4	–
Theses	0	0	1	3	2	2	1

Animal Production

a) *Animal Production Unit of the Department of Animal and Food Sciences, UAB*

b) *Animal Production Department, UdL*

c) *IRTA (Including the UdL-IRTA Center)*

d) *Evolution of Total Scientific Output for Animal Production*
Table 31 shows that more articles in Animal Production were published in SCI-registered journals than in other journals, or as reports, books, or theses.

Table 28. Evolution of scientific output in Animal Production, Department of Animal and Food Science, UAB

	1996	1997	1998	1999	2000	2001	2002
SCI-registered journals	15	12	7	13	11	17	19
Others	2	6	1	6	2	2	1
Reports	–	–	–	–	–	–	–
Books	–	–	–	–	–	–	–
Theses	3	6	4	2	3	6	6

Table 29. Evolution of scientific output in Animal Production», UdL

	1996	1997	1998	1999	2000	2001	2002
SCI-registered journals	8	9	6	2	9	4	12
Others	11	17	4	11	9	5	4
Reports	–	–	–	–	1	1	1
Books	3	6	4	–	3	3	2
Theses	1	9	2	–	2	–	–

Table 30. Evolution of scientific output in Animal Production, IRTA

	1996	1997	1998	1999	2000	2001	2002
SCI-registered journals	–	–	–	–	10	10	33
Others	8	15	7	14	14	18	7
Reports	–	–	–	–	–	–	–
Books	–	–	2	1	2	13	3
Theses	–	–	–	10	1	5	–

Table 31. Evolution of scientific output in Animal Production, Catalonia

	1996	1997	1998	1999	2000	2001	2002
SCI-registered journals	31	36	20	29	30	31	64
Others	12	38	12	31	25	25	12
Reports	0	0	0	0	1	1	1
Books	3	6	4	1	5	16	1
Theses	4	15	6	12	6	11	6

Nutrition and Bromatology

Table 32. Evolution of scientific output in Nutrition and Bromatology, UAB

	1996	1997	1998	1999	2000	2001	2002
SCI-registered journals	4	5	–	5	2	–	3
Others	–	1	2	1	–	–	–
Reports	–	–	–	–	–	–	–
Books	–	–	–	–	–	–	–
Theses	–	–	1	–	–	1	3

Veterinary Pharmacology

Table 33. Evolution of scientific output in Veterinary Pharmacology», UAB

	1996	1997	1998	1999	2000	2001	2002
SCI-registered journals	8	23	28	21	19	20	15
Others	–	–	–	–	–	–	–
Reports	–	–	–	–	–	–	–
Books	1	1	–	1	2	–	4
Theses	0	2	3	0	1	4	1

Animal Physiology

Table 34. Evolution of scientific output in Animal Physiology, UAB

	1996	1997	1998	1999	2000	2001	2002
SCI-registered journals	6	5	6	8	10	5	6
Others	–	–	–	–	–	–	–
Reports	–	–	–	–	–	–	–
Books	1	–	–	–	–	–	–
Theses	1	2	–	1	2	1	–

Total Scientific Productivity for Veterinary Research

During 1990–1995, 265 articles were published in SCI-registered journals in Catalonia. Between the years 1996 and 2002, this figure increased to 800 articles, of which 241 were authored by researchers in Animal Production, 223 from Animal Health, 93 from Animal Medicine and Surgery, and the remaining 243 from researchers working in Anatomy, Physiology, Pharmacology, and in Nutrition and Bromatology. There is a

possible redundancy, and thus an overestimation, since articles attributed to different departments might have been counted twice if the authors belonged to different research areas. Nevertheless, we considered it was useful to observe the evolution experienced by the different areas over the years regardless of whether the articles were published in collaboration with researchers from different research areas. This approach also allows us to compare the figures from the current study

with those of the previous period, since the same methodology was employed.

Figure 5 shows the percentages for the various types of publications in which scientific results for the years included in this study were documented. Most of the results were published in international scientific journals, and compared to the previous period there was an important increase in the number

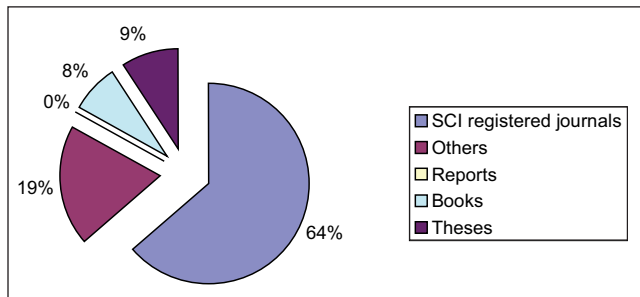


Figure 5. Publications in which the results of veterinary research are documented, 1996–2002.

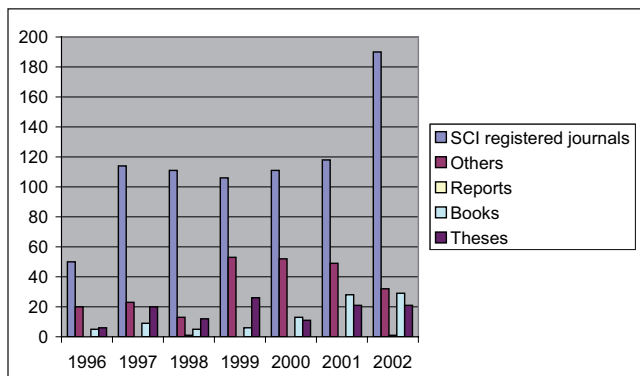


Figure 6. Evolution of the format and number of publications, 1995–2002.

of publications –a fact that can be attributed to an improvement in the quality of research and to the approach taken to assess the researchers’ careers (Fig. 6 and Table 35).

Although most of the financing for research came from agreements with public institutions and the private sector, this has generally not affected the quality of the output, since the results fulfilled the necessary requirements to be published in international journals. All the same, the increase in scientific output would have been larger if the research had been more dedicated to competitive projects rather than to agreements.

The proportion of 0.87 SCI articles per researcher, per year arises from agreements being the major source of financing, which shifts research’s main objective away from the publication of results and towards the resolution of a particular problem, e.g., technology transfer, accumulating data to design conservation or stockbreeding policies, personnel training, or any other target required by society.

Comparison with Other International Scientific Outputs

A list of scientific articles published in SCI journals from the world, Spain, the Netherlands, and Denmark was obtained from ISI databases. A group of journals covering the areas of Animal Sciences and Veterinary Sciences was selected (Appendix 1). It should be noted that researchers working in a certain area do not always publish in journals of that same area. Also, some results obtained by Catalan researchers were not published in journals of the two areas selected. Regarding the bibliographic search of the SCI, we searched every relevant journal over the periods 1995–1998 and by geographic location of the authors (Spain, Netherlands, and Denmark). For Catalonia, we searched for cities using the following key words: Barcelona* or Lleida or Lerida or Girona or Gerona or Tarragon* or Bellaterra or Mataro or Reus or Blanes or Badalona or Hospitalet or Monells.

Table 35. Evolution of scientific output for veterinary research.

	1996	1997	1998	1999	2000	2001	2002	TOTAL
SCI-registered journals	50	114	111	106	111	118	190	800
Others	20	23	13	53	52	49	32	242
Reports	–	0	1	–	–	–	1	2
Books	5	9	5	6	13	28	29	95
Theses	6	20	12	26	11	21	21	117

Table 36. Comparison of scientific output between countries during three 4-year periods, and the total number of articles published in selected SCI journals*.

	World	Catalonia	Spain	The Netherlands	Denmark
1991–1994	56,632	155	1,279	1,543	670
1995–1998	39,450	279	1,544	1,397	761
1999–2002	41,738	369	1,927	1,413	941
Total	137,820	803	4,750	4,353	2,372

* Source: Science Citation Index (ISI)
 Catalonia/Spain = 16.9%; Spain/world = 3.4%; Netherlands/Catalonia = 5.4%; Denmark/Catalonia = 2.9%

Appendix 1 shows the number of articles published in the selected journals in the 4-year period studied. Table 36 shows scientific output according to articles published in SCI journals, as determined using an ISI database search. This approach prevents the problem of duplicates but does not include articles that were published in journals not selected by the SCI.

The increase in the number of publications in Catalonia between the first and the second 4-year periods, and between the second and the third ones was 1.8 and 1.3, respectively; in Spain, 1.2 and 1.25, respectively; in the Netherlands, 1.1 and 1.0, respectively; and in Denmark, 1.1 and 1.2, respectively. Worldwide, the number of articles in the last two 4-year periods decreased compared to the first one.

The difference between the 648 published articles that make up the data in Table 37 and the 800 manually collected from items may be due to the fact that: (a) some of the articles collected had been entered more than once if the authors belonged to different centers or departments; or (b) the articles were published in journals not selected in this search, since these journals are included in broader thematic searches.

The percentages derived from a comparison between Catalonia and Spain and between Spain and the rest of the world are shown in parentheses. According to these data, articles published in Spain represent 4.3% of the world's total, and those in Catalonia 18.7% of Spain's total. During the previous period, in 1995, articles published in Catalonia represented 13.5% of the total number of articles published in Spain, and those in Spain

represented 3.1% of worldwide publication. Over the period 1995-2002, the numbers of articles published in the Netherlands (2,810), and Denmark (1,702) were, respectively, 4.3 and 2.6 times those published in Catalonia. This can be partially attributed to the fact that both the Netherlands and Denmark have ISI-registered veterinary journals. In spite of this, differences observed between Catalonia, the Netherlands, and Denmark decreased in the second 4-year period.

Tables 38 and 39 break down the number of articles published in selected journals of Animal Production and Veterinary Medicine.

Quality of Veterinary Research in Catalonia

To evaluate the quality of research, we used the ISI databases to analyze the number of citations of articles authored or coauthored by Catalan researchers were cited. The ISI databases consisted of the NCR and NSI (loaned by the DURSI). When interpreting the results obtained from them, some aspects must be taken into account:

- a) Criteria: number of items (D), number of accumulated citations (C), and citations/items ratio (C/D). Furthermore, the international comparison includes the number of items that did not receive any citation (NC).
- b) Type of item: the databases contain articles (approximately 80% of the total), conference communications, notes, reviews, editorials, and letters.

Table 37. Evolution of scientific output during two of the 4-year periods studied: numbers and percentages of articles published in selected SCI journals.*

	<i>World</i>	<i>Catalonia</i>	<i>Spain</i>	<i>The Netherlands</i>	<i>Denmark</i>
1995-1998	39,450	279 (18.1%) ¹	1,544 (3.9%) ²	1,397	761
1999-2002	41,738	369 (19.1%) ¹	1,927 (4.6%) ²	1,413	94
Total	81,188	648 (18.7%) ¹	3,471 (4.3%) ²	2,810 (4.3%) ²	1,702 (2.6%) ²

* Source: Science Citation Index (ISI).¹ Percentage of articles published in Spain.²

Table 38. Evolution of the number of articles published by Catalan researchers in Animal Production journals, and the total number of articles published in selected SCI journals*

	<i>World</i>	<i>Catalonia</i>	<i>Spain</i>	<i>The Netherlands</i>	<i>Denmark</i>
1995-1998	18,932	122	877	657	363
1999-2002	20,587	205	1,163	746	471
Total	39,519	327	2,040	1,403	834

* Source: Science Citation Index (ISI)

Table 39. Evolution of the number of articles published by Catalan researchers in Veterinary Medicine journals, and the total number of articles published in selected SCI journals*

	<i>World</i>	<i>Catalonia</i>	<i>Spain</i>	<i>The Netherlands</i>	<i>Denmark</i>
1995-1998	20,518	157	667	740	398
1999-2002	21,151	164	764	667	470
Total	41,669	321	1,431	1,407	868

* Source: Science Citation Index (ISI).

Appendix 2 lists all the data obtained from a search using these indexes.

Figures 7 and 8 show graphically the evolution of how often an item is cited (C/I) for the different countries.

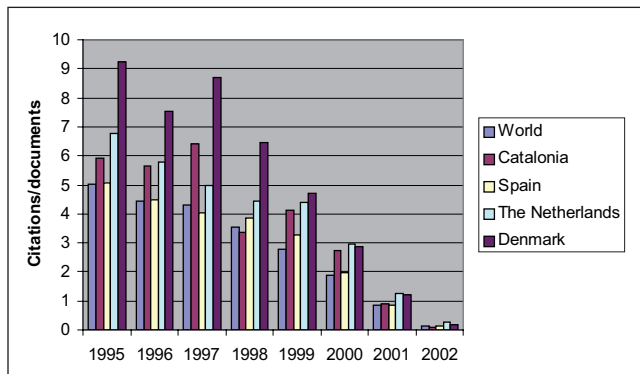


Figure 7. Number of citations received compared to the number of published articles in Veterinary Medicine in the different countries and the world.

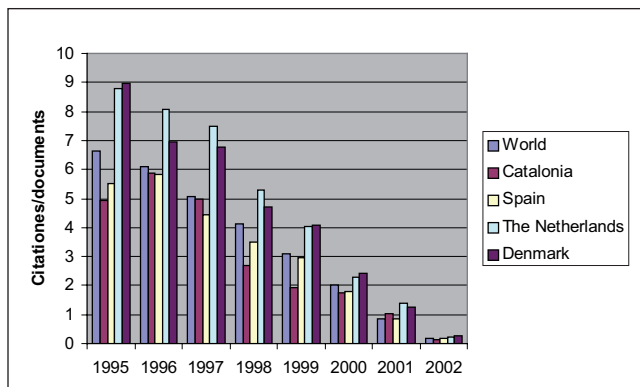


Figure 8. Number of citations received compared to the number of published articles in Animal Production in the different countries and the world.

In both areas, the impact of articles published in Catalonia is similar to the average of the world and Spain, but lower than that of the Netherlands or Denmark. In other words, every article published by a Catalan investigator is cited as many times as articles published in Spain and in the rest of the world, but less than articles published by Danish or Dutch researchers. The overall decrease in the number of citations for each area and country/the world is the result of the publishing dates, i.e., those articles published relatively recently have not received as many citations as those published earlier.

Scientific output should not only be considered according to the quality and quantity of articles published, but also for the social interest of the sector, as reflected by technology transfer, available services, and data generated that may contribute to the design of policies aimed at improving social welfare. However, most of these types of results are known only to the companies or administrations that requested the information, which made it impossible for us to evaluate and analyze them completely. Nonetheless, the continuous and accelerating increase in financing deriving from agreements leads us to conclude that the information has been satisfactory enough to produce the observed significant increment in agreements.

Conclusions

Compared to 1990–1995, current veterinary science research in Catalonia is characterized by the consolidation of research groups from different public institutions, and by a higher degree of cooperation between them, as in the case of the CReSA and the location of the research units of the IRTA at the UAB's campus.

Of all the scientific areas comprising veterinary research, Animal Production receives the largest proportion of funds and has the most personnel. Even so, since the creation of the CReSA, Animal Health has grown the most. The social and economic impact of diseases that have affected European and Catalan stockbreeding (such swine fever [or pig plague] and bovine spongiform encephalopathy) has favored this renewed interest in animal health.

Research staff has not increased in any area since the last study period, but there has been a slight increase in the number of technicians and a more significant one in personnel being trained. These data indicate that the number of researchers, especially at the universities, did not increase once teaching posts were filled, and that there have been no major policies for hiring researchers freed from teaching obligations. The recently created Ramón y Cajal and ICREA programs have not modified significantly the personnel figures. The slight increase in the number of technicians and interns is due to the higher competitiveness of veterinary science research groups compared to those in other scientific areas.

The majority of financing comes from private funds and by means of agreements. The slight increase in public financing was irregular and infrequent in the case of the European Union (1%), and autonomous sources increased only slightly for state-mandated competitive projects. By contrast, funds obtained through private agreements for research centers and areas increased exponentially. Given the importance of this type of financing, for the purposes of analysis, all public institutions should use the same criteria to classify allocations: research agreements, technological transfer, analytical techniques, consultancies, etc. Each type is of great interest and a full accounting of them would provide a more exact idea of their impact on research funding of veterinary science.

Research productivity focuses nearly exclusively on publishing results in international journals. However, publication of reports and data in national journals has decreased considerably since the last period, as determined by using citations in SCI-registered journals to evaluate researchers and their research. The present report has not considered scientific output in the forms of technology transfer, research assistance, or consultancies contracted for to improve competitiveness, although they are reflected in the fact that most financing comes from private agreements.

The relationship between the type of financing and research output leads to the conclusion that the demand for research from private companies, in addition to having an economic impact also affects the publication of scientific data in SCI journals. Nonetheless, it is expected that, if financing from competitive projects increases, scientific output will also increase.

In the 4 years covered by this study, important work has been done in the training of new researchers and the preparation of veterinary professionals. In the long term, these experts will serve as the link between public and private centers, and will be responsible for generating research in private institutions.

There has also been an important increase in the number and types of services provided by university departments to assist the private sector with respect to research and development.

Scientific output in Catalonia has increased significantly compared to that in Spain. Nevertheless, both the quality and the quantity remain lower than in the Netherlands or Denmark, although differences have narrowed in the last few years.

Recommendations

This report has shown that veterinary research in Catalonia is developed mainly at the UAB, the UdL, and the IRTA. Possibly, other public and private universities have not developed research because they are dedicated exclusively to teaching. The causes for those centers focusing only in teaching should be analyzed, to find solutions that made it possible to gain the maximum benefit from the unexploited potential of research, and increase scientific output in Catalonia.

In Catalonia, Veterinary research is strongly linked to the needs of the productive sector, as evidenced by the sources of

financing. This approach should be maintained, since applied research is clearly among the objectives of veterinary science. The quantitative importance of agreements for all of the organizations analyzed, as well as the extreme difficulty in analyzing the objectives of these agreements in detail, leads us to recommend that public institutions uniformly classify agreements according to their aims.

The deficiency of publicly financed competitive research projects should be noted. Research made-to-order through agreements, as in most of the analyzed cases, can diminish the initiative of researchers to develop more innovative and avant-garde lines of research. New lines of research in biotechnology, animal welfare, diagnostics, etc., in all areas of veterinary science, require strong investments from the public sector, since the productive sector cannot run completely the inherent risks.

Although veterinary science is a relatively new field in Catalonia, the reorganization of research personnel has an established history. Programs designed to incorporate doctors should be promoted to rejuvenate and promote new lines of research. Contracting more technicians by the universities would also optimize time and resources and would result in a larger scientific output.

Although major steps have already been taken, the creation of centers that integrate researchers from different institutions should be further promoted. In addition, new lines of research, with multidisciplinary collaborations between different scientific areas, will be essential.

Appendix 1

Selected journals of Animal Production and Veterinary Medicine: number of articles published in Catalonia

compared to the total worldwide, in Spain, in the Netherlands, and in Denmark

Animal Production (1995–1998)*

	<i>World</i>	<i>Catalonia</i>	<i>Spain</i>	<i>The Netherlands</i>	<i>Denmark</i>
Acta Agriculturae Scandinavica Section A: Animal Science	174	0	0	6	79
Agribiological-Research Zeitschrift fur Agrarbiologie Agrikulturchemie Ökologie	140	0	0	4	2
Animal Feed Science and Technology	683	8	41	27	29
Animal Research	0	0	0	0	0
Animal Science	510	3	36	16	13
Annales de Zootechnie	125	0	6	0	0
Applied Animal Behaviour Science	496	1	5	19	19
Archiv fur Geflügelkunde	223	1	5	10	12
Australian Journal of Dairy Technology	145	0	1	2	2
Australian Journal of Experimental Agriculture	534	0	1	1	0
British Journal of Nutrition	582	0	24	61	30
British Poultry Science	409	8	13	15	6
Canadian Journal of Animal Science	320	0	4	0	4
Genetics	1,678	16	45	26	9
Genetics Selection Evolution	150	3	11	5	6
Journal of Agricultural and Food Chemistry	3,000	43	402	58	41
Journal of Agricultural Science	410	2	11	9	8
Journal of Animal Breeding and Genetics	197	1	17	5	2
Journal of Animal Science	1,582	1	9	59	10
Journal of Dairy Research	250	4	19	8	21
Journal of Dairy Science	1,388	7	42	67	24
Journal of Food Science	1,116	3	60	8	8
Journal of Nutrition	1,408	3	19	34	12
Journal of Range Management	369	1	5	2	0
Livestock Production Science	365	5	16	65	14
Netherlands Journal of Agricultural Science	108	0	0	94	0
New Zealand Journal of Agricultural Research	227	0	4	0	0
Outlook on Agriculture	124	0	2	8	2
Poultry Science	1,002	6	16	33	9
Small Ruminant Research	548	3	57	7	1
Swedish Journal of Agricultural Research	92	0	0	1	0
Tropical Grasslands	234	0	1	6	0
Worlds Poultry Science Journal	45	0	0	0	0
Zuchtungskunde	151	0	0	1	0
Zygote	147	3	5	0	0
<i>Total</i>	<i>18,932</i>	<i>122</i>	<i>877</i>	<i>657</i>	<i>363</i>

* Source: Science Citation Index (ISI).

Veterinary Medicine (1995–1998)*

	<i>World</i>	<i>Catalonia</i>	<i>Spain</i>	<i>The Netherlands</i>	<i>Denmark</i>
Acta Veterinaria Scandinavica	206	0	0	0	53
American Journal of Veterinary Research	1,065	5	14	26	6
Animal Genetics	490	2	16	20	27
Animal Reproduction Science	456	6	17	9	6
Animal Production	0	0	0	0	0
Atlas Alternatives to Laboratory Animals	198	0	14	29	17
Australian Veterinary Journal	558	1	4	1	4
Avian Diseases	478	5	8	11	0
Avian Pathology	266	4	8	18	11
Berliner und Münchener Tierärztliche Wochenschrift	271	0	0	1	0
British Veterinary Journal	75	0	5	0	0
Canadian Journal of Veterinary Research/ Revue Canadienne de Recherche Veterinaire	203	1	2	3	9
Canadian Veterinary Journal Revue Veterinaire Canadienne	340	1	1	0	2
Comparative Immunology Microbiology and Infectious Diseases	134	0	11	1	1
Cornell Veterinarian	0	0	0	0	0
Deutsche Tierärztliche Wochenschrift	443	1	2	1	3
Diseases of Aquatic Organisms	397	2	45	3	21
Domestic Animal Endocrinology	163	0	0	9	1
Equine Veterinary Journal	296	1	5	11	3
Irish Veterinary Journal	393	0	0	2	0
Japanese Journal of Veterinary Research	37	0	0	0	0
Journal of Animal Physiology and Animal Nutrition	1	0	0	0	0
Zeitschrift für Tierphysiologie	0	0	0	0	0
Journal of Comparative Pathology	287	7	28	0	6
Journal of Experimental Animal Science	46	0	0	6	0
Journal of Medical Primatology	167	3	3	6	1
Journal of Small Animal Practice	347	2	8	7	8
Journal of the American Animal Hospital Association	252	1	2	1	0
Journal of the American Veterinary Medical Association	1,374	1	1	4	1
Journal of Veterinary Medical Science	980	0	4	0	0
Journal of Veterinary Medicine Series A/ Zentralblatt für Veterinärmedizin Reihe A	157	5	17	0	14
Journal of Veterinary Medicine Series B/ Zentralblatt für Veterinärmedizin Reihe B	169	1	14	3	5
Journal of Veterinary Pharmacology and Therapeutics	280	1	10	16	4
Journal of Wildlife Diseases	427	5	20	3	2
Journal of Zoo and Wildlife Medicine	293	5	10	1	1
Laboratory Animal Science	421	0	2	4	5
Laboratory Animals	206	3	10	36	8
Monatshefte für Chemie	564	10	15	1	6
New Zealand Veterinary Journal	173	0	2	1	0
Onderstepoort Journal of Veterinary Research	163	0	0	0	0

Veterinary Medicine (1995–1998)* (continuation)

	<i>World</i>	<i>Catalonia</i>	<i>Spain</i>	<i>The Netherlands</i>	<i>Denmark</i>
Preventive Veterinary Medicine	358	0	13	23	25
Reproduction in Domestic Animals	361	4	13	26	5
Research in Veterinary Science	422	7	30	12	8
Revue de Medecine Veterinaire	277	1	11	1	0
Schweizer Archiv für Tierheilkunde	212	1	1	1	0
Theriogenology	935	15	43	31	17
Tierärztliche Umschau	480	0	1	2	0
Tropical Animal Health and Production	236	0	1	3	3
Veterinary Microbiology	664	14	43	52	30
Veterinary Parasitology	776	16	51	41	34
Veterinary Pathology	258	2	10	7	3
Veterinary Quarterly	352	1	9	211	3
Veterinary Radiology & Ultrasound	303	1	4	5	1
Veterinary Record	1,180	18	77	67	25
Veterinary Research	212	0	21	1	2
Veterinary Research Communications	206	1	5	7	4
Total	20,008	154	631	724	385

* Source: *Science Citation Index (ISI)*.

Appendix 2

Quality of articles published in Catalonia, using the criterion of number of times the article is cited in other articles (C/D),

and comparison with the average published worldwide, in Spain, in the Netherlands, and in Denmark.

a) *Animal Sciences*

World

<i>Country</i>	<i>Category</i>	<i>Year</i>	<i>Citations</i>	<i>Documents</i>	<i>Not cited</i>	<i>C/D</i>
WORLD	AS	1995	63,660	9,620	1,736	6.62
WORLD	AS	1996	58,135	9,541	1,756	6.09
WORLD	AS	1997	46,715	9,208	1,840	5.07
WORLD	AS	1998	40,534	9,829	2,272	4.12
WORLD	AS	1999	29,949	9,730	2,819	3.08
WORLD	AS	2000	21,031	10,468	3,896	2.01
WORLD	AS	2001	8,372	9,752	5,538	0.86
WORLD	AS	2002	1,561	9,742	8,542	0.16

Source: *National Science Indicators (ISI)*, Department of Research, Universities and Information Society.

Catalonia

<i>Country</i>	<i>Category</i>	<i>Year</i>	<i>Citations</i>	<i>Documents</i>	<i>Not cited</i>	<i>C/D</i>
CATALONIA	AS	1995	237	48	5	4.94
CATALONIA	AS	1996	400	68	11	5.88
CATALONIA	AS	1997	274	55	4	4.98
CATALONIA	AS	1998	141	52	12	2.71
CATALONIA	AS	1999	115	59	13	1.95
CATALONIA	AS	2000	110	63	23	1.75
CATALONIA	AS	2001	61	59	32	1.03
CATALONIA	AS	2002	8	54	48	0.15

Source: *National Science Indicators (ISI)*, Department of Research, Universities and Information Society.

Spain

<i>Country</i>	<i>Category</i>	<i>Year</i>	<i>Citations</i>	<i>Documents</i>	<i>Not cited</i>	<i>C/D</i>
SPAIN	AS	1995	1,333	241	25	5.53
SPAIN	AS	1996	1,715	293	40	5.85
SPAIN	AS	1997	1,309	296	46	4.42
SPAIN	AS	1998	1,051	301	64	3.49
SPAIN	AS	1999	951	320	79	2.97
SPAIN	AS	2000	639	357	120	1.79
SPAIN	AS	2001	262	306	171	0.86
SPAIN	AS	2002	53	332	289	0.16

Source: *National Science Indicators (ISI)*, Department of Research, Universities and Information Society.

The Netherlands

<i>Country</i>	<i>Category</i>	<i>Year</i>	<i>Citations</i>	<i>Documents</i>	<i>Not cited</i>	<i>C/D</i>
NETHERLANDS	AS	1995	2,121	241	28	8.8
NETHERLANDS	AS	1996	1,722	214	27	8.05
NETHERLANDS	AS	1997	1,893	253	44	7.48
NETHERLANDS	AS	1998	1,322	249	34	5.31
NETHERLANDS	AS	1999	1,060	263	56	4.03
NETHERLANDS	AS	2000	598	263	96	2.27
NETHERLANDS	AS	2001	327	238	104	1.37
NETHERLANDS	AS	2002	54	236	197	0.23

Source: *National Science Indicators (ISI)*, Department of Research, Universities and Information Society.

Denmark

<i>Country</i>	<i>Category</i>	<i>Year</i>	<i>Citations</i>	<i>Documents</i>	<i>Not cited</i>	<i>C/D</i>
DENMARK	AS	1995	1,228	137	8	8.96
DENMARK	AS	1996	969	139	23	6.97
DENMARK	AS	1997	980	145	19	6.76
DENMARK	AS	1998	744	158	22	4.71
DENMARK	AS	1999	679	166	24	4.09
DENMARK	AS	2000	423	176	49	2.40
DENMARK	AS	2001	208	168	76	1.24
DENMARK	AS	2002	48	175	141	0.27

Source: *National Science Indicators (ISI)*, Department of Research, Universities and Information Society.

b) Veterinary Medicine/Animal Health

World

Country	Category	Year	Citations	Documents	Not cited	C/D
WORLD	VET	1995	37,917	7,553	1,842	5.02
WORLD	VET	1996	33,344	7,533	1,959	4.43
WORLD	VET	1997	31,455	7,300	1,946	4.31
WORLD	VET	1998	26,723	7,569	2,217	3.53
WORLD	VET	1999	20,451	7,377	2,506	2.77
WORLD	VET	2000	13,419	7,188	3,150	1.87
WORLD	VET	2001	6,582	7,590	4,613	0.87
WORLD	VET	2002	991	7,386	6,646	0.13

Source: *National Science Indicators (ISI)*, Department of Research, Universities and Information Society.

Catalonia

Country	Category	Year	Citations	Documents	Not cited	C/D
CATALONIA	VET	1995	214	36	4	5.94
CATALONIA	VET	1996	169	30	5	5.63
CATALONIA	VET	1997	231	36	2	6.42
CATALONIA	VET	1998	154	46	7	3.35
CATALONIA	VET	1999	124	30	8	4.13
CATALONIA	VET	2000	115	42	14	2.74
CATALONIA	VET	2001	41	45	23	0.91
CATALONIA	VET	2002	3	38	36	0.08

Source: *National Science Indicators (ISI)*, Department of Research, Universities and Information Society.

Spain

Country	Category	Year	Citations	Documents	Not cited	C/D
SPAIN	VET	1995	957	189	28	5.06
SPAIN	VET	1996	859	191	31	4.50
SPAIN	VET	1997	656	162	20	4.05
SPAIN	VET	1998	915	238	45	3.84
SPAIN	VET	1999	579	176	47	3.29
SPAIN	VET	2000	399	202	77	1.98
SPAIN	VET	2001	186	220	131	0.85
SPAIN	VET	2002	30	214	193	0.14

Source: *National Science Indicators (ISI)*, Department of Research, Universities and Information Society.

The Netherlands

<i>Country</i>	<i>Category</i>	<i>Year</i>	<i>Citations</i>	<i>Documents</i>	<i>Not cited</i>	<i>C/D</i>
NETHERLANDS	VET	1995	1,868	275	58	6.79
NETHERLANDS	VET	1996	1,071	185	39	5.79
NETHERLANDS	VET	1997	1,511	304	89	4.97
NETHERLANDS	VET	1998	1,138	255	58	4.46
NETHERLANDS	VET	1999	1,027	233	59	4.41
NETHERLANDS	VET	2000	759	258	81	2.94
NETHERLANDS	VET	2001	331	266	134	1.24
NETHERLANDS	VET	2002	63	252	200	0.25

Font: *National Science Indicators (ISI)*, Dept. d'Universitats, Recerca i Societat de la Informació.

Denmark

<i>Country</i>	<i>Category</i>	<i>Year</i>	<i>Citations</i>	<i>Documents</i>	<i>Not cited</i>	<i>C/D</i>
DENMARK	VET	1995	978	106	11	9.23
DENMARK	VET	1996	798	106	12	7.53
DENMARK	VET	1997	871	100	14	8.71
DENMARK	VET	1998	644	100	10	6.44
DENMARK	VET	1999	464	98	19	4.73
DENMARK	VET	2000	305	107	29	2.85
DENMARK	VET	2001	148	123	61	1.20
DENMARK	VET	2002	24	128	111	0.19

Font: *National Science Indicators (ISI)*, Dept. d'Universitats, Recerca i Societat de la Informació.