

ORIGINAL PAPER

RESEARCH DIRECTIONS IN EUROPEAN VETERINARY PATHOLOGY IN 2010-2016 BASED ON THE CONGRESSES OF THE EUROPEAN SOCIETY OF VETERINARY PATHOLOGY AND THE EUROPEAN COLLEGE OF VETERINARY PATHOLOGISTS

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The objective of this paper is to depict the current research directions in veterinary pathology in Europe. The analysis was carried out based on the abstracts and agendas of the annual European Society of Veterinary Pathology (ESVP) congresses organised together with the European College of Veterinary Pathologists (ECVP) in 2010-2016. In total, 1444 presentations were evaluated, including 41 plenary lectures, 319 short oral presentations, and 1081 posters, and in 2016 also three science slams. It was found that infectious and parasitic diseases (467 presentations, 32.34%) and oncology (450 presentations, 31.16%) were the most commonly discussed topics. Organ pathology was also addressed (327 presentations, 22.65%), with the subsequent places taken by research on different topics (140 presentations, 9.70%) and toxicopathology (67 presentations, 4.64%). Among the most commonly presented issues, there was a substantial number of presentations on neurology (129 speeches, 8.93%) and mammary gland diseases (101 presentations, 6.99%). A downward trend was revealed for infectious and parasitic diseases and for oncology, and a positive trend for organ pathology, the first and the third being statistically significant.

Key words: European Society of Veterinary Pathology, European College of Veterinary Pathologists.

Introduction

The European Society of Veterinary Pathology (ESVP) is the oldest body focusing on veterinary pathology in Europe. The society was established in 1951, then under the name *Arbeitsgemeinschaft für Veterinärpathologien* [1], and then under its current

name since 1994. For many years, it has been bringing together over 600 members [2]. The European College of Veterinary Pathologists (ECVP) unites certified and qualified veterinary pathologists, aiming at broadening knowledge and setting accurate scientific standards [3]. The annual congresses of these entities are a supranational platform for contacts and knowl-

edge, information, and skill sharing between scientists from all over Europe and beyond [4, 5, 6, 7, 8, 9, 10].

During the congress held in Bologna in 2016, a new type of information- and remark-sharing was introduced: the science slam [11], in addition to keynote lectures, short oral presentations, and poster sessions, as well as workshops and mystery slide sessions (which are not the subject of the present paper). This should serve as a platform for exchanging information on novelties and developments in pathology and related disciplines, being open to innovativeness, facilitating contacts between lecturers and the audience, and as a new communication media, described by Prof. Achim Gruber as “a focused, oral type of journal club contribution”, with elements of entertainment and in a manner typical of the Internet society [10]. This year, three such presentations were included [10, 11].

The paper constitutes an analysis of research tendencies in veterinary pathology in Europe in 2010-2016 and continues a set of such studies [12].

Material and methods

The study was carried out with the abstracts and agendas of seven annual congresses of the European Society of Veterinary Pathology (ESVP) co-organised with the European College of Veterinary Pathologists (ECVP) in 2010–2016 [4, 5, 6, 7, 8, 9, 10, 11, 13]. In total, 1444 presentations were evaluated (Fig. 1).

The generated results were statistically processed with an analysis that included the types of presented scientific reports and topics of the presentations considered in total and by time. The percentage proportion was calculated for each type of presentation and each topic category addressed at the annual ESVP and ECVP congresses for seven consecutive years.

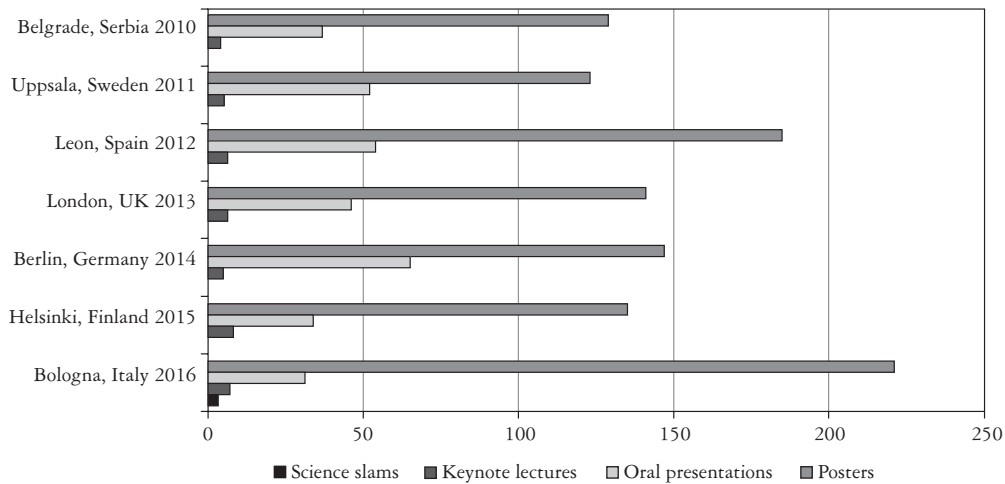


Fig. 1. Annual meetings of the European Society of Veterinary Pathology and European College of Veterinary Pathologists in the years 2010-2016 with regard to the number and type of research presentations

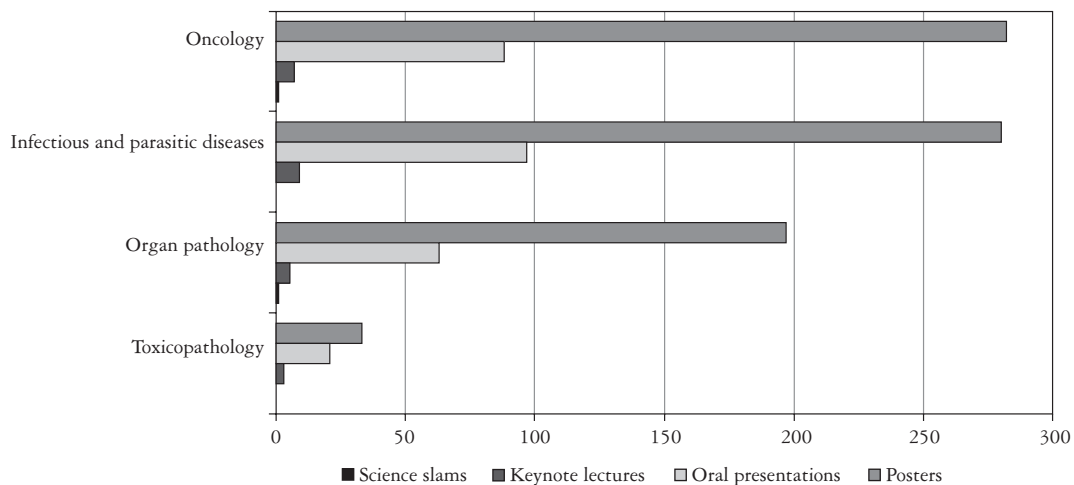


Fig. 2. Number of plenary lectures, oral presentations, science slams, and posters presented in various areas of veterinary pathology during annual meetings of the European Society of Veterinary Pathology and European College of Veterinary Pathologists in the years 2010-2016

The trend lines (tendencies) were determined for the topics by defining the linear regression equation and r-square formula. For the investigated parameters, the level of significance was identified (with Student's t-distribution for independent samples). The calculations were generated with the Statistica 9 pl StatSoft package [14, 15].

Results

It was found that of the 1444 presentations delivered during the ESVP and ECVF congresses held in 2010-2016, 1081 were posters (74.86%) and 363 were oral reports (25.14%), of which the plenary lectures amounted to 41, short oral presentations totalled 319 and the other three were science slams.

The profile of topics addressed in the abstracts submitted as the proceeding for the ESVP and ECVF Congresses held in 2010-2016 are presented in Fig. 2.

It was found that veterinary pathology of infectious and parasitic diseases was discussed in 467 presentations (32.34% of all presentations), being the topic of 13 plenary lectures, 105 short oral presentations, and 349 posters. The discussed issues included swine viral respiratory diseases such as porcine reproductive and respiratory syndrome, adenoviral infections, maedi-visna, Borna disease, influenza, paratuberculosis, chlamydiosis, Staphylococcal infections, tuberculosis, and listeriosis. For viral diseases, the examples are plenary lectures on retroviruses by Massimo Palmarini [5], orthobunyaviruses by John Edwards [6], teratogenic viruses by Sandra Scholes [6], new viral diseases in wild animals, such as severe acute respiratory syndrome and West Nile fever by Thijs Kuiken [10], and papilloma viruses by Luba Nasir and Simon Herrington [7]. There was also a plenary lecture on the immunity against *Mycobacterium*

cobacterium delivered by Adrian Martineau [7]. The addressed topics in virology also covered immunopathology and infectious diseases in exotic birds and poikilotherm animals. One presentation described lesions in ferrets caused by previously unknown *Chryseomonas*-like bacteria causing pleuropneumonia and mediastinitis [4].

Nearly 18% of the papers in this group (84 presentations) depicted morphological lesions caused by parasites. Nematode infestations, coccidiosis, toxoplasmosis, neosporosis, cryptococcosis, and the first case of intratesticular tetrathyridiosis in a cat. Some papers reported the first cases of parasitic diseases on a given area, e.g. *Pulmonary Nematodiasis Compatible with Aelurostrongylus Abstrusus Infection in a Wild Cat (Felis silvestris)* [4] or *Cryptosporidium Baileyi-Infection in Red-Breasted Merganser Ducklings* [5]. Single reports have addressed fungal diseases, although there is an upward trend in this field.

Oncology was discussed in a scope which was comparable with the pathology of infectious and parasitic diseases, i.e. in 450 presentations (31.16% of all presentations). These topics were addressed in eight plenary lectures, 99 short oral presentations, 342 posters, and one science slam. Among them, the analysis of mammary tumours was most common, combined with gene, receptor, and cellular line expression, as well as with the specification and search for neoplastic markers, cytological diagnostics, targeted therapy, and the efficacy of medicines. Most of the presented studies referred to the bitch, including the keynote lecture given by Laura Peña [6], while a smaller part concerned the females of cat and other species. It was repeatedly emphasised that there was a potential for, and rationale behind, applying the results of studies on animal models for oncological diagnostics and treatment in women.

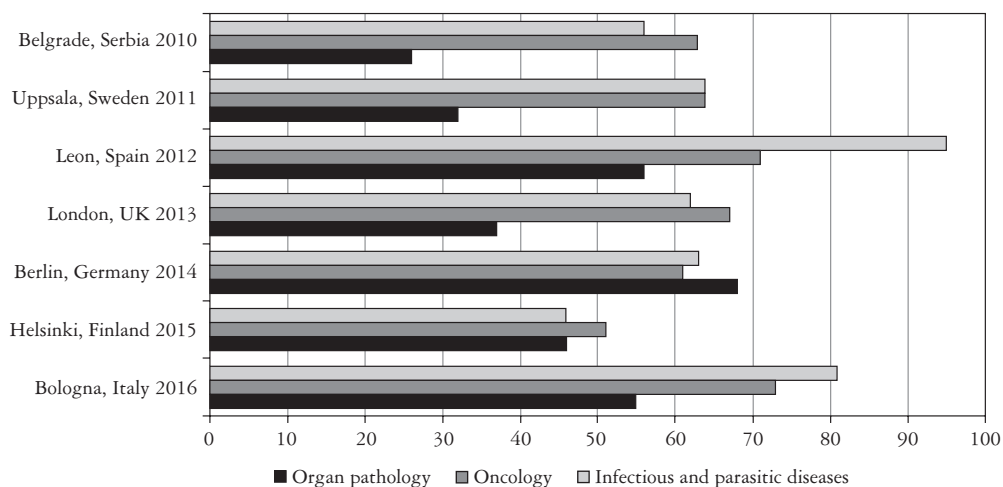


Fig. 3. Total number of presentations covering organ pathology, oncology, and infectious and parasitic diseases presented during annual meetings of the European Society of Veterinary Pathology and European College of Veterinary Pathologists in the years 2010-2016

Numerous papers have discussed the neoplasm of the male reproductive organs, skin, bones, nervous system, and the eye. Mast cell tumours, carcinoma, adenocarcinoma, and lymphoma were relatively commonly presented. While discussing the neoplastic lesions: diagnostics, apoptosis, cyclooxygenase-2 expression, grading and staging, the application of immunohistochemistry tests and the need to search for more effective diagnostic methods were often touched on. During the plenary sessions, the prognostic factors in oncology were discussed by comparing morphological, immunohistochemical, and molecular investigations by Sven Rottenberg [8] and by reporting the current scientific achievements for lymphoma and lymphatic leukaemia by Mary Anna Thrall [9] and common tumours in dogs and cats by Donald Meuten [9]. Skeleton tumours in domestic animals by Keith Thompson [4] and *Murine Teratocarcinomas – Tumours That Opened the Road to Embryonic Stem Cells and Transgenic Mice* by Ivan Damjanov [4] were also topics of the plenary sessions.

The pathology of infectious and parasitic diseases was reported on at the congresses statistically more often than topics in oncology, except for the following years: 2010, 2013, and 2015, in which the relation was inverted (Fig. 3).

Organ pathology included mainly neuropathology, which was the topic of nearly 130 presentations in total, including three plenary lectures and one science slam. A significant proportion of the papers combined cardiopathology and neuropathology, focusing on such issues as the impact of heart arrest on the central nervous system. Cases associated with pathology of cerebrospinal meningitis and encephalitis of different aetiology and ophthalmological problems were discussed.

Tendon and skeletal pathology, including orthopedy and the impact of spinal insults on the functions of the nervous system, as well as the pathology of the cardiovascular system and the tegument, were other topics addressed at the congresses. Among the lectures of hepatology, the keynote lectures by John M. Cullen and Johanna Arola presented in Helsinki [9] were particularly noteworthy.

Nutrition sciences were also touched on, such as the impact of diet on the health of animals and humans, as the consumers of animal-derived products, including poultry. Pathology of production animals, including fish, was also discussed together with the profitability of such production and problems faced by the modern public, and animal health protection presented, for instance, by Christian Gortazar [6] and Jens P. Teifke [8].

Toxicologicopathology was referred to in 67 presentations (4.64%), with such issues as the impact of selenium, bismuth, and cadmium on the internal

organs in animals, and drug toxicities, lethal alcohol toxicosis in cattle, and the application of morphometry in toxicological measurements being discussed. It should, however, be emphasised that although toxicologic pathology had such a minor percentage share in the topics, it was addressed in three plenary lectures: 1. Adam Hargreaves, *Toxicologic pathology enter the zebrafish* [4]; 2. John M. Cullen, *Cutting through to the truth: laser capture microdissection and toxic injury of the biliary tree* [5]; and 3. Ann F. Hubbs, *Understanding nanotechnology: an emerging challenge for the toxicologic pathologist* [8]. Furthermore, the ESVP and ECVP congresses held in 2011 and 2014 were accompanied by the deliberations of the European Congress of Toxicological Pathology, which is not subject to the analysis presented in the paper.

The other topics, constituting 9.70% of the presentations, may be categorised as *varia*. They include, among others, gene mapping and genome analysis, transgenic neuronal cultures, molecular studies, immunophenotyping, pluripotency of stem cells, cytoskeleton insults, apoptosis, or gene divergence. The results of studies on single gene insults by Hannes Lohi [9] and identification of autoimmune disease gene markers by Lorna Kennedy [9] were also included. New pathomorphological diagnostic techniques were also mentioned, such as radioactivity applied to detect nanoparticles as a novel method of labelling instead of the fluorochromatic method.

Some topics classified as *varia* referred to wild and exotic animals, of which a group of papers authored by Polish scientists are worth mentioning: the pathology of poikilothermic organisms, including turtles and fish [4, 6, 9, 10] and European bison [5, 6]. The papers on lagomorph pathology and the impact of nanoparticles on the pathomorphology of laboratory animals should be underlined; they were presented in London [7], and a presentation on oxidative stress pathology was given in Helsinki [9]. Single papers

Table I. Linear regressions (trends) of presentations covering various subjects during annual meetings of the European Society of Veterinary Pathology and European College of Veterinary Pathologists in the years 2010-2016

SUBJECT	LINEAR REGRESSION (TREND)	R ²
Infectious and parasitic diseases	$y = -1.2143x + 37$ (significant at $p \leq 0.05$)	$R^2 = 0.3937$
Oncology	$y = -1.4286x + 37.286$	$R^2 = 0.6231$
Toxicopathology	$y = 0.2857x + 3.5714$	$R^2 = 0.1311$
Organ pathology	$y = 1.5x + 15.857$ (significant at $p \leq 0.01$)	$R^2 = 0.3645$
Other topics	$y = 0.8571x + 6.2857$	$R^2 = 0.1846$

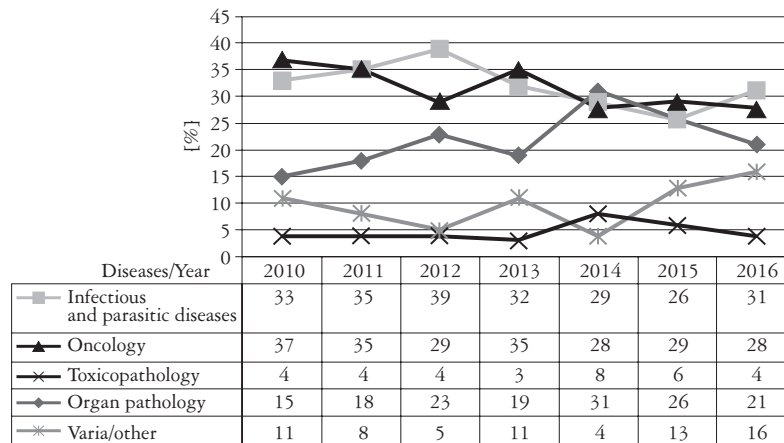


Fig. 4. Thematic directions of the research presentations in percentage terms during annual meetings of the European Society of Veterinary Pathology and European College of Veterinary Pathologists in the years 2010-2016

addressed lamas, dolphins, bears, parrots, foxes, and monkeys, also by giving comparisons to pathology in the human body. Two papers on algae were presented in Bologna [10].

A few papers discussed topics of forensic medicine, in particular in September 2016 [10]. A plenary lecture entitled *Dissecting the Evidence: the Forensic Pathologist's Role* presented by Randal Munro [9] is of special interest. The role and status of a modern pathologist were the topic of a lecture delivered by Albert Osterhaus in Bologna in 2016.

It should be emphasised that, dictated by the methodology of the study, related topics to the ones categorised as *varia* may also be an accompanying element in the papers classified to the other groups of veterinary pathology in this compilation, which is due to the interdisciplinary nature of many of these.

The statistical analysis identified a trend for addressing each of the topic categories (Table I and Fig. 4). It was found that for the infectious and parasitic diseases and oncology there was a downward (negative) trend that was statistically significant for the first of the mentioned cases. For the organ pathology category, there was a positive trend with high statistical significance.

Discussion

The analysis of the topics addressed during the ESVP and ECVF congresses held in 2010-2016 demonstrates that both the number of papers and the issues of studies in veterinary pathology in Europe have been changing throughout the years. There are visible trends directing the research activities of European pathologists, for instance, a continuous growth of interest in studies on diseases typical of animals and people in developed European societies and on the organ pathology. Because there was a statistically significant positive trend it is justified for organ pathology

topics to predict that this subject matter will be addressed more often at the European Society of Veterinary Pathology and the European College of Veterinary Pathologists congresses in the forthcoming years.

However, there has been an increase in the number of studies on infectious disease, which results from growing accuracy and progressive innovativeness in the available research methods, the tendency is the opposite. It may be foreseen that infectious and parasitic disease topics will be touched on less frequently in upcoming years, representing a downward tendency.

The tendencies in the analysed scientific studies that reveal numerous changes in research directions have been also seen over a longer period of time, concerning 1996-2016. It can be observed that in 2010-2016, as compared to the previous years [12], transmissible spongiform encephalopathies were of less interest and mainly limited to scrapie cases in the Balkan states. Papers on poikilothermic organisms, dermatology, disease classification schemes, or clinical studies of drugs are becoming more numerous. There is an ongoing trend, as noted in the years 1996-2010 [12], for close cooperation between clinical sciences and veterinary pathology involving studies of animal diseases.

The authors declare no conflict of interest.

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