

Dry eye researchers and their publications in Asia and Europe

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Dry eye, a visually disabling disease that has been reported to be a major public health issue in many countries, is known to induce a significant decrease in quality of life.¹ In this report, we aim to compile information on the investigators of dry eye that published most frequently in peer reviewed scientific journals and the publications in Asia and Europe.

We performed the search on the NCBI Entrez Pubmed database on February 28, 2014. Dry eye-related publications were analyzed based on authorship, country of author, and year of the publication. Keywords used in our search consisted of the phrase 'dry eye' OR 'tear dysfunction' OR 'tear film' OR 'ocular surface inflammation' OR 'meibomian' OR 'lacrimal'. The resulting publications were curated manually and articles that focused only on allergic eye disease, trauma, tumors or surgical procedures unrelated to dry eye were excluded.

The thirteen authors in Asia ([Table 1](#)) with the highest individual number of papers accounted for 469 unique publications whereas the thirteen authors in Europe ([Table 2](#)) were responsible for 401 publications. These numbers are less than the total in the table because different authors may have co-authored the same publications.

We have noticed that majority of the publications from Asia originated from researchers from Japan (in fact all were from Tokyo and Kyoto) and two authors were from Singapore. Tsubota K was responsible for 260 publications, leading the Asia researchers. The most published European author was Baudouin C, responsible for 78 eligible publications. Interestingly, unlike Asia, where all the publications investigated were from three cities and two countries, these European researchers were spread across twelve cities and six countries. We also noticed that most of the papers published were in the last ten years, as shown in the right most column ([Table 1](#) and [Table 2](#)).

However, we did not look into the total dry eye-related publications from a continent, particular country, city or research center. The total number of papers by

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region is perhaps not useful since the total number of ocular surface researchers at all levels cannot be easily captured. We also did not have any knowledge of where the published work was primarily performed, since collaborations can occur between people from different centers. We also would like to point out that the count included all types of journal papers including reviews, commentaries, editorials and letters. The most frequent scientific journal in the list is *Investigative Ophthalmology & Visual Science*.

The trend gathered in this research may reflect increasing awareness and incidence of dry eye in Asia¹ and consequently targeted funding of major centers in Asia for dry eye. In 2012, Japan spent 3.34% of Gross Domestic Product (GDP) on Research and Development (R&D), 5th highest in Organisation for Economic Co-operation and Development (OECD) countries.² Although the distribution of R&D expenditure across the various sectors is unknown, it can be assumed that there is a general increase in the importance of research as well as funding opportunities. On the other hand, the robust dry eye research in Singapore, driven primarily by the Singapore Eye Research Institute,³ could be fuelled by the associated high economic burden.⁴ This is also consistent with Singapore being the most productive in eye publications per capita in the world.⁵

Meanwhile in Europe, centers performing dry eye research tend to be more widespread, perhaps because there were more countries with a longer tradition for research in ophthalmology.

The nature of journals that are published by these eye researchers from both Asia and Europe is similar to those published by the most prolific dry eye researchers in the world⁶. In fact, the most prolific author from Asia (Tsubota K) is also the most prolific author on dry eye research in the world.

Nevertheless, our data show that both in Asia and Europe, the majority of these dry eye related papers were published in the last ten years. Over the last decade, spending for R&D intensity grew in both Japan (from 3.00% to 3.26%) and the European Union (from 1.74% to 1.91%).² This increase in research funding, together with increased awareness of dry eye, would at least partially explain this publication trend. Recent efforts in Asia include the formation of the Asia Cornea Society, registered in Singapore in 2007, to promote regional and international cooperation in ocular surface and other cornea research.⁷ Another reason for increased dry eye work may be related to commercially driven research. In Western Europe alone, the market revenue for dry eye products in 2013 was about 500 million US dollars.⁸

In conclusion, there is active dry eye research in Japan and Europe, particularly so in the last ten years. Asian countries, especially Japan, sees the development of a few specialised dry eye centers driven by a small number of academic individuals, resulting in clearly prolific authors in this field, who also tends to be key opinion leaders. On the other hand, dry eye research in Europe is more widespread across the continent.

References

1. Smith JA, Albeitz J, Begley C, Caffery B, Nichols K, Schaumberg D, Schein O. The epidemiology of dry eye disease: report of the Epidemiology Subcommittee of the International Dry Eye Workshop. *Ocul Surf* 2007;5:93-107.
2. OECD. Main Science and Technology Indicators. Vol. 2013/2, OECD Publishing 2014. DOI: 10.1787/msti-v2013-2-en.
3. Tan DT, Beuerman RW. Ocular surface research at the Singapore Eye Research Institute. *Ocul Surf* 2009;7(2):115-117.
4. Waduthantri SH, H.L.A.; Tan CH, Tong L. Annual medical expenditure of dry eye syndrome in Singapore. *Eur J Ophthalmol* 2011
5. Guerin MB, Flynn TH, Brady J, O'Brien CJ. Worldwide geographical distribution of ophthalmology publications. *Int Ophthalmol* 2009;29(6):511-516.
6. Nichols JJ. Citation analysis of the dry eye literature. *Ocul Surf* 2013;11(1):35-46.
7. Asia Cornea Society. About Us. Retrieved from <http://www.asiacorneasociety.org/abtus.asp>. Accessed April 1, 2014.
8. The Market Scope. (2013) Comprehensive report on the global dry eye products market

Table 1. Dry eye researchers in Asia.

		Country of research	City	Research Centre	Total number of publications	Total number of publications (2004-2014)
1	Tsubota K	Japan	Tokyo	Keio University School of Medicine	257	159
2	Dogru M	Japan	Tokyo	Keio University School of Medicine	119	109
3	Kinoshita S	Japan	Kyoto	Kyoto Prefectural University of Medicine	80	44
4	Yokoi N	Japan	Kyoto	Kyoto Prefectural University of Medicine	75	44
5	Matsumoto Y	Japan	Tokyo	Keio University School of Medicine	68	59
6	Shimazaki J	Japan	Tokyo	Tokyo Dental College Ichikawa Hospital	59	39
7	Goto E	Japan	Tokyo	Keio University School of Medicine	59	39
8	Toda I	Japan	Tokyo	Minamiaoyama Eye Clinic	41	9

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		Country of research	City	Research Centre	Total number of publications	Total number of publications (2004-2014)
9	Shimmura S	Japan	Tokyo	Keio University School of Medicine	40	23
10	Tong L	Singapore	Singapore	Singapore Eye Research Institute	39	39
11	Beuerman RW	Singapore	Singapore	Singapore Eye Research Institute	37	19
12	Kojima T	Japan	Tokyo	Keio University School of Medicine	35	33
13	Uchino M	Japan	Tokyo	Keio University School of Medicine	28	27

Table 2. Dry eye researchers in Europe.

		Country of research	City	Research Centre	Total number of publications	Total number of publications (2004-2014)
1	Baudouin C	France	Paris	Quinze-Vingts National Ophthalmology Hospital	76	54
2	Bron AJ	UK	Oxford	University of Oxford	54	21
3	Geerling G	Germany	Dusseldorf	University of Düsseldorf	44	31
4	Tomlinson A	UK	Glasgow	Glasgow Caledonian University	41	25
5	Calonge M	Spain	Valladolid	University of Valladolid	38	28
6	Rolando M	Italy	Genoa	University of Genoa	33	17
7	Knop E	Germany	Berlin	Ocular Surface Center Berlin	29	22
8	Barabino S	Italy	Genoa	University of Genoa	23	20

		Country of research	City	Research Centre	Total number of publications	Total number of publications (2004-2014)
9	Bonini S	Italy	Rome	University Campus Bio-Medico	21	18
9	Cursiefen C	Germany	Cologne	University of Cologne	21	18
9	Tervo T	Finland	Helsinki	Helsinki University Hospital	21	5
12	Aragona P	Italy	Messina	University of Messina	19	12
12	Kruse FE	Germany	Erlangen	University of Erlangen-Nuremberg	19	15