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Analysis of the international journal publishing activities for Swiss academic institutions with special emphasis on gold open access publishing

Data Paper by Max-Planck Digital Library, Big Data Analytics Group

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1 Summary

The following study was commissioned by the Consortium of Swiss Academic Libraries (CSAL) and was executed by the Max Planck Digital Library (MPDL).

The analysis focuses on the international journal publishing activities in Switzerland with special emphasis on gold open access publishing.

The main data source describing the publishing activity in Switzerland was Scopus, an abstract and citation database for peer reviewed scientific articles provided by Elsevier. The raw data provided were processed, cleaned and enriched from the Directory of Open Access Databases (DOAJ) and MPDL in-house databases to derive a data warehouse appropriate for the intended analytics.

Additional to the analysis for Switzerland in total, 31 institutions selected by the contractor were prepared for a separate analysis. The idea was to build up a selection that would be representative for the Swiss academic institutions. Thus, six Federal Institutes in Switzerland were selected, as well as the ten biggest Universities of Higher Education, seven Universities of Applied Sciences, seven Education Colleges and one National Library.

- Eidgenössische Technische Hochschule Zürich
- École polytechnique fédérale de Lausanne
- Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz
- Swiss Federal Laboratories for Materials Science and Technology
- Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft
- Paul Scherrer Institut
- Universität Zürich + Hospitals
- Université de Lausanne + Hospitals
- Universität Basel + Hospitals
- Universität Bern + Hospitals
- Université de Genève + Hospitals
- Universität St. Gallen
- Université de Fribourg
- Université de Neuchâtel
- Università della Svizzera italiana
- Universität Luzern
- Haute école spécialisée bernoise
- Fachhochschule Nordwestschweiz
- Fachhochschule Ostschweiz
- Haute école spécialisée de Suisse occidentale
- Hochschule Luzern
- Scuola universitaria professionale della Svizzera italiana
- Zürcher Fachhochschule
- Haute école pédagogique des cantons de Berne, du Jura et de Neuchâtel
- Haute école pédagogique du Valais
- Interkantonale Hochschule für Heilpädagogik Zürich (HfH)
- Haute école pédagogique de Fribourg
- Pädagogische Hochschule Thurgau
- Pädagogische Hochschule des Kantons St. Gallen
- Alta scuola pedagogica dei Grigioni
- Bibliothèque nationale suisse

For this selection, MPDL conducted an individual unification of Scopus affiliation strings.

Publication data were analysed with respect to the number of articles published and aggregated at the levels of the publishing journal and the publisher for Switzerland in total and the 31 selected institutions. Gold open access publishers and journals were compared to subscription journals at all aggregation levels. For the estimation of open access costs, the share of articles with a reprint affiliation from Switzerland or selected institutions was calculated. Open access numbers from Germany, Great Britain, the United States and Austria as well as from worldwide publishing are presented for comparison.

The aggregated results in this report are accompanied by more extensive basic data in an Excel file.

2 Introduction

Open access to research articles is evolving considerably in recent times. A constantly increasing number of authors select one of the pure open access journals for the dissemination of their scientific findings. After more than 15 years of steady evolution, business models have proven to be viable and many stakeholders now think of enforcing steps towards this publishing model. The open access market landscape is, however, characterized by an enormous diversity of variants considered – from pure gold or even platinum via hybrid and “hybrid 2.0” (offsetting) to the green way of depositing. Many sophisticated details add to that model variety.

Beside dedicated open access publishers like PLoS, BMC, Frontiers or Copernicus, more and more classical subscription publishers like Elsevier, Wiley or Springer Nature offer a selection of their journals in an APC-based version (gold open access). Hybrid models also recently gain interest again. Especially in their “offsetting” variant they are negotiated as a transition state from subscription to open access, balancing vendors and customers interests.

In the light of these dynamic market developments, libraries have to find a reasonable way of shaping a strategy well fitted to their specific situation. This is achieved best on base of sound evidence on the publishing profiles of their scientists. From that they are able to calculate expected costs for a transition in general, and with respect to selected publishers in particular. They can use these numbers in negotiations with publishers to achieve acceptable pricing frameworks, and identify journals of special interest for a transformation into an open access model.

The most appropriate sources for this type of information are the international bibliographic databases “Web of Science” (Thompson Reuters) and “Scopus” (Elsevier). They cover a broad range of subjects and journal types and thus may be used for a description of publication profiles of institutions from a variety of domains. Typically, they are used via web interfaces at the providers platforms but may also be acquired as so-called “raw data” in an XML format. The latter is an indispensable prerequisite for large scale quantitative analysis.

Max Planck Digital Library (MPDL) uses these raw data together with enriching data sources and in-house files for the buildup of a data warehouse since several years. Data cleaning and processing routines have been developed and tuned for the generation of publishing profiles.

Basic key numbers on publication profiles for the 31 member institutions of the Consortium of Swiss Academic Libraries (CSAL) have been compiled in this study.

3 Data Sources and Methods

3.1 Data Sources

The analysis in this report is based on a data warehouse derived from (1) Scopus, a bibliographic database owned by Elsevier, (2) the Directory of Open Access Journals (DOAJ) and (3) MPDL in-house authority files on journals and publishers.

3.1.1 Elsevier's Scopus

The bibliographic data source for this analysis is the abstract and citation database Scopus provided by Elsevier. At the time the data was fetched from Scopus (May, 2017), it comprised information for about 22,800 peer-reviewed journals and about 5,000 publishers. For general information, see the product's homepage¹ and the detailed content information².

Whereas Scopus is generally used via a web interface on the providers platform, large scale bibliometric analyses need to be based on local "raw data" in XML format delivered by Elsevier. This raw data is licensed by the Kompetenzzentrum Bibliometrie³, a German project and consortium funded by the German Federal Ministry of Education and Research (BMBF)⁴ under the grant 01PQ13001.

The dataset used for this report was provided by Scopus in May 2017. The XML raw data was uploaded into an Oracle relational database by the Fachinformationszentrum Karlsruhe⁵. Starting from this relational raw data, MPDL conducted extensive data transformation, cleaning and standardization to make them suitable for further bibliometric analysis. This study includes articles from 2001 to 2016 (with the caveat for completeness in 2016, see below).

Some of the general data characteristics of Scopus need to be taken into account for the current study:

Scopus covers a broad range of subjects and publishing countries but nevertheless has biases with respect to publication type, internationalization, pervasiveness, impact, or language of the journals in consideration. As there is no source of reference, these biases cannot be quantified.

Scopus constantly adds new data to the database, but there is a lag between articles being published and being added to the Scopus raw data. Even for the data delivered in May 2017 we have substantial indication that data for 2016 is neither complete in total numbers nor with respect to specific fields.

The total number of articles (document type "article" and "review") indexed in Scopus was 1,952,000⁶ in 2015 and 1,903,000 in 2016⁶ equaling to a change of -3%. However, in the recent 10 years, total publication numbers were continuously rising with a median of 5% within Scopus. Thus, it now would be rather unexpected to have a real decline in publication activities worldwide, concluding that the data for 2016 is incomplete.

The coverage of articles having a reprint affiliation identified seems to be a further indication of time lags in data processing for the Scopus database. Usually every publication has one affiliation among the list of affiliations which is identified as a so-called reprint or corresponding affiliation. In the Scopus database, this occurs up to the publication year 2012 (Table 1 on page 6). From then onwards, there is an increasing fraction of articles that misses that information. Especially problematic is the uneven distribution of these deficiencies. For the largest publishers ("Big 3") the situation remains acceptable even during the most recent years but for other publishers the completeness drops dramatically to an average of only 80% in 2016. Therefore, the numbers on reprint affiliations need to be corrected for this bias.

In the Scopus XML raw data publishers are not covered. Elsevier provides an extra "Scopus Source List"⁷, an Excel file including information on publishers. However, the level of harmonization of names and imprints is very low and it cannot be used "as is" for data analysis.

Scopus identifies journals by journal title, title abbreviations, print and electronic ISSN, and a proprietary journal identifier. Unfortunately, this information is to a large extent inconsistent and incomplete. Altogether, these fields add up to more than 60,000 unique combinations. Compared to the 21,500 journals that are indexed, this means that we have an average of three variants per journal title.

Quality assurance processes also revealed that a substantial number of article affiliations in Scopus lack information on the country. Unfortunately it is not a random pattern but has distinct dependencies on the publication year and eventually other sources of influence. These articles are omitted in country comparisons relying on that field, except for the cases where a clear pattern corresponding to Switzerland in the affiliation string was found.

3.1.2 MPDL Journal and Publisher Data

As outlined above, the quality of the journal metadata provided by Scopus is substantially lower than would be necessary for a meaningful analysis. This is true for journal titles and even more so for journal publishers.

Therefore, we matched Scopus raw data entries to an in-house database built and maintained by MPDL since about 10 years. The database currently indexes 80,000+ unique journal titles. A subset of 30,000+ journal titles is assigned to 200+ explicitly identified and harmonized publishers.

We developed extensive procedures to harmonize journal titles and assign them to the current publisher. This is notoriously

¹<https://www.elsevier.com/solutions/scopus>

²<https://www.elsevier.com/solutions/scopus/content>

³<http://www.bibliometrie.info>

⁴<https://www.bmbf.de>

⁵<https://www.fiz-karlsruhe.de>

⁶rounded to the nearest thousand.

⁷https://www.elsevier.com/__data/assets/excel_doc/0015/91122/title_list.xlsx

Country	Group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Switzerland	oa	99	99	99	99	100	99	99	80	82	85
Switzerland	other	100	99	99	100	99	99	97	83	74	73
Switzerland	big 3	100	100	100	100	100	100	100	96	97	96
Germany	oa	100	100	100	100	100	100	99	79	80	85
Germany	other	99	99	99	100	99	99	97	83	73	74
Germany	big 3	100	100	100	100	100	100	99	96	96	96
Austria	oa	100	100	100	100	100	100	98	77	77	83
Austria	other	99	99	99	100	99	98	96	83	74	75
Austria	big 3	99	100	100	100	100	100	100	96	96	96
Great Britain	oa	100	100	100	100	100	100	99	81	81	86
Great Britain	other	99	99	98	99	99	99	97	87	81	82
Great Britain	big 3	99	100	100	100	100	100	99	95	96	95
United States	oa	100	100	100	100	100	100	99	79	80	85
United States	other	99	99	99	99	99	99	97	87	81	82
United States	big 3	99	100	100	100	100	100	99	96	97	96
global	oa	100	99	100	100	99	100	98	81	81	84
global	other	99	99	99	99	99	99	96	84	77	79
global	big 3	100	100	100	100	100	100	99	95	95	96

Table 1: Completeness of reprint affiliation entries in the Scopus data source. Ratio of articles having a reprint affiliation from any country to the total number of articles in a given subset.

difficult as there is no single reference which provides this information. Constantly changing title names and titles moving from one publisher to another cause significant challenges for accuracy and topicality of the matching process.⁸

Within the bounds of our resources we try to consolidate information from as many sources as possible: title lists from big databases (Web of Science, Scopus, DOAJ) as well as individual title lists from a substantial number of publishers MPDL is interested in.

3.1.3 Directory of Open Access Journals

We use the Directory of Open Access Journals (DOAJ)⁹ for identification of gold open access journals. The DOAJ provides a list of over 9,000 gold open access journal titles along with meta-data including publisher information. The content is primarily maintained by the publishers with some extra input via a quality assurance team. There is no guarantee with respect to completeness or correctness and we are aware of several missing cases. For reproducibility however, we use the DOAJ as the only reference without adding information from other sources.

To utilize the DOAJ, the journal titles are matched against the in-house database. For the selection of gold open access articles, we also take into account the eventual year of transformation from the subscription model to gold open access if applicable. Some prominent examples are the journals transformed in 2014 to gold open access by the SCOAP³ program.

The DOAJ data used for the current study was fetched on September, 2017.

3.2 Affiliation matching

3.2.1 Challenges in Affiliation Matching

To be able to analyse publication patterns for individual institutions, it is crucial that their affiliation strings are identified in the bibliometric raw data and assigned to the corresponding institutions.

⁸In the present report the publisher Springer stands for subscription Springer Journals and Springer Open, while the publisher Nature Publisher Group (NPG) stands for Nature Journals. They are not merged into a single Springer Nature publisher.

⁹<https://doaj.org/about>

For the 384,007 Swiss articles selected for this study we have to deal with 798,731 affiliation entries. After a first step of automatic standardization (lower case, concatenating and harmonizing fields) we find 337,441 unique affiliation strings and 27,166 unique AFID entries. In Table 2 on page 8, we offer an overview about these number in an institution level. These table contains the number of articles per institution, number of affiliation entries, number of unique affiliation strings (after processing Scopus raw data) and unique AFIDS (proprietary Scopus affiliation IDs).

The Scopus database provides additional information via their proprietary Affiliation ID (AFID) which is supposed to be a unique identifier for institutions at the organization level. Cross checks against our in-house standardization (see below) show considerable deficiencies with respect to completeness and reliability.

Therefore, we developed a routine which directly evaluates affiliations from the Scopus raw data. We created a combined affiliation string from information provided in Scopus. Within a single publication, each author has at least one affiliation which consists of all or part of the following information: country, zip code, city, institution and department. However, when the affiliation does not follow typical affiliation patterns or not all information is present, it is because these fields are incorrectly filled by Scopus. This mostly happens when Scopus cannot clearly distinguish between an institution name at organization versus department level. Additionally, there are cases where the data do not make any sense, even after an intellectual check.

Some examples for the heterogeneity for the preprocessed affiliation strings are given here:

```
che:1211 geneva 4:university of geneva medical school
che:carouge 1227:université de genève section de mathématiques
che:genf:hug universität genf neurologische klinik und poliklinik
che:1211 geneva:université de genève département de physique th
che:1211 genève 4:uni mail universität de geneve fpse
che:ch 1211 genève 4:université de geneève
che:genève:université de genève cui
```

3.2.2 Affiliation Cleaning

We performed an in-depth cleaning of the affiliations for Switzerland. In order to match affiliations, a sub-sample was drawn from Scopus which contains all the affiliations with "Switzerland" or "no country" country code (for the cases where there is no information about the country but may be deduced from the

other information). Subsequently, this subset is parsed using regular expression pattern matching techniques for the individual institutions:

First, all affiliation strings are searched for the exact or nearly exact occurrences of institution names, while not taking into account the information about the city in the affiliation string. These search criteria match entries where institutions either are spread over several locations or the city string is a non standard entry (e.g. for a suburb) or severely misspelled. Affiliation strings matched to an institution are marked. An example, for a department in a different city or when the city is not filled in, is (city field should be after the first colon):

```
che::université de genève laboratoire smv
che::université de geneve department of orthodontics
che::université de geneve section de physique
che::university of geneva hospital cantonal university
che::university and university hospitals of geneva
```

Second, a subset of institutions is selected according to the location of the main campus. The search pattern for the institution is generalized to account for differences, inconsistencies and spelling errors in institution names.

Third, during the matching process, institutions which are clearly identifiable as being different are blacklisted.

After these steps, the results are evaluated based on a predefined decision tree. In the first iteration, results are checked by an independent person and feedback is provided for improving the algorithms. In the following iterations, only cases which are marked as unclear by the decision tree are checked by one to two independent data scientists.

Due to the significant long tail of the remaining affiliations, all the 337,441 affiliation strings cannot be checked manually. Only a sample containing the affiliation strings for 80% of the articles for each institution was manually checked. The rest of the affiliation strings was not manually checked. However, due to the iterative improvement in our matching algorithm, we are confident that the precision of affiliation assignments is acceptable within the general framework of this study.

In this study five universities are working with local hospitals. The scientific output of the local hospital and the selected institution was joined into the given institution. This is the case for the Universities of Zürich, Genève, Basel, Bern and Lausanne.

In the light of the challenges for affiliation matching it was agreed to accept a rate of 5 percent for false assignments. Intellectually checked samples indicate that this is well achieved in general and for the institutions selected. This is corroborated by an even more extensive search for ETHZ based on its zip code only.

3.3 Data Analysis and Reporting

After pre-processing of raw data and standardization of journal titles, publishers, and affiliations, the Switzerland dataset was ready for final analysis. All data aggregation steps were run as scripted SQL-Statements in a PostgreSQL database. Results were exported to CSV and Excel and processed with Python for visualization.

The following definitions are used throughout the report and the accompanying Excel file:

- *article*: records from the Scopus database with the document types "article" or "review"; other document type (e.g. book review, or proceedings) are excluded from the analysis.
- *reprint affiliation*: synonym to corresponding affiliation; usually one per article
- Rankings for publishers and journals are defined by the number of publication in the last publication year (here 2016).

Detailed data can be retrieved from the accompanying Excel file. More Details about the Excel file are given in Appendix C.

Institution	No Articles	No Aff.	No Aff. Strings	No AFID
École polytechnique fédérale de Lausanne	33,370	52,149	25,203	389
Eidgenössische Technische Hochschule Zürich	61,386	97,208	38,849	213
Universität Zürich + Hospitals	58,023	105,974	39,386	586
Université de Genève + Hospitals	39,718	72,760	32,794	381
Universität Bern + Hospitals	38,645	69,160	27,372	296
Universität Basel + Hospitals	35,969	65,235	23,240	683
Université de Lausanne + Hospitals	29,890	54,627	25,982	520
Université de Fribourg	6,681	10,200	3,342	81
Haute école spécialisée bernoise	785	1,099	681	60
Hochschule Luzern	238	353	220	24
Universität St. Gallen	2,221	3,683	1,455	49
Universität Luzern	501	704	267	10
Université de Neuchâtel	5,149	7,863	3,046	52
Università della Svizzera italiana	1,729	2,603	1,140	60
Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz	4,209	6,315	2,505	60
Swiss Federal Laboratories for Materials Science and Technology	5,827	9,468	4,408	176
Paul Scherrer Institut	12,911	18,502	5,548	111
Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft	3,840	5,810	1,959	69
Fachhochschule Nordwestschweiz	1,222	1,801	1,025	130
Fachhochschule Ostschweiz	378	555	376	113
Haute école spécialisée de Suisse occidentale	1,576	2,379	1,495	227
Scuola universitaria professionale della Svizzera italiana	99	140	92	8
Zürcher Fachhochschule	1,405	2,041	1,250	104
Haute école pédagogique des cantons de Berne, du Jura et de Neuchâtel	1	2	1	1
Interkantonale Hochschule für Heilpädagogik Zürich (HfH)	18	32	20	6
Haute école pédagogique de Fribourg	2	2	2	2
Pädagogische Hochschule des Kantons St. Gallen	10	17	11	1
Haute école pédagogique du Valais	1	2	2	1
Switzerland	384,007	798,731	337,441	27,166

Table 2: Number of articles, affiliation entries, unique affiliation strings (after MPDL processing of Scopus raw data) and unique AFIDS (proprietary Scopus affiliation IDs) entries per institution for the period 2001-2016.

4 Results for Switzerland

This section comprises the analysis of the international journal publishing activities for Switzerland. In addition the results for Switzerland is compared to Austria, Great Britain, Germany, United States, as well as to global numbers.

4.1 Open Access Articles

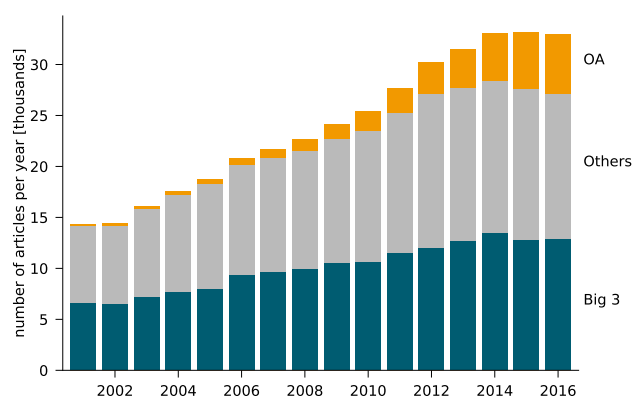


Figure 1: Development of the number of articles with at least one Switzerland affiliation, split into three groups: articles in gold open access journals (gold) and the remaining articles split up into the "Big 3" commercial publishers (green) and other publishers (gray)

For the publication year 2016, Scopus indexed a total number of 1,903,000¹⁰ articles in scientific journals. Authors affiliated with Switzerland accounted for 32,918 of these articles (Figure 1). This corresponds to a Switzerland article share on the world market of 1.7%.

In comparison, United States has a share of 23%, Great Britain of 7%, Germany of 6% and Austria of 1%. From 2006-2016 the global number of articles covered in Scopus changed by 68%. At the same time, the number of articles from Switzerland changed by 58%.

There has been a steady increase of absolute as well as relative numbers for gold open access articles since 2001. Over the recent decade (2006-2016) absolute numbers increased almost 657% worldwide and 818% for Switzerland.

The global share of Open Access articles has risen from 3% to 14% in that period. The share for Switzerland of Open Access articles has risen from 3% to 18% in that period.

The corresponding numbers for the selected countries in 2016 are: Austria 16%, Great Britain 14%, Germany 14%, United States 12% (Figure 2).

We see an overall decrease in numbers for 2016 as compared to 2015, both worldwide and for the selected countries. This is most likely explained by the still incomplete dataset of Scopus for the year 2016 (see section 3.1.1). As outlined in the methods sections, all numbers for 2016 presumably should be increased by 5% to 10%.

References are a good measure for the use of a resource as they imply also the usefulness to the author citing the article. In this

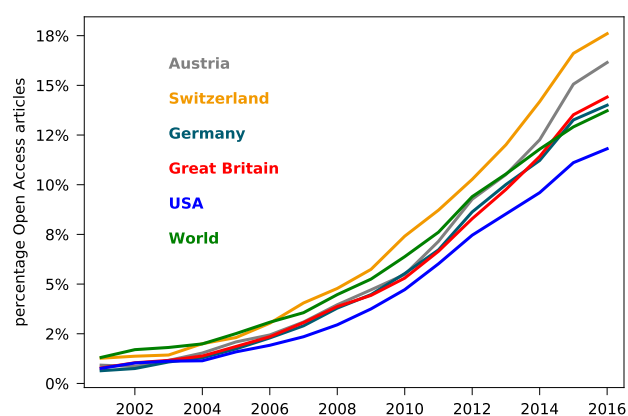


Figure 2: Share of gold open access articles in relation to all articles for selected countries and worldwide.

report, the term "references" corresponds to the citations of an article which appeared up to three years before the citing article. In Figure 3, each reference represents the number of swiss articles (splitted by their publisher type: Big 3, OA, Others) cited from articles of all institutions around the world.

Using this definition we find that the number of references rose since 2001 with an even steeper increase than for the article numbers (Figure 3).

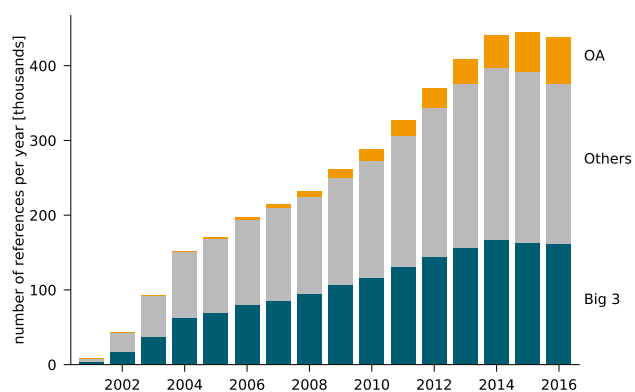


Figure 3: Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see Figure 1)

¹⁰rounded to the nearest thousand.

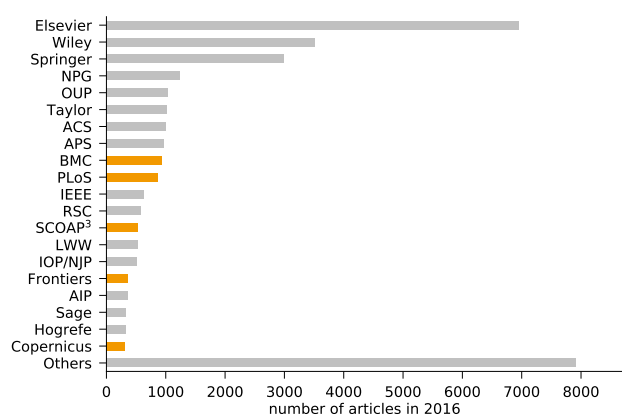


Figure 4: Top 20 publishers with which Switzerland authors published in 2016 – total numbers of articles are given irrespective of the journal type (Open Access versus subscription). Dedicated gold open access publishers are colour-coded in gold.

articles within gold open access journals	
BMC (OA only)	930
PLOS (OA only)	864
NPG	724
SCOAP ³	533
Frontiers (OA only)	360
Elsevier	326
Copernicus (OA only)	312
MDPI (OA only)	245
articles within subscription journals	
Elsevier	6,634
Wiley	3,376
Springer	2,898
Taylor & Francis	1,005
ACS	1,000
OUP	977
APS	905
IEEE	625

Table 3: Top publishers in subscription and gold open access journals. Number of articles in 2016 by publisher ranked top down. Dedicated open access publishers are indicated by "oa only"

4.2 Open Access Publishers

Table 3 and Figure 4 show the publishers that Switzerland authors chose most frequently in the year 2016. For the year 2016, with 21% of the articles, Elsevier is the largest publisher for Switzerland, followed by Wiley with 11%, and Springer with 9%. Nature Publishing Group (NPG) covers a share of less than 4% only. The "Big 3" (Elsevier, Wiley and Springer) cover a market share of more than 41%.

Figure 5 on page 10 show the largest dedicated gold open access publishers in Switzerland. In 2016 the largest gold open access Publishers are Bio Med Central (BMC) (with 930 articles) followed by Public Library of Science (PLOS) (with 864 articles). Immediately after them rank three publishers with respect to the number of Switzerland papers in Open Access Journals: Nature Publishing Group (NPG), SCOAP³, and Frontiers.

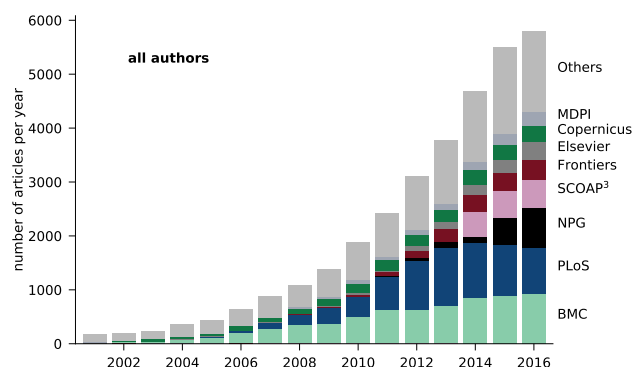


Figure 5: Development of the number of articles for Switzerland in Open Access journals, split into the eight largest Open Access journals for Switzerland and other publishers.

4.3 Open Access Journals

Publisher	Journal Title	#
PLOS	*PLOS ONE	651
NPG	*Scientific Reports	434
APS	Physical Review B	321
EDP	Astronomy and Astrophysics	284
SCOAP ³	*J. High Energy Physics	262
NPG	*Nature Communications	260
EMH	Revue Médicale Suisse	250
APS	Physical Review D	205
APS	Physical Review Letters	199
Hogrefe	Schweiz. Rundsch. Medizin Praxis	148
OUP	MN R. Royal Astronomical Soc.	143
AAS	Astrophysical Journal	137
Wiley	Angewandte Chemie Int. Ed.	133
SCOAP ³	*Physics Letters B	132
Elsevier	Nucl. Instr. Meth. Phys. Res. A	130
NAS	Proc. Natl. Acad. Sci. (PNAS)	121
SCOAP ³	*The European Physical Journal C	115
IEEE	IEEE Transactions on Applied Superconduc	103
ACS	Environm. Sci. Technol.	100
Impact	OncoTarget	100

Table 4: Number of articles in the top 20 journals for Switzerland in 2016. Gold open access journals are tagged with an asterisk.

Merging the data from the Scopus database and in-house standardization data, we identified a total of 10,001 unique journal titles with 384,290 articles in the subset for Switzerland in the time period 2001 to 2016. For the publication year 2016 there were 6,050 journal titles with 32,918 articles found. The top 20 journals altogether published 4,228 articles for 2016 – around 13% of the total number of articles. Thus, we see a very broad distribution with only little concentration towards some prominent journals.

Table 4 shows the journals with most of the articles in 2016. The journal with most of the articles is PLoS ONE, published by PLOS, followed by Scientific Reports published in NPG and the Physical Review B which is published by APS.

4.4 Reprint Affiliations

Subsection 4.1 introduced the number of articles with at least one Switzerland affiliation. However, each article has one affi-

ation which is the so-called corresponding affiliation or reprint affiliation. In gold open access articles there is a consensus that the reprint affiliation is responsible for paying the article processing charge (APC). To understand the cost of an open access transformation, it is therefore crucial to know the number of articles published by reprint affiliations from a given country or institution.

Figure 6 shows the time line for the number of articles by Switzerland reprint affiliations as indexed by Scopus.

The numbers changed from more than 71% in 2001 to an estimate of 53% in 2016 (after correction for presumably incomplete data – see methods section). This is found for many countries and might be explained by the growing number of authors per paper and their international cooperation.

Breaking down the results for 2016 for the Big 3 publishers, the ratio of reprint affiliations is as follows: for Springer (54.7%), Wiley (52.2%), and Elsevier (51.7%).

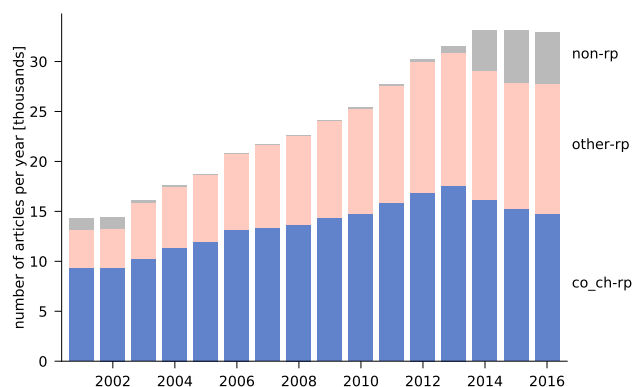


Figure 6: Development of the article numbers with at least one Switzerland affiliation, divided into articles with Switzerland reprint affiliations (co_ch-rp), reprint affiliations from other institutions (other-rp) and missing affiliations (non-rp).

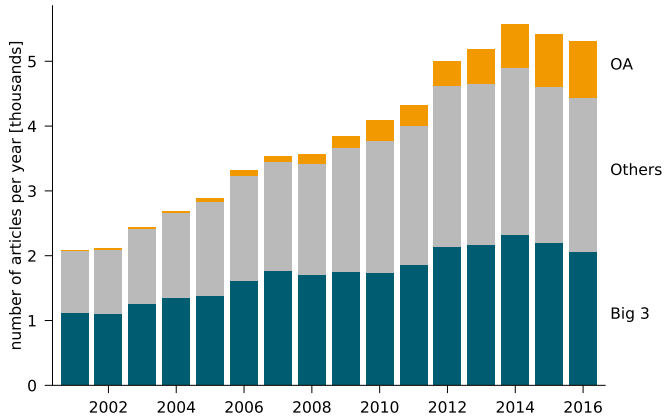
5 Results for Selected Institutions

This section shows the results for the selected individual institution. Together these 31 institutions publish about two thirds of the Swiss articles. In the table 5, Switzerland represent all the articles for the country, while Switzerland - Non-matched records represent all the items from Switzerland that were not mached into the 31 Institutions.

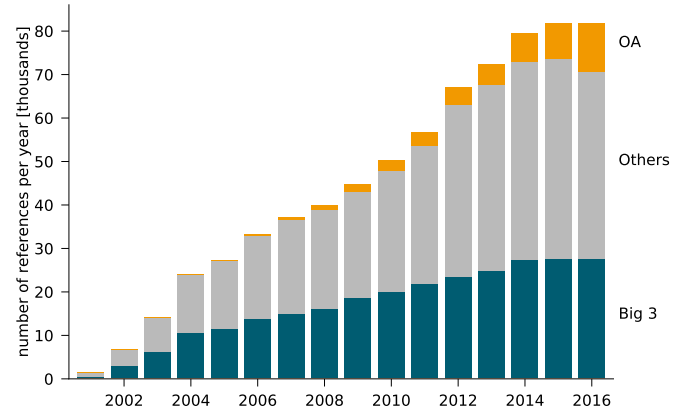
Institution	code	2012	2013	2014	2015	2016
Eidgenössische Technische Hochschule Zürich	eth	5,006	5,182	5,578	5,419	5,308
École polytechnique fédérale de Lausanne	epfl	2,810	3,145	3,177	3,211	2,989
Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz	eawag	368	379	395	386	396
Swiss Federal Laboratories for Materials Science and Technology	empa	507	504	575	692	590
Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft	wsl	305	386	390	402	404
Paul Scherrer Institut	psi	977	1,050	1,229	1,152	1,192
Universität Zürich + Hospitals	uzu	4,833	4,956	5,257	5,212	5,003
Université de Lausanne + Hospitals	chuv	2,402	2,562	2,638	2,866	2,752
Universität Basel + Hospitals	uba	2,820	3,069	3,268	3,175	3,093
Universität Bern + Hospitals	ube	3,075	3,231	3,538	3,576	3,670
Université de Genève + Hospitals	uge	3,239	3,363	3,465	3,350	3,440
Universität St. Gallen	sga	200	211	233	206	203
Université de Fribourg	ufr	504	558	615	751	725
Université de Neuchâtel	une	352	349	380	453	375
Università della Svizzera italiana	usi	172	179	226	215	243
Universität Luzern	ulz	46	53	79	77	84
Haute école spécialisée bernoise	bfh	85	112	127	119	133
Fachhochschule Nordwestschweiz	fhnw	119	117	178	158	182
Fachhochschule Ostschweiz	fho	26	39	37	47	48
Haute école spécialisée de Suisse occidentale	hesso	138	165	198	260	260
Hochschule Luzern	hslu	17	22	33	46	48
Scuola universitaria professionale della Svizzera italiana	supsi	13	10	19	16	24
Zürcher Fachhochschule	zfh	126	170	224	226	249
Haute école pédagogique des cantons de Berne, du Jura et de Neuchâtel	hepb	0	0	1	0	0
Haute école pédagogique du Valais	phvs	0	0	0	0	0
Interkantonale Hochschule für Heilpädagogik Zürich (HfH)	hfh	2	0	4	4	2
Haute école pédagogique de Fribourg	phfr	0	0	0	0	0
Alta scuola pedagogica dei Grigioni	phgr	0	0	0	0	0
Pädagogische Hochschule des Kantons St. Gallen	phsg	1	1	3	2	0
Pädagogische Hochschule Thurgau	phtg	0	0	0	0	0
Bibliothèque nationale suisse	nb	0	0	0	0	0
Switzerland	coch	30,178	31,482	33,093	33,107	32,918
Switzerland - Non-matched records	chother	10,687	10,816	11,318	11,417	11,676

Table 5: Articles with at least one Swiss affiliation, split by institution and publication year. Total shares sum up to more than 100% due to articles jointly published by more than one Swiss institution.

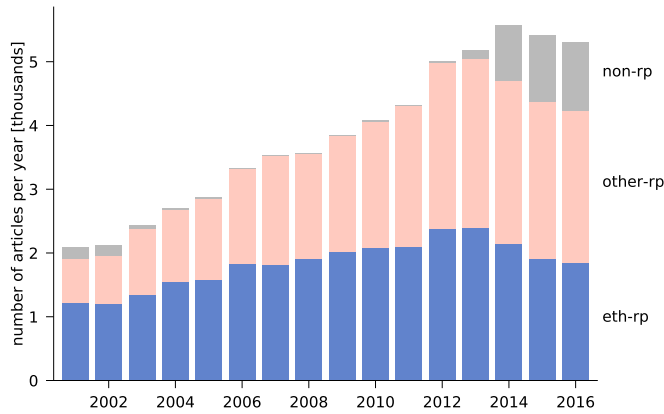
5.1 Eidgenössische Technische Hochschule Zürich



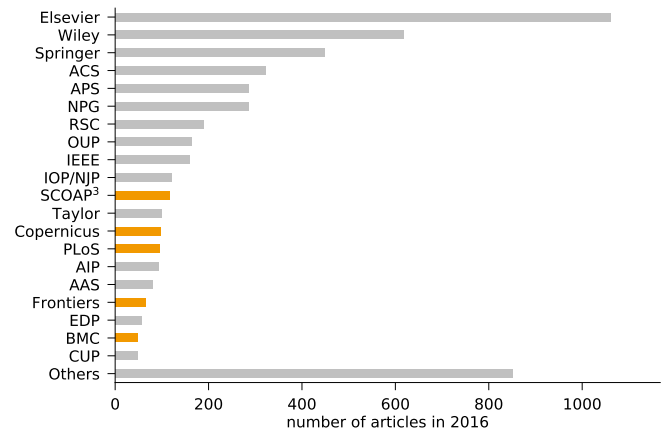
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

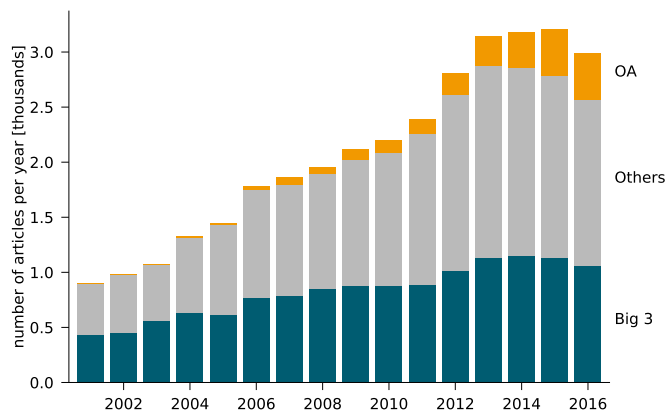


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (eth-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

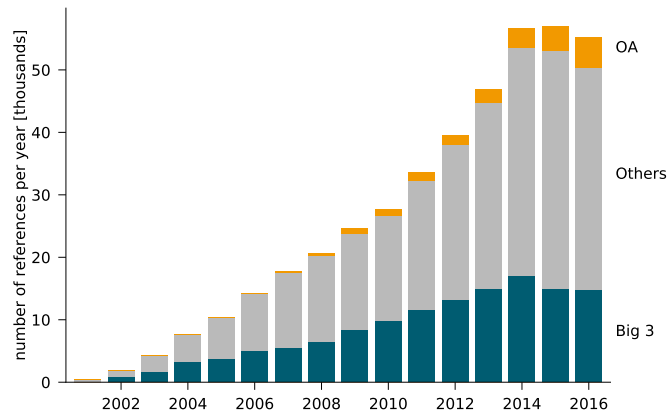


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

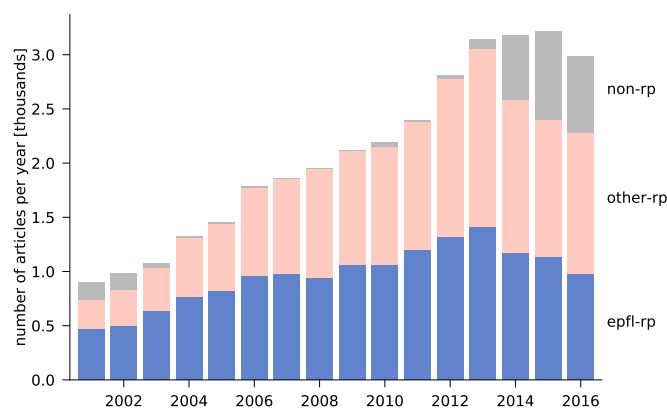
5.2 École polytechnique fédérale de Lausanne



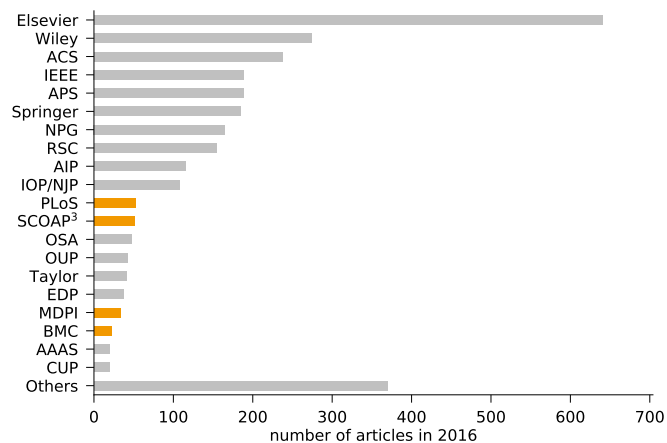
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey)).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

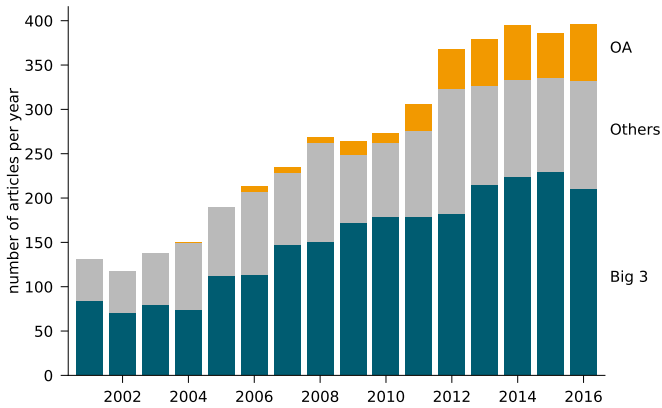


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (epfl-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

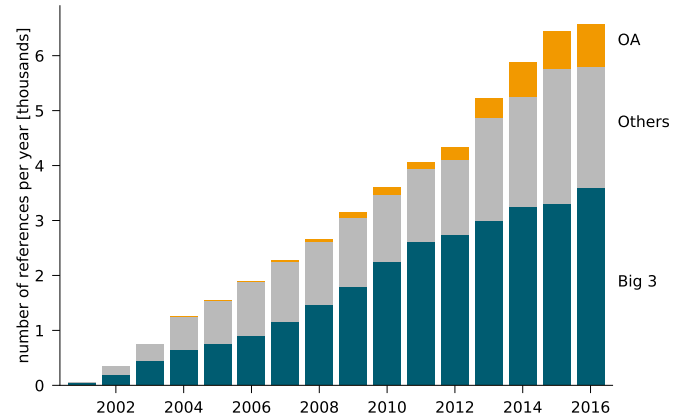


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

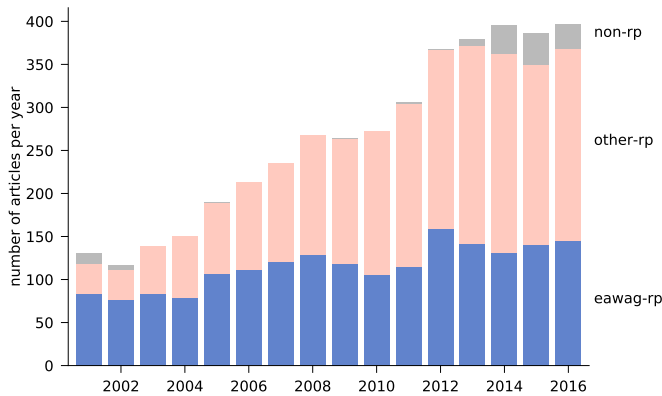
5.3 Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz



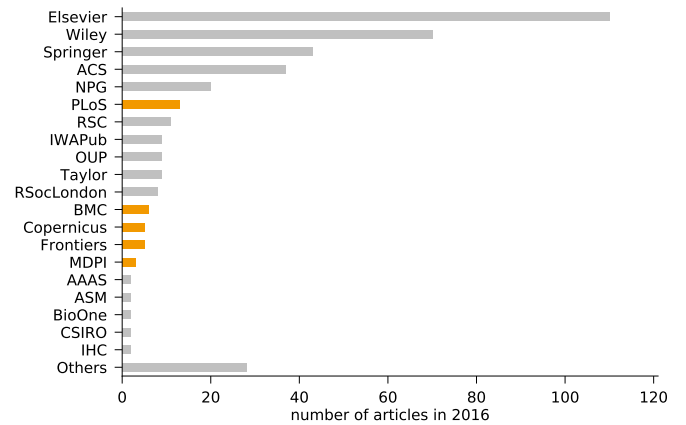
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey)).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

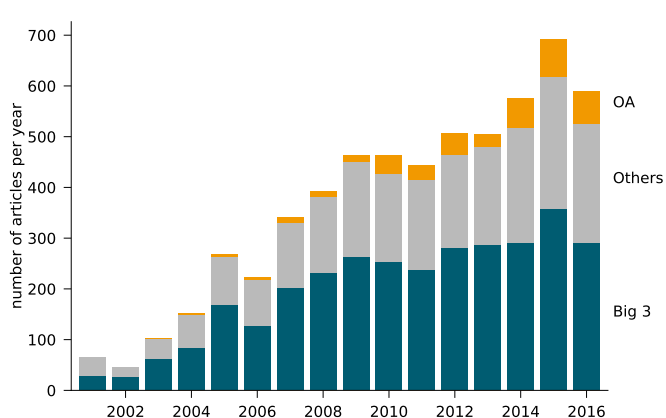


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (eawag-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

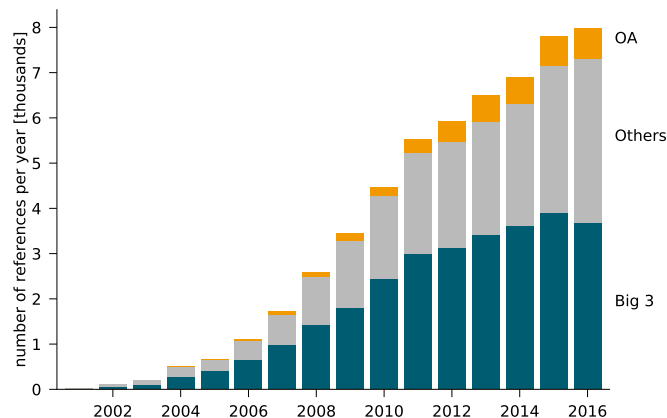


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

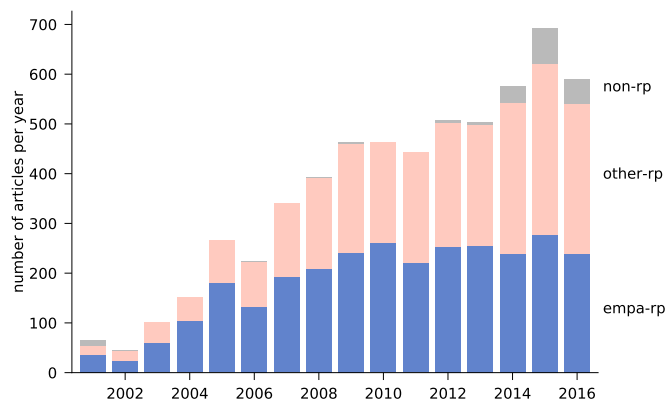
5.4 Swiss Federal Laboratories for Materials Science and Technology



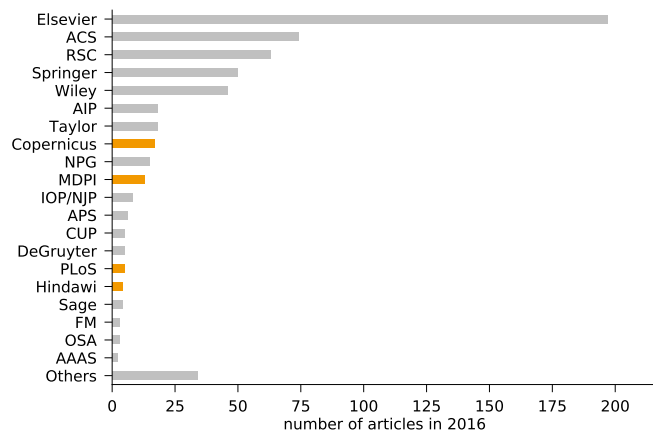
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

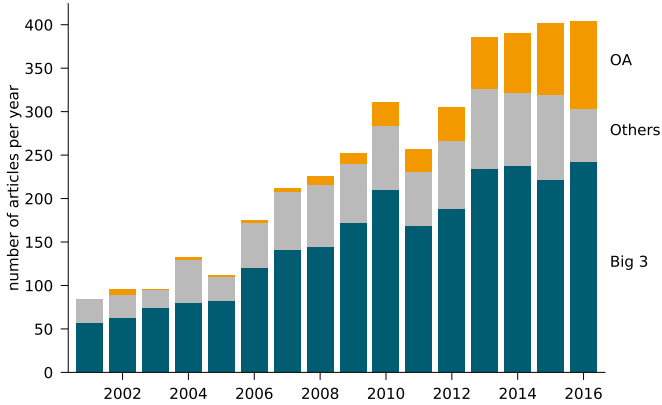


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (empa-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

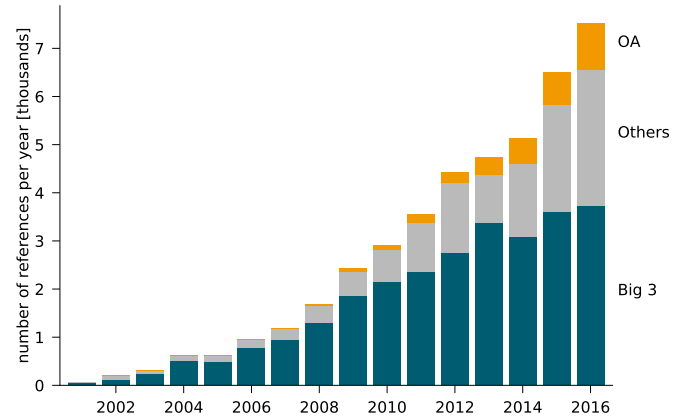


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

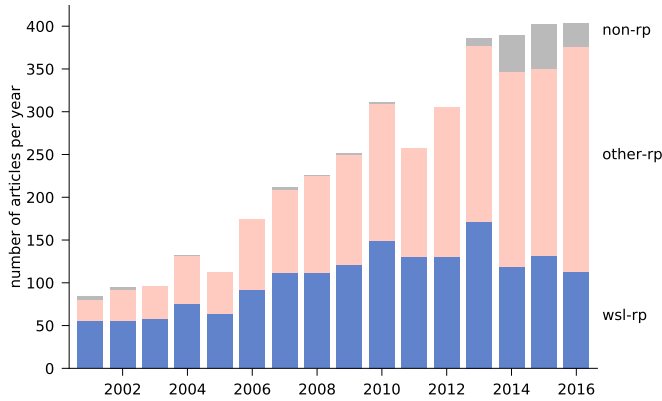
5.5 Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft



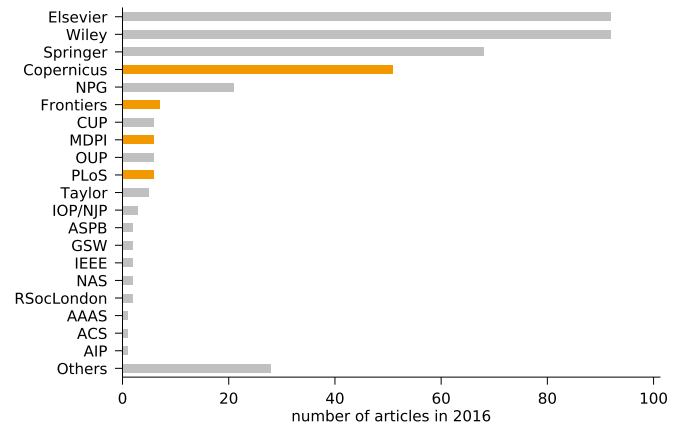
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

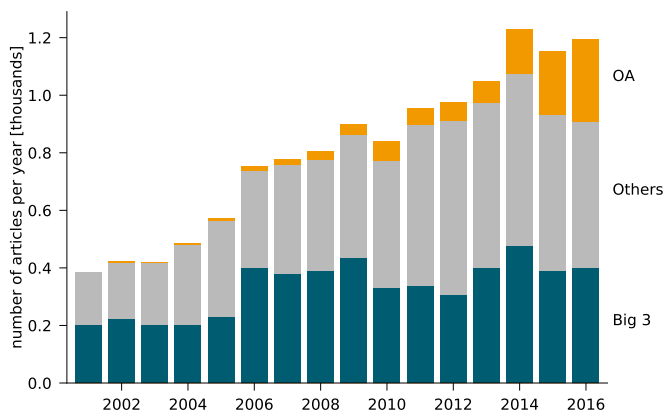


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (wsl-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

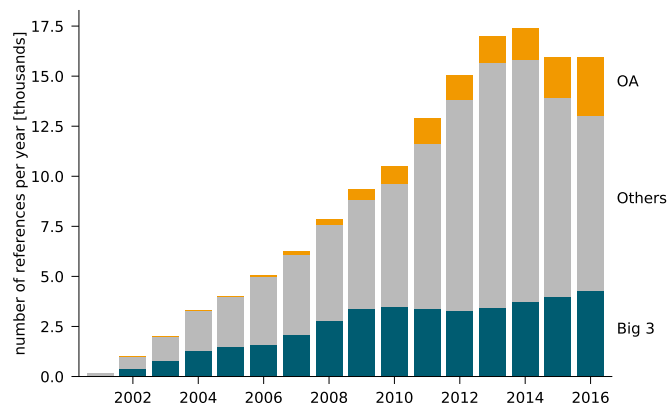


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

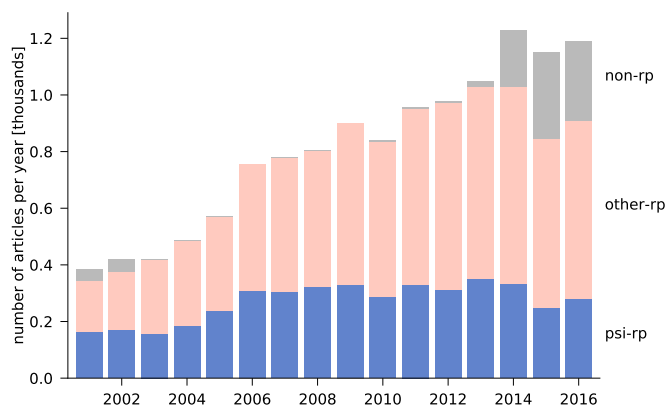
5.6 Paul Scherrer Institut



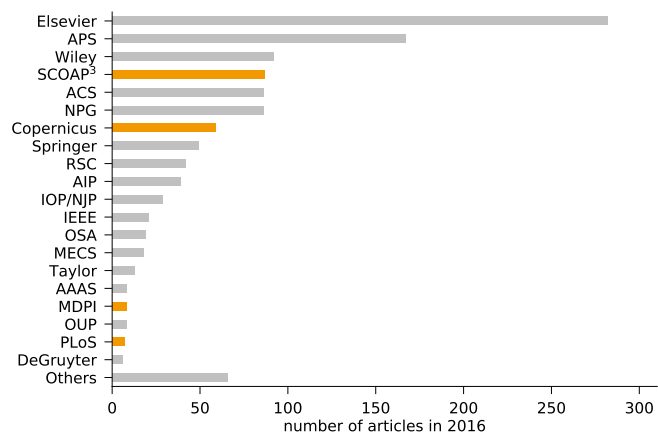
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

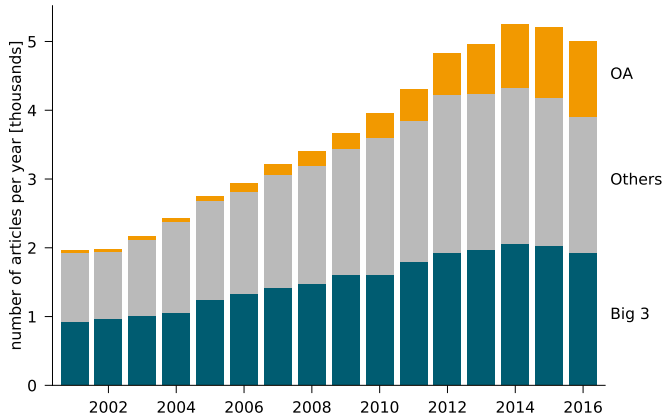


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (psi-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

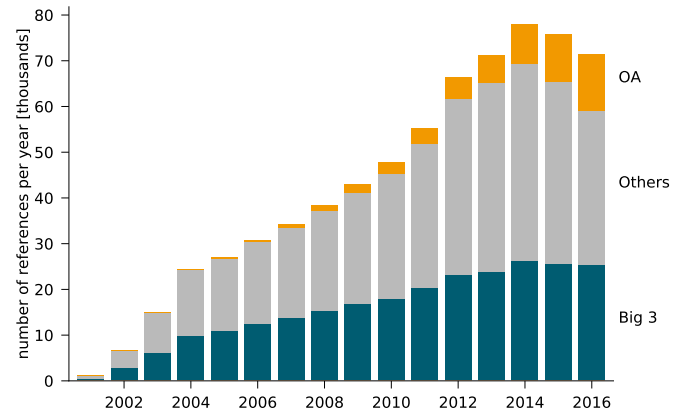


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in gray.

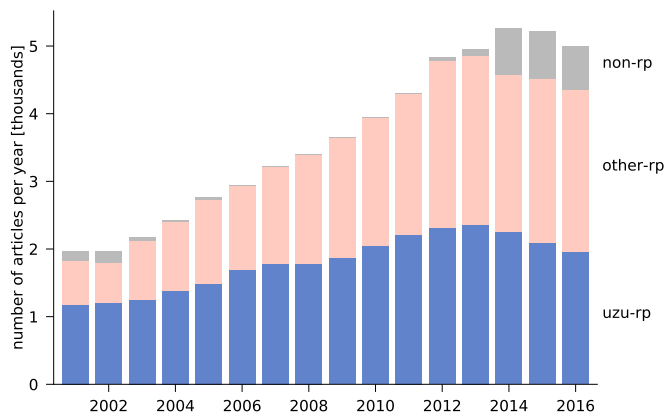
5.7 Universität Zürich + Hospitals



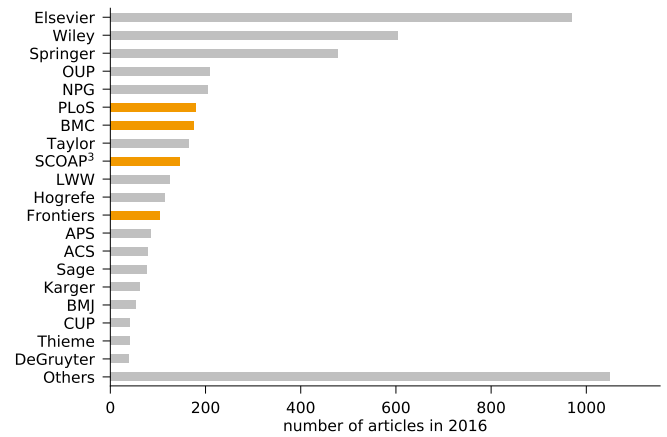
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

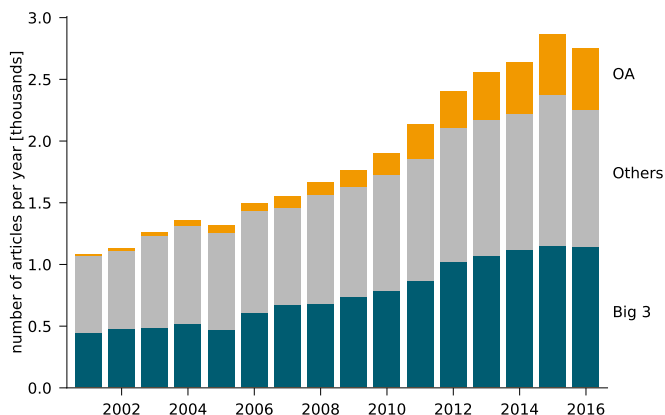


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (uzurp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

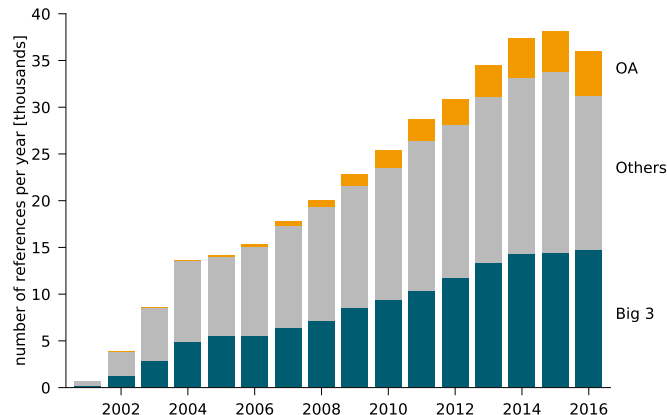


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

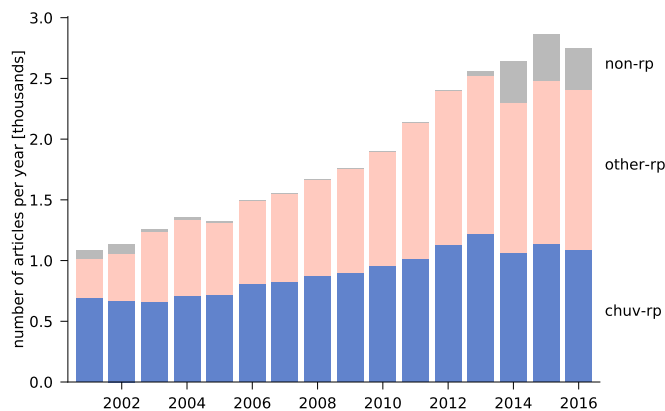
5.8 Université de Lausanne + Hospitals



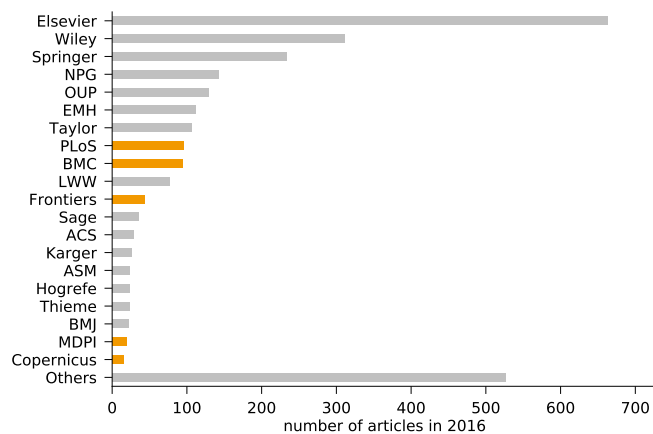
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

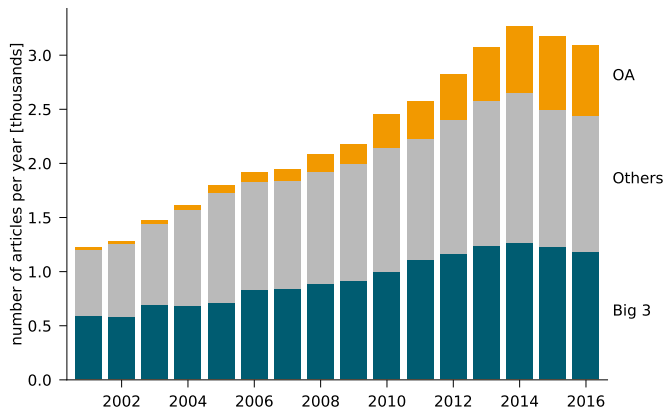


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (chuv-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

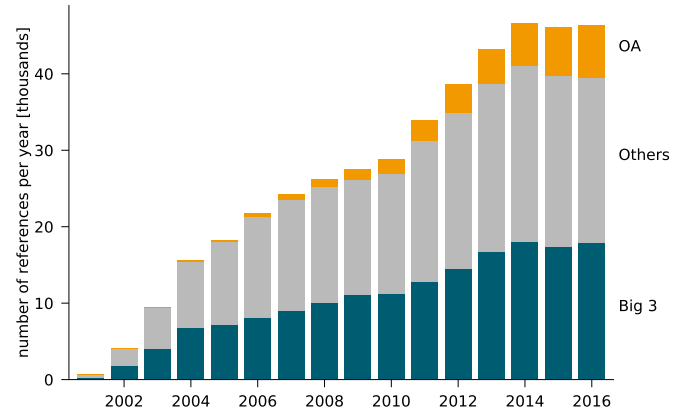


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

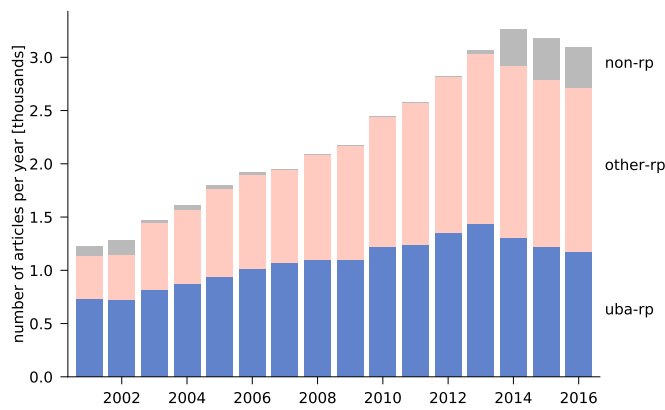
5.9 Universität Basel + Hospitals



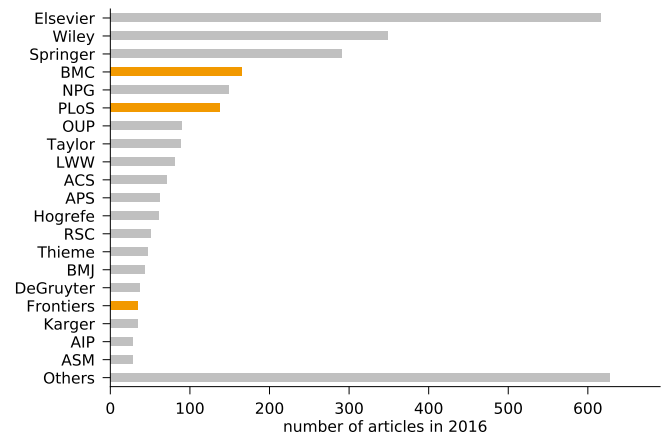
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

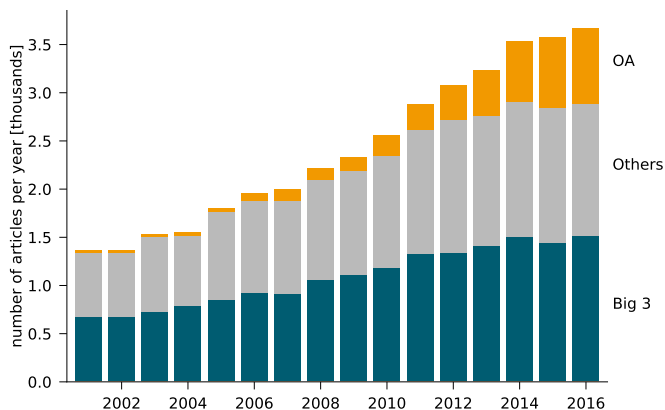


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (uba-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

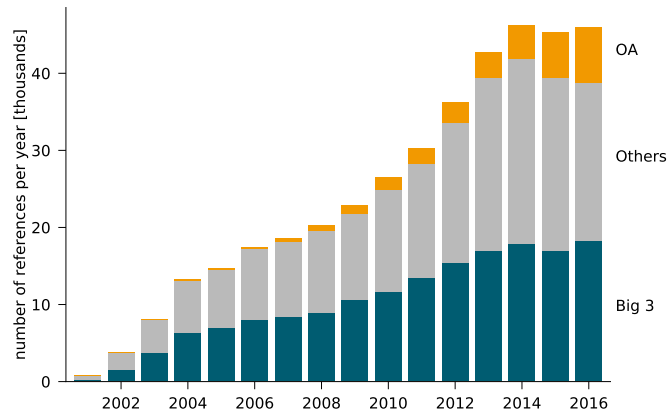


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

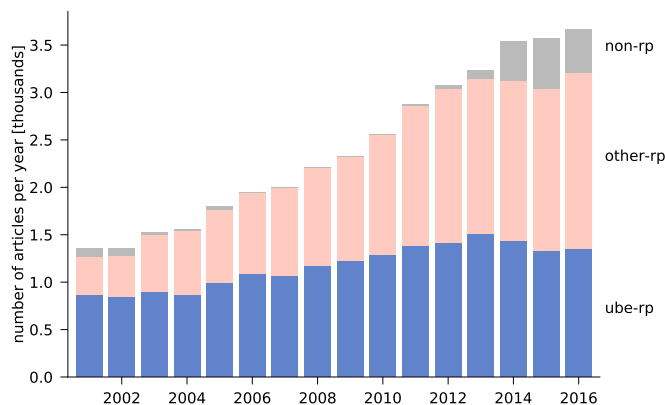
5.10 Universität Bern + Hospitals



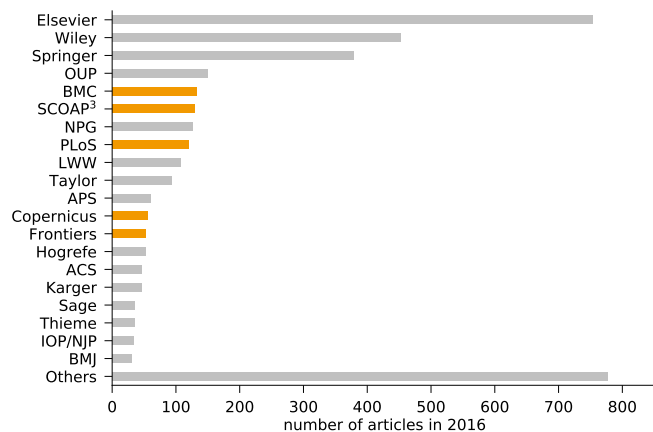
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

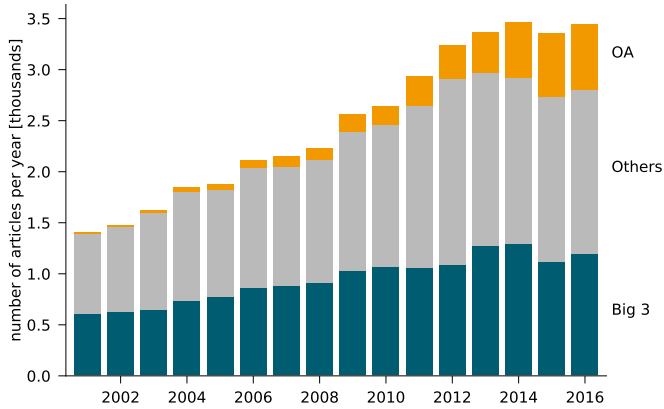


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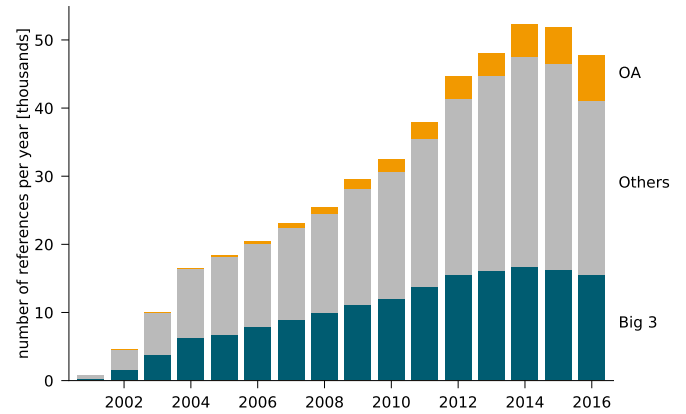


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

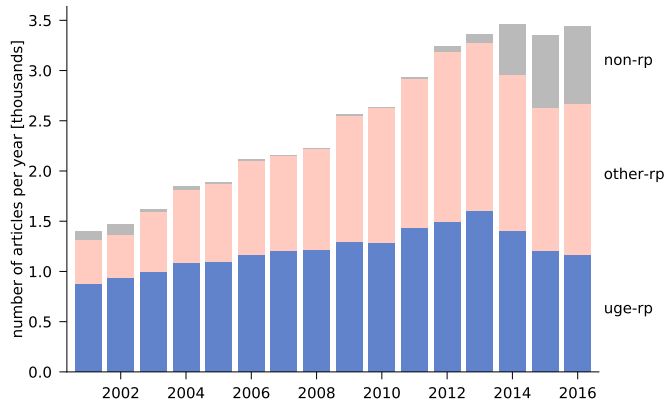
5.11 Université de Genève + Hospitals



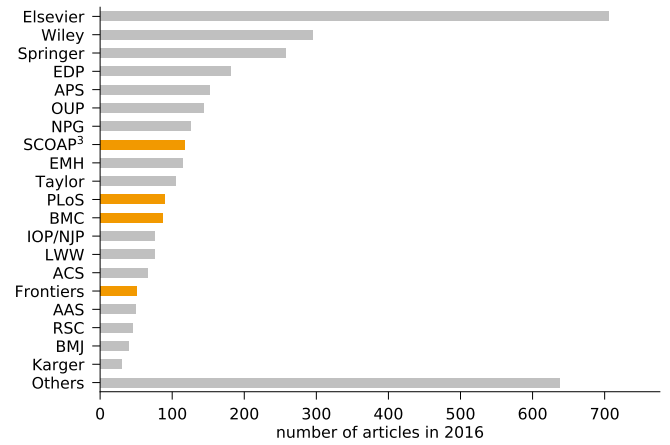
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

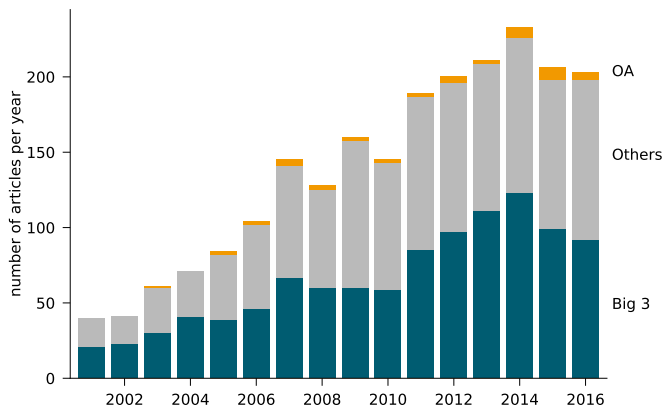


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (uge-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

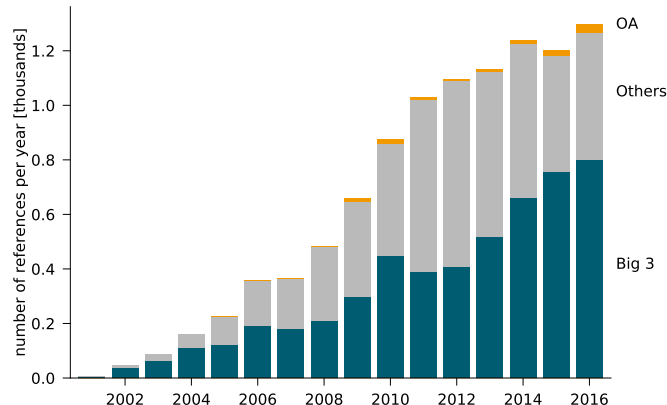


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

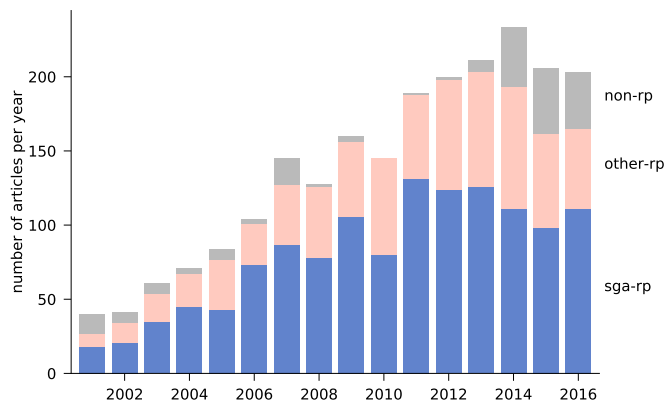
5.12 Universität St. Gallen



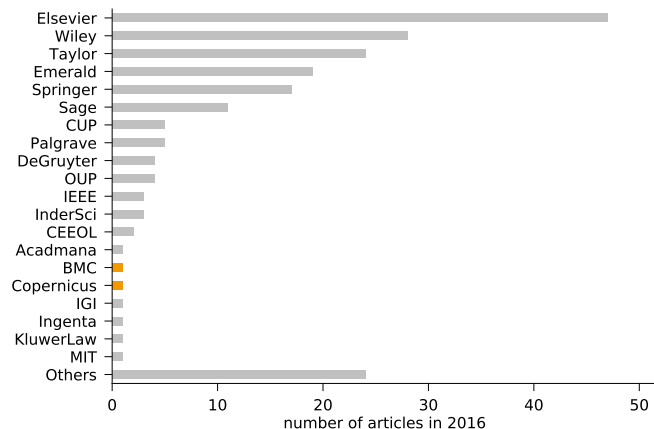
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

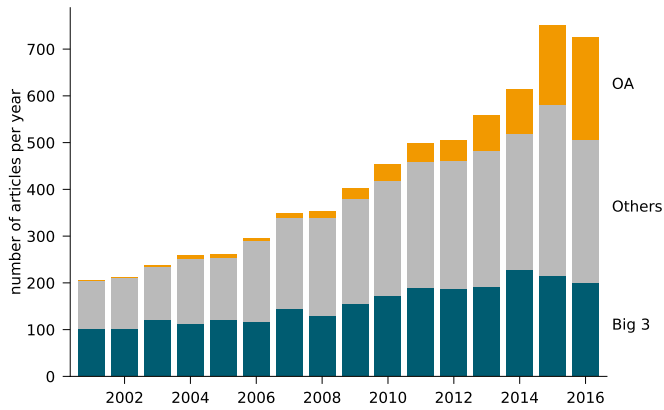


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (sga-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

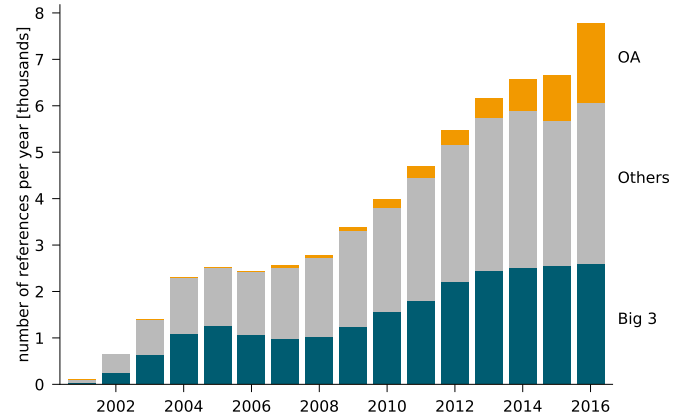


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in gray.

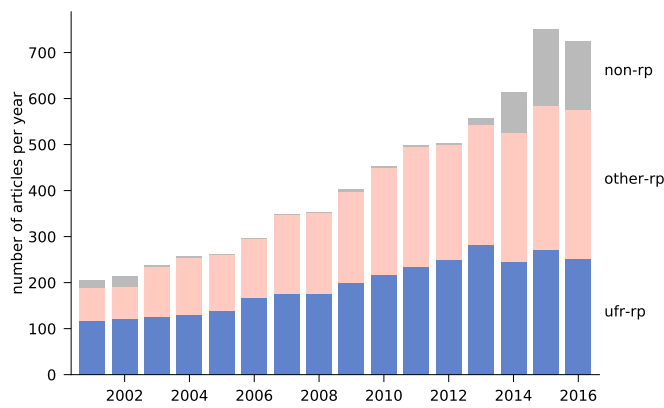
5.13 Université de Fribourg



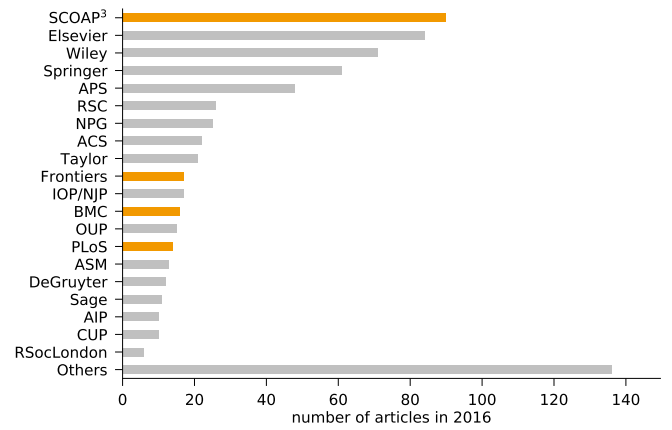
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

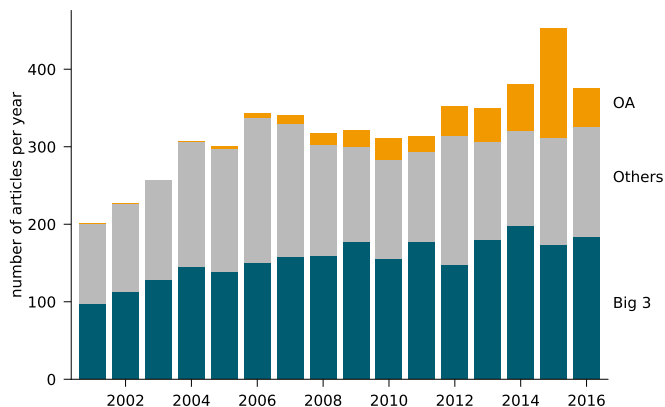


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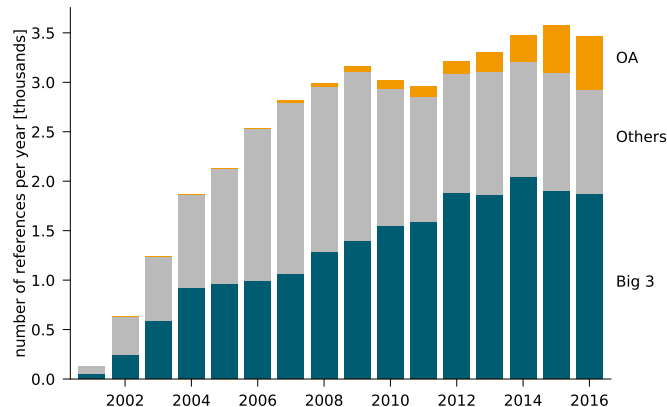


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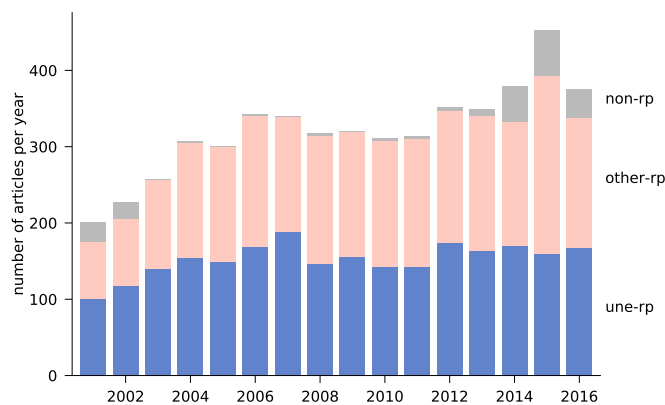
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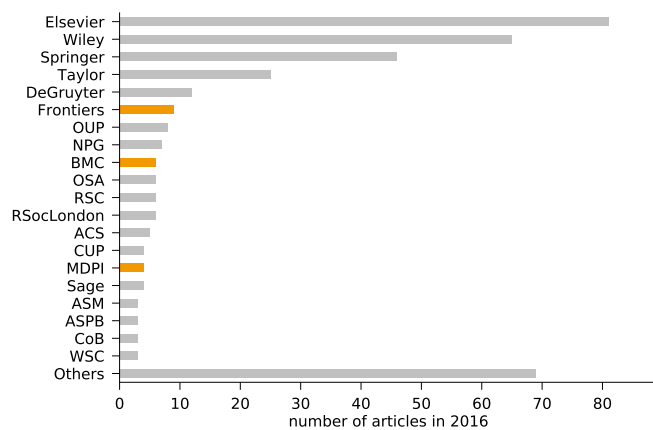
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

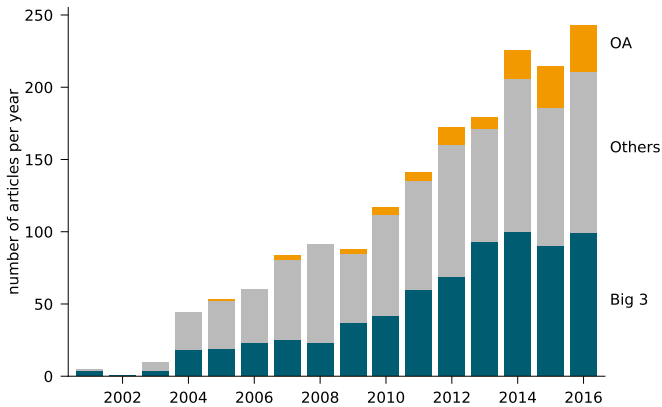


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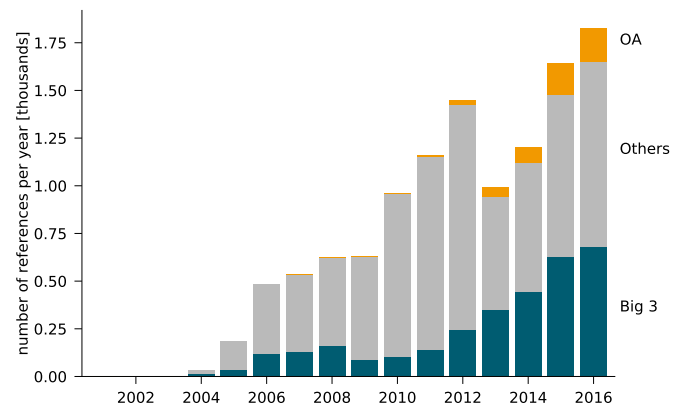


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in gray.

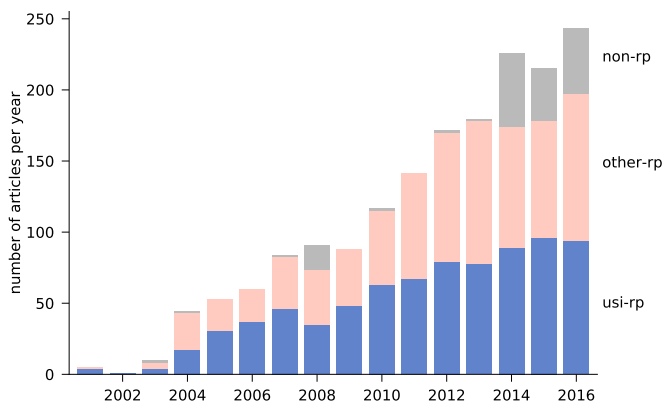
5.15 Università della Svizzera italiana



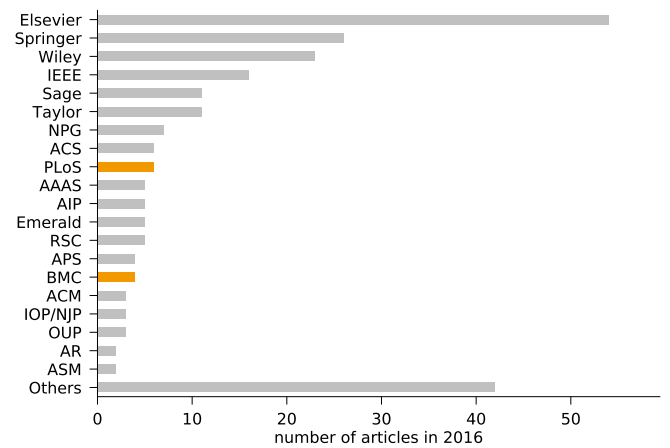
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

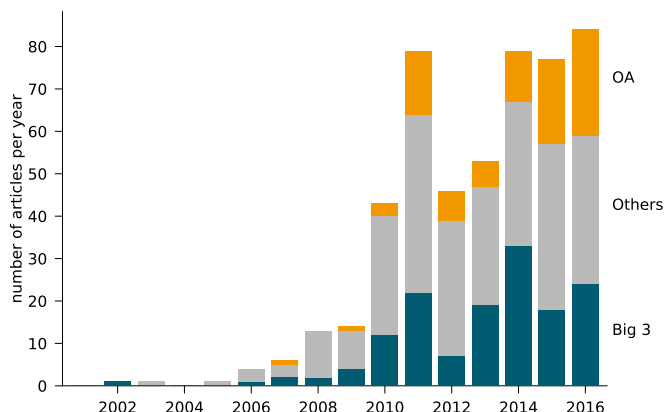


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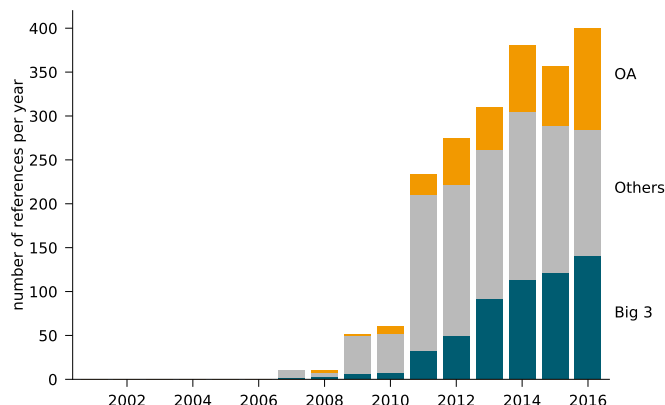


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in gray.

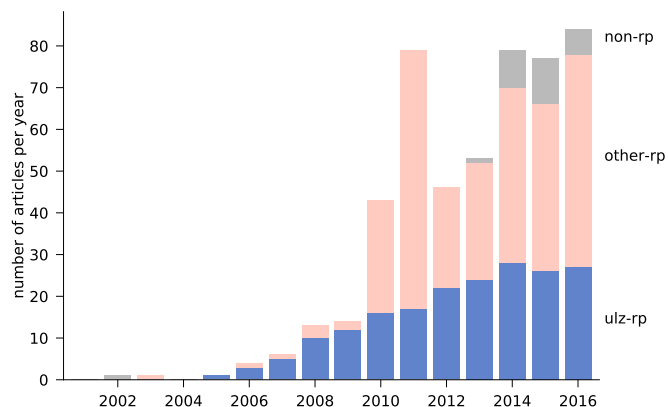
5.16 Universität Luzern



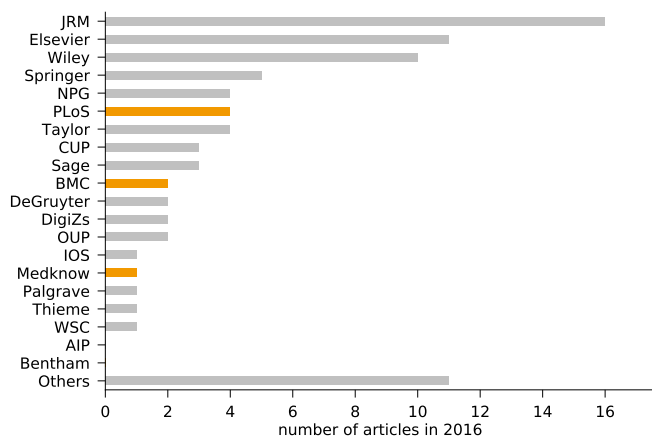
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

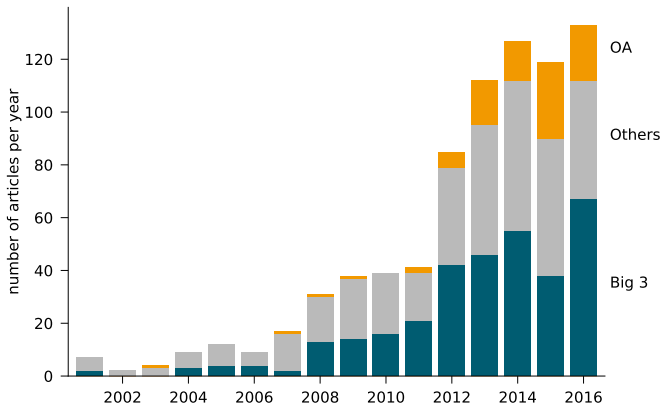


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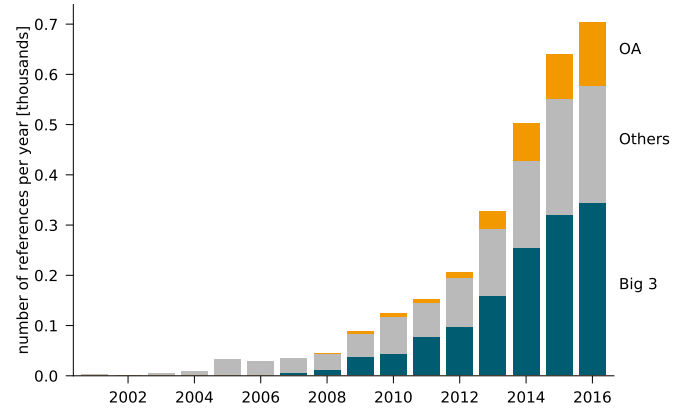


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

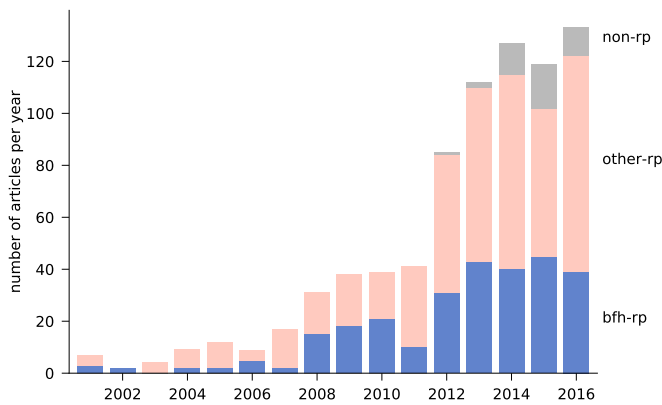
5.17 Haute école spécialisée bernoise



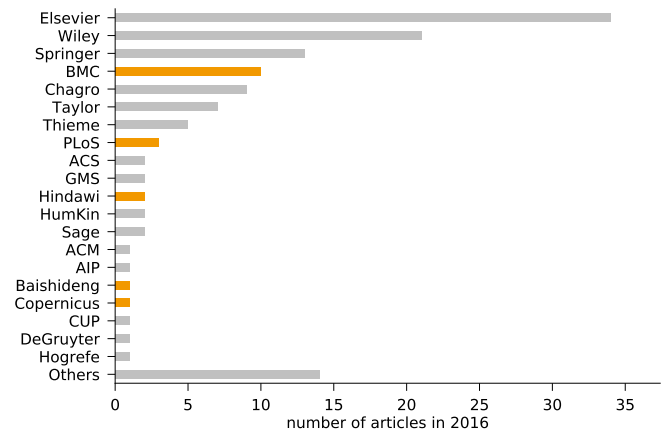
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

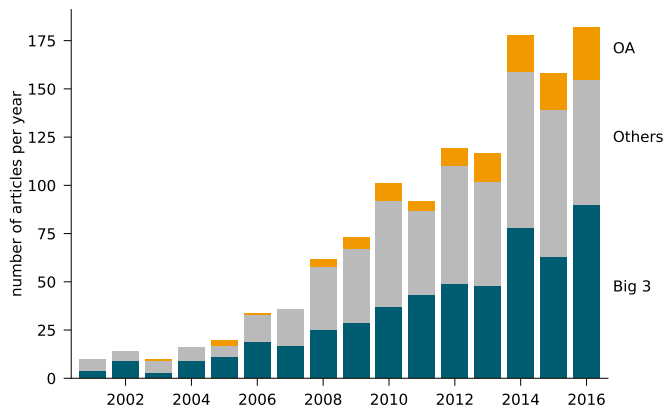


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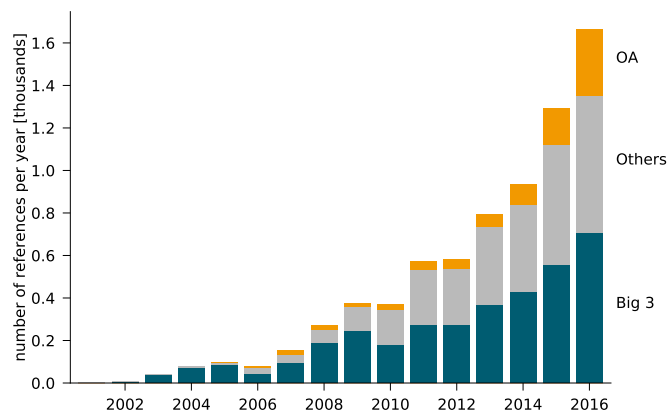


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in gray.

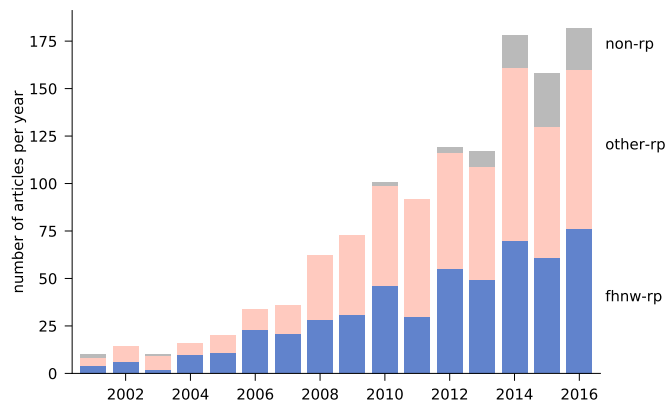
5.18 Fachhochschule Nordwestschweiz



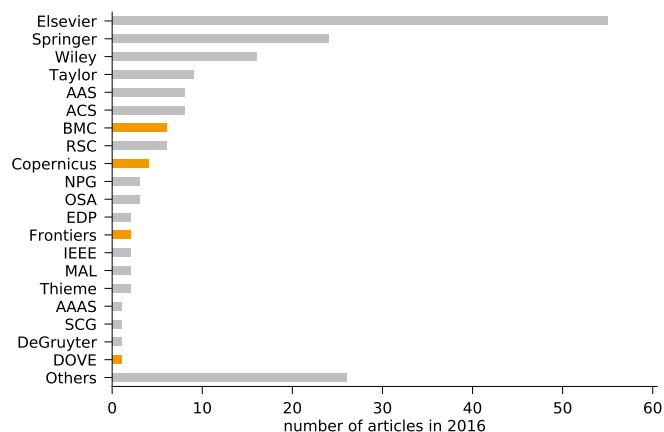
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

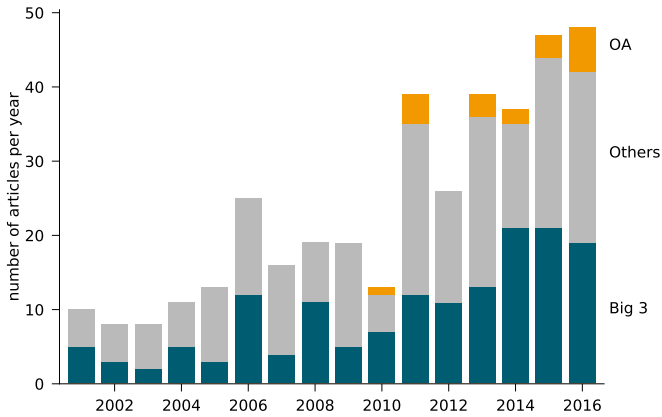


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (fhnw-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

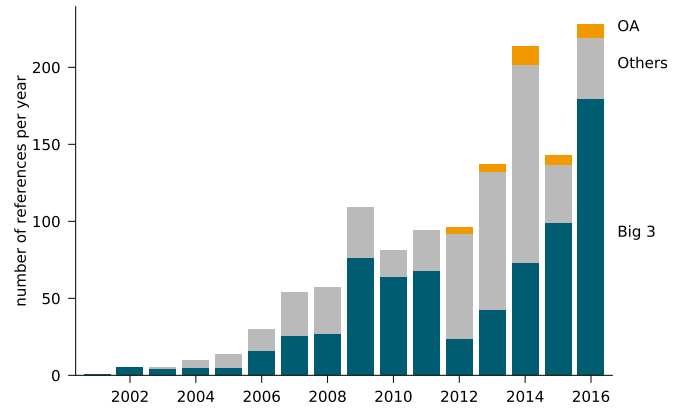


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

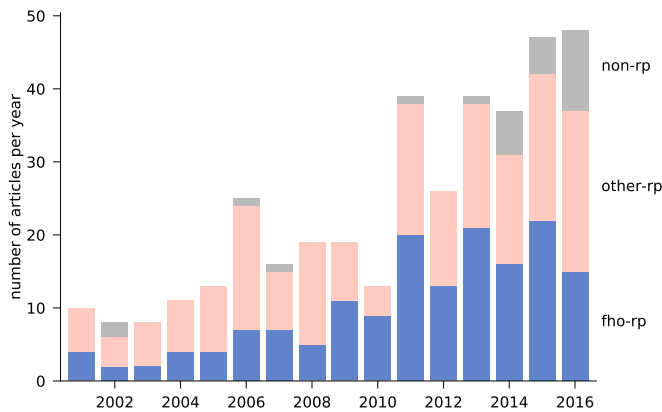
5.19 Fachhochschule Ostschweiz



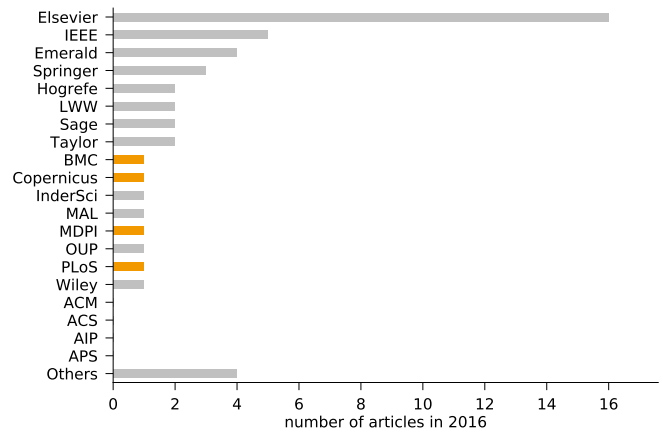
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

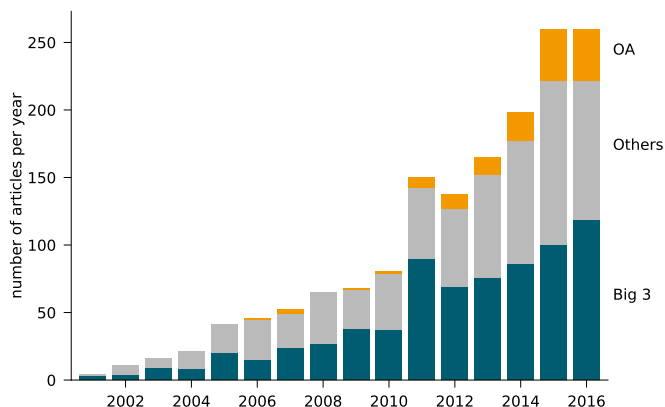


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (fho-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

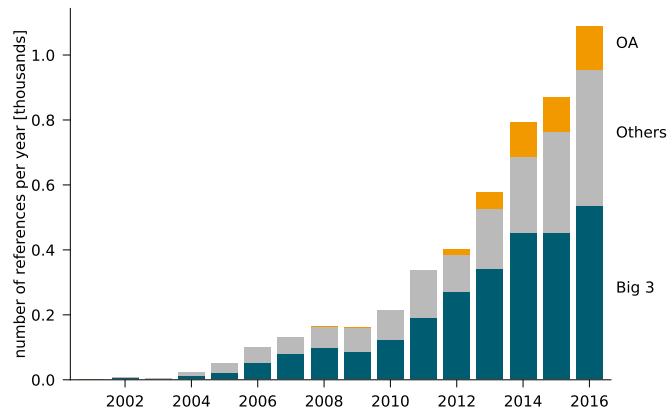


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in gray.

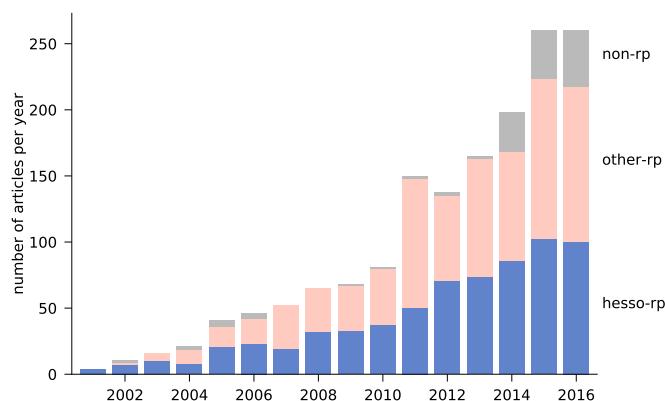
5.20 Haute école spécialisée de Suisse occidentale



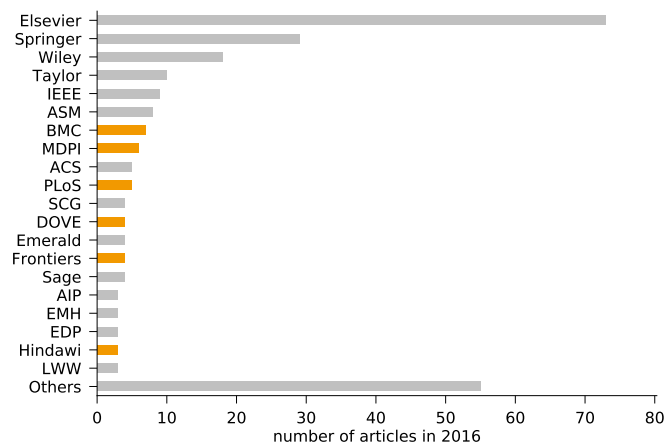
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

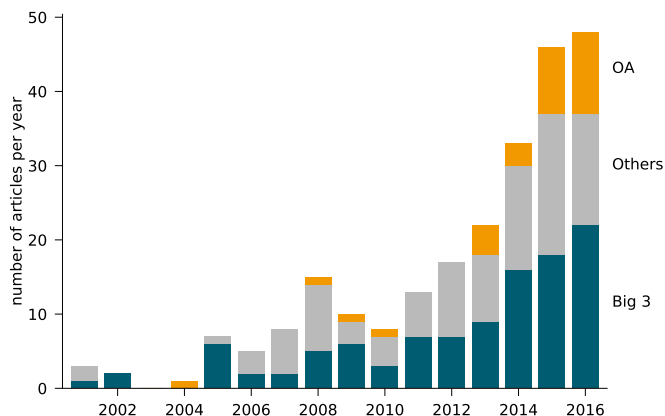


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (hesso-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

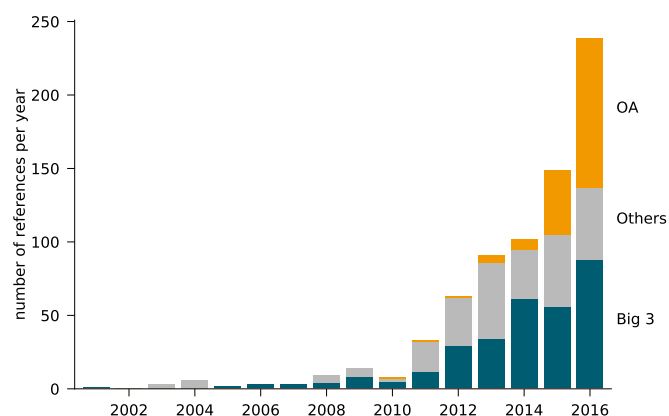


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in gray.

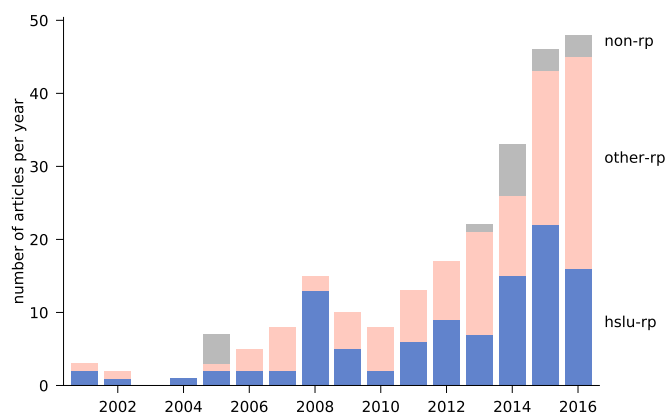
5.21 Hochschule Luzern



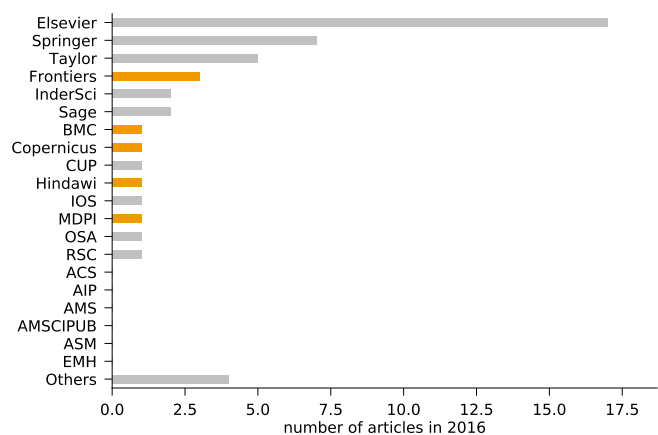
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

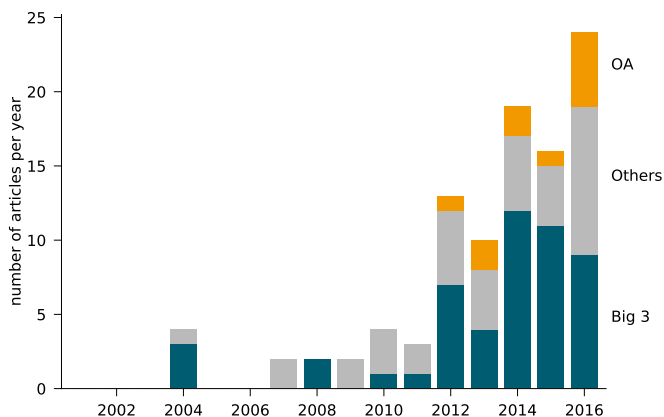


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (hslu-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

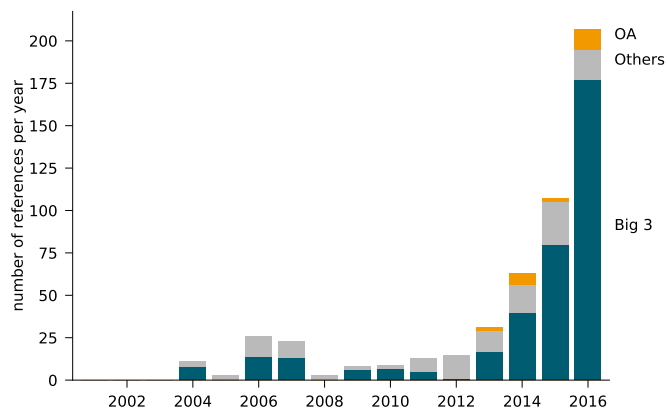


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

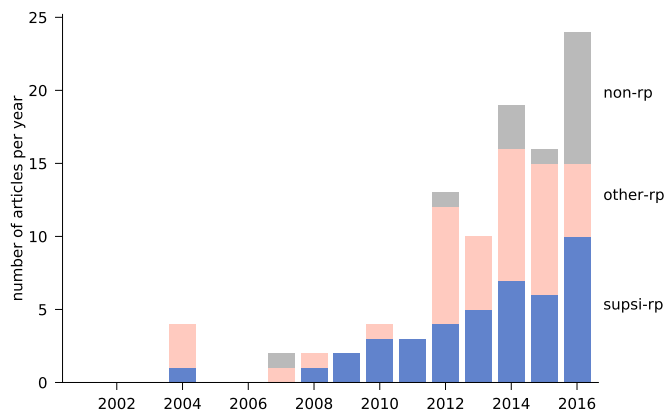
5.22 Scuola universitaria professionale della Svizzera italiana



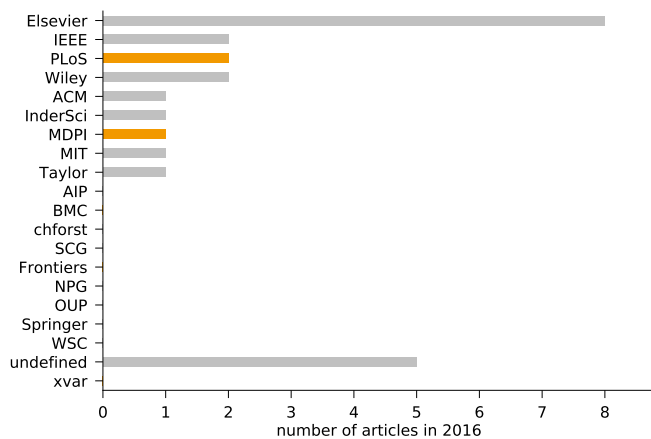
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).

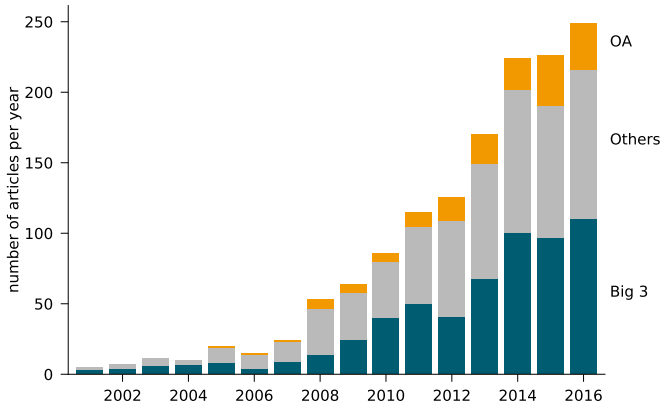


(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (supsi-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).

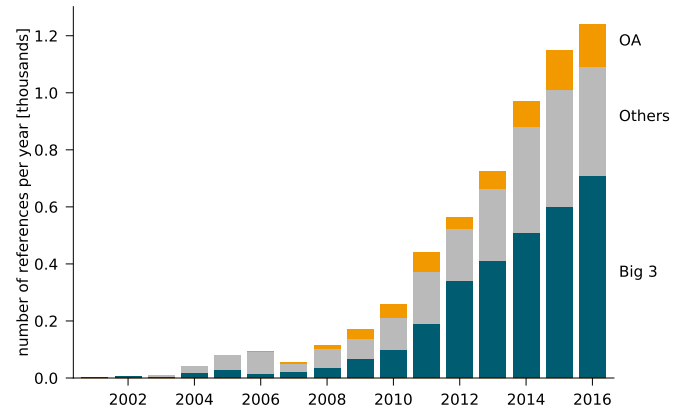


(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in gray.

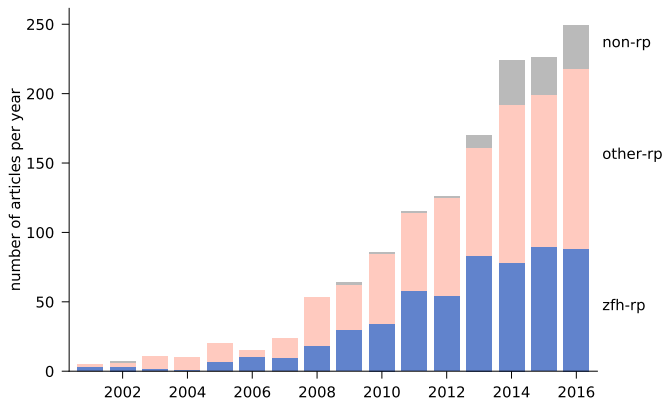
5.23 Zürcher Fachhochschule



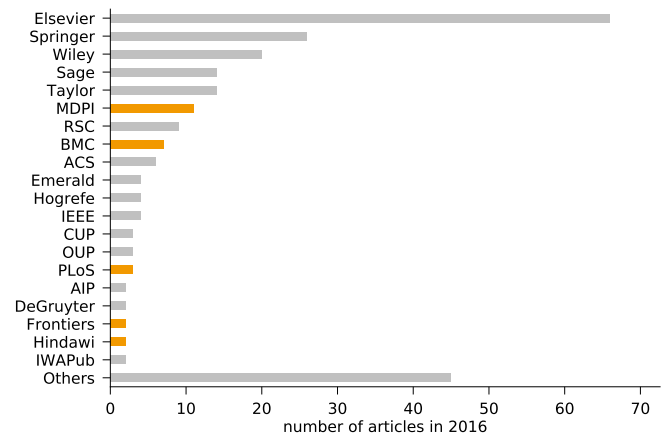
(a) Development of the number of articles split into three groups: (1) articles in gold open access journals and the remaining articles split up into (2) the three large commercial publishers (green) and (3) other publishers (grey)).



(b) Development of the number of global articles referencing articles with at least one Switzerland affiliation, split into three groups (color-coding see (a)).



(c) Development of the article numbers with at least one affiliation of the given institution, divided into articles with the given institution reprint affiliations (zfh-rp), reprint affiliations from other institutions (other_rp) and missing affiliations (non_rp).



(d) Top 20 publishers with which the given institution's authors published in 2016 – Dedicated Open Access Gold publishers are colour-coded in gold. Subscription and mixed publishers (OA and subscription) are colour-coded in grey.

5.24 Education Colleges

The following tables show the results for the seven analyzed Education Colleges in Switzerland and information about the name of each institution.

Institution	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
HEP-BEJUNE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
HEPVS	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
HfH	0	0	0	0	1	0	0	1	0	1	3	2	0	4	4	2
PHFR	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
PHGR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHSG	0	0	0	0	0	0	0	0	0	0	3	1	1	3	2	0
PHTG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6: Development of the number of articles per year for seven Education Colleges in Switzerland.

Institution Abbeviation	Institution Name
HEP-BEJUNE	Haute école pédagogique des cantons de Berne, du Jura et de Neuchâtel
HEPVS	Haute école pédagogique du Valais
HfH	Interkantonale Hochschule für Heilpädagogik Zürich
PHFR	Haute école pédagogique de Fribourg
PHGR	Alta scuola pedagogica dei Grigioni
PHSG	Pädagogische Hochschule des Kantons St. Gallen
PHTG	Pädagogische Hochschule Thurgau

Table 7: Institution name and abbreviation for the seven Education Colleges in Switzerland.

5.25 Switzerland National Library

No matches were found for the National Library of Switzerland

6 Conclusion

Key values on journal publication patterns in Switzerland and the thirty-one selected institutions have been derived from the bibliographic database Scopus (Elsevier) and were enriched with data from the Directory of Open Access Journals and MPDL in-house authoritative files.

The presented numbers highly rely on the data delivered by its primary source, the Scopus (Elsevier) bibliographic database. It covers more than 20,000 journals from a wide variety of scientific domains. Nevertheless, any interpretation should take into account intentional and unintentional biases with respect to coverage and data quality as provided by Scopus. Deficiencies specifically relevant to this study are the lack of country information and missing tags for reprint affiliations for many articles. Our procedures aimed to correct the data adequately.

In the light of the enormous variability of affiliation entries in the database (more than 400,000 unique entries for Switzerland) it is especially difficult to assign articles to the selected institutions. A multistep semi-automatic processing of these entries was successful in identifying institutions within the contracted margin of error of 5%. We expect this level of precision to be sufficient for interpretations at the large scale intentions of the overall program.

The data compiled for Switzerland show a plausible pattern with respect to the dimensions analyzed. Key values are within expected ranges from studies on other countries and institutions irrespective of the data sources used.

Switzerland currently publishes more than 32,000 articles per year that are indexed in Scopus. This corresponds to a share of 2% of the world market. In 2016 we find a share of 18% articles published in gold open access journals, which is at the higher end of a typical range for the countries of interest for comparison. Among all Swiss articles, 53% have a Swiss reprint affiliation recorded in Scopus. This compares well to numbers for Switzerland from Web of Science and other countries of similar size.

The thirty-one institutions selected are affiliated to about two thirds of the Swiss articles in 2016, with articles numbers per institution ranging from zero to more than 5000 per year. Patterns and relative numbers for institutions with less than 500 articles per year (Universities of Applied Science and Education Colleges) should be interpreted with caution as random influences might be predominant.

From these data it can be estimated that approximately half of the Swiss articles would be chosen for article processing fees (APCs) to be paid by Switzerland. Using data ¹¹ from the German INTACT project ¹², a median APC of EUR 1,500 per article would be a good estimate for current costs. Based on these assumptions, we would calculate a total APC cost of EUR 25M for international Swiss research articles. Among that a fraction of estimated EUR 4M (18%) already now is spent via gold open access channels.

We hope that the data presented fit into the overall framework of the main project on the analysis of the open access landscape in Switzerland and help to shape strategies for enforcing steps towards this publishing model.

¹¹Jochen Apel et al. (2014ff): Datasets on fee-based open access publishing across German institutions. Bielefeld University. <https://github.com/OpenAPC/openapc-de>

¹²<http://intact-project.org/>

Acknowledgments

This study was made possible by data made available by the Kompetenzzentrum Bibliometrie¹³ which is supported by the German Federal Ministry of Education and Research (BMBF), under grant number 01PQ17001. We gratefully acknowledge the helpful and indispensable work in manual quality assurance and institution normalization of our student assistant N. Nguyen.

¹³<https://www.bibliometrie.info>

7 Appendix

The appendix is composed by all the tables from the accompanying MS-Excel file.