

# Is open access still open: the case of article processing charge

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**Abstract.** *Open access (OA) is one of the most important initiatives in scientific publishing in modern age. Over time, its initial conception has gradually been altered by major scientific publishers which introduced changes in OA including article processing charge, a fee which covers preparation, publishing and archiving of scientific content. This paper presents results of an original research of presence and granularity of article processing charge in two major OA databases and at five major scientific publishers. The results indicate that while this fee represents a growing source of revenue for publishers, it also represents a growing problem for authors.*

**Keywords.** Scientific publishing, open access, article publishing charge

## 1 Introduction

Careers of scientists depend on published results of their research. Publishing is important because “to assume their true value, scientific results should be shared for the benefit of all” (Velterop, 2003, p. 113). Scientists publish their research results in many different publications in paper or digital format choosing carefully publications which will have a positive impact on development of their career. The process of publication of results of scientists’ work is burdened with financial, organizational, technical and other problems from the moment they hand over manuscripts of articles till the moment of actual publication of those articles. One of the biggest problems is most certainly fee based publishing and later on access to published articles in scientific journals (charging one time fees for articles or annual subscriptions for journals) which created a big scientific journal crisis during the 20<sup>th</sup> century when journal subscription prices plummeted. To solve this problem, scientists started experimenting with a new concept of free access to scientific literature at the beginning of the 1990s. The term open access was

coined a bit later, at the beginning of the new century around year 2000 (Laakso and Björk, 2013). From its beginnings, open access was introduced as a crucial initiative with aim to facilitate access to the corpus of scientific articles and to make it “equally available to anyone, anywhere free of charge at the time of publication” (Arndt, 2006, p. 1). Free of charge use of scientific articles maximize their impact, minimize redundancy, speed up scientific progress, and help authors and publishers to make their research easy to access (Lawrence, 2001). Open access also “fulfils the requirements that are increasingly being imposed by funders to make the products of their funding publicly available” (Philips, 2005). Finally, open access allows authors to freely distribute, anthologize, and repost their work while retaining copyright (Philips, 2005).

After the initial phase of the development, open access has become an area of broad interest in which the growing number of scholarly open access journals started to make their content available online to anyone thus helping solving the access challenges posed by subscription scientific journals (Solomon and Björk, 2012, p. 1485).

In spite of the growing popularity of open access in promotion and actual providing free access to scientific journals with no barriers at all or with very few of them, a number of scientific journals decided to make the case for open access harder by rethinking and implementing new revenue models and by introducing different new models of payment for authors, readers, or both. One model has caught a special attention of the global scientific community and this is introduction of article processing charge - obligatory payment for authors in some open access journals who wished to publish their articles in them. Kingsley (2014) confirmed existence of such a trend of introducing payment for authors in scientific publishing claiming that “payment for publication is an increasingly prevalent component of the scholarly publishing landscape”. Asking authors to pay article processing charge is now nothing new and many journals commenced this practice at least a decade ago. The main problem with it is that such a form of payment

puts a substantial burden on authors unable to pay for it by themselves. As this situation continues, scientists (authors) have a difficult task of searching for and choosing journals in which they will be able to publish their work and later be able to access the same journal content freely. Solomon and Björk (2012) investigated factors upon which authors decide where to send their manuscripts and ranked them by their importance: (article should) fit with the scope / quality / impact of the journal, it should provide speed review / publication, it should fit the type of readership, it should offer open access and provide reasonable likelihood of acceptance. As we can see, open access is among one of the major factors in the process of choosing a journal for publication. Other factors include high impact of the journal or proceedings in academic community, visibility of their publication in scientific community, long term preservation of published works and existence of possible article processing charge. Scientific journals charging for article processing or that do not help authors in making a decision where to publish their article make authors can substitute one journal for another in order to get the best deal (West, Bergstrom and Bergstrom, 2014). Being an important factor for choosing a scientific journal for publication of articles, article processing charge is in focus of this paper as a verified problem for authors.

## 2 Open access publishing

Generally speaking, open access publishing should be free. The question is – is it?

Being a part of the open access initiative, scientific publishers usually follow several models of publishing and access to scientific articles. Usually, they are divided in two large groups: articles that are directly provided by the journal publisher (gold open access), or indirectly by being uploaded and made freely available somewhere else on the Web (green open access) (Laakso, Björk, 2012). There are also other models of the open access initiative which include a bigger number of choices (such as embargo on access etc.) (Open Access: Types of OA).

This paper puts focus on gold open access and its submodels. In the first submodel, open access material is freely available immediately after the publication and such journals do not charge publishing fees and this is the best model for readers. In the second submodel, there are subscription journals that make individual articles available after payment and this model of access is called hybrid open access (Björk, 2012) as these journals charge for access to some of their articles while other (selected) articles are available free of charge. Hybrid model is also called paid open access, because it “refers to subscription journals with open access to individual articles usually when a fee is paid to the publisher or journal by the author, the author's organization, or the research

funder” (Open Access: Types of OA). In the third submodel there are subscription journals which allow access to published content after a delay or embargo (Laakso and Björk, 2013) which could last differently. According to The Publishers Association Decision Tree in the UK (The Publishers Association Decision Tree), the access delay could be between 12 and 24 months long in absence of payment of a fee. If the authors or their institution or some third party decide to pay the fee, the article will become available in open access immediately. This fee is usually called article processing charge and “covers the publisher's cost of production, so that readers or their libraries don't have to cover those costs through subscriptions” (Suber in LaGuardia 2015, p. 18). But, is this really so?

## 3. Article processing charge

According to Solomon and Bjork (2012), article processing charge appeared for the first time in 2000, a an alternative to the journal subscription (Tamber, Godlee and Newmark, 2003). Since then, article processing charge can be found mostly in medicine (STM) fields where it is the most common source of funding for scientific journals (Solomon and Björk, 2012). During the same period from 2000, the number of journals charging authors article processing charge has rapidly risen and “some journals have reached a high scientific status in their field” (Shen and Björk, 2015).

Two publishers, Library of Science (PLoS) and BioMed Central (BMC) were among first to establish journals that introduced article processing charges which were paid by the authors, their institutions, funders or by some research grant. In this way fee based journals managed to finance their operations. In his article on open access and article processing charge, Arndt (2006) counted reasons for applying article processing charge (in medicine): it pays for developing and maintaining electronic tools for peer review and publication, it pays for preparation of article in various formats for online publication, it secures inclusion in databases like PubMed as soon as possible after publication, it secures full text inclusion in a number of archives for long term preservation, it secures inclusion in linking tools enabling electronic citation in other journals that are available electronically, and it facilitates immediate world-wide barrier-free open access to the full text. During the last decade, a number of scientific journals accepted article processing charge. Crawford (2015) analysed changes in number of open access journals in the Directory of open access journals (DOAJ) charging article processing charge and found out that their number sharply increased in 2006–2007. During the same period more than 25 percent of new open access journals started to charge article processing charge. The same author found out that the percentage of free journals dropped sharply “from 2006 through 2010,

with 2008–2009 and 2010–2011 being the only two-year periods in which more than a thousand new open access journals emerged” (Crawford, 2015, p. 16).

While some authors are able to cover article processing charge, others send their article manuscripts to journals which do not apply such a fee thus potentially making their articles less visible (depending on the journal rank at major publishers, in major bibliographic and full-text databases and in other relevant information resources). Another solution is finding financial resources which will cover the publishing fee. Journal which decided to demand payment of the publishing fee from authors started establishing virtual exclusive communities which are not accessible to all scientists because they cannot pay article processing charge and / or their libraries cannot pay high journal subscriptions or access fees to individual articles. This practice may result of science becoming accessible only to well financed individuals and institution (as it was the case in the past). The next part of the paper presents results of a research study about presence of article processing charge at five major scientific publishers and its amounts which could both determine whether or not an author would send his/her article manuscript to a journal.

#### 4. Aims of the Study

The aims of the study were to:

- Identify current status of article processing charge in two major databases which include open access journals demanding article processing charge
- Identify the actual amount of article processing charge at five major scientific publishers as a factor which could determine to which journal scientists will send their articles for publication.

#### 4. Research study

Article processing was invented a potential source of revenue for publishers enabling them to survive on the very competitive global publishing market. Trying to find a solution to problems of payment which authors have to pay for publication of their work and lack of funds for publication of journals, many scientists investigated different aspects of article processing charge. As this paper is limited in scope (and number of pages) it will put focus on the identification of article processing charge at major scientific publishers to discover to what extent (number of journals) this fee has been accepted by major publishers and also what are actual fee categories that dictate the publishing of scientific journals. Some references to research about relationship between

authors' perspectives and article processing charge will be also mentioned.

Some scientists suggested very precisely what authors should do if and when faced with article processing charge. West, Bergstrom and Bergstrom (2014) suggested that open access publication are substitutes to fee based publications, and authors are basically free to compare publishing offers from different publishers “seeking out only the very best deals and patronizing these exclusively”. As a result, “publishers would be forced to compete aggressively on price” which they already do, resulting in better deals for individual scientists and the academic community (West, Bergstrom and Bergstrom, 2014). Aggressive competition between publishers does not come in question since the number of journals demanding article processing charge has become a fact and this fee has become substantial in some cases (Crawford, 2015) and each publisher is trying to fit article processing charge into its business plan and adjust it so not to lose individual authors or scientific institutions and societies willing to pay it.

This leads us to the main hypotheses of this paper which is that article processing charge has become a standard part of operation of major scientific publishers influencing flow of information in science. Article processing charge has become a potential barrier in reality for authors and their academic institutions trying to publish their work as quickly as possible and make it available to the global scientific community and general public at major scientific publishers.

The research study in this paper is motivated by the problem of existence of article processing charge and its purpose is to find out how high is this barrier of article processing charge (though any amount greater than zero could present a barrier). The research study is divided into two parts. The first part presents the results of article processing charge discovery in the Directory of open access journals (DOAJ) and SHERPA/ROMEO database. The limitation of the part of the research conducted in DOAJ is that it does not offer analysis of the actual prices or values of article processing charge. According to Newton, Cunningham and O'Connell (2014) who have researched article processing charge in open access publishing, it is sometimes very difficult to understand and evaluate publishing costs and this is done mostly by utilizing rough estimates. This is also the reason why part of this research study and similar research studies (like Crawford, 2015) will never be able to provide exact values for total publishing costs in open access publishing, but instead, they will research many important factors contributing to the understanding of the modern open access publishing process.

The second part of the research study presents the results of the analysis of the actual article processing charge amounts at Web sites of the five biggest scientific publishers in the world.

#### 4.1 Directory of open access journals (DOAJ)

The first part of the research study presents the results from discovery of the existence (current state) of article processing charge in open access journals in summer 2016. The source of data was the list of open access scientific journals in the world largest cross-disciplinary registry or index of open access journals - Directory of open access journals (DOAJ) at <https://doaj.org> on August 22 2016. DOAJ has been the source of data for many researches as it is the only global registry of open access journals which is maintained systematically and which is recognized as one of the most valuable and authoritative source of scientific information. The purpose of the part of the research was to determine the number of open access journals charging for the article processing as an important factor for authors when deciding whether or not to send an article manuscript to a journal.

**Table 1.** List of open access journals at DOAJ with article processing charge (APC)

Areas of science listed in DOAJ	N of journals as having APC	Total number of journals in a designated area of science	% of journals having APC
Medicine	116	1252	9,26
Science	70	996	7,03
Social Sciences	29	759	3,82
Technology	34	498	6,82
Medicine (General)	94	473	19,8
Education	22	465	4,73
Language and Literature	6	448	1,33
Mathematics	41	379	10,81
Internal Medicine	30	361	8,31
General works	10	338	2,96

The total number of journals listed in DOAJ on August 22 2016 was 9189. The total of 1635 journals or 17,79% of the total number of journals in DOAJ were reported to charge fee for article processing. This percentage is lower than percentage (26%) reported for year 2014 by Morrison, Salhab, Calvé-Genest and Horava (2015). Decline in percentage could be attributed to a number of factors such as growing number of open access journals and slower acceptance of article processing charge among authors and scientific institutions or journals are giving up on article processing charge etc. The current percentage is

still a significant indicator of a developing segment of the open access journal publishing industry. Actual article processing charges for open access journals listed in DOAJ are presented in different world currencies and were not analysed in this part of the research study as journals in the DOAJ lists belong to different publishers with different open access policies which are sometimes difficult to interpret and therefore to compare. Some authors did such a research and in their study of article processing charges in DOAJ, Solomon and Björk (2012) found out that it falls within range of 601-800 USD. Crawford (2015) also investigated article processing charges in DOAJ in details and found out that in addition to 4230 journals that don't charge article processing charge, the most expensive journal charges 5000 USD per article, three other journals charge more than 4000 USD, a dozen more charge 3000 USD to 3900 USD per article. The lowest charges are in 4 journals charging 8 USD or 9 USD, 6 more journals charge 12 USD to 19 USD, and 19 more journals charge 20 USD to 29 USD per article.

#### 4.2 SHERPA/ROMEO

Another valuable source of information about article processing charges in open access journals is ROMEO. ROMEO is "a searchable database of publisher's policies regarding the self-archiving of journal articles on the web and in Open Access repositories" (FAQ - Publisher copyright policies & self-archiving). It is part of SHERPA Services based at the University of Nottingham, UK. Data was extracted on June 1 2016 from the list Publishers with Paid Options for Open Access at <http://sherpa.ac.uk/romeo/PaidOA.php>. In this databases, article processing charge was presented in two forms: fixed (single value) and variable (range of values).

**Table 2.** Number of journals in open access model of publishing charging fixed article processing as recorded in ROMEO database

APC prices in USD	Open Access model	
	N of journals	% in total number of journals
0-99	2	0,84
100-499	11	4,60
500-999	24	10,04
1000-1499	16	6,69
1500-1999	29	12,13
2000-2499	24	10,04
2500-2999	63	26,36
3000-3499	62	25,94
3500-3999	5	2,1
4000-4499	1	0,42
4500-5000	2	0,84
Totals	239	100

Average article processing charge was 2240,96 USD (median is 2600 USD).

There are 86 journals with variable article processing recorded in ROMEO database starting with the range 40-100 USD and ending with range 3000-5000 USD. All other journals and article processing charges are in between these extremes and are combination of very different values which could not fit into some fixed categories of values in order to be compared.

The results in SHERPA/ROMEO database show a great variety of article processing charges. The fixed categories show a tendency towards higher articles processing charges which make journals falling into these high price categories expensive for publishing. Variable charges are very difficult to compare as they fall between extreme values of 40 and 5000 USD in a great variety of combinations and depend on publishers' / journal policies and business models.

The second part of the research study was focused on actual amounts of article processing charge at five biggest publishers in the world: Elsevier, Springer, Wiley, Taylor & Francis and Sage. Web pages of each publisher were visited on June 1 2016 in search for data about the amount of article processing charges. Generally speaking, some publishers keep all data about fees structured in tables containing titles of open access journals to which they belong, licence type for each journal, type of open access publishing model and the amount of article processing charge while other publishers have just one universal article processing charge without giving any other detail about their open access models, journal titles etc.

## 4.2 Elsevier

On the Web page at <https://www.elsevier.com/about/company-information/policies/pricing>, Elsevier published general information about article processing charge: "Elsevier's APC prices are set on a per journal basis, ranging from 500 - 5000 US Dollars". On the same Web page, there is a detailed list available with the name of each journal and accompanied article processing charge.

On this list Elsevier offers two types of open access models: hybrid and "pure" gold open access. Prices for both models are set on the basis of the following criteria and are subject to regular adjustments:

- Journal impact factor;
- The journal's editorial and technical processes;
- Competitive considerations;
- Market conditions;
- Other revenue streams associated with the journal.

For each model there are journals listed and their article processing charge. Average price for the hybrid model is 2564,82 USD (median value is 2600,00 USD). Average price for "pure" gold open access is

1319,63 USD (median value is 1500 USD). All prices are very high although authors are waived from paying article processing charge if it is paid by their institutions or some other source (like research grant etc.).

**Table 3.** Number of journals in open access model of publishing for Elsevier charging article processing

APC prices in USD	Open Access model	
	N of journals	% in total number of journals
0-99	310	61,39
100-499	7	1,39
500-999	39	7,72
1000-1499	18	3,56
1500-1999	61	12,08
2000-2499	20	3,96
2500-2999	1	0,2
3000-3499	47	9,30
3500-3999	1	0,2
4000-4499	0	0,0
4500-5000	1	0,2
Totals	505	100

**Table 4.** Number of journals in hybrid model of publishing for Elsevier charging article processing

APC prices in USD	Hybrid model	
	N of journals	% in total number of journals
0-99	0	0,0
100-499	2	0,09
500-999	15	0,70
1000-1499	115	5,37
1500-1999	336	15,69
2000-2499	233	10,88
2500-2999	425	19,84
3000-3499	901	42,06
3500-3999	92	4,3
4000-4499	0	0,0
4500-5000	23	1,07
Totals	2142	100%

Both tables indicate different approaches to charging article processing. Elsevier offers a smaller number of "pure" open access journals (505 of them) in comparison to the hybrid journals (2142 of them). Prices for each publishing model are different and are higher for hybrid journals. Generally speaking, prices are very steep and it is difficult to believe that individual scientists are capable of paying the suggested fees resulting in article processing charge being a real barrier for publishing of scientific knowledge. The percentages added to the individual price groups showing price distribution are also very high in hybrid model confirming that very few

individuals will be able to pay such fees from their own pocket.

### 4.3 Wiley

The next big publisher is Wiley. Facts about open access for Wiley can be found at <http://www.wileyopenaccess.com> and details about publication charges at <http://www.wileyopenaccess.com/details/content/12f25e0654f/Publication-Charges.html>. Much like Elsevier, Wiley has different and elaborated categories of article processing charges. It also offers waivers and discounts to authors from countries from a special list of developing countries upon their request.

**Table 5.** Number of journals in open access model of publishing for Wiley charging article processing

APC prices in USD	Open access model	
	N of journals	% in total number of journals
0-99	0	0,00
100-499	0	0,00
500-999	2	3,33
1000-1499	1	1,67
1500-1999	18	30,0
2000-2499	18	30,0
2500-2999	13	21,67
3000-3499	5	8,33
3500-3999	0	0,00
4000-4499	2	3,33
4500-5000	1	1,67
Totals	60	100

According to data in Table 5, fees for the article processing are grouped on similar value levels as for Elsevier. Wiley also offers multiple categories of journals accompanied by different article processing charges but these fees are also steep and are potentially presenting big barriers for scientists wishing to publish their articles in journals published by Wiley. Similarities in pricing between major publishers are not accidental as they are aware of the competition on the market and are adjusting their policies and prices according to their estimation of the financial potential of their clients and interest for their journals. Average price for article processing for open access at Wiley was 2215 USD (median value is 2138 USD).

### 4.4 Taylor and Francis

Taylor and Francis is the next big publisher on the list in this research study. This publisher offers information about journals offering gold open access, current article publishing charges, types of publishing licences in journals etc. at <http://authorservices.taylorandfrancis.com/journal-list>.

**Table 6.** Number of journals in open access model of publishing for Taylor & Francis

APC prices in USD	Open access model	
	N of journals	% in total number of journals
0-99	0	0,0
100-499	0	0,0
500-999	5	0,22
1000-1499	91	4,06
1500-1999	3	0,13
2000-2499	2	0,09
2500-2999	2140	95,50
3000-3499	0	0,0
3500-3999	0	0,0
4000-4499	0	0,0
4500-5000	0	0,0
Totals	2241	100%

Unlike Elsevier and Wiley, Taylor and Francis has grouped its article processing charges mostly in the middle of the distribution of all values used in comparison of the five top scientific publishers. Again, the price for article processing is high. Average price for article processing for open access for Wiley is 2871,3 USD (median value is 2950 USD). Wiley has adjusted their price to be a bit more expensive on average when compared to other publishers however also it doesn't offer highest values of article processing charges (in comparison to other publishers).

### 4.5 Sage

Sage is the last publisher in this comparison. It currently offers a single article processing charge at <http://sgo.sagepub.com/faq#v:395> USD. Compared to other publishers, Sage has set its price low attracting potential authors to publish in its journals.

## 5 Discussion

The results of the research study conducted in this paper are a good basis for longitudinal studies in development of open access journal publishing industry. In case of four out of five major scientific publishers, article processing charge is present in a significant number of scientific journals. Most journals analysed in this paper demand high article processing charge fees from authors, in some cases in amounts of thousands of dollars thus falling into category of being very expensive. For authors, these high article processing charge fees means presence of a real and a major barrier in dissemination of results of their scientific research in cases in which individual scientists or scientific institutions are unable to cover the costs of publishing. For research which is publicly funded mostly from national budgets of countries, inability to disseminate research results may in some

cases mean inability to receive new grant money. The public, of course, will then not be acquainted with the latest work of scientists and will become reluctant to continue providing financial support to new research from national budgets. As previously stated, the publishers see article processing charge as just another source of revenue and the results of this research prove that point as publishers have introduced different categories of article processing charge based on factors they consider important and are written in their policies of access to scientific journals they own. Since the widely known scientific journal crisis in the second part of the 20th century, scientific publishers have changed their subscription and access models and policies many times and they will continue to change them to achieve their business goals (Björk and Solomon, 2014). The current situation in which publishers seek variable amounts of money for article processing indicates that they have found niches in which they can operate and that the market of scientific publishing has evidently accepted article processing charge as something that is not necessarily good but can be accepted at the moment as long as scientific articles are published and are highly visible in the global scientific community and scientists and their institutions are able to access them.

## 5 Conclusion

The scientific publishing market has been developing for centuries. In the last hundred years it was face with many challenges. The IT revolution in the second part of the 20<sup>th</sup> century resulted in many organizational and technical changes in the publishing industry. One such change was the appearance of the open access initiative at the very end of the century. During the last two decades the open access initiative was also faced with the challenge of survival on the global publishing market because of the financial uncertainty. Theoretically, it is an initiative without precedence but realistically it is an initiative with many problems unsolved. One such problem is the revenue for publishers that decided to publish open access journals. As a form of payment they introduced article processing charge that has evidently become an important source of their revenue. However, it has also become the primary reason why some authors will avoid journals charging such a fee and search for journals that do not apply it. In this way, open access has put a big barrier to individual authors wishing to publish their research results in journals owned by prestigious publishers. The research study in this paper was initiated with two aims and both aims were accomplished. The numbers of scientific journals in two major registries / databases which include open access journals which demand article processing charge were identified. Article processing charge was identified in 17,79% of the total number of journals in DOAJ, the largest index of open access journals in the

world and in 239 journals in SHERPA/ROMEO database. The results mean that article processing charge has become a standard source of revenue in many scientific journals and cannot be considered as experimental any longer. Further investigation into the topic of article processing charge at five biggest scientific publishers showed that four out of five publishers charge a substantial amount of money for the article processing though there were also journals which charge the processing fee modestly although they were in minority. Only one publisher had fixed single value for the article processing which was also set modestly. To conclude, major scientific publishers have accepted article processing charge as a source of revenue for publishing scientific journals while this fee represents a substantial barrier for individual scientists as it is hard to believe that they would be able to cover such expenses on their own repeatedly. Whether or not article processing charge is a good solution or not remains to be seen. As long as journal publishing costs are not covered by other means or parties such as sponsors or membership in professional societies, article processing charge will remain the topic of research and discussion.

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