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ANALYSIS OF REQUESTS FOR JOURNALS *NATURE FOOD* AND *NPJ SCIENCE OF FOOD* BY THE DATA OF THE SCI-HUB SERVICE FOR THE FIRST HALF OF 2020

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Abstract
This paper analyses the history of Sci-Hub service requests for two food industry journals ***Nature Food*** *and* ***npj Science of Food*** *for the period from 1.01.2020 to 29.06.2020. Trends in the development of the food industry and the most popular papers are discussed. Ten of the most popular papers from the journals* ***Nature*** *and* ***Science*** *according to Sci-Hub are presented to compare the popularity of papers related to the food industry and papers from other fields. Based on the analysis of the obtained data we made a conclusion that the popularity of papers related to the food industry is relatively low compared to other papers, which is a paradoxical situation. The data for this paper were provided by the developer of Sci-Hub.*

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Introduction

Sci-Hub is a popular Internet service, which provides an access to scientific information. Despite the fact that this service positions itself as a "pirate", it is popular among scientific community [1]. The founder of Sci-Hub is Aleksandra Elbakyan [2]. This Internet resource has been in existence since 2011 and today its database covers more than 85% of all existing scientific papers [3].

From the moment the service was launched and up to now, the audience of Sci-Hub has been constantly growing and a significant percent of users is from the developed countries [1]. With that, Sci-Hub goes beyond distribution of only licensed content but distributes scientific literature without consideration for authors' rights, including scientific publications with open access. The founder of this Internet project was sued by rights holders several times; however, the activities of Sci-Hub were not stopped and, in 2016, Aleksandra Elbakyan entered the Nature's 10 list, which included people who had the highest influence on science in that year [2].

Therefore, the "pirate" activity of Sci-Hub can be perceived differently; however, the coverage of the broad scientific audience gives value to data on requests of one or another scientific paper, as these data are a kind of cross section of interests and activities of scientific community. It is necessary to note that many countries envisage liability for violation of author's rights. In this paper, we analyze data on the most requested papers for two journals related to the food industry — *Nature Food* and *npj Science of Food*.

Objects and methods

The initial data contained 50548903 requests of papers on different directions. We analyzed requests for two journals (*Nature Food* and *npj Science of Food*) that publish papers on themes linked to the food industry. For these journals, data for the period from 1.01.2020 to 29.06.2020 were analyzed and processed using a bash script.

Results and discussion

As a result of data processing, we identified fifteen papers that were more frequently requested on the Sci-Hub service for the journals *Nature Food* and *npj Science of Food*. These data are presented in Table 1. In general, papers presented in Table 1 have a review character. The first four positions in the table are occupied by papers devoted to genetic modifications of plants, including genetic modification of soybean [4,5,6,7]. We also would like to note the presence of papers devoted to production of edible gels and gelatin scaffolds for artificial meat fibers [8, 9]. Other papers are also of interest. For example, Herrero et al. discuss the ways of changes, prospects of optimization and general prospects of some processes associated with the food industry [10]. Mozaffarian et al. discuss peculiarities of different diets and questions of balanced substances in food to solve the problem of malnutrition and maintain the health of consumers [11]. Gibney et al. give recommendations for studying the nutrition process [12]. McClements et al. discuss the safety of using nanoparticles in semi-prepared food products [13]. Lessard et al. describe an interesting effect of feeding ill chickens with genetically modified corn that contained a region of an antibody to interleukin-10. It is noted that chickens had the same weight as those in the group received the corresponding pharmaceutical preparation [14]. Potentially, the same approach can be used, for example, in medicine. Cottrell et al. studied an effect of new aquafeeds on aquaculture growth [15]. Cui et al. present data on the demand for genetically modified products in all Chinese provinces [16].

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To compare how often papers related to the food industry are requested compared to other journals, we present the data for journals *Nature* and *Science* for the same time period (Table 2, Table 3).

According to the data of Yu-Ming Liao, the journals *Science* and *Nature* have the high impact factor and occupy leading positions in the journal ranking presented by the author [29]. It should be noted that, in general, the journals *Nature* and *Science* contain many papers linked with medical themes.

Analyzing data from Tables 2 and 3, we noticed that papers related to highly ranked journals of the food industry are requested relatively seldom compared to the most frequently requested papers from the journals *Science* and *Nature* (Figure 1)

Table 1. The most popular requests of papers for journals *Nature Food* and *npj Science of Food* according to the data from Sci-Hub for the indicated period of time

№	Paper title	Number of requests	Journal title	Reference
1	A CRISPR way for accelerating improvement of food crops	684	*Nature Food*	4
2	Local food crop production can fulfil demand for less than one-third of the population	531	*Nature Food*	5
3	Textured soy protein scaffolds enable the generation of three-dimensional bovine skeletal muscle tissue for cell-based meat	475	*Nature Food*	6
4	Crop biotechnology and the future of food	292	*Nature Food*	7
5	Innovation can accelerate the transition towards a sustainable food system	277	*Nature Food*	10
6	Dietary metabotype modelling predicts individual responses to dietary interventions	256	*Nature Food*	17
7	Design principles of food gels	215	*Nature Food*	8
8	Dietary and policy priorities to reduce the global crises of obesity and diabetes	194	*Nature Food*	11
9	Uncertainty in human nutrition research	171	*Nature Food*	12
10	Publisher Correction: The unmapped chemical complexity of our diet	150	*Nature Food*	18
11	Is nano safe in foods? Establishing the factors impacting the gastrointestinal fate and toxicity of organic and inorganic food-grade nanoparticles	146	*npj Science of Food*	13
12	Improved performance of Eimeria-infected chickens fed corn expressing a single-domain antibody against interleukin-10	124	*Nature Food*	14
13	Muscle tissue engineering in fibrous gelatin: implications for meat analogs	123	*npj Science of Food*	9
14	Global adoption of novel aquaculture feeds could substantially reduce forage fish demand by 2030	110	*Nature Food*	15
15	Public perception of genetically-modified (GM) food: A Nationwide Chinese Consumer Study	108	*npj Science of Food*	16

Table 2. The most popular requests of papers for the journal *Nature* according to the data from Sci-Hub for the indicated period of time

№	Paper title	Number of requests	Journal title	Reference
1	Deep learning	14258	*Nature*	19
2	Proteomics identifies new therapeutic targets of early-stage hepatocellular carcinoma	9352	*Nature*	20
3	A photophoretic-trap volumetric display	7705	*Nature*	21
4	Restoration of brain circulation and cellular functions hours post-mortem	7624	*Nature*	22
5	CD24 signalling through macrophage Siglec-10 is a target for cancer immunotherapy	6466	*Nature*	23
6	Dermatologist-level classification of skin cancer with deep neural networks	6267	*Nature*	24
7	A pneumonia outbreak associated with a new coronavirus of probable bat origin	6155	*Nature*	25
8	Electrochemical Photolysis of Water at a Semiconductor Electrode	6067	*Nature*	26
9	Prioritization of cancer therapeutic targets using CRISPR–Cas9 screens	5936	*Nature*	27
10	Search-and-replace genome editing without double-strand breaks or donor DNA	5680	*Nature*	28

Table 3. The most popular requests of papers for the journal *Science* according to the data from Sci-Hub for the indicated period of time

№	Paper title	Number of requests	Journal title	Reference
1	Thermal Barrier Coatings for Gas-Turbine Engine Applications	76618	*Science*	30
2	Culturally inclusive STEM education	11057	*Science*	31
3	Electric Field Effect in Atomically Thin Carbon Films	10059	*Science*	32
4	Plastic waste inputs from land into the ocean	7960	*Science*	33
5	The biology, function, and biomedical applications of exosomes	7001	*Science*	34
6	The Chemistry and Applications of Metal-Organic Frameworks	6665	*Science*	35
7	Combining theory and experiment in electrocatalysis: Insights into materials design	6108	*Science*	36
8	The global tree restoration potential	5641	*Science*	37
9	A Programmable Dual-RNA–Guided DNA Endonuclease in Adaptive Bacterial Immunity	5444	*Science*	38
10	A bacterium that degrades and assimilates poly(ethylene terephthalate)	5237	*Science*	39

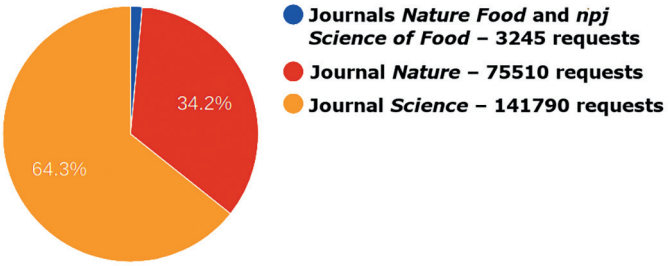

Figure 1. Comparison of the total number of requests for the first ten journals from each of the Tables 1, 2 and 3. The presented diagram reflects popularity of food industry papers compared to scientific papers from journals *Science* and *Nature*

Conclusion

Studies related to genome modification were most frequently requested on Sci-Hub during the period from 1.01.2020 to 29.06.2020. Apparently, attention of researches is focused in this direction, which will likely lead to appearance of new genetically modified agricultural cultures in the future. However, it should be noted that there are no papers dedicated to genetic modification of animals in Table 1. At the same time, part of presented papers touches on the question of interrelation between food quality and population health in the context of the excess weight and diabetes problems, but papers on such important direction as pathogen detection are absent in the presented table.

It is worth noting that there are many papers on the medical theme in Table 2 with high frequency of requests. Therefore, the attention of the world community is focused to a great extent on a search for new medical approaches (therapies), but at the same time, the attention to the work of the food industry is generally relatively low despite the fact that food quality directly influences population health. It should be emphasized that higher attention to the food industry can lead to reduction in the number of diseases among population.

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