INTELLECTUAL DISHONESTY IN SCIENCE

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The aim of this article is to obtain answers about the most important questions involving dishonesty in science. If we consider scientific work, we have to mention that various forms of errors need to be divided into two groups: reputable and disreputable errors. The third group, called the "grey zone", includes "cooking" and "trimming".

When we consider the problem of dishonesty in science we should mention the most important question: who and for what reasons commits plagiarism and other forms of intellectual crookedness? Is it for financial benefits or for advancement? It is difficult to say, but it is necessary to use all available remedies to eradicate all forms of intellectual dishonesty, which is hard, especially in biomedical sciences. However, some reputable journals in this field use some special software packages to detect plagiarism. *Acta Medica Medianae 2013;52(2):56-60.*

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Introduction

The concept of legal regulations and sanctioning their non-appliance is a well-known fact, but questionable are the so-called "unwritten" rules and norms, their (dis)respect and consequences they entail.

Morality and the question of moral standards have been met practically from the very beginnings of human civilization, with the intention of establishing relations in society and the system of norms and values. The law clearly regulates sanctions for breaking prescribed norms of behavior, moral norms, and their non-compliance is subject to ostracism. A system of values in one community may not be, and usually is not, identical to the one that is valid in another. Norms of behavior regulated in this manner are categories liable to modification, but what we definitely need to keep in mind is the fact that their ultimate goal is the regulation of relations in the community and establishing the system of moral norms and principles.

Searching for truth

Scientific research is, of course, an integral part of every scientific discipline that seeks for exactness. This raises the question of scientific problems and criteria that should be met to be classified in this category. According to the definitions available in the literature on the methodology of scientific research, under scientific issue is considered unexplained, i.e., unresolved problem, lack of clarification of the (contentious) issue or the one on which there are conflicting opinions. (1) The work of scientists directed towards addressing these problems directly influences the level of development in science. Here we come to the key question, which is the search for the truth. The essence of science development, and therefore, the scientific work, is actually discovering the truth previously unknown or unclear. This tendency in itself is not controversial, but controversial can be a way of its search. Finding new truth is almost always based on previously adopted knowledge and laws, but its refutation does not mean at the same time their challenging and outright rejection, because scientific development has cumulative and self-correcting character. Any newly discovered truth is a step higher on the ladder of scientific development. In an effort to find an answer to a problem, one should keep in mind that the absolute truth as a category does not exist, and therefore tends to draw conclusions from the greatest possible degree of probability. The next issue in considering the concept of truth and the truth itself is the way i.e. method applied in order to find it. Having defined the problem and hypothesis, it is verified through scientific research, and then the results are analyzed and published. Research design is affected by a numerous factors, primarily by the type of problem and methods and tools available, as well as by what is expected from its solution i.e. what kind of the benefit it brings to science and mankind. After deciding on the need to explore, it is necessary to keep in mind that there are ethical principles that need to be

respected and that is one of the postulates of good scientific practice. Many articles mentioned in the context are considering the issue of moral characteristics of researchers, and what are the desirable characteristics one should possess. One of the frequently asked questions is if the scientists are expected to be moral "puritans", and whether it is necessary. Of course, these features are desirable, but they can not be considered as the only prerequisite for a successful scientific work. Besides, when it comes to research in the field of biomedical science we should bear in mind the fact that this work is done by people who, by choosing their professions, had committed themselves to respecting the moral principles and standards, and therefore the appearance of any kind of prank and dishonesty are barely expected. However, there are evidences that such cases are still encountered in practice, and the question that arises is what the reasons for their appearance are. Before discussing the concept and causes of errors ("honest" and "dishonest"), I would like to mention that it is encouraging that the number of such cases is relatively small compared to the hyperproduction of published scientific articles, and the scientific literature is considered to be "pure" in 99.9% of cases. As for the Biomedical Sciences, the largest number of cases of intellectual dishonesty has been recorded in the U.S. (2).

Definition of intellectual dishonesty

In contemporary literature there are numerous definitions of intellectual dishonesty in science, and the differences encountered relate mainly to the details of the stage of scientific procedure in which they occur. This term usually means fabrication, falsification and plagiarism in proposing, performing or presenting research (2).

The term fabrication means complete fabrications of data or concepts, where analysis and measurement procedures that have never been performed are shown. (2)

The concept of falsification involves manipulation of the data obtained so that they do not reflect actual results obtained from the survey (2).

Plagiarism involves the appropriation of other people's ideas, concepts and texts and interpreting them as their own (2).

Danish Committee for Intellectual dishonesty in science in its definition includes "any intentional fraudulent act at any stage of the scientific process (application-research-publication) and all extreme cases of negligence questioned to the professional integrity" (2).

These definitions make it clear as to what is meant by the intellectual dishonesty, but the question is what does not belong to this category. The "gray zone" has been mentioned, or the area between the common errors and obvious intellectual dishonesty in which are classified phenomena not clearly defined and valued.

Mistakes in science

There are numerous articles giving the classification of errors in science that tend to make a distinction between accidental, unintentional errors and verified form of intellectual dishonesty. According to these definitions of errors in science, they are classified as follows:

- Honest errors (reputable) are classified as unintentional, accidental and often unavoidable, and are related to the risk of work (2).

- Dishonest errors (disreputable) represent deliberate disregard and violation of methodological rules and ethical norms (2).

Classification of errors in science in this or a similar way tends to highlight the fundamental, principled distinction between them. The first mistakes can be characterized as ordinary (common) or fair (honest) or errors in good faith.

Deliberate errors, on the contrary, are the hardest form of compromising the integrity of science, and are called intellectual dishonesty.

The third group, called "gray zone" includes cases of violating the principles of good scientific practice that cannot be characterized as intellectual dishonesty, but are not completely devoid of it. These techniques involve "tuning" of the data (trimming) or "cooking "("scam"). The following table shows the most common mistakes in science:

Table 1. Errors in science (2)

Unintended		„Gray zone"		Intended
Common errors		Data manipulation		Intellectuall dishonesty
Designing		Data selection		
Performance				Fabrication
Analysis		Undeserved autorship		Falsification
Publication	Partiality	Multiple publications	Undisclosed conflicts of interest	Plagiarism
	Self-deception	„Salami" publications		

Errors in science

The attached table shows the most important forms of errors in science, presented according to the severity of the offense (2).

Common mistakes are an integral part of a research process because they derive from the research methodology, design, installation irrelevant hypothesis, inadequate research plan, insufficient and unrepresentative samples, inadequate techniques, etc. The most frequent forms of common errors encountered in practice are related to writing numbers and their disagreement, typing mistakes and reference listings, and also honest differences in performing a research, its interpretation and conclusion. Bias and self-deception (self-delusion) are among the harder plain errors.

The "gray zone" includes the area between the common mistakes and severe cases of intellectual dishonesty or deviations from good scientific practice, but this type of offense is very hard to prove. This category includes: data manipulation and selection, errors in quoting references, multiple and "salami" publications, honorary authorship, etc.

- Data manipulation is the removal of unwanted data, statistical manipulation, concealing original primary documents and the like.

- Selection of data (suppressing inconvenient facts) is deliberate selection and presentation of data in favor of the set of hypotheses.

- Errors in quoting include inadequate quoting of references and deliberate omitting the contributions of other authors.

- The concept of multiple publication means publishing scientific articles twice or more times, and they can be bilingual (parallel) and repeated when they appear in the same language (2).

- "Salami" publications are frequently used term that refers to "fragmentation" of a scientific work into smaller articles (3). It often occurs as a result of the pursuit of prestige in the number of published titles ("Publish or perish"), with a significant decrease in quality of work and, therefore, such actions cannot be considered as real contribution to the development of science.

Basement / deception

The worst forms of intellectual dishonesty, which can occur in all phases of scientific research, are violation of the science fundamentals, and are called basements or deceptions like other cases of severe deviations from the principles of good scientific practice. Fabrication, falsification and plagiarism which were discussed earlier in the text are considered to be the most extreme forms of intellectual dishonesty (2).

Causes of intellectual dishonesty

When discussing the problem of intellectual dishonesty, the issue of their causes is one of the bases and is certainly the most important segment in an effort to solve this problem, or to "shed light". Literature available lists some probable reasons:

- Personal motives, where priority of findings is mentioned as the most important one, which may lead an author to early publication of unverified results and therefore to breaching the principles of good scientific practice;

- Syndrome of "publish or perish" is a consequence of "pressure" on researchers to publish articles as many as possible. This phenomenon is particularly prevalent in countries where scientometry is at low level of development;

- Aversion to negative results may also be a cause for serious violation of ethical principles in scientific practice. Numerous researchers consider refutation of hypothesis as failure, forgetting the fact that every idea to solve the problem, whether it is confirmed or not, represents a significant contribution to science and its development.

- Providing the necessary financial resources for research can also be a reason for the occurrence of these forms of intellectual dishonesty (3).

Consequences of intellectual dishonesty

According to the above, quite rightfully, arises the question of importance and influence of intellectual dishonesty on the development of science. Firstly, intellectual dishonesty is incompatible with science (2). Secondly, although we could assume the contrary, a large number of fabricated scientific titles have had no significant effect on the flow of scientific development and their effects were short-lived. Since science strives to discover the truth and nothing but the truth, fraud and deception are revealed sooner or later and usually hard offenses are detected first. Even in cases where scientific articles that contain intellectual dishonesty demonstrate a high impact factor, often it is the result of self-quotation or quoting close contributors. What is the conclusion? It is that the society must respond to the resolute manner; inter alia, the legal regulation of sanctioning these offenses. It should be noted that detecting plagiarism and other forms of intellectual dishonesty in biomedical sciences is very difficult and require professionally trained teams and the most sophisticated high technology (4).

Examples of bad acting

Literature available provides information about the most famous cases of fraud and deception in science, and here are some of them:

- McBride affair - young gynecologist who had first observed teratogenic effects of Thalidomide published an article about this subject despite manufacturer's opposing. Although the discovery brought considerable fame in the scientific community, it was not the case with the financial resources necessary for opening the Institute. Prestigious journals to which McBride had sent the article refused to publish it with the

explanation that the author did not use a control group and due to the lack of histopathological findings. To overcome this problem, McBride resorted to fabrication of data, which was revealed by his young co-workers. A court proceeding was started against Mc Bride, which lasted for many years (2).

- John Dárselo affair is one of the most famous scandals that have rocked the scientific community. He was young and successful cardiologist who in a three-year period (1978 to 1981), with 47 co-authors, produced 109 publications. His colleagues discovered fabricated data in one of them and official investigations discovered more in other publications (2).

- V. Soman affair - in 1979 V. Soman investigated the function of insulin at Dr. P. Feliga's who had turned down a manuscript he had reviewed. But he showed it to Soman who used that work, plagiarized some parts of it and, inventing new data, submitted new manuscript with Felig as a co-author. The manuscript was sent for review to the author of plagiarized work, who informed Yale University, where Soman worked. The process was long-lasting, but in the end the charges against Soman were proven (2).

Discussion

Considering the issue of intellectual dishonesty in all its forms, it is necessary to bear in mind that it is not the appearance of individual cases, but the phenomenon which, particularly in the recent years, has been assuming massive proportions. A research conducted in Nigeria provides data that as many as 42% of researchers had committed forgery offense, while in the case of plagiarism that percentage was 9.2% (5). On the other hand, our experiences suggest that even a short course on ethics in scientific research contributes significantly to the development of both medical students and young researchers' awareness of the offense seriousness such as forgery and plagiarism (6,7). The fact that it is a phenomenon that assumes massive proportions is supported by the results of a study showing that among 2.047 articles in the field of biomedical sciences indexed in Pub Med, only 21.3% of corrections can be attributed to unintentional errors, while 67.4% of these were classified as a form of misconduct, including fraud in science (43.4%), duplicate publication (14.2%), and plagiarism in 9.9% of cases (8). Analysis of MEDLINE database for the period 1966 - 2008 also provides some interesting data. Out of 213 withdrawn publications, 41.8% were cases of plagiarism, and in 52.1% it was the phenomenon of fabrication and falsification. (9) There is information that the occurrence of plagiarism and counterfeiting is not unknown to medical students either, and it is explained by easy access to electronic databases 10). Analyzing the displayed data raises the question of how to eradicate, or at least reduce to a lesser extent,

these now really common occurrences that represent violation of ethical principles in science. It is encouraging that implementing sophisticated technology to detect plagiarism has given satisfactory results (11). One of the practical examples is the Croatian Medical Journal, which in 2009 started using a software to detect plagiarism (eTBlast and CrossCheck) and manual control of manuscripts marked as a possible plagiarism (more than 10% of manuscripts). In this way, a significant advance in the detection of plagiarism has been achieved (12). Another issue that should be considered is how to sanction proven cases of plagiarism and other forms of intellectual dishonesty.

One of the ways would be withdrawal of already published articles (retraction) which are proven to be whole or partial forgeries, so the author would be denied the rights which he would otherwise have and articles like these should not be included in the author's bibliography. Unfortunately, in our country, it has not been done properly and these articles continue to be cited, for which authors receive undeserved benefits (13). The cases of forgery and plagiarism were proven not only in professional journals, but also in dissertations, due to which the University of Belgrade has a practice that dissertation have to be submitted in electronic form only, and then they pass a rigorous control of several months in order to establish any form of intellectual dishonesty, plagiarism and forgery. The same source states proven cases of fraud in the scientific community, as well as the possibilities of judicial and academic sanctions, such as rejection of these theses.

Conclusion

The problem of intellectual dishonesty in science, undoubtedly, has an important place in the scientific community, and even though it is not considered frequent, it deserves full attention. The examples given to illustrate the worst forms of fraud and deceit in science show that there is no clear boundary between good and bad, even in science. These cases prompted the scientific community to raise the issue of the scientific practice code, its formulation as a set of rules of conduct in all aspects of scientific activity. Codified rules of ethical action in science are called Good Scientific Practice (GSP) (2). The establishment of such a set of rules was initially met by reluctance of wider circles of the scientific community believing that the intellectual dishonesty in science is rare, and that too strict codes of conduct in scientific work would have negative impact on creativity, which is its driving force. However, after a period of time-consuming discussions even the opponents of these regulations accepted them as the only way to fight against fraud and deceit in science and sanction them.

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INTELEKTUALNO NEPOŠTENJE U NAUCI

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Ekspanzivni razvoj nauke dovodi do brojnih etičkih dilema i otvara vrlo delikatna pitanja, koja naročito poslednjih decenija postaju vrlo aktuelna. Spomenute moralne norme, odnosno etički principi, kao univerzalnija kategorija, regulišu i ovaj segment ljudske delatnosti, imajući u vidu prvenstveno dobrobit čovečanstva. Da je istina drugačija, svedoče brojni dokazi. U nastojanju da se postigne što veći stepen lične afirmacije, napredovanja, pa i finansijske koristi, vrlo često se krše osnovna moralna načela i principi u naučno-istraživačkom radu.Upravo iz spomenutih razloga, u ovom radu će biti razmatran problem definisanja pojma intelektualnog nepoštenja i uzroka i dilema koji ova pitanja uvek prate. *Acta Medica Medianae 2013;52(2):56-60.*

Ključne reči: *nauka, moralne norme, intelektualno nepoštenje*

60