USING BIOMIMICRY IN MEDICINE

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Why biomimicry researches are slowly implemented in the medicine of Kazakhstan?

Abstract. This article aims to illustrate the research why the biomimicry-based technologies slowly implement in healthcare of Kazakhstan. In the research was questioned 23 doctors among Aktobe region.

Keywords: Biomimicry, medicine, healthcare.

Authenticity Declaration.

I declare that the work in this research project is my own and is authentic. All resources and sources are acknowledged and cited, where sources and resources of other people have been used

Introduction. Biomimicry is the new sphere of engineering that analyze the biological blueprints that was created by nature and trying to recreate them into new technologies (Terrapin Bright Green, 2015). It can be used in many spheres such as the military, military, transport, healthcare and other. Biomimicry is the very interesting sphere that want to adapt the milliard year of evolution and experience of nature in order to help humanity to solve the issues. And according to the Darwin's theory of evolution all living organism has faced the millions of years of adaptations and mutations, which did them the perfect blueprints for the new technologies.

The reasons why I have chosen the using of biomimicry in medicine are that the biomimicry is the most rapidly developing sphere of bioengineering and my personal interest in this sphere.

First of all, biomimicry is the one of the fastest developing spheres of bioengineering. It is the new sphere which history started at the end of the 20th century, but now in the second decade of the 21st century biomimicry is the one of the most using type of research and development of new technologies and it is impressing.

Secondly, I have chosen this theme, because of my personal interest. I interest with this theme after the knowing fact that needle of syringe was copied from the proboscis mosquito.

Context

Biomimicry is the practice that learns biological blueprints in order to find fastest sustainable solution for issue (Biomimicry Institute, n.d.). The most common type of biomimicry is copying of forms for example, bullet train 500 Series Shinkansen’s nose has inspired by kingfisher’s beak that reduces noise and energy consumption (Sheppard, 2012). Also, researchers make attempts to copy structure of animals and plants, the one of them is shock absorbers inspired by woodpecker’s head (Marks, 2011). Additionally, biomimicry is used in the copying of behavior of animals, for example

the self-driving drones (McMullan, 2019).

These days biomimicry is widely used not only in engineering, but also in medicine. New prototypes, researches, development and implementation of most of the projects need a lot of financial investments, according to the book The Shark's Paintbrush: Biomimicry and How Nature is Inspiring Innovation by Jay Harman U.S. in 2010 has founded $700 million dollars, in other words 1% of U.S. Department of Defense budget (Harman, n.d.). .

From the economical lens the using of technologies inspired by the nature is unreliable for Kazakhstan, because the usage, application of this projects will negatively depend on the economy of Central Asia region. On the other side the usage of Sharklet technology can save million dollars of state budget. According to the research of Jeffrey Funk (2014) if we compare the price of disinfection and producing the plastic based on Sharklet technology the saves of money will be from $0.4 - $4 million for each hospital, so the benefits of using of biomimicry researches in one country will bring the development of healthcare and save the state budget of Kazakhstan. On the other side of healthcare, the usage of biomimicry in medicine is very important, because the 10% of the projects that are on research, developing and usage are specialized in medicine, healthcare and pharmacy (Terrapin, 2015). The using these technologies can improve the quality of medicine and reduce lethality during operations. For example, the Sharklet technology, which provides the medical supplements like Foley catheter and central venous catheter (Sharklet, n.d.). According to the statistic in the U.S. infections of central venous catheter are associated with 28000 death every year. The presence of a venous catheter often causes blood clots, starting with platelet adhesion and activation and ending up causing deadly clots and embolisms (Sharklet, n.d.). So, the Sharklet technology will reduce the lethality, because it inhibits the self-reproducing of bacteria, which cause the infections. Also, biomimicry technologies can replace the old methods, like using of surgical suture, because the developing project of surgical glue inspired by Sandcastle worms is the new step of surgery. This technology could save many lives, because this glue will bring new methods of surgery like the repair of vessels and heart defects, which was impossible few years ago (McKeag, 2015).

Methods

To investigate using of biomimicry inspired technologies into healthcare of Kazakhstan and to judge if it is a way to change classis medical tools also, to determine possible risks of using biology motivated technology in medicine analyzing of literature and the survey were used.

As the secondary research analyzing of literature were used. It is a quantitative method of research, because the research involves the analyzing of the literature. For this research was spent 4 hours, which most of them was involved on the searching of reliable sources, due to the lack of information about biomimicry.

The one of the advantages of using the analysis of literature is the time consuming. The time that was spent on the reading, searching information was a lot lower comparing with the time that was spent on other experimental methods of research and it has lower cost.

Also, the advantage of using the literature analysis is the analyzing the statistics of experiments of other researches, that are impossible to do in my conditions. For example, the properties of plastic that are made by SharkLet technology, which can experimentally research in laboratories.

On the other side, literature analysis has the biggest problem is the copyright on using of authors works. So, it can be the biggest challenge that I will face during research project.

Furthermore, the lack of literature about biomimicry theme, because this type of bioengineering is less popular than other, so there no perspectives that will be against this type of technologies.

As the primary research I used the survey. This survey was among the doctors of the Aktobe city and 23 people has answered it. I have questioned this group of people in order to know the reliability of using biomimicry technologies in medicine from people who work in healthcare sphere.

The one of the advantages is the precise of the result. As questions in the survey should undergo scrutiny and standardization, they provide uniform definitions to all the subjects who are to answer the questionnaires. Thus, there is a greater precision in terms of measuring the data gathered.

Also, the advantage of using surveys is the minimum of bias and stereotypes in the information. Surveys are ideal for scientific research studies because they provide all the participants with a standardized stimulus. With such high reliability obtained, the researcher's own biases are eliminated.

The disadvantage of using the survey is the inflexibility of the answers. Participants are constrained by the answers of author, so it can be no relevant answer on the question that participant wanted to say.

Results

As the primary research survey was used. In the survey was 7 questions:

1. Did you know what is the biomimicry?
2. Have you seen biomimicry-based technologies?
3. Rate the level of technologies used in medicine in Kazakhstan
4. In your opinion, does the financing of hospitals affect the implementation of new technologies in the medicine of Kazakhstan?
5. What factors do you think affect the speed of spread of biomimicry-based technologies in medicine?
6. Will biomimicry-based technologies improve the quality of medicine in the country?
7. In 2015, the development of a surgical glue inspired by sandworms began. Will these technologies replace the old methods of treatment?

23 people passed this survey and answered all questions. The answers of the first question was interesting, because only 60.9% of people know about the biomimicry-inspired technologies and only 21.7% of people faced them. It is interesting information, because I have asked the qualified doctors with the big work experience, so the illiteracy in this sphere of engineering is enormous, therefore it could be the one of the reasons why the biomimicry-based technologies implement in the medicine of the Kazakhstan.

The result of the 3rd question is also interesting, because majority of the doctors, exactly 43.5%, rated the level of technologies for 3 points, that means that hospitals of Kazakhstan has the average level of technology, but the number of people, who rated it for 1 and 2 points is surprisingly big and form 47.8%, which is the biggest percent and it gives information that in small towns has the problems with the new technologies.

Answers for the 4th question was predictable, because the main part of the people answered that the investments to hospitals of Kazakhstan can help to implement the biomimicry-based technologies in medicine, so the low investments can be also the reason why the implementation is so slow.

The results of the 5th question can give the information what factors from the opinion of the doctors can affect to the using of biomimicry-inspired in the hospitals. So, from the opinion of the medic low investments is the most affecting point that blocking the implementation of new technologies.

The answers of the following question under the number 6 was expected, because 91.3% of participants answered that the biomimicry-based technologies will improve the quality of medicine in Kazakhstan, so the biomimicry researches are reliable in medicine industry and will reduce the lethality of surgeon operations.

And the results of the last question were reasonable, because most of the answers was that the biomimicry-inspired technologies could replace the conventional methods of treatment. But the 17,1%, exactly 4 of people say that it cannot replace and bring the same efficiency as the ordinary method like the using the surgical sutures. Also, the one doctor answered that the new technologies will incompletely replace the old method and this is true, because the using of new technologies

needs to be combined with the old method and get the most efficiency with the symbiosis of 2 methods.

Conclusion

According to the research questions it is possible to make these conclusions:

- Biomimicry technologies slowly implement into the medicine of Kazakhstan, because of the low investments into the biomimicry researches

Yes, it is the one of the reasons, why the biomimicry technologies slowly implement in Kazakhstan. The low investments that funding the government of Kazakhstan from the capital budget leads to the impossibility of purchasing these technologies in the hospitals of Kazakhstan.

- Biomimicry technologies can replace the traditional methods in the medicine of Kazakhstan

There is plenty of the answers and all are the correct, so they need to be mentioned. For the positive answers that say the biomimicry-based technologies will replace the ordinary methods of treatment, for example surgical glue. From the other perspective, the new technologies cannot replace the traditional methods of treatment, because their usage are limited by the one function. So, concluding, the biomimicry-inspired technologies needs to be combined with the conventional method of treatment and make the symbiosis with them to get the most efficiency.

- Can illiteracy in biomimicry sphere affect to the implementation of biomimicry researches in the medicine of Kazakhstan?

Illiteracy also one of the affecters that slow down the speed of the implementation of biomimicry-inspired technologies in the hospitals of Kazakhstan, because the minor part of citizens knows about the biomimicry sphere and don’t know about the pros and cons of using them in the healthcare industry, so the illiteracy of the population leads to the slow implementation of biomimicry-based technologies.

Overall, from this research was investigated 2 major reasons why the biomimicry inspired technologies are slowly implemented in Kazakhstan. The one of the reasons is the illiteracy of the population in this sphere of engineering. The people simply don’t know about the biomimicry researches and don’t face them in real life, if they know, so the conservative citizens of Kazakhstan do not accept their usage, because people do not realize the advantages of using the biomimicry-based technologies. The second reason is the low investments of the government of Kazakhstan into the healthcare and researches of the biomimicry. So, this finances that receive hospitals is not enough to implement them in hospitals of Kazakhstan.

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