J Appl Biotechnol Rep. 2020 Sep;7(3):135-138

doi 10.30491/JABR.2020.117882

Journal of
Applied Biotechnology
Reports

Mini Review

Biotech's Growing Activity in the World of Social Media Networking

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Received August 11, 2019; **Accepted** December 1, 2019; **Online Published** June 13, 2020

Abstract
Nowadays, social media is involved in various aspects of knowledge and science. Social scientists, IT experts, biologists, and businesses widely analyze social media data to learn about human behavior. Biotechnology is a leading scientific field that has opened new horizons to the study of the natural and social aspects of human life. Biotechnologists need to use novel communication tools such as social media for education, research and marketing. Biotechnology education has been significantly affected by the Internet and social media because students and instructors increasingly tend to acquire and share scientific knowledge online. Moreover, the dynamic development of online social networks has paved the way for marketing innovations in the biotechnology industry. This study, on one hand, aims to explain the use of social media in biotechnology research, education, and industry, and on the other hand, investigates how social media contributes to the improvement this scientific field.
Keywords: Social Media, Biotechnology, Online Social Networks, Education, Industry
Citation: Nourani H, Taghavi SMA, Latifi F, Rashidyani J. Biotech's growing activity in the world of social media networking. J Appl Biotechnol Rep. 2020;7(3):135-138. doi:10.30491/JABR.2020.117882.

Introduction

Social media is an internet-based technology that simplifies the distribution of ideas and information over the structure of virtual network platforms and online communities. Social media platforms, such as Twitter and Facebook, contain massive information resources as well as various communication tools. Social media facilitate mutual interactions between multiple people simultaneously.[1,2] The use of online platforms is popular with scientists because they use them to share their research findings.[3] Biotechnology is an interdisciplinary field of study that encompasses genetics, biochemistry, molecular biology, etc.[4] The objective of this study is to explore the application of social media in different aspects of biotechnology research, education, and industrial areas.

What Is Social Media?

Online social media websites have more than 3.2 billion active users.[5] As of October 2018, Facebook had 2.234 billion active users, YouTube had 1.9 billion active users, and WhatsApp had 1.5 billion users.[6] Other popular platforms such as Twitter and LinkedIn had 335 million and 303 million active users, respectively.[6] In fact, 4.02 billion people use the Internet around the world.[5] Over 90% of Americans aged 18 to 29 use social media.[2] A 2015 review found that 47% of the American Association for the Advancement of Science (AAAS) members use social media for sharing their scientific achievements.[7]

Social Media in Biotechnology Education

Technology has significantly contributed to the improvement of education in the past few decades. As social networking websites establish themselves as undeniable means of communication, biotechnology instructors and students seek to use them to boost active learning, scientific collaboration and class participation. Biotechnology, as an academic discipline, has recently gained significant recognition around the world.[8] A research conducted in New Zealand presented three models for biotechnology education: mental, expressed consensus, and teaching models.[9] Certainly, in all three models, social media play an effective role in information circulation and the process of education.

Many universities around the world offer online biotechnology courses at postgraduate and undergraduate levels. For example, the Massachusetts Institute of Technology's Open Course Ware (OCW) provides free access to class sessions held on campus. This system facilitates access

to notes, assignments, and reading materials, many of which may be downloaded for free. Biotech courses are also available on edX.org which is an online education website created by Harvard University and MIT.

In order to move beyond traditional education and training methods, it is essential to find out how industries and universities involved in Biotechnology may benefit from social media. We may have to ensure that the societal questions (including all the stakeholders of biotechnology) are integrated into discussions about technical change or knowledge updating so that the technology/knowledge is not isolated from the society.[10]

Due to the interdisciplinary nature of biotechnology, the use of online social networks and communication tools help scientists, students, and industries contribute to the transfer of concepts.

Social Media in Biotechnology Research

Knowledge in general has grown in an exponential phase in the twentieth century and is still growing at a faster rate in this century. The explosive growth of knowledge has been described by David Linowes in the following terms: "It took from the time of Christ to the mid-eighteenth century for knowledge to double. It doubled again 150 years later and then again in only 50 years. Today it doubles every 4 or 5 years. More new information has been produced in the last 30 years than in the previous 5,000."[11]

The knowledge explosion in the case of biotechnology is very complex considering its multidisciplinary and applied nature (Figure 1). Biotechnology is expanding the frontiers of knowledge with discoveries in fields as diverse as agriculture, energy, health care, the environment, and the sustainable development of natural resources.[12]

Research and Development (R&D) and innovation are increasingly considered as key policy components of national and international strategies to create economic growth (employment, productivity, and social cohesion). The important biotech research tools are up-to-date specialized information, advanced laboratory equipment, laboratory materials, and expert researchers. One of the key challenges in science and technology analysis is to combine different databases and indicators such as patents and articles to offer a more accurate picture of the scientific world.[13] It is often productive to consult with research experts through social networks such as ResearchGate and LinkedIn.

A simple search on LinkedIn shows an online network of more than two and a half million biotechnologists. This capacity is high enough for members to share their knowledge and find answers to their potential questions. Scientific meetings and seminars are used to describe a research talk, often given by a visiting researcher and primarily attended by academics, research staff, and postgraduate students. In traditional seminars, participants and speakers have to come together at a specific time and place. Transportation cost is usually a big concern for participants. However, thanks to online social networks, online seminars or webinars lower this cost. A webinar is an online seminar that turns a presentation into a real-time conversation. Webinars allow large groups of participants to engage in online discussions or training events and share audio, documents, or slides even when they're not in the same place as the meeting host or in the same room where the event or presentation takes place. Different networking applications facilitate webinar sessions such as 1) ezTalks webinar (https://www.eztalks.com/webinar) is one of the best free webinar services. It allows you to quickly host a webinar for free from your Android, iOS, Mac, and Windows easily. 2) Zoom (https://zoom.us) is a leading modern video communications website with an easy and reliable cloud platform for video and audio conferencing, collaboration, chat, and webinars across mobile devices, desktops, telephones, and room systems. Zoom Rooms is the original software-based conference room solution used around the world on board, conference, huddle, and training rooms, as well as executive offices and classrooms. 3) Google+ Hangouts (https://hangouts.google.com/) is a sufficient option available for minimum cost. This website has created

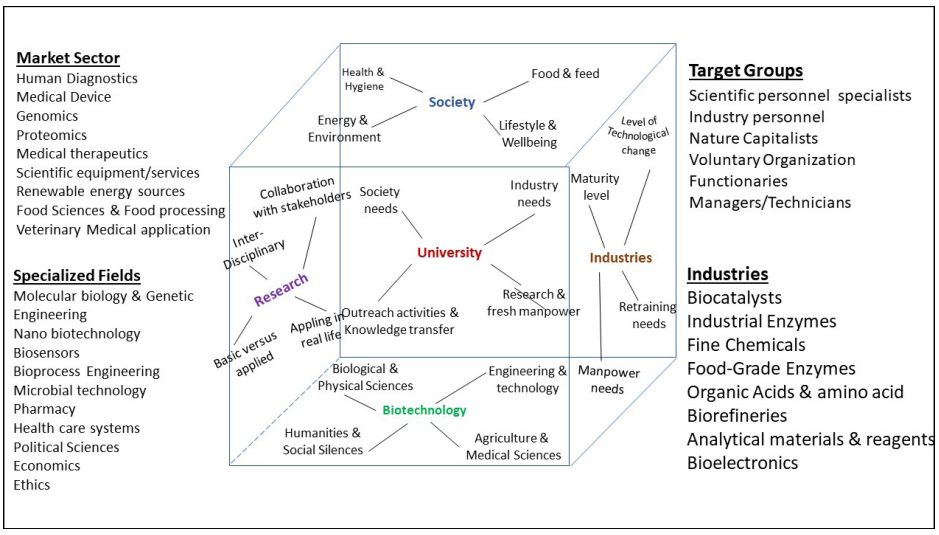

Figure 1. Multidisciplinary and applied nature of Biotechnology – University, industry, and society.[9]

an increasing demand for research and innovation indicators to frame policy objectives, and to design, implement, and evaluate policy actions. Also, improvements in information and communications technology (ICT) have increased the availability of databases. Academic performance indicators, principally articles and patents have become some of the most commonly used tools to characterize and evaluate both the scientific production and public policies regarding R&D.[14] Seasoned internet users are often adamant that online tools can increase their productivity and lead to overall improvements in their research efficiency.

Social media portals in particular undergo regular reinvention and transformation, with different tools becoming popular for different populations.[15] Although several instructions exist online, many researchers still feel overwhelmed and hesitant toward the virtual world because they are still unfamiliar with sufficient information and instructions. To better familiarize researchers with the existing internet resources and social media abilities, here we discuss prospective benefits that can stem from online science conversations, explain how scientists can efficiently and effectively harness online resources, and provide an overview of popular online tools.[4]

Social Media in the Biotechnology Industry

Commercialized biotechnology concentrates on biotechnology clusters surrounded by universities and life sciences research institutes.[16] The university's responsibility in the present-day knowledge society changes to emphasize knowledge transfer. Studies on industrial and academic biotechnology performance are growing with extraordinary speed in many global sectors. As a result of commercialization and industrialization, the biotechnology field needs a large work-force. Current employment in biotechnology (including pharmaceutical firms, government labs, and private research institutions) is put at 400 000.[16,17] As a biotechnology company grows from a small start-up to a large manufacturing company, human resources need change. A survey by the US Department of Commerce shows that the total biotechnology industry workforce grew 13% for four consecutive years from 1999 to 2003.[9,18] Social media marketing can be a foreign set of words to any business owner, but for professionals in the pharmaceutical, biotech, and life science sectors the term can be especially nerve-racking.

Networks have well-established importance in business. Network analysis, grounded in the social network theory, is used to analyze two international biotech business-to-business environments. The dynamic development of interactive electronic media of a social network gives also a huge field of possibilities for the use of innovative methods of selling and building a market position of companies operating in the pharmaceutical industry. Marketing of pharmaceutical companies in social media can rely on generating Internet traffic through the use of social networking sites. It enables direct contact with a target group, also reducing marketing costs. It aims to form a relationship between a pharmaceutical company and doctors or patients. This is not a method to achieve rapid sales growth, but it is to become a partner for dialog. The goal is to influence the positive image of a company and, at the same time, encourage customers to share information with friends. Social media marketing relies on effective fan page management of a brand or a company. This is a public relations and marketing operation. Pharmaceutical companies may place counseling articles on social networking sites. The topics may cover health, medicine, lifestyle, nutrition, etc. Photos, videos, commercials, and short text messages can be also published.[1]

Conclusions

Biotechnology covers various subjects such as genetics, biochemistry, molecular biology, etc. Biotechnology scholars certainly need new and effective research and education methods.[4] Better access to the global network increases the number of users (46% of the world population – 3.42 billion people).[18] Thanks to social media, Biotechnology business industry can reach out to millions of customers worldwide.[19] It can help communicate all necessary information about pharmaceutical products but also promote pro-health actions in the field of promotion and prevention.[20] In various social media channels, it is possible to find information on any drug. This information is available on websites of a manufacturer, social network brand fan pages, and portals for white staff specialists.[1]

Scientific databases and journals such as BIOSIS, PubMed, and Scopus are powerful tools in education and research. Free online courses offered by prominent universities have significantly lowered the education cost. Sharing personal experiences and two-way online communication between scientists and biotech students through the LinkedIn, Facebook, Twitter, and WhatsApp can provide thematic distribution and geographical distribution of teachers, researchers, and students in knowledge acquisition and research. In this regard, there has been a strong increase in social media activity using officially endorsed conference hashtags at North American urology meetings. The content of the Twitter dialogue has improved and urologists have taken over as prime contributors.[21] Biotechnology companies can achieve several goals through the use of social media. They can make use of social media for e-pharma marketing, creating commercial networks and information sharing. As the benefits of the use of social media become more apparent, they will find more recognition by the wider academic community.

Authors' Contributions

All authors contributed equally to current research.

Conflict of Interest Disclosures

The authors declare they have no conflicts of interest.

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