Curriculum vitae

Mohammed Bahey-El-Din, *M.Sc.*, *Ph.D.*

- **Name:** Mohammed Bahey-El-Din Hassan Bahey-El-Din
- **Current post:** Professor
- **Address:** Department of Microbiology and Immunology, Faculty of Pharmacy, Alexandria University, 1-El-Khartoum Square, El-Azarita, Alexandria, Egypt.
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- ***h*-index:** 14 (according to Scopus; Accessed 17th May, 2022)

- **Qualifications and degrees:**

➢ **June 2000**: Bachelor degree in Pharmaceutical Sciences. Mohammed Bahey-El-Din was the Top of pharmacy graduates year 2000 (Faculty of Pharmacy, Alexandria University, Egypt), with a general grade of Distinction Honor.
➢ **September 2001-April 2004**: Master degree in Pharmaceutical Microbiology (Department of Pharmaceutical Microbiology, Alexandria University, Egypt).
➢ **November 2005-September 2009**: Ph.D. degree in Microbiology (The School of Pharmacy, University College Cork (UCC), Ireland).

- **Positions:**

➢ September 2000-March 2004: Demonstrator for the undergraduate pharmacy students at the department of Microbiology and Immunology, Faculty of Pharmacy, Alexandria University.
➢ April 2004-October 2005: Assistant lecturer at the department of Microbiology and Immunology, Faculty of Pharmacy, Alexandria University.
➢ November 2005-September 2009: PhD candidate and demonstrator at the School of Pharmacy, University College Cork (UCC), Ireland.
➢ September 2009-July 2010: Post-Doctoral Researcher at the Department of Microbiology, University College Cork (UCC), Ireland.
➢ August 2010-July 2015: Lecturer at the Department of Microbiology and Immunology, Faculty of Pharmacy, Alexandria University, Egypt.
➢ August 2015- March 2021: Associate Professor at the Department of Microbiology and Immunology, Faculty of Pharmacy, Alexandria University, Egypt.

- April 2021-present: **Professor** at the Department of Microbiology and Immunology, Faculty of Pharmacy, Alexandria University, Egypt.
- April 2021-Sep. 2021: **Head** of the Department of Microbiology and Immunology, Faculty of Pharmacy, Alexandria University, Egypt.
- Dec. 2010-Sep. 2017: **Visiting Microbiological Consultant** in Medizen Pharmaceutical Industries Co., Borg El-Arab, Alexandria.
- Oct. 2017-July 2018: **Visiting Fulbright Scholar** at University of Illinois at Chicago (UIC), **USA**.
- Oct. 2021-present: **Senior research Marie-Curie scientist**, University College Cork (UCC), **Ireland**.

- **Research work and interests:**

Mohammed Bahey-El-Din is interested in the areas of immunotherapy, vaccinology and genetic engineering. Of particular interest is the development of *Lactococcus lactis*-based safe vaccines against potential pathogens. He has been involved in research projects for the development of live vaccines against *Listeria monocytogenes* and *Clostridium difficile*. In addition, Dr. Bahey-El-Din has been involved in the development of recombinant subunit vaccines with various immunoadjuvants. He has been the Principal Investigator (PI) of several research projects for the development of recombinant subunit vaccine candidates against *Schistosoma mansoni, Acinetobacter baumannii, Klebsiella pneumoniae, Stenotrophomonas maltophilia, Enterococcus faecium* and *pseudomonas aeruginosa*. He is also interested in developing rapid and cost-effective diagnostics for Hepatitis C virus and *Mycobacterium tuberculosis*.

More recently, Dr. Bahey-El-Din has been involved in monoclonal antibody discovery using the phage display technology and its use in immunotherapy and diagnostics. He published more than 30 journal publications mostly in the areas of vaccinology and medical microbiology. He is a regular reviewer in a number of international journals such as *Vaccine, Journal of Medical Microbiology*, *Journal of Biomedical sciences*, *Microbial Cell Factories, Frontiers in immunology, Microbial Pathogenesis, BMC Biotechnology* and *BMC Microbiology*. Furthermore, he co-authored two book chapters published by international publishers (Landes Bioscience and Humana Press (Springer)) on bacterial immunomodulation and immunological protocols, respectively.

Dr. Bahey-El-Din also acted as an **International Grant Examiner** on several occasions e.g. for grant applications submitted to The **Netherlands** Organization for Health Research and Development (ZonMw), National Research Fund (NRF) of **South Africa** and **The Royal Society of New Zealand** (MARSDEN fund). Dr. Bahey-El-Din is very interested in translational medicine and applied microbiology/immunology which would result in beneficial products for therapy and diagnosis of diseases.

- **Research skills and techniques:**

Dr. Bahey-El-Din has deep hands-on expertise in all essential molecular techniques starting from bioinformatic analysis of DNA and proteins, primer design and optimization of Polymerase Chain Reactions (PCR), gene splicing using SOE (Splicing by Overlap

extension) technique, real time PCR, cloning in plasmid/phagemid vectors by restriction/ligation approach and restriction-independent approach, transformation into bacteria (Gram positive and Gram negative*), Pichia pastoris* and mammalian cells (with relevant cell culture experience), screening for protein expression using SDS-PAGE and Western blotting; Protein purification using various chromatographic techniques such as affinity chromatography for tagged proteins and protein A/G purification of antibodies, Size exclusion chromatography (gel filtration) for desalting and buffer exchange. Furthermore, he has deep hands-on experience in antibody raising and animal infection models including handling, injection/administration (intraperitoneal, subcutaneous, intramuscular, intradermal, intranasal, oral gavage) and serum sampling using submandibular bleeding technique. In addition, he is experienced in essential immunological techniques such as opsonophagocytic assays, proliferation assays, agglutination tests, ELISA (direct, indirect, competitive) for detection of antigens or antibodies and ELiSPOT for detection of cytokine-secreting cells. He has also appreciable experience in phage display technology and development of antigen-specific antibody mimetics and ScFv antibody fragments with subsequent sub-cloning for mammalian expression of full-length antibodies.

- **Journal Publications:**

1. Mahgoub YA, Shawky E, Eldakak M., **Bahey-El-Din M**, Darwish FA, El Sebakhy NA, El-Hawiet A. Plant DNA barcoding and metabolomics for comprehensive discrimination of German Chamomile from its poisonous adulterants for food safety. *Food Control* 2022; 136: 108840
2. Sarhan AT, **Bahey-El-Din M**, Zaghloul TI. Recombinant Ax21 protein is a promising subunit vaccine candidate against *Stenotrophomonas maltophilia* in a murine infection model. *Vaccine* 2021;39:4471–80. doi:10.1016/j.vaccine.2021.06.051
3. **Bahey-El-Din M**, Mohamed SA, Sheweita SA, Haroun M, Zaghloul TI. Recombinant N-terminal outer membrane porin (OprF) of *Pseudomonas aeruginosa* is a promising vaccine candidate against both *P. aeruginosa* and some strains of *Acinetobacter baumannii*. *Int J Med Microbiol* 2020;310:151415.
4. **Bahey-El-Din M**, Younes MH, Zaghloul TI. Detection of *Mycobacterium tuberculosis* Serum Biomarkers and the Relation with Previous BCG Vaccination. *J Adv Pharm Res* **2021**; 5(1):x-x. doi:10.21608/aprh.2020.30543.1108.
5. Elhosary M, El Guink N, AbdelBary A, Aboushleib H, **Bahey-El-Din M**. Recombinant Flagellin and Incomplete Freund's Adjuvant Potentiate the Vaccine Efficacy of the Iron Acquisition Protein (HitA) of Pseudomonas aeruginosa. *J Adv Pharm Res* 2020;4:101–10. doi:10.21608/aprh.2020.30543.1108.
6. Abdel-Rahman LM, Eltaher HM, Abdelraouf K, **Bahey-El-Din M**, Ismail C, Kenawy ERS, et al. Vancomycin-functionalized Eudragit-based nanofibers: Tunable drug release and wound healing efficacy. *J Drug Deliv Sci Technol* 2020;58:101812. doi:10.1016/j.jddst.2020.101812.

7. Yousief SW, **Bahey-El-Din M**, Zaghloul TI. Immunization with the basic membrane protein (BMP) family ABC transporter elicits protection against *Enterococcus faecium* in a murine infection model. *Microbes and Infection* 2019 Oct 1; pii: S1286-4579(19)30108-X. doi: 10.1016/j.micinf.2019.09.002.
8. Elhosary MA, **Bahey-El-Din M**, AbdelBary A, El Guink N, Aboushleib HM. Immunization with the ferric iron-binding periplasmic protein HitA provides protection against *Pseudomonas aeruginosa* in the murine infection model. *Microbial Pathogenesis* 2019;131:181–185.
9. Hussein KE, **Bahey-El-Din M**, Sheweita SA. Immunization with the outer membrane proteins OmpK17 and OmpK36 elicits protection against *Klebsiella pneumoniae* in the murine infection model. *Microbial Pathogenesis*. 2018;119:12-18.
10. Zayed DG, Ebrahim SM, Helmy MW, Khattab SN, **Bahey-El-Din M**, Fang JY, et al. Combining hydrophilic chemotherapy and hydrophobic phytotherapy via tumor-targeted albumin-QDs nano-hybrids: Covalent coupling and phospholipid complexation approaches. *J Nanobiotechnology* 2019;17.
11. AbdElhamid AS, Zayed DG, Helmy MW, Ebrahim SM, **Bahey-El-Din M**, Zein-El-Dein EA, et al. Lactoferrin-tagged quantum dots-based theranostic nanocapsules for combined COX-2 inhibitor/herbal therapy of breast cancer. *Nanomedicine* 2018;13:2637–56.
12. Elmataeeshy ME, Sokar MS, **Bahey-El-Din M**, Shaker DS. Enhanced transdermal permeability of Terbinafine through novel nanoemulgel formulation; Development, in vitro and in vivo characterization. *Future J Pharm Sci*. 2018;4(1):18-28.
13. AbdElhamid A.S., Helmy M.W., Ebrahim S.M., **Bahey-El-Din M**, Zayed D.G., Zein El Dein E.A., El-Gizawy S.A., Elzoghby A.O., Layer-by-layer gelatin/chondroitin quantum dots-based nanotheranostics: combined rapamycin/celecoxib delivery and cancer imaging, *Nanomedicine*. 2018; nnm-2018-0028. doi:10.2217/nnm-2018-0028.
14. Zeitoun H, **Bahey-El-Din** M, Kassem MA, Aboushleib HM. Mycothiol acetyltransferase (Rv0819) of *Mycobacterium tuberculosis* is a potential biomarker for direct diagnosis of tuberculosis using patient serum specimens. *Lett Appl Microbiol*. 2017 Dec;65(6):504-511.
15. Elnaggar YS, Talaat SM, **Bahey-El-Din M**, Abdallah OY. Novel lecithin-integrated liquid crystalline nanogels for enhanced cutaneous targeting of terconazole: development, in vitro and in vivo studies. *Int J Nanomedicine*. 2016;11:5531-47.
16. Dowd GC, **Bahey-El-Din M**, Casey PG, Joyce SA, Hill C, Gahan CG. Listeria monocytogenes mutants defective in gallbladder replication represent safety-enhanced vaccine delivery platforms. *Hum Vaccin Immunother*. 2016 Aug 02;12(8):2059-63.
17. Shehat MG, **Bahey-El-Din M**, Kassem MA, Farghaly FA, Abdul-Rahman MH, Fanaki NH. Recombinant expression of the alternate reading frame protein (ARFP) of Hepatitis C virus genotype 4a (HCV-4a) and detection of ARFP and anti-ARFP antibodies in HCV-infected patients. *Archives of virology* 2015*;* 160: 1939-1952.
18. Mossallam SF, Amer EI, Ewaisha RE, Khalil AM, Aboushleib HM, **Bahey-El-Din M.** Fusion protein comprised of the two schistosomal antigens, Sm14 and Sm29,

provides significant protection against *Schistosoma mansoni* in murine infection model. *BMC infectious Diseases* 2015; 15:147

19. Ewaisha RE, **Bahey-El-Din M,** Mossallam SF, Amer EI, Aboushleib HM, Khalil AM. Combination of the two schistosomal antigens Sm14 and Sm29 elicits significant protection against experimental *Schistosoma mansoni* infection. *Experimental Parasitology* 2014; 145:51-60
20. Ewaisha RE, **Bahey-El-Din M,** Mossallam SF, Khalil AM, Aboushleib HM. Successful detection, expression and purification of the alternatively spliced truncated Sm14 antigen of an Egyptian strain of *Schistosoma mansoni*. *J Helminthol* 2015; 89:764-768.
21. Hanin A, Culligan EP, Casey PG, **Bahey-El-Din M**, Hill C and Gahan CG. Two tiered biological containment strategy for *Lactococcus lactis*-based vaccine or immunotherapy vectors. *Human Vaccines and Immunotherapeutics* 2014; 10(2), 333-37.
22. McLaughlin HP, **Bahey-El-Din M**, Casey PG, Hill C, Gahan CG. A mutant in the Listeria monocytogenes Fur-regulated virulence locus (frvA) induces cellular immunity and confers protection against listeriosis in mice. *J Med Microbiol* 2013; 62**:** 185-190.
23. **Bahey-El-Din M**. *Lactococcus lactis*-based vaccines from laboratory bench to human use: An overview. *Vaccine* 2012; 30(4):685-90.
24. **Bahey-El-Din M** & Gahan CG. *Lactococcus lactis*-based vaccines: Current status and future perspectives. *Human vaccines,* 2011; 7(1): 106-109.
25. **Bahey-El-Din M**, Gahan CG & Griffin BT. *Lactococcus lactis* as a cell factory for delivery of therapeutic proteins. *Current Gene Therapy* 2010; 10: 34-45.
26. **Bahey-El-Din M**, Casey PG, Griffin BT & Gahan CG. Efficacy of a *Lactococcus lactis ΔpyrG* vaccine delivery platform expressing chromosomally integrated *hly* from *Listeria monocytogenes*. *Bioengineered Bugs* 2010; 1: 66-74.
27. **Bahey-El-Din M**, Casey PG, Griffin BT & Gahan CG. Expression of two *Listeria monocytogenes* antigens (P60 and LLO) in *Lactococcus lactis* and examination for use as live vaccine vectors. *J Medical Microbiology* 2010; 59: 904-12.
28. **Bahey-El-Din M** & Gahan CG. *Lactococcus lactis*: from the dairy industry to antigen and therapeutic protein delivery. *Discovery Medicine* 2010; 9: 455-61.
29. **Bahey-El-Din M**, Griffin BT & Gahan CG. Nisin inducible production of listeriolysin O in *Lactococcus lactis* NZ9000. *Microbial Cell Factories* 2008; 7:24.
30. **Bahey-El-Din M**, Casey PG, Griffin BT & Gahan CG. Lactococcus lactis-expressing listeriolysin O (LLO) provides protection and specific CD8(+) T cells against *Listeria monocytogenes* in the murine infection model. *Vaccine* 2008; 26: 5304-14.
31. El-nakeeb MA, Abou-Shleib HA, Khalil A & **Bahey-El-Din M**. Effect of Beta-lactamases and Nor-A inhibitors on the activities of Ampicillin, Ciprofloxacin and Levofloxacin against *Staphylococcus aureus* clinical isolates. *Alex. J. Pharm. Sci.* 2005; 19(1): 33-40.
32. El-nakeeb MA, Abou-Shleib HA, Khalil A & **Bahey-El-Din M**. Susceptibility of *Staphylococcus aureus* clinical isolates against various antibiotics, selected antibiotic combinations and post-antibiotic effect. *Alex. J. Pharm. Sci.* 2004; 18(2): 157-164.

- **Book Chapters:**

1. **Bahey-El-Din M,** Gahan CG. Vaccination Studies: Detection of a *Listeria monocytogenes*-Specific T Cell Immune Response Using the ELISPOT Technique. In: Jordan K, Fox EM and Wagner M, eds. "*Listeria monocytogenes* Methods and Protocols"; *Methods Mol Biol*. New York: Humana Press (Springer), **2014**; 1157:263-74.
2. **Bahey-El-Din M**, Griffin BT & Gahan CG. Attack and counter-attack: Targeted immunomodulation using bacterial virulence factors. In: Sleator R, Hill C, eds. "Patho-Biotechnology". Austin: Landes Bioscience, **2008**: 163-172.

- **Research projects:**

Dr. Bahey-El-Din has been the **Principal Investigator (PI)** of the following three projects:

1- Project title: "Development of potential vaccine candidates against *Schistosoma mansoni* using novel delivery systems".
-The project was funded by Alexandria University Research Enhancement Program (ALEX-REP).

2- Project title: "Investigation of anti-hepatitis C (HCV) antibodies in the serum of HCV-infected Egyptian patients at different stages of disease prognosis and treatment".
-The project was funded by the Science and Technology Development Fund (STDF).

3- Project title: "Investigation of novel *Mycobacterium tuberculosis* antigens as potential serodiagnostic tools and possible vaccine candidates".
-The project was funded by the Science and Technology Development Fund (STDF).