

MAHMOUD M. ELNAGGAR, Ph.D.

CURRICULUM VITAE

CONTACTS

- **Address:** College of Applied and Health Sciences, A'Sharqiyah University, P.O. Box 42, Postal Code 400, Ibra, Sultanate of Oman
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CAREER POSITIONS

- October 2022 – Present Assistant Professor of Veterinary Microbiology, College of Applied and Health Sciences, A'Sharqiyah University, Oman.
- August 2021 – September 2022 Associate Professor of Microbiology, Faculty of Veterinary Medicine, Alexandria University, Egypt.
- September 2020 – July 2021 Lecturer of Microbiology, Faculty of Veterinary Medicine, Alexandria University, Egypt.
- November 2019 – August 2020 Research Fellow, The Trinity Biomedical Science Institute, School of Biochemistry & Immunology, Trinity College Dublin and Animal & Grassland Research and Innovation Centre, Teagasc, Ireland.
- August 2015 – October 2019 Postdoctoral Research Associate, The Washington State University Monoclonal Antibody Center, College of Veterinary Medicine, Washington State University, USA.
- December 2014- June 2015 Visiting Scholar, Department of Veterinary Microbiology and Pathology, College of Veterinary Medicine, Washington State University, USA.
- January 2014- December 2014 Lecturer of Microbiology, Faculty of Veterinary Medicine, Alexandria University, Egypt.
- February 2009- December 2013 Assistant Lecturer of Microbiology, Faculty of Veterinary Medicine, Alexandria University, Egypt.
- March 2006- January 2009 Teaching Assistant, Department of Microbiology, Faculty of Veterinary Medicine, Alexandria University, Egypt.

EDUCATION

- 2009-2013 Ph.D. in Veterinary Microbiology (Immunology)
Faculty of Veterinary Medicine, Alexandria University, Egypt. A joint collaborative study between Faculty of Veterinary Medicine Alexandria University Egypt, College of Veterinary Medicine Washington State University USA and LIONEX Diagnostics & Therapeutics Braunschweig Germany.
Dissertation title: Application of flow cytometric assay for diagnosis of bovine tuberculosis.

2006-2009	Master of Veterinary Medical Sciences in Microbiology (MVSc), Faculty of Veterinary Medicine, Alexandria University, Egypt. A joint collaborative study between Faculty of Veterinary Medicine Alexandria University Egypt and College of Veterinary Medicine Washington State University USA. <i>Dissertation title:</i> Identification of leukocyte differentiation molecules of water buffalo using different panels of monoclonal antibodies.
2000-2005	Bachelor of Veterinary Medical Science (BVSc) Faculty of Veterinary Medicine, Alexandria University, Egypt.

GRANTS INVOLVEMENTS AS TEAM MEMBER

Period	Grant title and Fund	Amount of Fund
January 2024 – December 2025	Foot and Mouth Disease Virus in Oman: Sero-Molecular Epidemiology and Vaccine Matching (PI).	OMR 20,000.00
November 2019- August 2020	The Bovine epigenome and susceptibility to mycobacterial diseases (Co-I).	€ 498,000.00
July 2019- October 2019	Validation of a BCG relA deletion mutant as an improved vaccine for M. bovis and M. tuberculosis. Funded by intramural grant, Washington State University, USA (Co-I).	USD 20,000.00
2018-2019	Immune reagents for agricultural animals with a focus on bovine. Funded by USDA-NIFA, USA (Co-I).	USD 500,000.00
2016-2018	EAGER: Biomanufacturing: Polymer Protective Effector T-Cell Isolation and Centrifugal Bioreactor Expansion for a Parasitic Disease Model with Relevance in Human Cancer Treatment. Funded by NSF, USA (Co-I).	USD 300,000.00
2016-2017	Development of a peptide-based vaccine for Johne's Disease. Funded by intramural grant, Washington State University, USA (Co-I).	USD 20,000.00
2013-2014	Emerging viral vector borne diseases. Funded by European Commission Seventh Framework (EC-FP7) programs that include collaboration between 16 institutes from 13 European and African countries (Co-I).	A total of EUR 2,999,120.00. The amount allocated for the Egyptian partner (FVM, AU); EUR 79,999.00

2012-2014	A new approach in Egypt toward detection of bovine TB by using highly advanced methods of Bovigam and Flow cytometric assays: Alexandria and Beheira governorate are starting geographical areas. Funded by Research Enhancement Program (ALEX REP), Alexandria University, Egypt (Co-I).	EGP 200,000.00
2010-2014	Using a cytokine flow cytometric assay as a complementary diagnostic test for detection of bovine tuberculosis: A new approach in Egypt. ID: 2081. Funded by Science & Technology Development Fund (STDF), Egypt (Co-PI)	EGP 1,000,000.00
2009-2011	A rapid molecular detection and epidemiological assay of Mycobacterium infection in west and middle Egypt. Funded by Research Enhancement Program (ALEX REP), Alexandria University, Egypt (Co-I).	EGP 200,000.00

PUBLICATIONS

1. **2023:** Bhat, S. A., Elnaggar, M., Hall, T. J., McHugo, G. P., Reid, C., MacHugh, D. E., & Meade, K. G. (2023). Preferential differential gene expression within the WC1.1(+) gammadelta T cell compartment in cattle naturally infected with *Mycobacterium bovis*. *Front Immunol*, 14, 1265038. doi:10.3389/fimmu.2023.1265038
2. **2023:** Giovanna De Matteis, Maria Carmela Scatà, Michele Zampieri, Francesco Grandoni, Mahmoud M. Elnaggar, Lorena Schiavo, Giovanna Cappelli, Monica Cagiola, Esterina De Carlo, William C. Davis, Alessandra Martucciello, Flow cytometric detection of IFN- γ production and Caspase-3 activation in CD4⁺ T lymphocytes to discriminate between healthy and *Mycobacterium bovis* naturally infected water buffaloes. *Tuberculosis* 139 (2023): 102327
3. **2022:** Mahmoud M. Elnaggar, Gaber S. Abdellrazeq, Randy E. Sacco, Trevor R. Harsla, Mallory L. Mucci, Lindsay M. Fry, Victoria Hulubei, William C. Davis. Comparative analysis of the specificity of monoclonal antibodies developed against the bottlenose dolphin, *Tursiops truncatus*, TNF- α , IL1- β , IL-6, IL-8, IL-10 with monoclonal antibodies made against ovine IFN- γ bovine IL-17A and IL-1 β revealed they recognize epitopes conserved on dolphin and bovine orthologues. *Veterinary Immunology and Immunopathology*, 250:110456, doi: 10.1016/j.vetimm.2022.110456.
4. **2022:** Davis William C., Mahmoud Asmaa H., Abdellrazeq Gaber S., Elnaggar Mahmoud M., Dahl John L., Hulubei Victoria, Fry Lindsay M. Ex vivo Platforms to Study the Primary and Recall Immune Responses to Intracellular Mycobacterial Pathogens and Peptide-Based Vaccines. *Frontiers in Veterinary Science* 9:878347
5. **2021:** Davis, W.C.; Abdellrazeq, G.S.; Mahmoud, A.H.; Park, K.-T.; Elnaggar, M.M.; Donofrio, G.; Hulubei, V.; Fry, L.M. Advances in Understanding of the Immune Response to Mycobacterial Pathogens and Vaccines through Use of Cattle and *Mycobacterium avium subsp. paratuberculosis* as a Prototypic Mycobacterial Pathogen. *Vaccines* 2021, 9, 1085.
6. **2021:** Mahmoud M. Elnaggar, Donald P. Knowles, William C. Davis and Lindsay M. Fry (2021). Flow Cytometric Analysis of the Cytotoxic T-Cell Recall Response to *Theileria parva* in Cattle Following Vaccination by the Infection and Treatment Method. *Veterinary Sciences* 8(6):114.
7. **2020:** Abdellrazeq, G. S., A. H. Mahmoud, K. T. Park, L. M. Fry, M. M. Elnaggar, D. A. Schneider, V. Hulubei and W. C. Davis (2020). relA is Achilles' heel for mycobacterial pathogens as demonstrated with deletion mutants in *Mycobacterium avium subsp. paratuberculosis* and *Mycobacterium bovis* bacillus Calmette-Guérin (BCG). *Tuberculosis (Edinb)* **120**: 101904.

- 8. 2020:** Abdellrazeq, G. S., L. M. Fry, M. M. Elnaggar, J. P. Bannantine, D. A. Schneider, W. M. Chamberlin, A. H. A. Mahmoud, K. T. Park, V. Hulubei and W. C. Davis (2020). Simultaneous cognate epitope recognition by bovine CD4 and CD8 T cells is essential for primary expansion of antigen-specific cytotoxic T-cells following ex vivo stimulation with a candidate *Mycobacterium avium subsp. paratuberculosis* peptide vaccine. Vaccine **38**(8): 2016-2025.
- 9. 2020:** DePompeo, C. M., M. I. Giasseti, M. M. Elnaggar, J. M. Oatley, W. C. Davis and B. A. Fransson (2020). "Isolation of canine adipose-derived mesenchymal stem cells from falciform tissue obtained via laparoscopic morcellation: A pilot study." Veterinary Surgery **49**(S1): O28-O37.
- 10. 2019:** Franceschi, V., A. H. Mahmoud, G. S. Abdellrazeq, G. Tebaldi, F. Macchi, L. Russo, L. M. Fry, M. M. Elnaggar, J. P. Bannantine, K.-T. Park, V. Hulubei, S. Cavirani, W. C. Davis and G. Donofrio (2019). Capacity to Elicit Cytotoxic CD8 T Cell Activity Against *Mycobacterium avium* subsp. *paratuberculosis* Is Retained in a Vaccine Candidate 35 kDa Peptide Modified for Expression in Mammalian Cells. Frontiers in Immunology **10**(2859).
- 11. 2019:** Abdellrazeq, G. S., M. M. Elnaggar, J. P. Bannantine, D. A. Schneider, C. D. Souza, J. Hwang, A. H. A. Mahmoud, V. Hulubei, L. M. Fry, K. T. Park and W. C. Davis (2019). A peptide-based vaccine for *Mycobacterium avium subspecies paratuberculosis*. Vaccine **37**(21): 2783-2790.
- 12. 2019:** Elnaggar, M. M., F. Grandoni, G. S. Abdellrazeq, L. M. Fry, K. El-Naggar, V. Hulubei, L. Buttazoni, S. A. Khaliel, H. A. Torkey and W. C. Davis (2019). Pattern of CD14, CD16, CD163 and CD172a expression on water buffalo (*Bubalus bubalis*) leukocytes. Veterinary Immunology and Immunopathology **211**: 1-5.
- 13. 2018:** Elnaggar, M. M., G. S. Abdellrazeq, R. P. Dassanayake, L. M. Fry, V. Hulubei and W. C. Davis (2018). Characterization of $\alpha\beta$ and $\gamma\delta$ T cell subsets expressing IL-17A in ruminants and swine. Developmental and Comparative Immunology **85**: 115-124.
- 14. 2018:** Abdellrazeq, G. S., M. M. Elnaggar, J. P. Bannantine, K. T. Park, C. D. Souza, B. Backer, V. Hulubei, L. M. Fry, S. A. Khaliel, H. A. Torkey, D. A. Schneider and W. C. Davis (2018). A *Mycobacterium avium subsp. paratuberculosis* relA deletion mutant and a 35 kDa major membrane protein elicit development of cytotoxic T lymphocytes with ability to kill intracellular bacteria. Veterinary Research **49**(1): 53.
- 15. 2017:** Elnaggar, M. M., G. S. Abdellrazeq, S. K. Venn-Watson, E. D. Jensen, V. Hulubei, L. M. Fry, R. E. Sacco and W. C. Davis (2017). Identification of monoclonal antibodies cross-reactive with bottlenose dolphin orthologues of the major histocompatibility complex and leukocyte differentiation molecules. Veterinary Immunology and Immunopathology **192**: 54-59.
- 16. 2017:** Elnaggar MM, Abdellrazeq GS, Elsisy A, Mahmoud AH, Shyboub A, Sester M, Khaliel SA, Singh M, Torkey HA, Davis WC. Evaluation of antigen specific interleukin-1 β as a biomarker to detect cattle infected with *Mycobacterium bovis*. Tuberculosis (Edinb) **105**:53-59.
- 17. 2017:** Grandoni F, Elnaggar MM, Abdellrazeq GS, Signorelli F, Fry LM, Marchitelli C, Hulubei V, Khaliel SA, Torkey HA, Davis WC. Characterization of leukocyte subsets in buffalo (*Bubalus bubalis*) with cross-reactive monoclonal antibodies specific for bovine MHC class I and class II molecules and leukocyte differentiation molecules. Developmental and Comparative Immunology **74**:101-109. (Equal contribution as first author).
- 18. 2016:** Elnaggar, M.M., Abdellrazeq, G.S., Mack, V., Fry, L.M., Davis, W.C., Park, K.T. Characterization and use of new monoclonal antibodies to CD11c, CD14, and CD163 to analyze the

phenotypic complexity of ruminant monocyte subsets. Veterinary Immunology and Immunopathology **178**: 57-63.

19. 2016: Park, K. T., M. M. Elnaggar, G. S. Abdellrazeq, J. P. Bannantine, V. Mack, L. M. Fry and W. C. Davis (2016). "Phenotype and Function of CD209+ Bovine Blood Dendritic Cells, Monocyte-Derived-Dendritic Cells and Monocyte-Derived Macrophages." PLoS One **11**(10): e0165247. (Equal contribution as first author).

20. 2016: Abdellrazeq, G.S., Elnaggar, M.M., Osman, H.S., Davis, W.C., Singh, M. Prevalence of Bovine Tuberculosis in Egyptian Cattle and the Standardization of the Interferon-gamma Assay as an Ancillary Test. Transboundary and Emerging Diseases **63**: 497-507.

21. 2015: Mahmoud M. Elnaggar, Gaber S. Abdellrazeq, Martina Sester, Samy A. Khaliel, Mahavir Singh, Helmy A. Torkey, William C. Davis. Development of an improved ESAT-6 and CFP-10 peptide-based cytokine flow cytometric assay for bovine tuberculosis. Comparative Immunology, Microbiology & Infectious Diseases **42**: 1-7.

ORAL CONFERENCE PRESENTATIONS

1. 2019: Mahmoud M. Elnaggar. Phenotypic analysis of T cell subsets expressing Interferon-gamma, interleukin-17A and tumor necrosis factor-alpha across ruminant species. International Veterinary Immunology Symposium (IVIS) 2019, Seattle, USA, August 13-16, 2019.

2. 2016: Mahmoud M. Elnaggar. Co-expression of CD209 and CD163 on bovine blood dendritic cells, monocytes derived dendritic cells and macrophages. International Veterinary Immunology Symposium (IVIS) 2016, the Gold Coast Convention Centre, The Gold Coast, Australia, August 16-19, 2016.

SELECTED POSTER CONFERENCE PRESENTATIONS

1. 2019: Mahmoud M. Elnaggar, Francesco Grandoni, Gaber S. Abdellrazeq, Lindsay Fry, Victoria Hulubei, William C. Davis. Unique features of water buffalo (*Bubalus bubalis*) $\gamma\delta$ T cells and monocytes. IVIS2019, Seattle, USA, August 13-16, 2019.

2. 2018: Mahmoud M. Elnaggar, Gaber S. Abdellrazeq, Lindsay Fry, Victoria Hulubei, William C. Davis. Phenotypic analysis of T cell subsets expressing interleukin-17A across ruminant species. Student and Post-Doctoral Research Symposium, College of Veterinary Medicine, WSU, USA. October 25, 2018.

3. 2018: GS Abdellrazeq, MM Elnaggar, CD Souza, JP Bannantine, WC Davis. Cytotoxic CD8 T cells with ability to kill intracellular bacteria are elicited by antigen presenting cells pulsed with a 35 kDa membrane protein from *Mycobacterium a paratuberculosis*. 14th International Colloquium on Paratuberculosis 4-8 June 2018 in Riviera Maya, Mexico.

4. 2017: C Souza, GS Abdellrazeq, MM Elnaggar, WC Davis, JP Bannantine. Blood and monocyte derived dendritic cells pulsed with a nanoparticle vectored 35kD membrane protein from *M a paratuberculosis* elicit development of cytotoxic CD8 T cells with ability to kill intracellular bacteria. ESVCP congress, London (UK), Thursday 7-9 September 2017.

5. 2017: William C. Davis, Francesco Grandoni, Mahmoud M. Elnaggar, Gaber S. Abdellrazeq, Federica Signorelli, Lindsay M. Fry, Victoria Hulubei, Samy A. Khaliel, Helmy A. Torkey, Cinzia Marchitelli, Luca Buttazzoni. Identification and use of cross-reactive monoclonal antibodies to characterize leukocyte subsets in water buffalo (*Bubalus bubalis*). Topic: Animal breeding and genetics, P095. 22nd Congress of the Animal Science and Production Association (ASPA) – 13 to 16 June 2017, - Perugia, Italy.

6. 2017: Mahmoud M. Elnaggar, Gaber S. Abdellrazeq, Victoria Hulubei, William C. Davis. Pattern of expression of scavenger receptor molecule, CD163, across ruminant species. Student and Post-Doctoral Research Symposium, College of Veterinary Medicine, WSU, USA, October 26, 2017.

7. 2017: Bernard J. Van Wie, Nehal I. Abu-Lail, Arda Gozen, William Davis, Juana Mendenhall, Mahmoud Amr, Alia Mallah, Arshan Nazempour, Chrystal Quisenberry, Christopher Detzel, Baran Arslan and David Kidwell, Gaber Abdellrazeq and Mahmoud Elnaggar. Biomimicry in a High Cell Population Density Perfusion Centrifugal Bioreactor, American Institute of Chemical Engineers (AIChE), Oct. 29 – Nov. 3, 2017, Minneapolis, MN. Abstract #501944, topical conference: chemical engineers in medicine.

8. 2016: Gaber S. Abdellrazeq, Mahmoud M. Elnaggar, John P. Bannantine, Kun Taek Park, Victoria Mack, Lindsay M. Fry, and William C. Davis. Ex vivo platforms to evaluate CD4 and CD8 T cell immune responses to candidate vaccines. IVIS2016, the Gold Coast Convention Centre, The Gold Coast, Australia, August 16-19, 2016.

TEACHING AND PROFESSIONAL EXPERIENCE

1. Veterinary Microbiology [Undergraduate students, Fall 2022/2023, College of Applied and Health Sciences (CAHS), A'Sharqiyah University (ASU), Oman].
2. Veterinary Microbiology Laboratory (Undergraduate students, Fall 2022/2023, CAHS, ASU, Oman).
3. Veterinary Parasitology (Undergraduate students, Fall 2022/2023, CAHS, ASU, Oman).
4. Veterinary Parasitology Laboratory (Undergraduate students, Fall 2022/2023, CAHS, ASU, Oman).
5. Veterinary Infectious and Zoonotic Diseases (Undergraduate students, Fall 2023, CAHS, ASU, Oman).
6. Veterinary Immunology (Undergraduate students, Spring 2023/2024, CAHS, ASU, Oman).
7. Avian Diseases (Undergraduate students, Spring 2024, CAHS, ASU, Oman).
8. Microbiology (Undergraduate students, Spring 2023/2024, CAHS, ASU, Oman).
9. Food Microbiology (Undergraduate students, Spring 2024, CAHS, ASU, Oman).
10. Bacteriology and Mycology [Undergraduate students, Spring 2014/2021 – 2022, Faculty of Veterinary Medicine (FVM), Alexandria University (AU), Egypt].
11. Basic Immunology (Undergraduate students, Fall 2014/2020 – 2022, FVM, AU, Egypt).
12. Bacteriology and Mycology labs (Undergraduate students, Fall and Spring 2007 – 2014 and 2021 – 2022, FVM, AU, Egypt).
13. Immunology labs (Undergraduate students, Fall 2007 – 2014 and 2020 – 2022, FVM, AU, Egypt).
14. One-on-one mentoring (2007 – present): Graduate and undergraduate students, junior postdocs and laboratory technicians.

REFERENCES

1. **Dr. Qais Al Rawahi**

Assistant Professor, Head of Department of Veterinary Medicine, College of Applied and Health Sciences, A'Sharqiyah University, Oman. E-mail: qais.alrawahi@asu.edu.om, Phone: (+968) 99229910 (cell).

2. **Prof. William C. Davis**

Professor, Director of The Washington State University Monoclonal Antibody Center, Department of Veterinary Microbiology and Pathology, College of Veterinary Medicine, Washington State University, Pullman WA 99164-7040, USA. Phone: +1-509-335-6051, E-mail: davisw@wsu.edu

3. **Dr. Kieran Meade**

Associate Professor of Immunobiology, School of Agriculture and Food Science, University College Dublin, Ireland. Phone: +353-86-8181951, E-mail: Kieran.Meade@ucd.ie

4. **Prof. Samy A. Khalil**

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