Indigo-Clean Publication List (Updated May 2022)

Scientific Journal Publications on the Antimicrobial Effects of 405 nm-light:

Maclean M., S.J. MacGregor, J.G. Anderson & G.A. Woolsey (2008). High-Intensity Narrow-Spectrum Light Inactivation and Wavelength Sensitivity of *Staphylococcus aureus.* FEMS Microbiology Letters, 285(2); 227-232. DOI: 10.1111/j.1574-6968.2008.01233.x

Maclean M., S.J. MacGregor, J.G. Anderson & G.A. Woolsey (2008). The Role of Oxygen in the Visible-Light Inactivation of *Staphylococcus aureus.* Journal of Photochemistry and Photobiology B: Biology, 92(3); 180-184. DOI: 10.1016/j.jphotobiol.2008.06.006 *(*Please note: download requires purchase)

Maclean M., S.J. MacGregor, J.G. Anderson & G.A. Woolsey (2009). Inactivation of Bacterial Pathogens Following Exposure to Light from a 405-nm LED Array. Applied and Environmental Microbiology,75(7); 1932-1937. DOI: 10.1128/AEM.01892-08

"405-nm Light Proves Potent at Decontaminating Bacterial Pathogens", featured Current Topics article, Microbe: The News Magazine of the American Society for Microbiology, Volume 4(5), p216, May 2009.

Endarko E., M. Maclean, I.V. Timoshkin, S.J. MacGregor & J.G. Anderson (2012). High intensity 405nm light inactivation of *Listeria monocytogenes*. Photochemistry and Photobiology, 88: 1280-1286. DOI: 10.1111/j.1751-1097.2012.01173.x

Murdoch L.E., M. Maclean, Endarko, S.J. MacGregor & J.G. Anderson (2012). Bactericidal effects of 405-nm light exposure demonstrated by inactivation of *Escherichia*, *Salmonella*, *Shigella*, *Listeria* and *Mycobacterium* species in liquid suspensions and on exposed surfaces. The Scientific World Journal (TSWJ), Volume 2012, Article ID 137805, 8 pages. DOI: 10.1100/2012/137805

Maclean M., L.E. Murdoch, S.J. MacGregor & J.G. Anderson (2013). Sporicidal effects of high-intensity 405nm visible light on endospore-forming bacteria. Photochemistry and Photobiology, 89(1); 120-126. DOI: 10.1111/j.1751-1097.2012.01202.x (published online 30 Aug 2012).

Murdoch L.E., K. McKenzie, M. Maclean, S.J. MacGregor & J.G. Anderson (2013). Lethal effects of high intensity violet 405-nm light on *Saccharomyces cerevisiae, Candida albicans* and on dormant and germinating spores of *Aspergillus niger.* Fungal Biology, 117; 519-527. DOI: 10.1016/j.funbio.2013.05.004 (Please note: download requires purchase.)

McDonald R.S., Gupta S., MacLean M., Ramakrishnan P., Anderson J.G., MacGregor S. J., Meek R.M.D. & Grant M.H. (2013) 405 nm light exposure of osteoblasts and inactivation of bacterial isolates from arthroplasty patients: potential for new disinfection applications, European Cells and Materials Vol. 25 2013 (pages 204-214) DOI: 10.22203/eCM.v025a15

McKenzie K., M. Maclean, I.V. Timoshkin, E. Endarko, Scott J. MacGregor & John G. Anderson (2013). Photoinactivation of Bacteria Attached to Glass and Acrylic Surfaces by 405nm Light: Potential Application for Biofilm Decontamination. Photochemistry and Photobiology, 89: 927- 935. DOI: 10.1111/php.12077

McKenzie K., M. Maclean, I.V. Timoshkin, S.J. MacGregor, J.G. Anderson (2014). Enhanced inactivation of *Escherichia coli* and *Listeria monocytogenes* by exposure to 405 nm light under sub-lethal temperature, salt and acid stress conditions.
International Journal of Food Microbiology, 170; 91–98. DOI: 10.1016/j.ijfoodmicro.2013.10.016
(Please note: download requires registration)

Tomb R.M., Maclean M., Herron, P.R., Hoskisson, P.A., MacGregor S.J., Anderson, J.G. (2014). Inactivation of *Streptomyces* phage ϕC31 by 405 nm light Requirement for exogenous photosensitizers, Bacteriophage 4, e32129; January–December 2014.

Ramakrishnan P., Maclean M., MacGregor S.J., Anderson J.G., & Grant M. H., (2016). Cytotoxic responses to 405 nm light exposure in mammalian and bacterial cells: Involvement of reactive oxygen species, Toxicology in Vitro, 33 (2016); 54-62.

Moorhead S., Maclean M., Coia J.E., MacGregor S.J., & Anderson J.G. (2016). Synergistic efficacy of 405nm light and chlorinated disinfectants for the enhanced decontamination of *Clostridium difficile* spores, Anaerobe, 37 (2016); 72-77.

McKenzie K., MacLean M., Grant M. H., Ramakrishnan P., MacGregor S. J., & Anderson J.G (2016). The effects of 405 nm light on bacterial membrane integrity determined by salt and bile tolerance assays, leakage of UV-absorbing material and SYTOX green labelling, Microbiology, 162(9): 1680–1688.

Halstead F.D., Ahmed Z., Bishop J.R.B. & Oppenheim B. A. (2019) The potential of visible blue light (405 nm) as a novel decontamination strategy for carbapenemase-producing enterobacteriaceae (CPE), Antimicrobial Resistance & Infection Control volume 8 (2019), Article number: 14

Rathnasinghe, R., Jangra, S., Miorin, L. et al. The virucidal effects of 405 nm visible light on SARS-CoV-2 and influenza A virus. Sci Rep **11,** 19470 (2021).

Lau, B.; Becher, D.; Hessling, M. High Intensity Violet Light (405 nm) Inactivates Coronaviruses in Phosphate Buffered Saline (PBS) and on Surfaces. Photonics 2021, 8, 414.

Scientific/Medical Journal Publications Validating Indigo-Clean or 405 nm-light:

Maclean M., S.J. MacGregor, J.G. Anderson, G.A. Woolsey, J.E. Coia, K. Hamilton, I. Taggart, S.B. Watson, B. Thakker & G. Gettinby (2010). Environmental Decontamination of a Hospital Isolation Room using High-Intensity Narrow-Spectrum Light. Journal of Hospital Infection, 76(3); 247-251. DOI: 10.1016/j.jhin.2010.07.010 (Please note: purchase required for download)

Bache S.E., M. Maclean, S.J. MacGregor, J.G. Anderson, G. Gettinby, J.E. Coia & I. Taggart (2012). Clinical studies of the High-Intensity Narrow-Spectrum light Environmental Decontamination System (HINS-light EDS), for continuous disinfection in the burn unit inpatient and outpatient settings. Burns, 38: 69-76. DOI:10.1016/j.burns.2011.03.008

Maclean M., M. Booth, S.J. MacGregor, J.G. Anderson, G.A. Woolsey, J.E. Coia, K. Hamilton & G. Gettinby (2013). Continuous decontamination of an intensive care isolation room during patient occupancy using 405nm light technology. Journal of Infection Prevention, 14(5); 176-181. DOI: 10.1177/1757177413483646 *(Please note: download requires registration.)*

Ramakrishnan P., Maclean M., MacGregor S.J., Anderson J.G., & Grant M. H., (2014). Differential sensitivity of osteoblasts and bacterial pathogens to 405-nm light highlighting potential for decontamination applications in orthopedic surgery, Journal of Biomedical Optics, 19 (10); 10500-1-10500-7.

MacLean M., McKenzie K., Anderson J.G., Gettinby G. & MacGregor S.J. (2014) 405 nm light technology for the inactivation of pathogens and its potential role for environmental disinfection and infection control Journal of Hospital Infection Review Volume 88, ISSUE 1, P1-11, September 01, 2014 Published: July 03, 2014 DOI

Maclean M., McKenzie K., Moorhead S., Tomb R.M., Coia J.E., MacGregor S.J., & Anderson J.G. (2015). Decontamination of the Hospital Environment: New Technologies for Infection Control, Current Treatment Options in Infectious Diseases, New Technologies and Advances in Infection Prevention. *DOI* 10.1007/s40506-015-0037-5

Gupta S., Maclean M., Anderson J.G., MacGregor S.J., Meek R.M.D., & Grant M.H. (2015) Inactivation of micro-organisms isolated from infected lower limb arthroplasties using high-intensity narrow-spectrum (HINS) light, Bone Joint Journal, 97 (2015); 283-288.

Rutala, W.A., Kanamori H., Gergen M.F. & Sickbert-Bennett E.E. (2018) Antimicrobial activity of a continuous visible light disinfection system. Infection Control & Hospital Epidemiology, Volume 39, Issue 10, October 2018, pp. 1250-1253

Murrell, L.J., Hamilton, Johnson H.B. & Spencer M (2019) *"*Influence of a visible-light continuous environmental disinfection system on microbial contamination and surgical site infections in an orthopedic operating room*"*, American Journal of Infection Control, Volume 47, Issue 7, July 2019, Pages 804-810

MacLean M., Gelderman M.P., Kulkarni S., Tomb R.M., Stewart C.F., Anderson J.G., MacGregor S.J.& Atreya C.D. (2020) Non-ionizing 405 nm Light as a Potential Bactericidal Technology for Platelet Safety: Evaluation of in vitro Bacterial Inactivation and in vivo Platelet Recovery in Severe Combined Immunodeficient Mice. Frontiers in Medicine, 15 January 2020

Taylor S, Yang D (2021) Evaluate of Virucidal Effectiveness of Indigo Clean Fixture Against SARS-CoV-2. University of Tennessee Health Science Center – Regional Biocontainment Laboratory, 22 June 2021

Medical Conference Presentations validating the 405 nm EDS:

Booth M., M. Maclean, S.J. MacGregor, J.G. Anderson, G.A. Woolsey, J.E. Coia, K. Hamilton & G. Gettinby. Use of a novel light technology for environmental disinfection within an Intensive Care Unit. *Euroanaesthesia 2010*, conference of the European Society of Anaesthesiology, Helsinki, Finland, 12-15 June 2010.

Coyle A., M. Maclean, J.G. Anderson, G. Gettinby, S.J. MacGregor & I Taggart. High-Intensity Narrow-Spectrum light decontamination of a staff changing room in a burns ward. Oral presentation at the *European Burn Association Congress* in The Hague, Sept 2011.

Bache S.E., M. Maclean, J.G. Anderson, G. Gettinby, J.E. Coia, S.J. MacGregor & I Taggart. Laboratory inactivation of healthcare-associated isolates by a visible HINS-light source and its clinical application in the burns unit. Oral presentation at the *European Burn Association Congress* in The Hague, Sept 2011.
(Please note: download requires purchase.)

Gupta S, M Maclean, JG Anderson, SJ MacGregor, RMD Meek, MH Grant. Inactivation of microorganisms isolated from infected arthroplasty using High Intensity Narrow Spectrum light. Glasgow Meeting of Orthopaedic Research (GLAMOR) 2013, Beardmore Hotel, Clydebank, 23rd March, 20

Sandhu S., Murillo M., Wyatt D., Bhanot N., Min Z., and Thomas J., Environmental Decontamination of Medical ICU Suites Using High-Intensity Narrow-Spectrum Light, *ID Week 2016.*

Rutala W., Kanamori H., Gergen M., Sickbert-Bennett E., Sexton D., Anderson D., Weber D.J., Antimicrobial Activity of a Continuous Visible Light Disinfection System, *ID Week 2016*.

Dougall L.R., Anderson, J.G., Timoshkin I.V., MacGregor S.J.& Maclean M. (2018) Efficacy of antimicrobial 405 nm blue-light for inactivation of airborne bacteria Proceedings Volume 10479, Light-Based Diagnosis and Treatment of Infectious Diseases; 104791G (2018) Event: SPIE BiOS, 2018, San Francisco, California, United States

Awards:

The HINS-light project was awarded the Times Higher Education Award for 'Research Project of the Year' 2011. Thursday 24th November, Grosvenor House Hotel, Park Lane, London. (Reference pg 13 of linked document.)

LEDs Sapphire Award 2016 Winner, Specialty SSL Design: Indigo-Clean

Healthcare Design Product Innovation Awards, Silver Winner: Indigo-Clean

Buildings 2016 Money Saving Products Winner: Indigo-Clean

Architectural SSL 2018 Product Innovation Award

FacilitiesNet.com Vision Awards "Reopening" Products, 2021