Application for the degree of Doctor of Science (DSc.)

Of

Dublin City University

By

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Thesis Title:

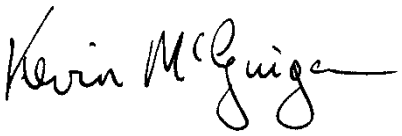
Solar disinfection of drinking water in the developing world, photoluminescence analysis of point defects in crystalline silicon and acoustic analysis of the human voice: A physicist's journey in foreign lands.

September 2012

VOLUME 1 Of 2

DECLARATION

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of Doctor of Science (DSc) is my own work, and that I have exercised reasonable care to ensure that the work is original, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work. I confirm that none of the published works contained within have been previously submitted for any other award.

Signed: 

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ACKNOWLEDGEMENTS

All of this work was made possible through the love, support and sacrifices of my wife Sineád, my daughter Roisín and my parents Edward and Susan. Professors Martin Henry, Kevin Nolan and Ronán Conroy taught me all I ever needed to know about research, team leadership and professional collaboration. I would like to thank my RCSI Foundation Year colleagues, and particularly Dr Kenny Winser, for stepping into the breach whenever I found myself in the middle of the bush when I should have been teaching my students. The SODIS work originated from a coffee-break conversation with Dr Joseph Barnes over 20 years ago and he still remains a source of inspiration. I would like to thank all of the communities in Africa and South East Asia for their trust and cooperation without which the SODIS field trials would never have been the successes that they were. Finally I would like to thank all of my collaborating co-workers and co-authors for their patience whenever my enthusiasm exceeded my knowledge-base.

Kevin McGuigan, August 2012-08-06

Optimist: The glass is half-full.

Pessimist: The glass is half-empty.

Physicist: The glass is full of liquid and air.

SYNOPSIS

The following publications are a chronological account of my research career spanning the past three decades. The body of work is divided into three broad categories corresponding to: (i) Solid State Physics, (ii) Point-of-Use Water Treatment and (iii) Other Fields of Research. Each category has brought its own rewards.

Section 1. Solid State Physics: Section 1 presents my solid state physics research. This began in the early years of my research career in the semiconductor spectroscopy research group led by Prof. Martin Henry from 1985 to 1991 at the National Institute of Higher Education in Dublin, which subsequently became Dublin City University in the last year of my PhD. I joined this group in October 1985 having graduated from St Patrick's College, Maynooth with a first class honours BSc degree in Experimental Physics and Mathematics. My early research focused on characterizing point defects in crystalline silicon using either uniaxial stress or Zeeman perturbational photoluminescence (PL) spectroscopy to identify the geometrical and electronic configuration of defects within the crystal lattice.

All of the interesting electronic properties of silicon originate, not from the silicon itself, but chemical impurities which are deliberately introduced, or doped, into the crystal. These defects occur at such low concentrations that their chemical properties are of only secondary importance since it is their electronic and molecular properties that determine the nature of the disturbance that they create within the electronic band structure of the material. The majority of the defects that I studied were caused by transition metals that had been doped into oriented ingots of crystalline silicon.

The central thrust of my PhD research focused on an examination of the 943meV Cu* PL system in silicon. This work established that the Cu* PL spectrum consists of five zero-phonon lines accompanied by a series of Stokes and anti-Stokes phonon replicas originating within a 5 energy level manifold. The uniaxial and Zeeman studies strongly indicated that the defect consisted of interstitial copper in a site with tetrahedral symmetry. I found these

uniaxial stress experiments which were conducted in the DCU School of Physics to be among the most exciting of my Physics career. There can be fewer more satisfying experiences for an experimental physicist than sitting in a darkened lab, surrounded by 3W 514nm argon ion laser excitation beams and iced up helium transfer siphons, applying tons of pressure to an ingot of crystalline silicon that has been cooled to 4.2K. The thrill of seeing an originally sharp zero phonon line broaden and then eventually split into several polarized stress-induced sub-components, as you have predicted, is never forgotten.

My solid state research between 1990 and 2000 remained predominantly centered on developing tools (both physical and mathematical) for uniaxial stress analysis of defects in crystal. The highlight of this research, in my opinion, was published in 2000, after I had moved to RCSI, in *Journal of Physics: C.* (2000; 12:31, 7055-7068). Titled "*Piezo-spectroscopic induced perturbations for defects in cubic crystals under uniaxial stress applied along arbitrary low symmetry crystal directions*" it describes a completely novel technique for identifying defect symmetry based on an original idea of my own. Usually a complete uniaxial stress analysis of defect symmetry requires low temperature (in liquid helium ~4.2K) spectroscopic data to be taken from 3 ingots, each oriented along a different crystal axis of high symmetry ((001), (110) and (111)). The difficulties associated with conducting uniaxial stress studies on 3 samples at liquid helium temperatures result in such analyses requiring much time and high consumables costs. The Low Symmetry Axis Perturbation Spectroscopy (LSAPS) technique that I developed used only one ingot which was oriented along the (136) crystal axis which has extremely low symmetry. The paper predicted the number of components, shift rate equations and polarization intensities expected for all point defects in crystalline solids and provided experimental corroboration of this with analysis the 983meV Cd*A* line in silicon under uniaxial stress. Consequently the LSAPS technique reduced the work and cost of such studies by 66% since only one instead of 3 samples needs to be studied.

Since the publication of my Duffy *et al.* paper in 2004 ("*A novel TiO_2-assisted solar photocatalytic batch-process disinfection reactor for the treatment of biological and chemical contaminants in domestic drinking water in developing countries*") my solid state physics and point-of use disinfection research have merged through investigations of semiconductor

based photocatalytic enhancements of optical disinfection processes. This research examines the possibility of speeding up the optical inactivation of waterborne pathogens by creating a highly oxidative environment for microbes in contact with the optically illuminated photocatalyst. Titanium dioxide has been the primary photocatalyst studied but zinc oxide has also received some attention. In fact further publications in this area were either submitted or in preparation at the time of submission of this thesis.

Section 2. Point-of-Use Water Treatment: Section 2 deals with point-of-use household water treatment and storage (HWTS) technologies, particularly solar water disinfection (SODIS), for use in developing countries. In my opinion this is my most important (and personally most rewarding) research output since it deals with technologies designed to prevent waterborne disease in the most vulnerable communities throughout the developing world, especially children under the age of 5 years. While the impact of my solid state physics research output might be measured in milliseconds saved during electronic signal transmission, SODIS impact is ultimately measured using reduction in morbidity and mortality. Surely it is for such reasons that most scientists embark upon their careers.

I was originally approached in 1992 by Dr Joseph Barnes, an emeritus lecturer in Tropical Medicine and Infectious Diseases at the RCSI. This was only a few months after I had started lecturing there. He was interested in the possibility of using glass Coca-Cola® bottles to store and disinfect contaminated water using sunlight and had constructed a rudimentary UV-B lamp array to conduct some simulations. He asked if I could help him measure the optical output of the system he had developed. His enthusiasm was infectious and within a few months we had embarked on a research adventure which has continued to this day. The earliest publications in this section deal with (i) identifying the enteric pathogens resident that would be encountered in subsequent field trial cohort and (ii) demonstrating the bactericidal effect of solar heating within solar-exposed plastic bottles. These are followed by the seminal 1996 *Lancet* paper reporting the successful results of the first ever randomized controlled field trial of SODIS in a human population. Several different aspects were pursued in subsequent work between 1996 and 2010, including:

1. Conducting randomized controlled field trials (RCTs) to determine the health benefits of SODIS.
2. Laboratory-based investigations of which important waterborne pathogens are susceptible to SODIS
3. Describing the bactericidal mechanism of SODIS inactivation.
4. Developing enhancement technologies to treat larger volumes or inactivate the pathogens more quickly.

The EU-funded SODISWATER Project (contract no. EU-FP6-INCO-CT-2006-031650) ran from October 2006 to February 2010. This project was born out of the December 2004 Indian Ocean Tsunami disaster. Despite a large body of work showing that SODIS was an effective and low-cost point-of-use water treatment, very few aid organisations were willing to consider using it despite it being promoted as an effective emergency intervention by both the W.H.O. and UNICEF. The reason most frequently cited was insufficient knowledge of the technique. Consequently SODISWATER funded three large RCTs in South Africa, Zimbabwe and Kenya. A fourth RCT in Cambodia, funded by the Health Research Board (GHRA-06-01) was added 6 months later using the same methodology.

The Zimbabwe study was ultimately unsuccessful owing to: (i) a 3 month government enforced suspension of all foreign funded projects prior to national elections and (ii) a nationwide cholera epidemic during which chlorine disinfection tablets were distributed freely to the entire population. While the distribution in Zimbabwe of freely available chlorine tablets by the major aid agencies for those at risk was the correct course of action, it nevertheless produced drastic reductions in SODIS compliance within the study test group who no longer saw a need to practice the technique. By the time that the cholera epidemic had passed and chlorine tablets were no longer freely available, most of the SODIS bottles that had been distributed to the test groups were lost, discarded or used for other purposes (storing fuel, cooking oil, beer, milk etc.). The successful results from the remaining three RCTs are described in a series of papers published in *Environmental Science and Technology* from 2010 to 2012. The data from all of the SODIS field studies were analysed by Prof Ronán Conroy from the RCSI Dept. of Public Health and Epidemiology. Ronán has been my most

trusted and dependable colleague throughout my twenty years of research in the developing world. His study designs and subsequent statistical analyses of the RCT data sets have been masterpieces of logistical realism and mathematical insight.

The non-RCT related aspects of the SODISWATER project with which I was involved investigated technological enhancements to (i) treat larger volumes (~30 litres) in the normal time (6-8 hours); (ii) treat standard volumes (~2 litres) in a quicker time; or (iii) operate under less-than-full sunshine conditions. The first two enhancement objectives were investigated using compound parabolic collectors (CPCs) and photocatalysts. The latter is dealt with in the previous section. CPCs allowed us to operate under cloudy conditions since the larger reflecting surface collected not only the direct UV which is present in strong sunshine but also the diffuse UV that filters through cloud cover. Much of this work was carried out in collaboration with Dr Pilar Fernandez-Ibanez at the Spanish Government CIEMAT solar research platform at Plataforma Solar d'Almeria (PSA) in Southern Spain.

The SODIS body of work was summarized in August 2012 with the publication of our review paper in the *Journal of Hazardous Materials* titled "*Solar water disinfection (SODIS): A review from bench-top to roof-top*." The paper is co-authored with two former RCSI PhD students (Dr Eunice Ubomba-Jaswa and Dr Martella du Preez) as well as other colleagues from the SODISWATER project. In addition to summarizing the SODIS projects over the past 20 years, the review describes in full all the developments in laboratory studies, field trials and psychological factors influencing up-take of the technology which is in everyday use throughout the developing world.

While some researchers might consider my 1996 publication in *The Lancet* to be my most prestigious I personally view the 2011 *Environ. Sci. Technol.* papers describing the results of the Cambodian and Kenyan SODISWATER randomized controlled field trials to be of most importance since they demonstrated clear and significant health benefits associated with SODIS at a time when other researchers using less elegant study designs had reported no significant effect but received widespread attention in the media.

Section 3. Other Fields of Research: This section contains those papers that do not fit comfortably into the first two sections. They cover a range of topics from acoustics, impedance spectroscopy, chemistry, chemical education and plastic surgery.

During my career I have changed my field of research on two occasions. On arrival from DCU to RCSI I was encouraged to engage in medically related research. Since I am an optical spectroscopist by training I decided to investigate frequency analysis of acoustic, rather than optical signals and embarked on a short career in acoustic analysis of the human voice. This work produced my first PhD student (Peter Murphy, thesis title "Acoustic analysis of vocal pathologies") and one MSc student (Orla Cooney, thesis title "Acoustic analysis of the effects of alcohol on the human voice"). Ultimately I withdrew from this field on the grounds that the main challenges in this area resided primarily in the field of computing which was not a subject that interested me greatly.

Several publications deal with impedimetric sensing of microbial biofilms forming on surfaces which are acting as substitutes for medical devices. This work was conducted in collaboration with Dr John "Tony" Byrne in the Northern Ireland BioEngineering Centre (NIBEC) in the University of Ulster (Jordanstown). At that time we were collaborating on a "North-South" research project to coat surfaces with photocatalysts which could then be optically activated to deter and/or remove bacterial colonisation by non-socomal bacterial fauna resident on skin.

My favourite paper among all my publications resides in this section. Curran *et al.* (A case of deep burns while diving the Lusitania. *J Plast Reconstr Aesth Surg.* 2010, 63(7): e579-e581) was instigated by Dr. John Curran, a plastic surgeon working in Cork University Hospital whom I had taught 10 years previously while he was in his premedical year. He told me that he was treating a patient in his intensive care unit who had suffered extensive burns during a scuba dive on the wreck of the Lusitania which lies at a depth of 90m some 10 miles off the West coast of Cork. He could not explain how or why the burns had occurred in the first place and, recalling the lectures on barotrauma that he had endured from me in his premed years,

he asked if I might help get to the bottom of it. What emerged is a paper which describes a "perfect storm" of circumstances that combined to create an almost fatal accident. The victim had placed several hand warming packs inside his dry-suit. These hand warming packs worked on the principle of oxidation of iron filings in air, which is an exothermic reaction. The packs are sold as hand-warmers for outdoor enthusiasts such as hill-walkers or golfers. Unfortunately the victim was unaware that the rate of chemical reaction is proportional to the ambient pressure, which on the wreck of the Lusitania at 90m seawater depth is approximately 10 atmospheres. Consequently the packs produced much more heat than anticipated, so much in fact that a spontaneous ignition occurred within the dry-suit setting fire to the nylon clothing which he was wearing underneath. He was "lucky" however, in that the fire eventually breached the integrity of his diving suit, and the inflowing seawater extinguished the fire. Nevertheless he sustained approximately 35% full thickness burns to arms, anterior chest, upper back, bilateral hips, bilateral buttocks, genitals and both lower limbs. We were able to identify the source of the risk and make recommendations that have made diving safer for thousands of practitioners. The appeal of this paper is that it all stemmed from the impact I made upon a Premed student during a regularly scheduled "fun" lecture that I give to the medical students each year. It confirms for me the concept that even our smallest actions can have the most profound effects.

Summary Statement:

In my career I have been fortunate to work with expert researchers in many different disciplines such as solid state physics, spectroscopy, chemistry, epidemiology, microbiology, mathematics, computing, psychology, otolaryngology, medicine and surgery. The reason that these collaborations have taken place is that I have a basic research philosophy of being unafraid to admit that "I don't know." I see no merit in trying to become expert in everything when there are colleagues available who have already spent a life-time accumulating expert knowledge that they are happy to share. Consequently interdisciplinary and multidisciplinary collaborations are at the heart of all of my research output, which explains why I have not produced any single-author peer-reviewed publications.

In many respects my most fruitful collaborations have been those that have formed within the supervisor – graduate student relationship. I have had a full spectrum of post-graduate students from the very challenging to the very gifted. Each one, in their own way, has taught me as much as I ever taught them. Martin Henry was an exemplary PhD supervisor whose style I have tried to emulate with my own graduate students. He led by example and taught me the most important lessons for a life time in research:

- Enjoy your work
- Enjoy your colleagues.
- Never be afraid to say “I don’t know the answer to that question”
- Always be willing to collaborate.
- Go into each collaboration with an open and honest attitude.
- Learn from your failures and move on.
- Celebrate your successes when they come.

LIST OF PUBLICATIONS

(*Author for Correspondence, §Principal Investigator)

SECTION 1: Publications in the Field of Solid State Physics Research

PEER-REVIEWED PUBLICATIONS

1.1. Henry MO*, **McGuigan KG**, Barklie RC. Bound exciton recombination at Mn-Zn pair centres in silicon. *Solid State Communication* 1987;64:31-33.

1.2. Henry MO*, Beckett DJ, Steele AG, Thewalt MLW, **McGuigan KG**. A zinc related isoelectronic bound exciton in silicon. *Solid State Communication* 1988;66:689-694.

1.3. **McGuigan KG***, Henry MO, Lightowlers EC, Steele AG, Thewalt MLW. A new photoluminescence band in silicon lightly doped with copper. *Solid State Communication* 1988;68:7-11.

1.4. **McGuigan KG***, Henry MO, Lightowlers EC, Do Carmo MC, Davies G. A uniaxial stress study of a copper related photoluminescence band in silicon. *Materials Science Engineering* 1989;B4:269-272.

1.5. Henry MO*, Campion JD, **McGuigan KG**, Lightowlers EC, Thewalt MLW. A photo-luminescence study of zinc - implanted silicon. *Materials Science Engineering* 1989;B4:201-204.

1.6. **McGuigan KG***, Henry MO, Lightowlers EC, Nazare MH. Excitonic recombination at a transition metal related defect in silicon. *Materials Research Society Symposium Proceedings* 1990;163:299-302.

1.7. Do Carmo MC, **McGuigan KG,** Henry MO, Davies G, Lightowlers EC. Uniaxial stress and Zeeman measurements on the 943 meV luminescence band in silicon. *Materials Research Society Symposium Proceedings* 1990;163:273-276.

1.8. Henry MO*, **McGuigan KG**, Do Carmo MC, Nazare MH, Lightowlers EC. A photoluminescence investigation of local-mode vibrations of the beryllium pair centre in silicon. *Journal of Physics: C* 1990;2:9697-9700.

1.9. Hughes GJ*, Roberts L, Henry MO, **McGuigan KG**, Morgan GP, Glynn T. An investigation of the passivating effects of hydrogen sulphide on the GaAs(100) surface. *Materials Science Engineering* 1991; B9:37-41.

1.10. O'Morain C, **McGuigan KG**[§*], Henry MO, Campion JD. A simple apparatus for uniaxial piezo-spectroscopic measurements. *Measurement Science & Technology* 1992;3:337-339.

1.11. Campion JD, **McGuigan KG***, Henry MO, Nazare MH. Photoluminescence of a berylium related defect in silicon. *Materials Science Forum* 1993;117-118:177-182.

1.12. McCarren AL*, Ruskin HJ, **McGuigan KG**, Henry MO. Piezo-spectroscopic data analysis: a P.C. tool. *Proceedings of the I.E.E.-A, Science & Measurement Technology* 1994;141:185-189.

1.13. Henry MO*, Campion JD, **McGuigan KG**, Lightowlers EC, Do Carmo MC, Nazare MH. A photo-luminescence study of Zn-O complexes in silicon. *Semiconductor Science Technology* 1994;9:1375-1381.

1.14. Daly SE*, McGlynn E, Henry MO, Campion JD, **McGuigan KG**, Do Carmo MC, Nazare MH. Oxygen complexing with group II impurities in silicon. *Materials Science Forum* 1995;196-201:1303-1308.

1.15. **McGuigan KG***, Henry MO, Campion JD, Daly, SE. McGlynn E, Do Carmo MC. A series of closely related axial defects of monoclinic I and rhombic I symmetry in oxygen-rich, zinc-doped silicon. *Semiconductor Science Technology* 1996;11:930-934.

1.16. Daly SE, Henry MO, **McGuigan KG**, Do Carmo MC. A complex luminescent defect in Be-doped oxygen-rich silicon. *Semiconductor Science Technology* 1996;11:996-1001.

1.17. Daly SE*, McGlynn E, Henry MO, Campion JD, **McGuigan KG**, Do Carmo MC, Nazare MH. The

complexing of oxygen with the group II impurities Be, Cd and Zn in silicon. *Materials Science Engineering B* 1996;36(1-3):116-119.

1.18. McGlynn E, Henry MO, **McGuigan KG**, Do Carmo MC. A photoluminescence study of cadmium-related defects in oxygen-rich silicon. *Physics Review B* 1996;54(**14**):494-503. PubMed I.D. 9985454

1.19. Frehill CA, Henry MO*****, McGlynn E, Daly SE, Deicher M, Magerle R, **McGuigan KG**, Safanov A, Lightowlers EC. Novel luminescence centres in cadmium doped silicon. *Materials Science Forum* 1997;258-263:521-526.

1.20. Henry MO*****, Alves E, Bollmann J, Burchard A, Deicher M, Fianciulli M, Forkel-Wirth D, Knopf MH, Lindner S, Magerle R, McGlynn E, **McGuigan KG**, Soares JC, Stotzler A, Weyer G. Radioactive isotope identifications of Au and Pt luminescence centres in silicon. *Physica Status Solidi (b)* 1998; 210:853-858.

1.21. **McGuigan KG**[§]***,** McGlynn E, O'Cairbre F, Love J, Henry MO. Piezo-spectroscopic induced perturbations for defects in cubic crystals under uniaxial stress applied along arbitrary low symmetry crystal directions. *Journal of Physics: C.* 2000; 12:31, 7055-7068.

1.22. Duffy EF, Al Touati F, Kehoe SC, McLoughlin OA, Gill L, Gernjak W, Oller I, Maldonado MI, Malato S, Cassidy J, Reed RH, **McGuigan KG**[§]*****. A novel TiO_2-assisted solar photocatalytic batch-process disinfection reactor for the treatment of biological and chemical contaminants in domestic drinking water in developing countries. *Solar Energy* 2004;77(**5**):649-655.

1.23. Lonnen J, Kilvington S, Kehoe SC, Al Touati F, **McGuigan KG**[§]*****. Solar and photocatalytic disinfection of protozoan, fungal and bacterial microbes in drinking water. *Water Research*. 2005;39(**5**):877-883. PubMed I.D. 15743634

1.24. Mosnier JP*, O'Haire RJ, McGlynn E, Henry MO, McDonnell S, Boyle MAG, **McGuigan KG**. ZnO thin films grown by pulsed-laser deposition on soda lime glass substrates for the ultraviolet

inactivation of S*taphylococcus epidermidis* biofilms. *Science and Technology of Advanced Materials*. 2009;10: 045003. doi:10.1088/1468-6996/10/4/045003.

1.25. Dunlop PSM; Sheeran CP; Byrne AJ[§]; Boyle MA; **McGuigan KG**[§]. Inactivation of clinically relevant pathogens by photocatalytic coatings. *Journal of Photochemistry and Photobiology A: Chemistry.* 2010:216; 303–310.

BOOK CHAPTER

1.26. McGlynn E, Henry MO, Daly SE, **McGuigan KG**. Complexes of oxygen and Group II impurities in silicon. R. Jones (Ed.), Early Stages of Oxygen Precipitation in Silicon: NATO ASI Partnership Sub-Series 3, High Technology vol. 17, 1996:355-362. (Kluwers Academic Publishers, the Netherlands).

INVITED EDITORIALS

1.27. **McGuigan KG***, Poulios I, Matzavinos D. "In Focus: Advanced Photochemical Disinfection". *Journal of Chemical Technology & Biotechnology*. 2010;85: p1027.

PUBLISHED ABSTRACT

1.28. Campion JD, **McGuigan KG**, Henry MO*, Nazare MH. Photoluminescence due to Zn-O complexes in silicon. *Materials Science Forum* 1993; 117-118:519-520.

END OF VOLUME 1

VOLUME 2

SECTION 2. Point-of-Use Water treatments

Peer-reviewed Publications

2.1. Joyce TM, **McGuigan KG**[§*], Elmore-Meegan M, Conroy RM. Prevalence of enteropathogens in stools of rural Maasai children under five years of age in the Maasailand region of the Kenyan Rift Valley. *East African Medical Journal* 1996;73:59-62. PubMed I.D. 8625866

2.2. Joyce TM, **McGuigan KG**[§*], Elmore-Meegan M, Conroy RM. Inactivation of faecal bacteria in drinking water by solar heating. *Applied Environmental Microbiology* 1996;62(**2**):399-402. PubMed I.D. 8593045

2.3. Conroy RM*****, Elmore-Meegan M, Joyce TM, **McGuigan KG**, Barnes J. Solar disinfection of drinking water and incidence of diarrhoea in Maasai children: a controlled field trial. The *Lancet* 1996;348:1695-97. PubMed I.D. 8973432

2.4. **McGuigan KG**[§*], Joyce TM, Conroy RM, Gillespie JB, Elmore-Meegan M. Solar disinfection of drinking water contained in transparent plastic bottles: characterizing the bacterial inactivation process. *Journal of Applied Microbiology* 1998;84(**6**):1138-1148. PubMed I.D. 9717300

2.5. Conroy RM*****, **Elmore**-Meegan M, Joyce TM, **McGuigan KG**, Barnes J. Use of sunlight to reduce risk of diarrhoeal disease in Maasai children. An update. *Archive of Disease in Children,* 1999; 81: 337-338. PubMed I.D. 10490440

2.6. Smith RJ*****, Kehoe SC, **McGuigan KG**[§], Barer MR. Effects of simulated solar disinfection on infectivity of S*almonella typhimurium*. *Letters in Applied Microbiology* 2000; 31(**4):**284-288. PubMed I.D. 11068908

2.7. Kehoe SC, Joyce TM, Ibrahim P, Gillespie JB, Shahar RA, **McGuigan KG**[§*]. Effect of agitation, turbidity, aluminium foil reflectors and volume on inactivation efficiency of batch-process solar

disinfectors. *Water Research* 2001;35(**4**):1061-1065. PubMed I.D. 11235872

2.8. Wegelin M*****, Canonica A, Alder A, Suter M, Bucheli TD, Haefliger OP, Zenobi R, **McGuigan KG**, Kelly MT, Ibrahim P, Larroque M. Does sunlight change the material and content of PET bottles? *Journal of Water Science Research & Technology - Aqua* 2001;50,125-135.

2.9. Conroy RM*****, Elmore-Meegan M, Joyce TM, **McGuigan KG**, Barnes J. Use of solar disinfection protects children under 6 years from cholera. *Archive of Disease in Children*, 2001:85, 293-295. PubMed I.D. 11567937

2.10. Kehoe SC*****, Barer MR, Devlin L, **McGuigan KG**. Batch process solar disinfection is an efficient means of disinfecting drinking water contaminated with *Shigella dysenteriae* Type I. *Letters in Applied Microbiology*. 2004;38(**5**):410-414. PubMed I.D. 15059213

2.11. McLoughlin OA, Kehoe SC, **McGuigan KG**, Duffy EF, Al Touati F, Gernjak W, Oller I, Malato S, Gill LW*****. Solar disinfection of contaminated water: a comparison of three small-scale reactors. *Solar Energy* 2004;77(**5**):657-664.

2.12. Méndez-Hermida F, Castro-Hermida JA, Ares-Mazás E, Kehoe SC, **McGuigan KG§*.** Effect of batch process solar disinfection (SODIS) on the survival of *Cryptosporidium parvum* oocysts in drinking water. *Applied Environmental Microbiology* 2005;71(**3**):1653-4. PubMed I.D. 15746372

2.13. **McGuigan KG§***, Méndez-Hermida F, Castro-Hermida JA, Ares-Mazás E, Kehoe SC, Boyle M, Sichel C, Fernández-Ibáñez P, Meyer BP, Ramalingham S, Meyer EA. Batch solar disinfection (SODIS) inactivates oocysts of *Cryptosporidium parvum* and cysts of *Giardia muris* in drinking water. *J Applied Microbiology.* 2006;101(**2**):453-463. PubMed I.D. 16882154

2.14. Heaselgrave W, Patel N, Kehoe SC, Kilvington S, **McGuigan KG§***. Solar disinfection of poliovirus and *Acanthamoeba polyphaga* cysts in water – a laboratory study using simulated sunlight. *Letters in Applied Microbiology.* 2006;43(**2**):125-130. PubMed I.D. 16869893

2.15. Méndez-Hermida F*, Ares-Mazás E, **McGuigan KG**, Boyle M, Sichel C, Fernández-Ibáñez P. Disinfection of *Cryptosporidium parvum* oocysts in drinking water using natural sunlight and the photocatalyst TiO_2. *Journal of Photochemistry & Photobiology B:* 2007;88: 105-111. PMID: 17624798

2.16. Ubomba-Jaswa E, Boyle MAR, **McGuigan KG**[§*]. Inactivation of enteropathogenic *E. coli* by solar disinfection (SODIS) under simulated sunlight conditions. *Journal of Physics: Conference Series*. 2008;101:1-4 (online) doi:10.1088/1742-6596/101/1/012003.

2.17. Boyle M, Sichel C, Fernández-Ibáñez P, Arias-Quiroz GB, Iriarte-Puña M, **McGuigan KG**[§*]. Bactericidal effect of solar water disinfection under real sunlight conditions. *Applied & Environmental Microbiology.* 2008;74(10):2997-3001. PMID: 18359829.

2.18. Navntoft C, Ubomba-Jaswa E, **McGuigan KG**, Fernández-Ibáñez P[*]. Enhancement of batch solar disinfection (SODIS) using non-imaging reflectors. *Journal of Photochemistry & Photobiology B: Biol.* 2008;93:155-161. PMID: 18835188

2.19. Lantagne D, Meierhofer R, Allgood G, **McGuigan KG**, Quick R. Comment on "Point of Use Household Drinking Water Filtration: A Practical, Effective Solution for Providing Sustained Access to Safe Drinking Water in the Developing World". *Environmental Science & Technology.* 2009;43(3):968-969. PMID: 19245044.

2.20. Ubomba-Jaswa E, Navntoft C, Polo MI, Fernández-Ibáñez P[*], **McGuigan KG**[§*]. Solar disinfection of drinking water (SODIS): An investigation of the effect of UVA dose on inactivation efficiency. *Photochemical & Photobiological Sciences*, 2009;8(5): 587-595. PMID: 19424529.

2.21. Gómez-Couso H*, Fontán-Sainz M, Fernández-Alonso J, **McGuigan KG**, Ares-Mazás E*. Effect of radiation intensity and water turbidity on the survival of *Cryptosporidium parvum* oocysts during simulated solar disinfection. *Acta Tropica*. 2009, 112(1):43-8. PMID: 19539587

2.22. Ubomba-Jaswa E, Fernández-Ibáñez P[*], Navntoft C, Polo-López MI, **McGuigan KG**[§*]. Investigating the microbial inactivation efficiency of a 25 litre batch solar disinfection (SODIS) reactor enhanced with a compound parabolic collector (CPC) for Household Use. *Journal of Chemical Technology & Biotechnology*. 2010;85: 1028-1037.

2.23. Ubomba-Jaswa E*, Fernández-Ibáñez P[*]**, McGuigan KG** [§]. A preliminary Ames-fluctuation assay assessment of the genotoxicity of drinking water that has been solar disinfected in polyethylene terephthalate (PET) bottles. *Journal of Water & Health.* 2010;8(4):712-719. PMID: 20705982

2.24. du Preez M, **McGuigan KG*** [§], Conroy RM. Solar disinfection of drinking water (SODIS) in the prevention of dysentery in South African children aged under 5 years: the role of participant motivation. *Environmental Science and Technology*. 2010;44(22):8744-9. PMID: 20977257

2.25. **McGuigan KG**[§*], Samaiyar P, du Preez M, Conroy RM. A high compliance randomised controlled field trial of solar disinfection (SODIS) of drinking water and its impact on childhood diarrhoea in rural Cambodia. *Environmental Science & Technology*. 2011;45(18):7862-7867. PMID: 21827166

2.26. Polo-López MI, Fernández-Ibáñez P*, Ubomba-Jaswa E, Navntoft C, **McGuigan KG,** Dunlop PSM, Byrne JA. Elimination of water pathogens with solar radiation using an automated sequential batch CPC Reactor. *Journal of Hazardous Materials*. 2011;196:16-21.

2.27. du Preez M, Conroy RM, Ligondo S, Hennessy J, Elmore-Meegan M, Soita A, **McGuigan KG**[§*]. Solar disinfection of drinking water (SODIS) in the prevention of dysentery in Kenyan children aged under 5 years. *Environmental Science & Technology*. 2011;*45* (21), pp 9315–9323. PMID:21936492

2.28. du Preez M, Conroy RM, **McGuigan KG**[§*]. Response to Comment of Arnold and colleagues on “A randomised intervention study of solar disinfection of drinking water (SODIS) in the

prevention of dysentery in Kenyan children aged under 5 years". *Environmental Science & Technology*. 2012;46:3033−3034. PMID: 22299603

2.29. du Preez M, Conroy RM, **McGuigan KG**[§*]. Response to Comment of Hunter and colleagues on "A randomised intervention study of solar disinfection of drinking water (SODIS) in the prevention of dysentery in Kenyan children aged under 5 years". *Environmental Science & Technology*. 2012;46:3036−3037. PMID: 22299656

2.30. **McGuigan KG**[*], Conroy RM, Mosler HJ, du Preez M, Ubomba-Jaswa E, Fernández-Ibáñez P. Solar Water Disinfection (SODIS): A review from bench-top to roof-top. *Journal of Hazardous Materials*. 2012;235-236:29-46.

INVITED EDITORIALS

2.31. **McGuigan KG***, Joyce TM, Conroy RM. Solar disinfection - using sunlight to decontaminate drinking water in developing countries. *Journal of Medical Microbiology*, 1999; 48: 785-787. PubMed I.D. 10482288

2.32. **McGuigan KG***, Kehoe SC. "Cooking the Waste", Invited Commentary on "Solar Disinfection of Infectious Biomedical Waste: A New Approach For Developing Countries" by V. Chitnis et al." *The Lancet*. 2003; 362: 1251-1252. PubMed I.D. 14575964 .

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BOOKS

2.34. Ubomba-Jaswa E*, Fernández-Ibáñez P[*]**, McGuigan KG.** A study of the genotoxic implications and enhancement technologies for solar disinfection (SODIS) of drinking water. Ed CIEMAT, Madrid. December 2010, NIPO: 471-10-038-3. ISBN: 978-84-7834-648-6.

UNREFEREED PUBLICATIONS

2.35. **Mac Uiginn CG**. Ag sábháil beatha le solas na gréine. *An tEolaí,* Fomhar 1997: 7-8.

SECTION 3: Other Fields of Research

PEER-REVIEWED PUBLICATIONS

3.1. Oliver, LM*; Dunlop, PSM; Byrne, JA; Blair, IS; Boyle, M; **McGuigan, KG**; McAdams, ET. An impedimetric sensor for monitoring the growth of Staphylococcus epidermidis**.** *Conference Proceedings of the IEEE Engineering Medicine & Biology Society.* 2006;1:535-538. PubMed I.D 17946403

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3.3. Al Touati F**,** Cassidy J*, **McGuigan KG**§. A novel TiO_2/PVC layer for use in a photoelectrochemical cell. *Solar Energy Materials & Solar Cells*. 2007;91:740-744.

3.4. Murphy PJP*, **McGuigan KG**§, Walsh M, Colreavy M. Investigation of a glottal related harmonics-to-noise ratio and spectral tilt as indicators of glottal noise in synthesized and human voice signals. *Journal of the Acoustical Society of America* 2008;123(3):1642-1652. PMID: 18345852.

3.5. Curran JN*, **McGuigan KG**, O'Broin E. A case of deep burns while diving the Lusitania. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2010, 63(7): e579-e581. PMID: 20056502

BOOK CHAPTERS

3.6. Oliver LM, McAdams ET, Dunlop PSM, Byrne JA, Blair IS, Boyle MA **McGuigan KG**. (2008) *Electrical Impedance Spectroscopy as a Powerful Analytical Tool for Monitoring Microbiological Growth on Medical Implants.* In: "Encyclopedia of Healthcare Information Systems". Medical

Information Science Reference (an imprint of IGI Global), pp. 487-496. (Ed. N Wickramasinghe & E. Geisler). Publ. Hershey, New York. ISBN 1599048892.

INVITED ARTICLES

3.7. **McGuigan KG**. Baboons, lions and water safety. *Physics World* 1999;12:(8): p64.

3.8. **McGuigan KG** The wrong stuff. *Physics World* 2002;15(10): p64.

3.9. . **McGuigan KG**. The experimental spirit. *Physics World* 2002;15(6): p64.

3.10. **McGuigan KG**. Alcohol and physics seemed a good idea. *Physics World* 2003;16(8): p56.

3.11. **McGuigan KG**. Introducing the Darwin unit. *Physics World* 2009;22(7): p64.

3.12. **McGuigan KG**. The Twin-Tub Theory. *Physics World* 2012, 25(6): p56.

SECTION 1

PUBLICATIONS IN THE FIELD OF

SOLID STATE PHYSICS RESEARCH

1.1

Henry MO*, **McGuigan KG**, Barklie RC.

Bound exciton recombination at Mn-Zn pair centres in silicon.

Solid State Communication 1987;64:31-33.

PEER-REVIEWED PUBLICATION

1.2

Henry MO*, Beckett DJ, Steele AG, Thewalt MLW, **McGuigan KG**.

A zinc related isoelectronic bound exciton in silicon.

Solid State Communication 1988;66:689-694.

PEER-REVIEWED PUBLICATION

1.3

McGuigan KG*, Henry MO, Lightowlers EC, Steele AG, Thewalt MLW.

A new photoluminescence band in silicon lightly doped with copper.

Solid State Communication 1988;68:7-11.

PEER-REVIEWED PUBLICATION

1.4

McGuigan KG*, Henry MO, Lightowlers EC, Do Carmo MC, Davies G.

A uniaxial stress study of a copper related photoluminescence band in silicon.

Materials Science Engineering 1989;B4:269-272.

PEER-REVIEWED PUBLICATION

1.5

Henry MO*, Campion JD, **McGuigan KG**, Lightowlers EC, Thewalt MLW.

A photo-luminescence study of zinc - implanted silicon.

Materials Science Engineering 1989;B4:201-204.

PEER-REVIEWED PUBLICATION

1.6

McGuigan KG*, Henry MO, Lightowlers EC, Nazare MH.

Excitonic recombination at a transition metal related defect in silicon.

Materials Research Society Symposium Proceedings 1990;163:299-302.

PEER-REVIEWED PUBLICATION

1.7

Do Carmo MC, **McGuigan KG,** Henry MO, Davies G, Lightowlers EC.

Uniaxial stress and Zeeman measurements on the 943 meV luminescence band in silicon.

Materials Research Society Symposium Proceedings 1990;163:273-276.

PEER-REVIEWED PUBLICATION

1.8

Henry MO*, **McGuigan KG**, Do Carmo MC, Nazare MH, Lightowlers EC.

A photoluminescence investigation of local-mode vibrations of the beryllium pair centre in silicon.

Journal of Physics: C 1990;2:9697-9700.

PEER-REVIEWED PUBLICATION

1.9

Hughes GJ*, Roberts L, Henry MO, **McGuigan KG**, Morgan GP, Glynn T.

An investigation of the passivating effects of hydrogen sulphide on the GaAs(100) surface.

Materials Science Engineering 1991; B9:37-41.

PEER-REVIEWED PUBLICATION

1.10

O'Morain C, **McGuigan KG**[§*], Henry MO, Campion JD.

A simple apparatus for uniaxial piezo- spectroscopic measurements.

Measurement Science & Technology 1992;3:337-339.

PEER-REVIEWED PUBLICATION

1.11

Campion JD, **McGuigan KG***, Henry MO, Nazare MH.

Photoluminescence of a berylium related defect in silicon. *Materials Science Forum* 1993;117-118:177-182.

PEER-REVIEWED PUBLICATION

1.12

McCarren AL*, Ruskin HJ, **McGuigan KG**, Henry MO.

Piezo-spectroscopic data analysis: a P.C. tool.

Proceedings of the I.E.E.-A, Science & Measurement Technology 1994;141:185-189.

PEER-REVIEWED PUBLICATION

1.13

Henry MO*, Campion JD, **McGuigan KG**, Lightowlers EC, Do Carmo MC, Nazare MH.

A photo-luminescence study of Zn-O complexes in silicon.

Semiconductor Science Technology 1994;9:1375-1381.

PEER-REVIEWED PUBLICATION

1.14

Daly SE*, McGlynn E, Henry MO, Campion JD, **McGuigan KG**, Do Carmo MC, Nazare MH.

Oxygen complexing with group II impurities in silicon.

Materials Science Forum 1995;196-201:1303-1308.

PEER-REVIEWED PUBLICATION

1.15

McGuigan KG*, Henry MO, Campion JD, Daly, SE. McGlynn E, Do Carmo MC.

A series of closely related axial defects of monoclinic I and rhombic I symmetry in oxygen-rich, zinc-doped silicon.

Semiconductor Science Technology 1996;11:930-934.

PEER-REVIEWED PUBLICATION

1.16

Daly SE, Henry MO, **McGuigan KG**, Do Carmo MC.

A complex luminescent defect in Be-doped oxygen-rich silicon.

Semiconductor Science Technology 1996;11:996-1001.

PEER-REVIEWED PUBLICATION

1.17

Daly SE*, McGlynn E, Henry MO, Campion JD, **McGuigan KG**, Do Carmo MC, Nazare MH.

The complexing of oxygen with the group II impurities Be, Cd and Zn in silicon.

Materials Science Engineering B 1996;36(1-3):116-119.

PEER-REVIEWED PUBLICATION

1.18

McGlynn E, Henry MO, **McGuigan KG**, Do Carmo MC.

A photoluminescence study of cadmium-related defects in oxygen-rich silicon.

Physics Review B 1996;54(**14**):494-503.

PubMed I.D. 9985454

PEER-REVIEWED PUBLICATION

1.19

Frehill CA, Henry MO*, McGlynn E, Daly SE, Deicher M, Magerle R, **McGuigan KG**, Safanov A, Lightowlers EC.

Novel luminescence centres in cadmium doped silicon.

Materials Science Forum 1997;258-263:521-526.

PEER-REVIEWED PUBLICATION

1.20

Henry MO*, Alves E, Bollmann J, Burchard A, Deicher M, Fianciulli M, Forkel-Wirth D, Knopf MH, Lindner S, Magerle R, McGlynn E, **McGuigan KG**, Soares JC, Stotzler A, Weyer G.

Radioactive isotope identifications of Au and Pt luminescence centres in silicon.

Physica Status Solidi (b) 1998; 210:853-858.

PEER-REVIEWED PUBLICATION

1.21

McGuigan KG[§]***,** McGlynn E, O'Cairbre F, Love J, Henry MO.

Piezo-spectroscopic induced perturbations for defects in cubic crystals under uniaxial stress applied along arbitrary low symmetry crystal directions.

Journal of Physics: C. 2000; 12:31, 7055-7068.

PEER-REVIEWED PUBLICATION

1.22

Duffy EF, Al Touati F, Kehoe SC, McLoughlin OA, Gill L, Gernjak W, Oller I, Maldonado MI, Malato S, Cassidy J, Reed RH, **McGuigan KG**[§]*.

A novel TiO_2-assisted solar photocatalytic batch-process disinfection reactor for the treatment of biological and chemical contaminants in domestic drinking water in developing countries.

Solar Energy 2004;77(**5**):649-655.

PEER-REVIEWED PUBLICATION

1.23

Lonnen J, Kilvington S, Kehoe SC, Al Touati F, **McGuigan KG**[§]*.

Solar and photocatalytic disinfection of protozoan, fungal and bacterial microbes in drinking water.

Water Research. 2005;39(**5**):877-883.

PubMed I.D. 15743634

PEER-REVIEWED PUBLICATION

1.24

Mosnier JP*, O'Haire RJ, McGlynn E, Henry MO, McDonnell S, Boyle MAG, **McGuigan KG**.

ZnO thin films grown by pulsed-laser deposition on soda lime glass substrates for the ultraviolet inactivation of S*taphylococcus epidermidis* biofilms.

Science and Technology of Advanced Materials. 2009;10: 045003. doi:10.1088/1468-6996/10/4/045003. (online)

PEER-REVIEWED PUBLICATION

1.25

Dunlop PSM; Sheeran CP; Byrne AJ[§]; Boyle MA; **McGuigan KG**[§].

Inactivation of clinically relevant pathogens by photocatalytic coatings.

Journal of Photochemistry and Photobiology A: Chemistry. 2010:216; 303–310.

PEER-REVIEWED PUBLICATION

1.26

McGlynn E, Henry MO, Daly SE, **McGuigan KG**.

Complexes of oxygen and Group II impurities in silicon.

R. Jones (Ed.)

Early Stages of Oxygen Precipitation in Silicon.

NATO ASI Partnership Sub-Series 3, High Technology vol. 17, 1996:355-362.

(Kluwers Academic Publishers, the Netherlands).

BOOK CHAPTER

1.27

McGuigan KG*, Poulios I, Matzavinos D.

In Focus: Advanced Photochemical Disinfection.

Journal of Chemical Technology & Biotechnology. 2010;85: p1027.

INVITED EDITORIALS

1.28

Campion JD, **McGuigan KG**, Henry MO*, Nazare MH.

Photoluminescence due to Zn-O complexes in silicon.

Materials Science Forum 1993; 117-118:519-520.

PUBLISHED ABSTRACT

Application for the degree of Doctor of Science (DSc.)

Of

Dublin City University

By

Dr Kevin G. McGuigan BSc (NUIM), PhD (DCU), FInstP

Department of Physiology and Medical Physics

Royal College of Surgeons in Ireland

Thesis Title:

Solar disinfection of drinking water in the developing world, photoluminescence analysis of point defects in crystalline silicon and acoustic analysis of the human voice: A physicist's journey in foreign lands.

September 2012

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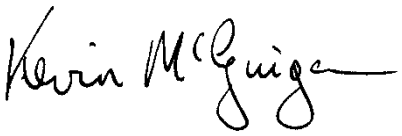
DECLARATION

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of Doctor of Science (DSc) is my own work, and that I have exercised reasonable care to ensure that the work is original, and does not to the best of my knowledge breach any law of copyright, and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work. I confirm that none of the published works contained within have been previously submitted for any other award.

Signed: 

Date: Monday, December 09, 2013

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LIST OF PUBLICATIONS

(*Author for Correspondence, §Principal Investigator)

SECTION 2. Point-of-Use Water treatments

Peer-reviewed Publications

2.1. Joyce TM, **McGuigan KG**§*, Elmore-Meegan M, Conroy RM. Prevalence of enteropathogens in stools of rural Maasai children under five years of age in the Maasailand region of the Kenyan Rift Valley. *East African Medical Journal* 1996;73:59-62. PubMed I.D. 8625866

2.2. Joyce TM, **McGuigan KG**§*, Elmore-Meegan M, Conroy RM. Inactivation of faecal bacteria in drinking water by solar heating. *Applied Environmental Microbiology* 1996;62(**2**):399-402. PubMed I.D. 8593045

2.3. Conroy RM*, Elmore-Meegan M, Joyce TM, **McGuigan KG**, Barnes J. Solar disinfection of drinking water and incidence of diarrhoea in Maasai children: a controlled field trial. The *Lancet* 1996;348:1695-97. PubMed I.D. 8973432

2.4. **McGuigan KG**§*, Joyce TM, Conroy RM, Gillespie JB, Elmore-Meegan M. Solar disinfection of drinking water contained in transparent plastic bottles: characterizing the bacterial inactivation process. *Journal of Applied Microbiology* 1998;84(**6**):1138-1148. PubMed I.D. 9717300

2.5. Conroy RM*, **Elmore**-Meegan M, Joyce TM, **McGuigan KG**, Barnes J. Use of sunlight to reduce risk of diarrhoeal disease in Maasai children. An update. *Archive of Disease in Children,* 1999; 81: 337-338. PubMed I.D. 10490440

2.6. Smith RJ*, Kehoe SC, **McGuigan KG**§, Barer MR. Effects of simulated solar disinfection on infectivity of S*almonella typhimurium*. *Letters in Applied Microbiology* 2000; 31(**4):**284-288. PubMed I.D. 11068908

2.7. Kehoe SC, Joyce TM, Ibrahim P, Gillespie JB, Shahar RA, **McGuigan KG**[§]*****. Effect of agitation, turbidity, aluminium foil reflectors and volume on inactivation efficiency of batch-process solar disinfectors. *Water Research* 2001;35(**4**):1061-1065. PubMed I.D. 11235872

2.8. Wegelin M*****, Canonica A, Alder A, Suter M, Bucheli TD, Haefliger OP, Zenobi R, **McGuigan KG**, Kelly MT, Ibrahim P, Larroque M. Does sunlight change the material and content of PET bottles? *Journal of Water Science Research & Technology - Aqua* 2001;50,125-135.

2.9. Conroy RM*****, Elmore-Meegan M, Joyce TM, **McGuigan KG**, Barnes J. Use of solar disinfection protects children under 6 years from cholera. *Archive of Disease in Children*, 2001:85, 293-295. PubMed I.D. 11567937

2.10. Kehoe SC*****, Barer MR, Devlin L, **McGuigan KG**. Batch process solar disinfection is an efficient means of disinfecting drinking water contaminated with *Shigella dysenteriae* Type I. *Letters in Applied Microbiology*. 2004;38(**5**):410-414. PubMed I.D. 15059213

2.11. McLoughlin OA, Kehoe SC, **McGuigan KG**, Duffy EF, Al Touati F, Gernjak W, Oller I, Malato S, Gill LW*****. Solar disinfection of contaminated water: a comparison of three small-scale reactors. *Solar Energy* 2004;77(**5**):657-664.

2.12. Méndez-Hermida F, Castro-Hermida JA, Ares-Mazás E, Kehoe SC, **McGuigan KG**[§]***.** Effect of batch process solar disinfection (SODIS) on the survival of *Cryptosporidium parvum* oocysts in drinking water. *Applied Environmental Microbiology* 2005;71(**3**):1653-4. PubMed I.D. 15746372

2.13. **McGuigan KG**[§]*****, Méndez-Hermida F, Castro-Hermida JA, Ares-Mazás E, Kehoe SC, Boyle M, Sichel C, Fernández-Ibáñez P, Meyer BP, Ramalingham S, Meyer EA. Batch solar disinfection (SODIS) inactivates oocysts of *Cryptosporidium parvum* and cysts of *Giardia muris* in drinking water. *J Applied Microbiology*. 2006;101(**2**):453-463. PubMed I.D. 16882154

2.14. Heaselgrave W, Patel N, Kehoe SC, Kilvington S, **McGuigan KG§***. Solar disinfection of poliovirus and *Acanthamoeba polyphaga* cysts in water – a laboratory study using simulated sunlight. *Letters in Applied Microbiology*. 2006;43(**2**):125-130. PubMed I.D. 16869893

2.15. Méndez-Hermida F*, Ares-Mazás E, **McGuigan KG**, Boyle M, Sichel C, Fernández-Ibáñez P. Disinfection of *Cryptosporidium parvum* oocysts in drinking water using natural sunlight and the photocatalyst TiO_2. *Journal of Photochemistry & Photobiology B:* 2007;88: 105-111. PMID: 17624798

2.16. Ubomba-Jaswa E, Boyle MAR, **McGuigan KG§***. Inactivation of enteropathogenic *E. coli* by solar disinfection (SODIS) under simulated sunlight conditions. *Journal of Physics: Conference Series*. 2008;101:1-4 (online) doi:10.1088/1742-6596/101/1/012003.

2.17. Boyle M, Sichel C, Fernández-Ibáñez P, Arias-Quiroz GB, Iriarte-Puña M, **McGuigan KG§***. Bactericidal effect of solar water disinfection under real sunlight conditions. *Applied & Environmental Microbiology.* 2008;74(10):2997-3001. PMID: 18359829.

2.18. Navntoft C, Ubomba-Jaswa E, **McGuigan KG**, Fernández-Ibáñez P*. Enhancement of batch solar disinfection (SODIS) using non-imaging reflectors. *Journal of Photochemistry & Photobiology B: Biol.* 2008;93:155-161. PMID: 18835188

2.19. Lantagne D, Meierhofer R, Allgood G, **McGuigan KG**, Quick R. Comment on "Point of Use Household Drinking Water Filtration: A Practical, Effective Solution for Providing Sustained Access to Safe Drinking Water in the Developing World". *Environmental Science & Technology.* 2009;43(3):968-969. PMID: 19245044.

2.20. Ubomba-Jaswa E, Navntoft C, Polo MI, Fernández-Ibáñez P*, **McGuigan KG§***. Solar disinfection of drinking water (SODIS): An investigation of the effect of UVA dose on inactivation efficiency. *Photochemical & Photobiological Sciences*, 2009;8(5): 587-595. PMID: 19424529.

2.21. Gómez-Couso H*, Fontán-Sainz M, Fernández-Alonso J, **McGuigan KG**, Ares-Mazás E*. Effect of radiation intensity and water turbidity on the survival of *Cryptosporidium parvum* oocysts during simulated solar disinfection. *Acta Tropica*. 2009, 112(1):43-8. PMID: 19539587

2.22. Ubomba-Jaswa E, Fernández-Ibáñez P*, Navntoft C, Polo-López MI, **McGuigan KG**§*. Investigating the microbial inactivation efficiency of a 25 litre batch solar disinfection (SODIS) reactor enhanced with a compound parabolic collector (CPC) for Household Use. *Journal of Chemical Technology & Biotechnology*. 2010;85: 1028-1037.

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PMID:21936492

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2.30. **McGuigan KG**[*], Conroy RM, Mosler HJ, du Preez M, Ubomba-Jaswa E, Fernández-Ibáñez P. Solar Water Disinfection (SODIS): A review from bench-top to roof-top. *Journal of Hazardous Materials*. 2012;235-236:29-46.

INVITED EDITORIALS

2.31. McGuigan KG*, Joyce TM, Conroy RM. Solar disinfection - using sunlight to decontaminate drinking water in developing countries. *Journal of Medical Microbiology*, 1999; 48: 785-787. PubMed I.D. 10482288

2.32. **McGuigan KG***, Kehoe SC. "Cooking the Waste", Invited Commentary on "Solar Disinfection of Infectious Biomedical Waste: A New Approach For Developing Countries" by V. Chitnis et al." *The Lancet*. 2003; 362: 1251-1252. PubMed I.D. 14575964 .

2.33. **McGuigan KG***, "Solar Disinfection of Drinking Water: Saving Lives with Sunlight". *European Photochemistry Association Newsletter*. Dec. 2006, 20-23.

BOOKS

2.34. Ubomba-Jaswa E*, Fernández-Ibáñez P*, **McGuigan KG.** A study of the genotoxic implications and enhancement technologies for solar disinfection (SODIS) of drinking water. Ed CIEMAT, Madrid. December 2010, NIPO: 471-10-038-3. ISBN: 978-84-7834-648-6.

UNREFEREED PUBLICATIONS

2.35. **Mac Uiginn CG**. Ag sábháil beatha le solas na gréine. *An tEolaí,* Fomhar 1997: 7-8.

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PEER-REVIEWED PUBLICATIONS

3.1. Oliver, LM*; Dunlop, PSM; Byrne, JA; Blair, IS; Boyle, M; **McGuigan, KG**; McAdams, ET. An impedimetric sensor for monitoring the growth of Staphylococcus epidermidis**.** *Conference Proceedings of the IEEE Engineering Medicine & Biology Society*. 2006;1:535-538. PubMed I.D 17946403

3.2. Al Touati F, **McGuigan KG,** Cassidy J*. An experiment using a simple photoassisted fuel cell designed to remediate simulated wastewater. *Journal of Chemistry Education* 2007;84(**2**): 299-302.

3.3. Al Touati F**,** Cassidy J*, **McGuigan KG**§. A novel TiO_2/PVC layer for use in a photoelectrochemical cell. *Solar Energy Materials & Solar Cells*. 2007;91:740-744.

3.4. Murphy PJP*, **McGuigan KG**§, Walsh M, Colreavy M. Investigation of a glottal related harmonics-to-noise ratio and spectral tilt as indicators of glottal noise in synthesized and human voice signals. *Journal of the Acoustical Society of America* 2008;123(3):1642-1652. PMID: 18345852.

3.5. Curran JN*, **McGuigan KG**, O'Broin E. A case of deep burns while diving the Lusitania. *Journal of Plastic, Reconstructive & Aesthetic Surgery.* 2010, 63(7): e579-e581. PMID: 20056502

BOOK CHAPTERS

3.6. Oliver LM, McAdams ET, Dunlop PSM, Byrne JA, Blair IS, Boyle MA **McGuigan KG**. (2008) *Electrical Impedance Spectroscopy as a Powerful Analytical Tool for Monitoring Microbiological Growth on Medical Implants.* In: "Encyclopedia of Healthcare Information Systems". Medical Information Science Reference (an imprint of IGI Global), pp. 487-496. (Ed. N Wickramasinghe & E. Geisler). Publ. Hershey, New York. ISBN 1599048892.

INVITED ARTICLES

3.7. **McGuigan KG**. Baboons, lions and water safety. *Physics World* 1999;12:(8): p64.

3.8. **McGuigan KG** The wrong stuff. *Physics World* 2002;15(10): p64.

3.9. . **McGuigan KG**. The experimental spirit. *Physics World* 2002;15(6): p64.

3.10. **McGuigan KG**. Alcohol and physics seemed a good idea. *Physics World* 2003;16(8): p56.

3.11. **McGuigan KG**. Introducing the Darwin unit. *Physics World* 2009;22(7): p64.

3.12. **McGuigan KG**. The Twin-Tub Theory. *Physics World* 2012, 25(6): p56.

END OF VOLUME 2

SECTION 2

PUBLICATIONS IN THE FIELD OF

POINT-OF-USE WATER TREATMENTS

2.1

Joyce TM, **McGuigan KG**[§*], Elmore-Meegan M, Conroy RM.

Prevalence of enteropathogens in stools of rural Maasai children under five years of age in the Maasailand region of the Kenyan Rift Valley.

East African Medical Journal 1996;73:59-62.

PubMed I.D. 8625866

PEER-REVIEWED PUBLICATION

2.2

Joyce TM, **McGuigan KG**[§*], Elmore-Meegan M, Conroy RM.

Inactivation of faecal bacteria in drinking water by solar heating.

Applied Environmental Microbiology 1996;62(**2**):399-402.

PubMed I.D. 8593045

PEER-REVIEWED PUBLICATION

2.3

Conroy RM*, Elmore-Meegan M, Joyce TM, **McGuigan KG**, Barnes J.

Solar disinfection of drinking water and incidence of diarrhoea in Maasai children: a controlled field trial.

Lancet 1996;348:1695-97.

PubMed I.D. 8973432

PEER-REVIEWED PUBLICATION

2.4

McGuigan KG[§]*, Joyce TM, Conroy RM, Gillespie JB, Elmore-Meegan M.

Solar disinfection of drinking water contained in transparent plastic bottles: characterizing the bacterial inactivation process.

Journal of Applied Microbiology 1998;84(**6**):1138-1148.

PubMed I.D. 9717300

PEER-REVIEWED PUBLICATION

2.5

Conroy RM*, **Elmore**-Meegan M, Joyce TM, **McGuigan KG**, Barnes J.

Use of sunlight to reduce risk of diarrhoeal disease in Maasai children. An update.

Archive of Disease in Children, 1999; 81: 337-338.

PubMed I.D. 10490440

PEER-REVIEWED PUBLICATION

2.6

Smith RJ*, Kehoe SC, **McGuigan KG**[§], Barer MR.

Effects of simulated solar disinfection on infectivity of S*almonella typhimurium*.

Letters in Applied Microbiology 2000; 31(**4):**284-288.

PubMed I.D. 11068908

PEER-REVIEWED PUBLICATION

2.7

Kehoe SC, Joyce TM, Ibrahim P, Gillespie JB, Shahar RA, **McGuigan KG**[§*].

Effect of agitation, turbidity, aluminium foil reflectors and volume on inactivation efficiency of batch-process solar disinfectors.

Water Research 2001;35(**4**):1061-1065.

PubMed I.D. 11235872

PEER-REVIEWED PUBLICATION

2.8

Wegelin M*, Canonica A, Alder A, Suter M, Bucheli TD, Haefliger OP, Zenobi R, **McGuigan KG**, Kelly MT, Ibrahim P, Larroque M.

Does sunlight change the material and content of PET bottles?

Journal of Water Science Research & Technology - Aqua 2001;50,125-135.

PEER-REVIEWED PUBLICATION

2.9

Conroy RM*, Elmore-Meegan M, Joyce TM, **McGuigan KG**, Barnes J.

Use of solar disinfection protects children under 6 years from cholera.

Archive of Disease in Children, 2001:85, 293-295.

PubMed I.D. 11567937

PEER-REVIEWED PUBLICATION

2.10

Kehoe SC*, Barer MR, Devlin L, **McGuigan KG**.

Batch process solar disinfection is an efficient means of disinfecting drinking water contaminated with *Shigella dysenteriae* Type I.

Letters in Applied Microbiology. 2004;38(**5**):410-414.

PubMed I.D. 15059213

PEER-REVIEWED PUBLICATION

2.11

McLoughlin OA, Kehoe SC, **McGuigan KG**, Duffy EF, Al Touati F, Gernjak W, Oller I, Malato S, Gill LW*.

Solar disinfection of contaminated water: a comparison of three small-scale reactors.

Solar Energy 2004;77(**5**):657-664.

PEER-REVIEWED PUBLICATION

2.12

Méndez-Hermida F, Castro-Hermida JA, Ares-Mazás E, Kehoe SC, **McGuigan KG[§]*.**

Effect of batch process solar disinfection (SODIS) on the survival of *Cryptosporidium parvum* oocysts in drinking water.

Applied Environmental Microbiology 2005;71(**3**):1653-4.

PubMed I.D. 15746372

PEER-REVIEWED PUBLICATION

2.13

McGuigan KG[§*], Méndez-Hermida F, Castro-Hermida JA, Ares-Mazás E, Kehoe SC, Boyle M, Sichel C, Fernández-Ibáñez P, Meyer BP, Ramalingham S, Meyer EA.

Batch solar disinfection (SODIS) inactivates oocysts of *Cryptosporidium parvum* and cysts of *Giardia muris* in drinking water.

Journal of Applied Microbiology. 2006;101(**2**):453-463.

PubMed I.D. 16882154

PEER-REVIEWED PUBLICATION

2.14

Heaselgrave W, Patel N, Kehoe SC, Kilvington S, **McGuigan KG**[§*].

Solar disinfection of poliovirus and *Acanthamoeba polyphaga* cysts in water – a laboratory study using simulated sunlight.

Letters in Applied Microbiology. 2006;43(**2**):125-130.

PubMed I.D. 16869893

PEER-REVIEWED PUBLICATION

2.15

Méndez-Hermida F*, Ares-Mazás E, **McGuigan KG**, Boyle M, Sichel C, Fernández-Ibáñez P.

Disinfection of *Cryptosporidium parvum* oocysts in drinking water using natural sunlight and the photocatalyst TiO_2.

Journal of Photochemistry & Photobiology B: 2007;88: 105-111.

PMID: 17624798

PEER-REVIEWED PUBLICATION

2.16

Ubomba-Jaswa E, Boyle MAR, **McGuigan KG**[§]*.

Inactivation of enteropathogenic *E. coli* by solar disinfection (SODIS) under simulated sunlight conditions.

Journal of Physics: Conference Series. 2008;101:1-4 (online)

doi:10.1088/1742-6596/101/1/012003.

PEER-REVIEWED PUBLICATION

2.17

Boyle M, Sichel C, Fernández-Ibáñez P, Arias-Quiroz GB, Iriarte-Puña M, **McGuigan KG**[§*].

Bactericidal effect of solar water disinfection under real sunlight conditions.

Applied & Environmental Microbiology. 2008;74(10):2997-3001.

PMID: 18359829.

PEER-REVIEWED PUBLICATION

2.18

Navntoft C, Ubomba-Jaswa E, **McGuigan KG**, Fernández-Ibáñez P*.

Enhancement of batch solar disinfection (SODIS) using non-imaging reflectors.

Journal of Photochemistry & Photobiology B: Biol. 2008;93:155-161.

PMID: 18835188

PEER-REVIEWED PUBLICATION

2.19

Lantagne D, Meierhofer R, Allgood G, **McGuigan KG**, Quick R.

Comment on "Point of Use Household Drinking Water Filtration: A Practical, Effective Solution for Providing Sustained Access to Safe Drinking Water in the Developing World".

Environmental Science & Technology. 2009;43(3):968-969.

PMID: 19245044.

PEER-REVIEWED PUBLICATION

2.20

Ubomba-Jaswa E, Navntoft C, Polo MI, Fernández-Ibáñez P[*], **McGuigan KG**[§*].

Solar disinfection of drinking water (SODIS): An investigation of the effect of UVA dose on inactivation efficiency.

Photochemical & Photobiological Sciences, 2009;8(5): 587-595.

PMID: 19424529.

PEER-REVIEWED PUBLICATION

2.21

Gómez-Couso H*, Fontán-Sainz M, Fernández-Alonso J, **McGuigan KG**, Ares-Mazás E*.

Effect of radiation intensity and water turbidity on the survival of *Cryptosporidium parvum* oocysts during simulated solar disinfection.

Acta Tropica. 2009, 112(1):43-8.

PMID: 19539587

PEER-REVIEWED PUBLICATION

2.22

Ubomba-Jaswa E, Fernández-Ibáñez P[*], Navntoft C, Polo-López MI, **McGuigan KG**[§*].

Investigating the microbial inactivation efficiency of a 25 litre batch solar disinfection (SODIS) reactor enhanced with a compound parabolic collector (CPC) for household Use.

Journal of Chemical Technology & Biotechnology. 2010;85: 1028-1037.

PEER-REVIEWED PUBLICATION

2.23

Ubomba-Jaswa E*, Fernández-Ibáñez P[*], **McGuigan KG**[§].

A preliminary Ames-fluctuation assay assessment of the genotoxicity of drinking water that has been solar disinfected in polyethylene terephthalate (PET) bottles.

Journal of Water & Health. 2010;8(4):712-719.

PMID: 20705982

PEER-REVIEWED PUBLICATION

2.24

du Preez M, **McGuigan KG***§, Conroy RM.

Solar disinfection of drinking water (SODIS) in the prevention of dysentery in South African children aged under 5 years: the role of participant motivation.

Environmental Science and Technology. 2010;44(22):8744-9.

PMID: 20977257

PEER-REVIEWED PUBLICATION

2.25

McGuigan KG[§*], Samaiyar P, du Preez M, Conroy RM.

A high compliance randomised controlled field trial of solar disinfection (SODIS) of drinking water and its impact on childhood diarrhoea in rural Cambodia.

Environmental Science & Technology. 2011;45(18):7862-7867.

PMID: 21827166

PEER-REVIEWED PUBLICATION

2.26

Polo-López MI, Fernández-Ibáñez P*, Ubomba-Jaswa E, Navntoft C, **McGuigan KG,** Dunlop PSM, Byrne JA.

Elimination of water pathogens with solar radiation using an automated sequential batch CPC Reactor.

Journal of Hazardous Materials. 2011;196:16-21.

PEER-REVIEWED PUBLICATION

2.27

du Preez M, Conroy RM, Ligondo S, Hennessy J, Elmore-Meegan M, Soita A, **McGuigan KG**[§*].

Solar disinfection of drinking water (SODIS) in the prevention of dysentery in Kenyan children aged under 5 years.

Environmental Science & Technology. 2011;*45* (21), pp 9315–9323.

PMID:21936492

PEER-REVIEWED PUBLICATION

2.28

du Preez M, Conroy RM, **McGuigan KG**[§*].

Response to Comment of Arnold and colleagues on “A randomised intervention study of solar disinfection of drinking water (SODIS) in the prevention of dysentery in Kenyan children aged under 5 years”.

Environmental Science & Technology. 2012;46:3033–3034.

PMID: 22299603

PEER-REVIEWED PUBLICATION

2.29

du Preez M, Conroy RM, **McGuigan KG**[§*].

Response to Comment of Hunter and colleagues on “A randomised intervention study of solar disinfection of drinking water (SODIS) in the prevention of dysentery in Kenyan children aged under 5 years”.

Environmental Science & Technology. 2012;46:3036–3037.

PMID: 22299656

PEER-REVIEWED PUBLICATION

2.30

McGuigan KG[*], Conroy RM, Mosler HJ, du Preez M, Ubomba-Jaswa E, Fernández-Ibáñez P.

Solar Water Disinfection (SODIS): A review from bench-top to roof-top.

Journal of Hazardous Materials. 2012;235-236:29-46.

PEER-REVIEWED PUBLICATION

AND INVITED REVIEW

2.31

McGuigan KG*, Joyce TM, Conroy RM.

Solar disinfection - using sunlight to decontaminate drinking water in developing countries.

Journal of Medical Microbiology, 1999; 48: 785-787.

PubMed I.D. 10482288

INVITED EDITORIAL

2.32

McGuigan KG*, Kehoe SC.

"Cooking the Waste", Invited Commentary on "Solar Disinfection of Infectious Biomedical Waste: A New Approach For Developing Countries" by V. Chitnis et al."

The Lancet. 2003; 362: 1251-1252.

PubMed I.D. 14575964 .

INVITED EDITORIAL

2.33

McGuigan KG*

"Solar Disinfection of Drinking Water: Saving Lives with Sunlight".

European Photochemistry Association Newsletter. Dec. 2006, 20-23.

INVITED EDITORIAL

2.34

Ubomba-Jaswa E*, Fernández-Ibáñez P*, **McGuigan KG.**

A study of the genotoxic implications and enhancement technologies for solar disinfection (SODIS) of drinking water.

Ed CIEMAT, Madrid. December 2010,

NIPO: 471-10-038-3.

ISBN: 978-84-7834-648-6.

(Inserted in CD Format inside rear cover)

BOOK

2.35

Mac Uiginn CG.

Ag sábháil beatha le solas na gréine.

An tEolaí, Fomhar 1997: 7-8.

UNREFEREED PUBLICATION

SECTION 3

PUBLICATIONS IN

OTHER FIELDS OF RESEARCH

3.1

Oliver, LM*; Dunlop, PSM; Byrne, JA; Blair, IS; Boyle, M; **McGuigan, KG**; McAdams, ET.

An impedimetric sensor for monitoring the growth of Staphylococcus epidermidis**.**

Conference Proceedings of the IEEE Engineering Medicine & Biology Society. 2006;1:535-538.

PubMed I.D 17946403

PEER-REVIEWED PUBLICATION

3.2

Al Touati F, **McGuigan KG,** Cassidy J*.

An experiment using a simple photoassisted fuel cell designed to remediate simulated wastewater.

Journal of Chemistry Education 2007;84(**2**): 299-302.

PEER-REVIEWED PUBLICATION

3.3

Al Touati F**,** Cassidy J*, **McGuigan KG**§.

A novel TiO_2/PVC layer for use in a photoelectrochemical cell.

Solar Energy Materials & Solar Cells. 2007;91:740-744.

PEER-REVIEWED PUBLICATION

3.4

Murphy PJP*, **McGuigan KG**§, Walsh M, Colreavy M.

Investigation of a glottal related harmonics-to-noise ratio and spectral tilt as indicators of glottal noise in synthesized and human voice signals.

Journal of the Acoustical Society of America 2008;123(3):1642-1652.

PMID: 18345852.

PEER-REVIEWED PUBLICATION

3.5

Curran JN*, **McGuigan KG**, O'Broin E.

A case of deep burns while diving the Lusitania.

Journal of Plastic, Reconstructive & Aesthetic Surgery. 2010, 63(7): e579-e581 (online)

PMID: 20056502

PEER-REVIEWED PUBLICATION

3.6

Oliver LM, McAdams ET, Dunlop PSM, Byrne JA, Blair IS, Boyle MA **McGuigan KG**.

Electrical Impedance Spectroscopy as a Powerful Analytical Tool for Monitoring Microbiological Growth on Medical Implants.

In: “Encyclopedia of Healthcare Information Systems”.

Medical Information Science Reference (an imprint of IGI Global), (2008) pp. 487-496.

(Ed. N Wickramasinghe & E. Geisler).

Publ. Hershey, New York.

ISBN 1599048892.

BOOK CHAPTER

3.7

McGuigan KG.

Baboons, lions and water safety.

Physics World 1999;12:(8): p64.

INVITED ARTICLE

3.8

McGuigan KG.

The wrong stuff.

Physics World 2002;15(10): p64.

INVITED ARTICLE

3.9

McGuigan KG.

The experimental spirit.

Physics World 2002;15(6): p64.

INVITED ARTICLE

3.10

McGuigan KG.

Alcohol and physics seemed a good idea.

Physics World 2003;16(8): p56.

INVITED ARTICLE

3.11

McGuigan KG.

Introducing the Darwin unit.

Physics World 2009;22(7): p64.

INVITED ARTICLE

3.12

McGuigan KG.

The Twin-Tub Theory.

Physics World 2012, 25(6): p56.

INVITED ARTICLE