Nonlinear optical imaging as a diagnostic tool for cutaneous squamous cell carcinoma
Thomas, G.

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Nonlinear optical imaging as a diagnostic tool for cutaneous squamous cell carcinoma

Giju Thomas (2015)

INVITATION
To the public defense of the PhD thesis
‘Nonlinear optical imaging as a diagnostic tool for cutaneous squamous cell carcinoma’
on Wednesday, January 14th 2015 at 13.00h
in the auditorium of Aula - Oude Lutherse Kerk
Singel 411, 1012 XA, Amsterdam, The Netherlands

The reception afterwards will take place in the Tetterode Bibliotheek (Library) next to the auditorium

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Nonlinear optical imaging as a diagnostic tool for cutaneous squamous cell carcinoma

Giju Thomas
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Cover Illustration: Giju Thomas
The central image shows a transverse nonlinear optical scan taken from a skin tumour of 1 mm diameter in a hairless mouse. Laser beam background obtained freely from the online public domain www.wallpapers-xs.blogspot.com.

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Nonlinear optical imaging as a diagnostic tool for cutaneous squamous cell carcinoma

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad van doctor
aan de Universiteit van Amsterdam
op gezag van de Rector Magnificus
prof. dr. D. C. van den Boom
ten overstaan van een door het College voor Promoties ingestelde commissie, in het openbaar te verdedigen in de Aula der Universiteit
op woensdag 14 januari 2015, te 13.00 uur

door

Giju Thomas

geboren te Fujairah, Verenigde Arabische Emiraten
Promotiecommissie:

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Prof. dr. J. van Rheenen

Faculteit der Geneeskunde
Contents

Abbreviations used in this thesis 7

Chapter 1 General Introduction 11

Chapter 2 Advances and challenges in label-free nonlinear optical imaging using two-photon excitation fluorescence and second harmonic generation for cancer research 29

Chapter 3 Systems Overview 51

Chapter 4 Carcinogenic damage induced to deoxyribonucleic acid by femtosecond laser pulses via combination of two- and three-photon absorption during nonlinear optical imaging 57

Chapter 5 Estimating the risk of squamous cell cancer induction in skin following nonlinear optical imaging 75

Chapter 6 Investigation of 7, 12-dimethylbenz(a)anthracene as a complete carcinogen in development of cutaneous squamous cell carcinomas by chronic exposure in immunocompetent hairless mice 103

Chapter 7 In vivo nonlinear optical imaging to monitor early microscopic changes in a murine cutaneous squamous cell carcinoma model 129

Chapter 8 In vivo nonlinear spectral imaging as a tool to monitor early spectroscopic and metabolic changes in a murine cutaneous squamous cell carcinoma model 149

Chapter 9 Discussion and Outlook 171

Chapter 10 Summary 182
    Samenvatting 184

Appendices
    Acknowledgements 187
    List of publications 189
    PhD Portfolio 193
    About the Author 195
Abbreviations used in this thesis

AK  actinic keratoses
AUC  area under curve
BSA  bovine serum albumin
cBCC  cutaneous basal cell carcinomas
cMM  cutaneous malignant melanomas
cSCC  cutaneous squamous cell carcinomas
CCD  charge coupled device
CHO  Chinese Hamster Ovary
CPDs  cyclobutane pyrimidine dimers
CSLM  confocal scanning laser microscopy
CT  computerised tomography
CW  continuous wave
DAB  3, 3'-diaminobenzidine
DAPI  4', 6-diamidino-2-phenylindole
DMBA  7, 12-dimethylbenz(a)anthracene
DNA  deoxyribonucleic acid
DRS  diffuse reflectance spectroscopy
FAD  flavin adenine dinucleotide
EMCCD  electron multiplying charge coupled device
FPs  family practitioners
Fs  femtoscond
GPs  general practitioners
GW  gigawatt
H&E  haematoxylin and eosin
HFUS  high frequency ultrasound
HPV  human papilloma virus
LIFS  laser-induced fluorescence spectroscopy
MAF  multi-photon autofluorescence
MOPS  3-(N-morpholino) propanesulfonic acid
MPE  multi-photon excitation
MRI  magnetic resonance imaging
mW  milliwatt
NADH  nicotinamide adenine dinucleotide
NIR  near infrared
NLOI  nonlinear optical imaging
NLSI  nonlinear spectral imaging
nm  nanometre
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>NMSC</td>
<td>non-melanoma skin cancer</td>
</tr>
<tr>
<td>OCT</td>
<td>optical coherence tomography</td>
</tr>
<tr>
<td>PBS</td>
<td>phosphate buffered saline</td>
</tr>
<tr>
<td>PBS-T</td>
<td>phosphate buffered saline with 0.1% Tween</td>
</tr>
<tr>
<td>PET</td>
<td>positron emission tomography</td>
</tr>
<tr>
<td>PHCCs</td>
<td>primary health care clinicians</td>
</tr>
<tr>
<td>PMT</td>
<td>photomultiplier tube</td>
</tr>
<tr>
<td>RGB</td>
<td>red, green and blue</td>
</tr>
<tr>
<td>SHG</td>
<td>second harmonic generation</td>
</tr>
<tr>
<td>THG</td>
<td>third harmonic generation</td>
</tr>
<tr>
<td>TPA</td>
<td>12-O-tetradecanoylphorbol-13-acetate</td>
</tr>
<tr>
<td>TPEF</td>
<td>two-photon excitation fluorescence</td>
</tr>
<tr>
<td>TW</td>
<td>terawatt</td>
</tr>
<tr>
<td>UV</td>
<td>ultraviolet</td>
</tr>
</tbody>
</table>
‘And God said, “Let there be light,” and there was light.

God saw that the light was good,

and He separated the light from the darkness.’

*Genesis 1: 3 – 4, The Holy Bible*

For my Mama and Papa

For Christ, my Saviour and Redeemer