References


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After one and a half years of painstaking experiments on my first project — PET imaging of alpha-synuclein, I was sitting in Rudi’s office, feeling sad about the termination of my first project, and worried about the plan B — imaging of adenosine $A_{2A}$ receptors. I had no clue about the A2A project, so I asked a good deal of questions based on the limited literature that I had read, hoping to get some support and comfort from Rudi and my daily supervisors — Philip and Erik. But rather disappointingly, Rudi seemed unsatisfied at my reaction to my new project, he responded that I should not only post questions but find the way to solve them. ‘What! I am just a beginner. It’s already a great encouragement to ask these questions’, I went out of the office, unhappy. Rudi is right. Finally, I truly understood his attitude one year after the appointment. Now I am at the end of my PhD career and I know how a responsible researcher should be: asking interesting questions and dealing with them to the best of your ability. Thanks Rudi, your criticism pushes me moving forward in science.

Philip and Erik, my daily supervisors, thank you for your tolerance. I think I am a rather tough student, but don’t be annoyed with me. I challenged you as I challenge myself. When I disagreed, it usually means that I want more elaboration. Philip and Erik, thank you for your guidance and support during the past 5 years. I can still recall the moment when I had the telephone interview with Erik. I found it very stressful. I wrote down tips and taped them everywhere in the room: on the walls, tables, chairs, wardrobe doors…I was struggling to memorize and pronounce the names of isotopes correctly. At that time, I had no confidence about my level of English and no idea of radiochemistry. Through your education of me, I become a qualified radiochemist, an independent researcher, and am capable of completing my thesis, writing articles, and presenting my work in international conferences. I would like to thank Philip for providing me with opportunities and freedom to try my ideas. Without your help, I would not be able to test my compounds with alpha-synuclein in my first project and have successful cooperation with researchers from Japan in my second project. Erik, thank you for your constructive criticisms of my research and my writings. Your criticisms were difficult to handle and sometimes
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Finally, my love goes to Guohui Huang. My achievement is partly yours. Thank you for all your affection, even though it is coming from thousands of miles away, I can still feel the warmth of your love. You are the person I believe and trust the most, and the reason why I strive to achieve my best. Because of you, I have managed to keep healthy and overcome all obstacles, because I believe in the future, our future.

Xiaoyun Zhou

26 November 2016

‘In a thousand different forms you may hide yourself, but all the same, my best-beloved, I will recognize you’

— Johann Wolfgang von Goethe
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aβ</td>
<td>Amyloid-β peptide</td>
</tr>
<tr>
<td>A&lt;sub&gt;n&lt;/sub&gt;R</td>
<td>Adenosine A&lt;sub&gt;n&lt;/sub&gt; receptor</td>
</tr>
<tr>
<td>AC</td>
<td>Adenylyl cyclase</td>
</tr>
<tr>
<td>AD</td>
<td>Alzheimer’s disease</td>
</tr>
<tr>
<td>AIC</td>
<td>Akaike information criterion</td>
</tr>
<tr>
<td>AIM</td>
<td>Abnormal involuntary movement</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of variance</td>
</tr>
<tr>
<td>ARG</td>
<td>Autoradiography</td>
</tr>
<tr>
<td>ATP</td>
<td>Adenosine triphosphate</td>
</tr>
<tr>
<td>AUC</td>
<td>Area under the curve</td>
</tr>
<tr>
<td>BBB</td>
<td>Blood brain-barrier</td>
</tr>
<tr>
<td>BD</td>
<td>Biodistribution</td>
</tr>
<tr>
<td>B&lt;sub&gt;max&lt;/sub&gt;</td>
<td>Total density of target molecules</td>
</tr>
<tr>
<td>BOLD</td>
<td>Blood oxygenation-level dependent</td>
</tr>
<tr>
<td>BP&lt;sub&gt;ND&lt;/sub&gt;</td>
<td>Non-displaceable binding potential</td>
</tr>
<tr>
<td>Bq</td>
<td>Becquerel</td>
</tr>
<tr>
<td>BRET</td>
<td>Bioluminescence resonance energy transfer</td>
</tr>
<tr>
<td>cm</td>
<td>Centimeter</td>
</tr>
<tr>
<td>CBV</td>
<td>Cerebral blood volume</td>
</tr>
<tr>
<td>Ci</td>
<td>Curie</td>
</tr>
<tr>
<td>CNS</td>
<td>Central nervous system</td>
</tr>
<tr>
<td>COV</td>
<td>Coefficient of variation</td>
</tr>
<tr>
<td>C&lt;sub&gt;p&lt;/sub&gt;</td>
<td>Radioactivity concentration in plasma</td>
</tr>
<tr>
<td>C&lt;sub&gt;R&lt;/sub&gt;</td>
<td>Radioactivity concentration in a reference region</td>
</tr>
<tr>
<td>C&lt;sub&gt;T&lt;/sub&gt;</td>
<td>Radioactivity concentration in tissue</td>
</tr>
<tr>
<td>CT</td>
<td>Computed tomography</td>
</tr>
<tr>
<td>Da</td>
<td>Atomic mass unit dalton</td>
</tr>
<tr>
<td>D&lt;sub&gt;n&lt;/sub&gt;R</td>
<td>Dopamine D&lt;sub&gt;n&lt;/sub&gt; receptor</td>
</tr>
<tr>
<td>DMAA</td>
<td>N,N-Dimethylacetamide</td>
</tr>
<tr>
<td>DMSO</td>
<td>Dimethyl sulfoxide</td>
</tr>
<tr>
<td>2D-OSEM</td>
<td>2-Dimensional ordered-subset expectation maximization algorithm</td>
</tr>
<tr>
<td>DVR</td>
<td>Distribution volume ratio</td>
</tr>
</tbody>
</table>
ED  Effective dose

$ED_{50}$  Drug dose corresponds to 50% occupancy

ERK  Extracellular signal–regulated kinase

ESI-HRMS  Electro-spray ionization high-resolution mass spectrometry

fmol  Femtomole

tfMRI  Functional magnetic resonance imaging

FDG  Fluo-2-rodeoxy-D-glucose

FOV  Field of view

g  Gram

GBq  Gigabecquerel

GCF  Global correction factor

GDNF  Glial cell line-derived neurotrophic factor

GPe  Globus pallidus pars externa

GPI  Globus pallidus pars interna

HCl  Hydrogen chloride

HD  Huntington’s disease

HIV  Human immunodeficiency virus

HPLC  High performance liquid chromatography

Hz  Herz

ICC  Intra-class correlation coefficient

ICRP  International Commission on Radiological Protection

keV  Kiloelectronvolt

$K_1$-$K_n$  Rate constant ‘n’

kBq  Kilobecquerel

kDa  Kilodalton

$K_d$  Dissociation constant

kg  Kilo gram

$K_i$  Inhibition constant

$K_m$  Metabolic rate constant

L-DOPA  Levodopa

LGA  Logan graphical analysis

LID  Levodopa-induced dyskinesia

LogD$_{7.4}$  Octanol water partition coefficient at pH7.4

mg  Minigram

min  Minute

mL  Minilitre

mm  Minimitre
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>mmol</td>
<td>Minimole</td>
</tr>
<tr>
<td>mM</td>
<td>Molar</td>
</tr>
<tr>
<td>M</td>
<td>Concentration (1 M = 1 mole/litre)</td>
</tr>
<tr>
<td>MBq</td>
<td>Mega becquerel</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>MRI</td>
<td>Magnetic resonance imaging</td>
</tr>
<tr>
<td>MRTM</td>
<td>Ichise’s multilinear reference tissue model</td>
</tr>
<tr>
<td>MS</td>
<td>Multiple Sclerosis</td>
</tr>
<tr>
<td>nm</td>
<td>Namometre</td>
</tr>
<tr>
<td>nM</td>
<td>Nanomolar</td>
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<tr>
<td>NMDA</td>
<td>N-methyl-D-aspartate</td>
</tr>
<tr>
<td>NMR</td>
<td>Nuclear magnetic resonance</td>
</tr>
<tr>
<td>$Occ_{max}$</td>
<td>Maximum occupancy</td>
</tr>
<tr>
<td>6-OHDA</td>
<td>6-Hydroxydopamine</td>
</tr>
<tr>
<td>OSEM3D/MAP</td>
<td>Ordered set expectation maximization-3-Dimension/maximum a posteriori</td>
</tr>
<tr>
<td>PBS</td>
<td>Phosphate-buffered saline</td>
</tr>
<tr>
<td>PD</td>
<td>Parkinson’s disease</td>
</tr>
<tr>
<td>PEG400</td>
<td>Polyethylene glycol 400</td>
</tr>
<tr>
<td>PET</td>
<td>Positron-emission tomography</td>
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<tr>
<td>PVE</td>
<td>Partial volume effect</td>
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<tr>
<td>QC</td>
<td>Quality control</td>
</tr>
<tr>
<td>RLogan</td>
<td>Reference tissue Logan plot</td>
</tr>
<tr>
<td>ROI</td>
<td>Regions of interest</td>
</tr>
<tr>
<td>RP</td>
<td>Reverse-phase</td>
</tr>
<tr>
<td>RT</td>
<td>Residence time</td>
</tr>
<tr>
<td>s</td>
<td>Second</td>
</tr>
<tr>
<td>SD</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>SNc</td>
<td>Substantia nigra pars compacta</td>
</tr>
<tr>
<td>SNr</td>
<td>Substantia nigra pars reticulate</td>
</tr>
<tr>
<td>SPM</td>
<td>Statistical parametric mapping</td>
</tr>
<tr>
<td>SPMS</td>
<td>Secondary progressive multiple sclerosis</td>
</tr>
<tr>
<td>SRTM</td>
<td>Simplified reference tissue model</td>
</tr>
<tr>
<td>STN</td>
<td>Subthalamic nucleus</td>
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<tr>
<td>SUV</td>
<td>Standardized uptake value</td>
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<tr>
<td>$SUV_r$</td>
<td>Standardized uptake value ratio</td>
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<tr>
<td>$Sv$</td>
<td>Sievert</td>
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<tr>
<td>Symbol</td>
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<td>--------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>t</td>
<td>Time</td>
</tr>
<tr>
<td>$t_{1/2}$</td>
<td>Half-life</td>
</tr>
<tr>
<td>T</td>
<td>Tesla</td>
</tr>
<tr>
<td>TAC</td>
<td>Time-activity curve</td>
</tr>
<tr>
<td>TAT</td>
<td>Trans-activator of transcription</td>
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<tr>
<td>nTCM</td>
<td>n-Tissue compartment model</td>
</tr>
<tr>
<td>THF</td>
<td>Tetrahydrofuran</td>
</tr>
<tr>
<td>TLC</td>
<td>Thin-layer chromatography</td>
</tr>
<tr>
<td>TM</td>
<td>Transmembrane</td>
</tr>
<tr>
<td>TRV</td>
<td>Test-retest variability</td>
</tr>
<tr>
<td>TSPO</td>
<td>Translocator protein 18 kDa</td>
</tr>
<tr>
<td>UPLC</td>
<td>Ultra-high performance liquid chromatography</td>
</tr>
<tr>
<td>v/v</td>
<td>Volume per volume</td>
</tr>
<tr>
<td>$V_B$</td>
<td>Fractional blood volume</td>
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<tr>
<td>$V_{ND}$</td>
<td>Non-displaceable volume of distribution</td>
</tr>
<tr>
<td>VOI</td>
<td>Volume of interest</td>
</tr>
<tr>
<td>$V_T$</td>
<td>Volume of distribution</td>
</tr>
<tr>
<td>YFP</td>
<td>Yellow fluorescent protein</td>
</tr>
<tr>
<td>$\mu g$</td>
<td>Microgram</td>
</tr>
<tr>
<td>$\mu L$</td>
<td>Microlitre</td>
</tr>
<tr>
<td>$\mu M$</td>
<td>Micromolar</td>
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<tr>
<td>$\mu m$</td>
<td>Micrometre</td>
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<tr>
<td>$\mu Sv$</td>
<td>Microsievert</td>
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