出國報告（出國類別：其他）

赴奧地利參加第 30 屆歐洲核醫學年會國際會議出國報告

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出國期間：106 年 10 月 19 日~106 年 10 月 27 日
報告日期：106 年 11 月 22 日

摘　　要

本次國外公差主要為參加奧地利維也納舉辦之2017年第30屆歐洲核子醫學學會年（2017 Annual Congress of European Association of Nuclear Medicine，EANM’17），發表及e-poster walk解說核能研究所之學術論文海報，並參與會議中的各項研討議程，蒐集研討會最新核醫藥物發展資訊，作為日後計畫執行之參考依據。

歐洲核醫學會(European Association of Nuclear Medicine；簡稱 EANM) 每年輪流在歐洲各會員國舉辦國際性「歐洲核醫年會」，為全球最盛大的核子醫學創新與新技術研發會議之一，邀集各界提出核醫領域相關論文數以千計，會議中不僅展示了最新的核醫藥物研發進展及創新技術，更提供了產學交流與合作的機會。今年第30屆歐洲核醫學會年會在奧地利維也納國際中心ACV（Austria Center Vienna；ACV）舉行，由EANM Congress Chair （2017-2019）Francesco Giammarile教授擔任會議主席，會期於2017年10月21日起至10月25日止，為期五天。來自世界各地的專家學者共同參與盛會，探討的主題範圍極廣，從創新核醫診療藥物開發、臨床試驗進展探討到相關核子醫療儀器都包含在內，應用的領域包含心血管疾病、腦神經退化疾病、各種癌症診療等，可作為核能研究所對於核醫藥物研發領域以及未來發展策略與方向參考。

今年有幸參加全球規模數一數二的歐洲核醫學會年會，對於世界各國研究人員相互交流探討新知印象深刻，不僅拓展了的眼界也感受到研究學者們對知識追求的熱情，同時一窺全世界在核子醫學及分子影像領域的最新現況及未來研發方向。

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一、目　的

核子醫學因為具有高標靶性、高靈敏性、高親和性與高專一性等優勢，已成為最廣泛使用之分子診斷與造影技術，核能研究所長期投入大量人力物力於核醫藥物與醫材相關領域，為瞭解世界各國在核醫藥方面新技術之研發現況與未來市場拓展之規劃，本所諮議會副執行秘書林武智研究員與同位素組江秉芳助理研究員，奉派代表參加本次第30屆歐洲核醫學年會。

本年度本所共6篇壁報論文榮獲大會接受(論文統計如表一,論文內容請參閱附錄一)，除將我國在核子醫學領域的研發成果與世界各國交流，提升本所國際能見度，並藉此機會瞭解國外學者之觀點及目前研究潮流，學習最新核醫發展新知。期盼能尋求藥物研發新契機，對本所未來核醫藥物相關計畫策略規劃與發展方向有所助益。

表 一、參加 30th EANM_本所發表核醫研究論文統計表

序號	作者	論著名稱	壁報展示類別
1	李世瑛、羅盛男、黃永睿、陳明偉、李銘忻、張志賢	A method of DOTA-SP90 with ^{111}In labeling, has stability and potential for breast cancer imaging	Presentation Number: E-TPW28 Session: E-TPW2 – Technologist e-Poster Session 2 Session Date: Tuesday, October 24, 2017 Session Time: 8:00 AM - 9:30 AM Area: TE-Poster Walk Area
2	李銘忻、薛晴彥、馮俊方、張瀚之	The distribution of F-18-labeled Histone deacetylase inhibitor (HDACi) by PET/CT imaging	Presentation Number: E-TPW29 Session: E-TPW2 - Technologist e-Poster Session 2 Session Date: Tuesday, October 24, 2017 Session Time: 8:00 AM - 9:30 AM Area: TE-Poster Walk Area
3	陳明偉、黃永睿、李世瑛、羅盛男、陳亮丞、張志賢	Cytotoxicity, In Vitro Binding and Imaging Evaluation of Radiolabeled-DOTA-SP90 in 4T1 Breast Cancer Model	Presentation Number: EP-0263 Session Number: EP-14 Session Title: Radiopharmaceuticals & Radiochemistry : Radiopharmaceuticals - SPECT

4	彭正良、施映霞、江秉芳、郭裕民、羅彩月	Theranostic probe Lu-177-DOTA-NIR790 for multimodal diagnosis and therapy of cancer	Presentation Number: EP-0269 Session Number: EP-15 Session Title: Radiopharmaceuticals & Radiochemistry: Radiopharmacy
5	翁茂琦、王美惠、楊浚泓、李偉銘、林武智	Preclinical evaluation of non-invasive imaging molecules of growth differentiation factor-11 for aging-related diseases' uses	Presentation Number: EP-0376 Session Number: EP-26 Session Title: Neurosciences: Basic Science
6	江秉芳、彭正良、施映霞、羅彩月	Brachytherapy treatment for hepatocellular carcinoma in rats with biodegradable microspheres following intra-arterial chemoembolization	Presentation Number: EP-0478 Session Number: EP-37 Session Title: Basic Oncology: Animal Models

二、過　程

（一） 行程

本次第30屆歐洲核醫學年會（30th EANM）在奧地利維也納國際中心ACV（Austria Center Vienna；ACV）舉行。維也納是奧地利的首都，與美國紐約和瑞士日內瓦同為聯合國僅有的駐地城市，國際原子能總署（IAEA）就坐落在維也納。本次公差自106年10月19日至106年10月27日共計9天，扣除飛機行程之來往，實際工作共5天，工作內容重點如表二。維也納國際中心ACV會場位置及場內，請參見圖一及圖二。

表 二、參加 30th EANM_行程與工作重點

月	日	星期	地點	工作紀要
10	19	四	桃園機場	去程: 台灣桃園國際機場(TPE)—德國法蘭克福機場(FRA)—奧地利維也納機場(VIE)
	20	五	維也納機場	
	21	六	奧地利維也納 ACV	參加第 30 屆歐洲核醫學年會（30th EANM），並代表本所報告兩篇海報論文（e-Poster Walk）。
	22	日	奧地利維也納 ACV	
	23	一	奧地利維也納 ACV	
	24	二	奧地利維也納 ACV	
	25	三	奧地利維也納 ACV	
	26	四	維也納機場	返程: 奧地利維也納機場(VIE)—台灣桃園國

	27	五	桃園機場	際機場(TPE)

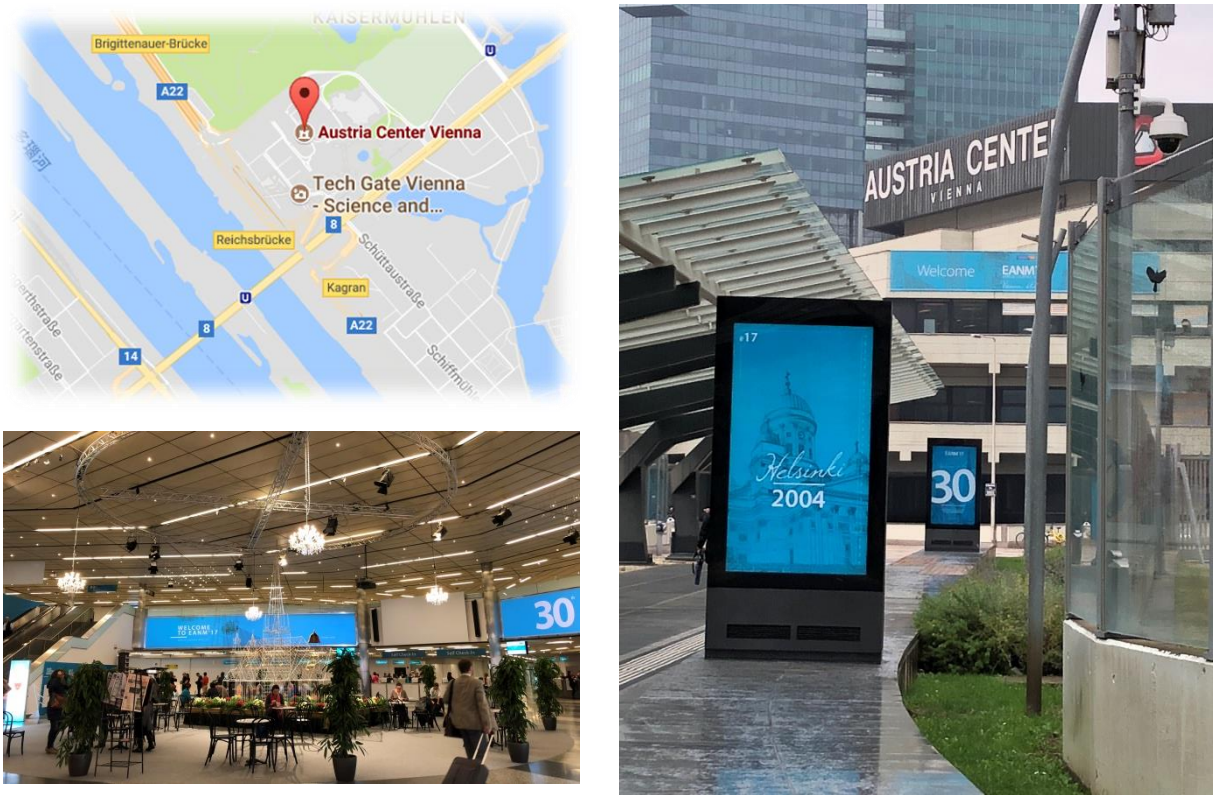


圖 一、奧地利維也納國際中心 ACV（Austria Center Vienna；ACV）

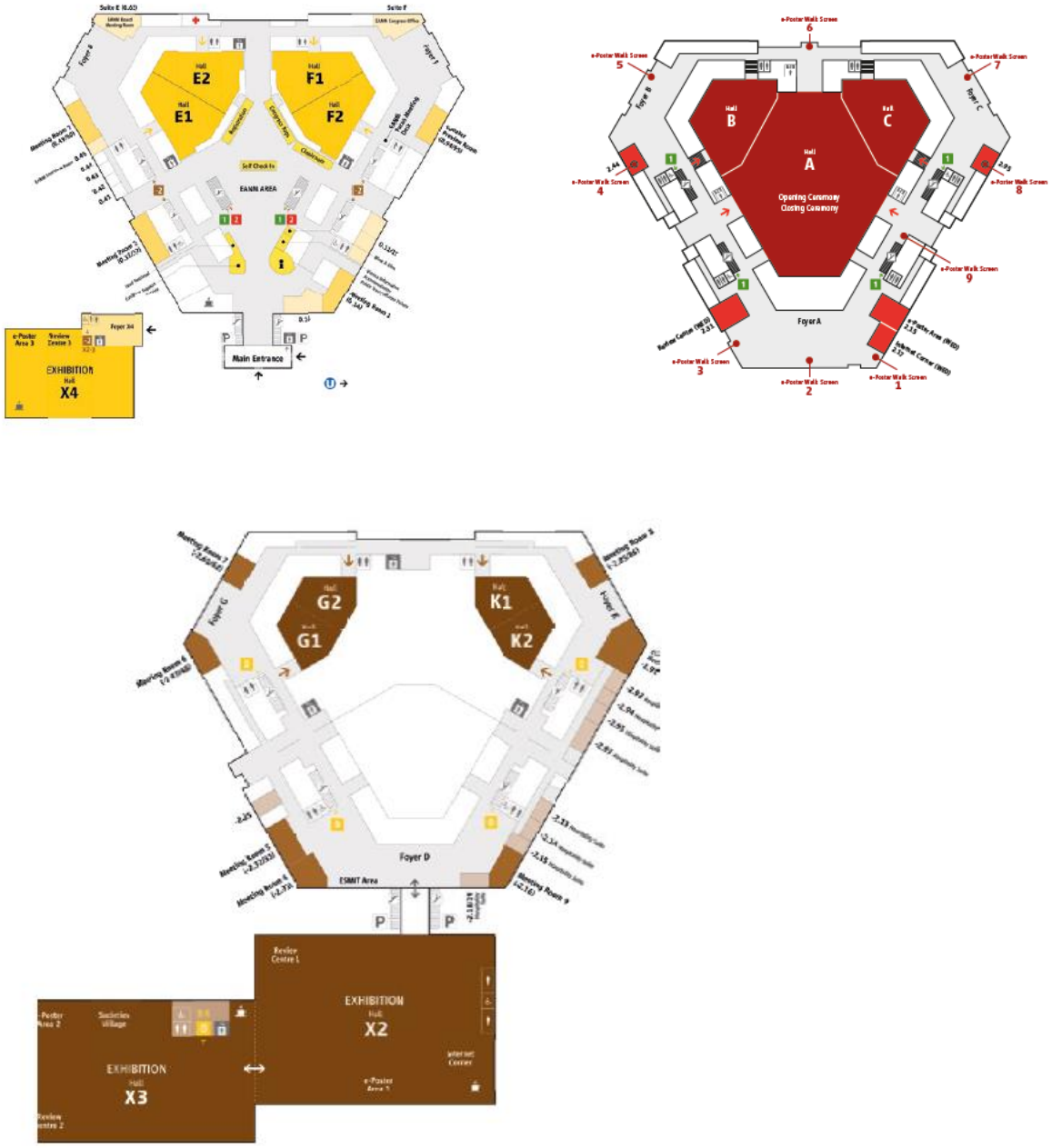


圖 二、第 30 屆歐洲核醫學年會(30th EANM)會場指示圖

（二） 30th EANM 簡介

歐洲核醫學會(European Association of Nuclear Medicine；簡稱 EANM) 每年輪流在歐洲各會員國舉辦國際性「歐洲核醫年會」，為全球最盛大的核子醫學創新與新技術研發會議之一，邀集各界提出核醫領域相關論文數以千計，會議中不僅展示了最新的核醫藥物研發進展及創新技術，更提供了產學交流與合作的機會。

30th EANM在奧地利維也納國際中心ACV（Austria Center Vienna；ACV）舉行。會議主席由EANM Congress Chair（2017-2019）Francesco Giammarile教授擔任。會期於2017年10月21日起至10月25日止，為期五天，由歐洲核醫學會（包括科學組與技術組委員會）主辦，議程內容專注於現行核醫藥物發展與未來趨勢，並有相關先進技術廠商舉辦專題座談會，會議主題包含新藥開發、基礎研究、臨床技術及疾病治療探討、影像數據分析、診斷與治療之核醫藥物到新穎醫療儀器發展現況等領域，依性質不同，可分為以下十大主題：Basic Oncology、Cardiovascular System、Clinical Oncology、Conventional & Specialized Nuclear Medicine、Molecular & Multimodality Imaging、Neurosciences、Physics & Instr. & Data Analysis plus Dosimetry、Radionuclide Therapy without Dosimetry、Radiopharmaceuticals & Radiochemistry。

今年依循去年採e-poster（電子壁報）呈現會議海報，投稿者將已被接受的海報內容上傳電子檔，會議期間不需再印製紙本海報張貼，與會者可以在e-poster專區利用電腦登入帳號後自行瀏覽（如圖三），可以直接輸入關鍵字查詢有興趣的研究，系統還會連帶提供其他相關海報供參考，相當便利且節省展示空間。此外e-poster Walk area則是會場提供大型電子螢幕展示電子壁報，由工作人員擔任主席主持會議流程，並請作者現場進行4分鐘簡短的口頭報告，提供與會者跟作者直接請教討論的機會，相較於正式的口頭發表顯得較為精簡（如圖四），今年職亦代表本所報告兩篇屬於Technologist類別的e-poster Walk，題目分別為：1.「A

method of DOTA-SP90 with In-111 labeling, has stability and potential for breast cancer imaging」，研究目的為建立SP90標誌In-111的方法，並進行穩定性試驗以及乳癌動物模式NanoSPECT/CT影像，將作為乳癌診斷造影劑之用；2.「The distribution of F-18-labeled Histone deacetylase inhibitor (HDACi) by PET/CT imaging」，研究目的為建立可穿透血腦屏蔽的F-18-HDACi標誌方法並以PET/CT小鼠腦部影像作為驗證，將用於阿茲海默症的診斷，結束後主持人詢問是否將進入臨床試驗，不過目前兩篇研究都仍在動物試驗階段。

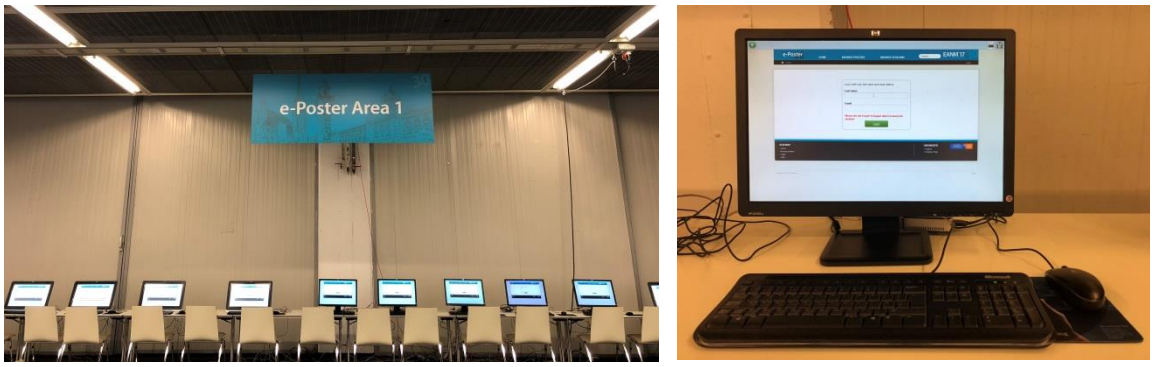


圖 三、e-poster（電子壁報）查詢專區

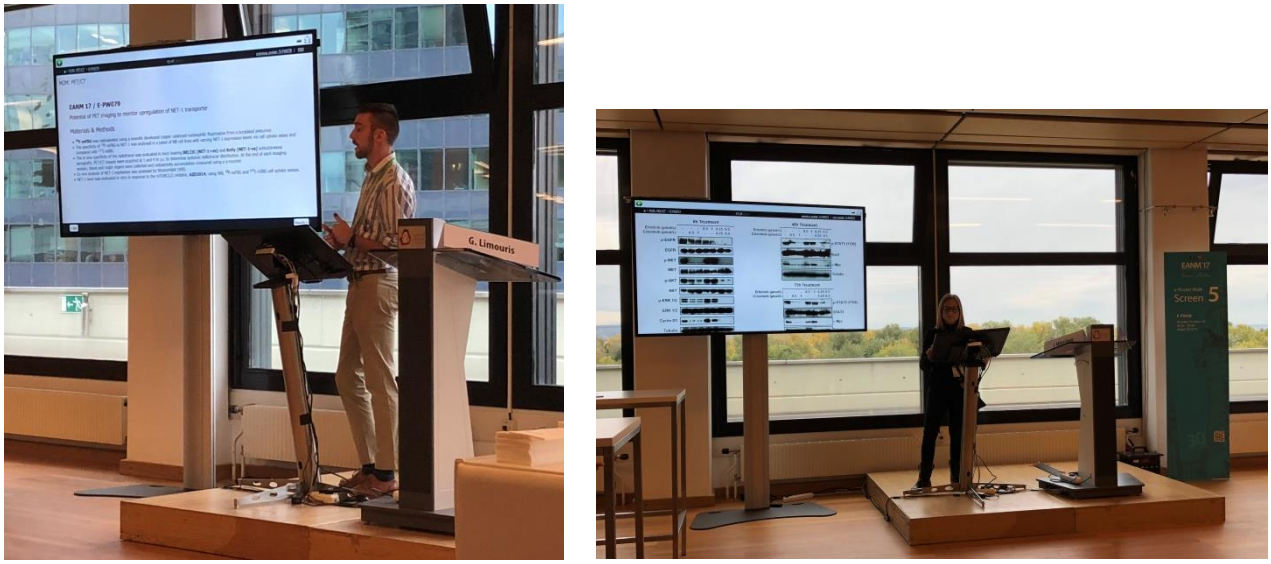
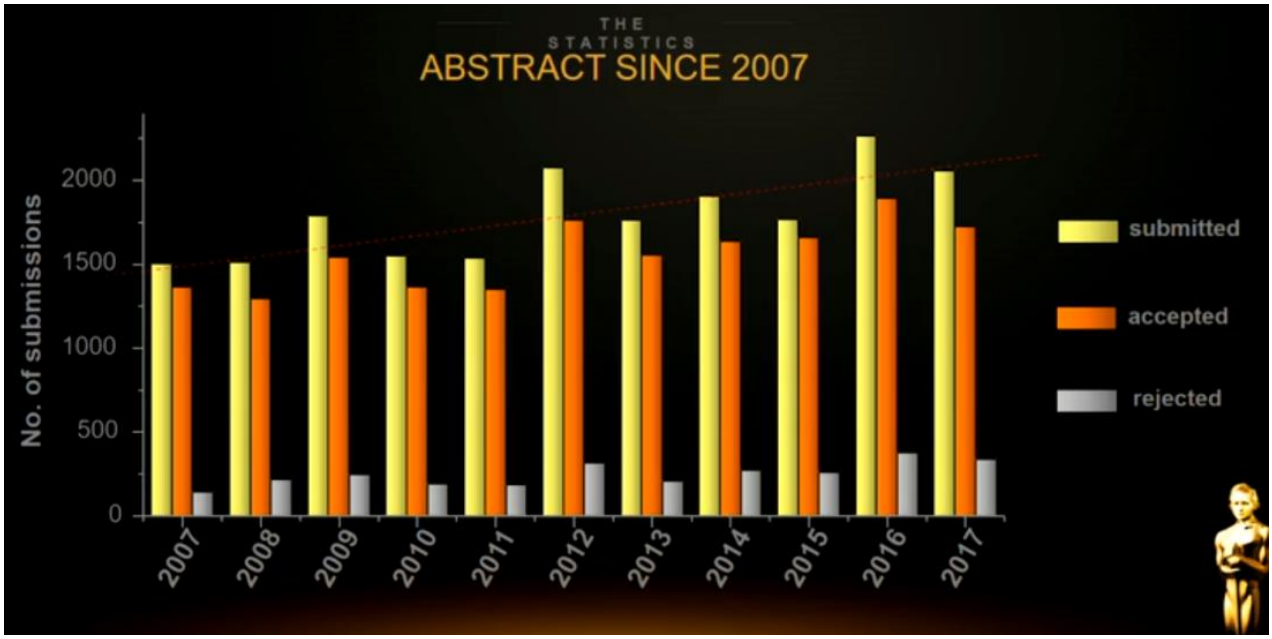


圖 四、e-poster Walk presentation

（三） 30th EANM 國際投稿分析

30th EANM由來自全球多國踴躍投稿，投稿主以歐盟國家為主，今年由義大利拔得頭籌，獲得許多會議獎項的德國則為第二，亞洲地區則有來自日本、中國大陸、韓國與台灣積極參與。本屆大會超過6200名世界各地研究人員參與，2,058篇摘要投稿，在占地3,500平方公尺的會場，共舉辦159場會議。

由2007-2017歷年投稿篇數與趨勢來看，呈現逐年遞增，主持人還預估2023年將會突破3000篇。另由投稿篇數的國家排名來看，本次研討會台灣投稿排名為第25名，韓國排名第12名，中國大陸為第11名，日本為第5名。由此可看出，我國與鄰近國家相比，仍有很大的進步空間（圖五）。



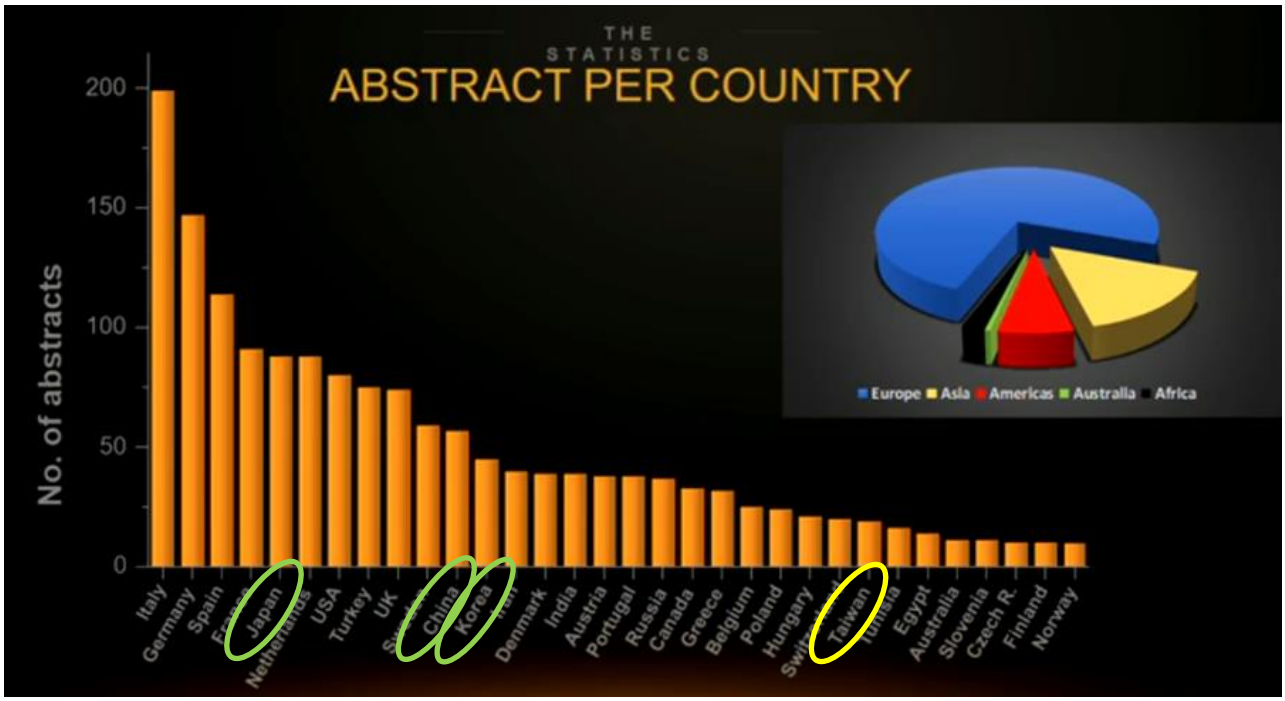


圖 五、30th EANM研討會之國際投稿分析與台灣排名（作者摘錄）

（四） 30th EANM Award 及 Highlight lectures

每年度EANM大會所頒發兩個重要獎項分別為：EANM Eckert & Ziegler Abstract Award及Marie Curie Award，目的是為了鼓勵年輕的研究學者與歐洲的EANM會員踴躍提交成果，在眾多研究當中獲獎是參與發表研究團隊的最高榮譽。本次第30屆EANM最終獲獎題目皆來自於德國（如表三），研究項目皆與本屆大會的焦點「前列腺癌」相關。Highlight lectures則是最後由大會的專家學者從本屆投稿中所挑選出的卓越研究報告，在會議最後一天由Stefano Fanti教授及Clemens Decristoforo教授彙整簡介。（如表四）

表 三、30th EANM Award 獲獎的研究成果

Award	Winner
EANM Eckert & Ziegler Abstract Award	Dual-labeled PSMA-11 for PET/CT imaging and precise fluorescence guided intraoperative identification of prostate cancer German Cancer Research Center, Heidelberg, GERMANY. University Hospital, Heidelberg, GERMANY. University Hospital, Essen, GERMANY. University Hospital, Freiburg, GERMANY. German Cancer Consortium, Heidelberg, GERMANY.
Marie Curie Award	PSMA-targeting alpha-Radiation therapy with ^{225}Actinium-PSMA-617: Dosimetry, toxicity and duration of tumor-control University Hospital Heidelberg, Heidelberg, GERMANY. EC-JRC, Directorate for Nuclear Safety and Security, Karlsruhe, GERMANY.

表 四、30th EANM Highlight lectures

Physics & Instrumentation			
1	OP511	A Promising PET Detector Design that Achieves 100 ps FWHM Coincidence Time Resolution	Do.MoRe
2	OP517	PET 20.0 : a cost-efficient, 2mm spatial resolution Total Body PET with point sensitivity up to 22% and adaptive axial FOV of maximum 2.00m	Do.MoRe
3	OP281	Feasibility of state-of-the-art PET/CT system performance harmonisation	Do.MoRe

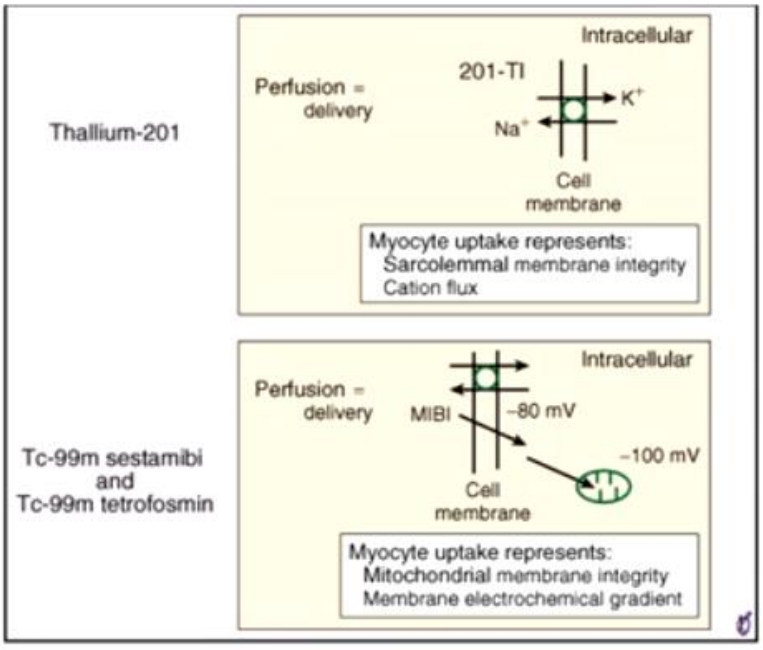
4	OP242	Radiomics analysis predicts N- and M-stage of primary cervical cancer using multiple PET/MR-derived quantitative features	Clinical Oncology
5	OP666	Voxel based internal dosimetry of radiopharmaceuticals in diagnostic nuclear medicine	Do.MoRe
Cardiovascular			
6	OP179	Segmental comparison of myocardial inflammation, area at risk, edema and irreversible tissue damage after acute myocardial infarction	Cardiovascular system
7	OP708	Non-invasive visualization of healing phase 2 after myocardial infarction (MI) using ^{68}Ga-NOTA-anti-CD206-Nb: targeting mannose receptor (MR, CD206) on M2 macrophages	Cardiovascular system
8	OP709	Targeting mannose receptor (MR, CD206) expression on macrophages in atherosclerotic plaques of apolipoprotein E-knockout mice using ^{68}Ga-NOTA-anti-MMR nanobody	Cardiovascular system
9	OP714	Diagnosis of Deep Venous Thrombosis and Pulmonary Embolism Using ^{18}F-GP1 Positron Emission Tomography: An Exploratory Openlabel Study	Cardiovascular System
10	OP357	[^{18}F]-Florbetaben PET/CT in cardiac amyloidosis: results from the FLORAMICAR study	Cardiovascular System
Basic science & Preclinical			
11	E-PW011	Imaging and Biodistribution ^{18}F-RPS-544: An Imaging Agent Targeting CXCR4.	Cardiovascular System
12	OP310	Dual-labeled PSMA-11 for PET/CT imaging and precise - fluorescence guided intraoperative identification of prostate cancer	Tomorrow's Experts Session
13	OP066	Monitoring tumor PD-L1 expression with microSPECT/CT during radiotherapy	Antibodies
14	OP065	Ab-1881, An Anti-PDL1 Immune Checkpoint Inhibitor Serves as A Theranostic Agent for Cancer Immunotherapy	Antibodies
15	OP061	Immunotargeting of Galectin-3 in thyroid orthotopic tumor models opens new challenges for thyroid cancer imaging and biological characterization in vivo	Antibodies
16	OP062	Pretargeted radionuclide therapy of HER2-expressing SKOV-3 human xenografts using an A body molecule-based PNA-mediated pretargeting	Antibodies
17	OP491	Low molecular weight target module for PET imaging and UniCAR T cell immunotherapeutic treatment of PSMA expressing tumors	Prostate Cancer Targeting
Neuroscience			

18	OP110	First in vivo imaging and in vitro studies of ^{18}F-DABTA in rat model with E46K alpha synuclein mutation	New Targets
19	OP190	PET imaging of mGluR5 with [^{18}F]FPEB in Parkinson's disease	Neurosciences
20	OP188	Validation of a reliable and convenient PET protocol for striatal dopaminergic dysfunction imaging using ^{18}F-LBT-999	Neurosciences
21	OP313	TSPO-PET for high-grade glioma imaging using the novel ligand [^{18}F]GE-180 - first in human results in the course of radiotherapy	Tomorrow's Experts Session
22	OP366	Clinical evaluation of ^{18}F-PI-2620, a next generation tau PET agent in subjects with Alzheimer's disease, progressive supranuclear palsy, and non-demented controls	Neurosciences
New radiopharmaceutcals - clinical			
23	OP112	Imaging beta cells in patients after Roux-en-Y gastric bypass (RYGB) surgery by ^{68}Ga-NODAGAexendin-4 PET/CT	New Targets
24	OP547	[$^{123/131}$I]IMAZA as a new theranostic tool in patients with advanced adrenocortical carcinoma	Clinical Oncology
25	OP172	First experience using LMI1195 in patients with the suspicion of pheochromocytoma or paraganglioma	Clinical Oncology
26	OP079	A proof-of-concept study of ^{68}Ga-TATE-RGD PET/CT for duel-target imaging of somatostatin receptor and integrin $\alpha_v\beta_3$ to detect lung cancer and neuroendocrine tumor in a single scan	Clinical Oncology
Clinical Oncology			
27	E-PW082	Prediction of small early lung adenocarcinoma with aggressive histopathologic subtypes using PET and CT radiomic features	Clinical Oncology
28	OP113	^{68}Ga-Pentixafor PET/CT Imaging Targeting CXCR4 chemokine receptors : The First Clinical Experience in Lung carcinoma subtypes	New Targets
29	OP302	Combined FDG and 4FMFES PET Imaging in ER+ Breast Cancer Patients for Improved Diagnostic and Prognostic Value	Clinical Oncology
30	OP238	Repeatability of tumor hypoxia imaging using [^{18}F]EF5 PET/CT in head and neck cancer	Clinical Oncology
Prostate			

31	OP126	Impact of ^{68}Ga-PSMA-11 PET/CT on salvage radiotherapy planning in post-prostatectomy patients with early biochemical recurrence	Clinical Oncology
32	OP121	Impact of Ga-68 PSMA PET/CT on radiation treatment planning of prostate cancer	Clinical Oncology
33	OP243	Simultaneous whole-body ^{18}F-PSMA-1007-PET/MRI with integrated high-resolution multiparametrical imaging of the prostatic fossa for comprehensive oncological staging of patients with prostate cancer	Clinical Oncology
34	OP119	Tc-99m-MIP-1404 Imaging for the Detection of PSMA-Positive Lesions. A Pilot Study in 380 Patients with Histologically Confirmed Prostate Cancer	Clinical Oncology
35	OP073	Comparison study between ^{18}F-Choline (FCH) and 68Ga-NODAGA-MJ9 (MJ9, Bombesin) PET-CT in prostate cancer initial staging	Clinical Oncology
36	OP492	^{89}Zr-df-IAB2M for PET/CT imaging of prostate cancer	Prostate Cancer Targeting
		Therapy & Dosimetry	
37	EP0621	The FOXFIRE/SIRFLOX/FOXFIRE-Global randomised studies of – first-line selective internal radiation therapy for metastatic colorectal cancer	Clinical Oncology
38	OP237	First Interim Results of the Radium-223 REASSURE Observational Study: Analysis of Patient Characteristics and Safety by Prior Use of Chemotherapy	Clinical Oncology
39	OP545	Somatostatin antagonist theranostic pair ^{68}Ga-OPS202 and ^{177}Lu-OPS201 for well differentiated neuroendocrine tumors (NETs)	Clinical Oncology
40	OP012	Pre-dosing with Lilotomab Prior to Antibody-Radionuclide Conjugate Therapy with ^{177}Lu-Lilotomab Satetraxetan Signi cantly Increases the Ratio of Tumour to Red Marrow Absorbed Dose in non-Hodgkin Lymphoma Patients	Radionuclide Therapy
41	OP013	Bi-213-anti-EGFR-MAb therapy of recurrent bladder cancer - a pilot study	Radionuclide Therapy
		The Specials	
41	OP153	A 3D-Printed 2-Compartment Kidney Phantom for Evaluating the Accuracy of Quantitative SPECT/CT Imaging	SPECT Quanti- cation
42	E-PW042	Incremental value of ultrasonography in incidental focal thyroid uptake at ^{18}F-FDG PET-CT	Do.MoRe
43	EP0727	Applying radiomics and machine learning on PET images to predict lung metastases in soft tissue sarcoma patients	Clinical Oncology

（五） 核醫心肌灌流成像

核醫心肌灌流照影是目前核醫心臟學中發展非常迅速的檢查方式。自 1974 年 Tl-201 應用在核子醫學臨床使用後已是心肌灌注掃描檢查常使用的放射製劑，Tl-201 chloride（半衰期 72 小時，68-80 KeV）經由鈉鉀離子幫浦（Sodium-potassium pump）主動運輸進入心肌細胞，主要由腎臟代謝。注射 3-24 小時之後照影評估心肌存活（myocardial viability），心肌細胞攝取量與血流量成正比，因其再分佈（redistribution）特性，病患只要注射一次放射藥物，即可評估運動壓力態以及休息狀態的心肌血流灌注狀況。Tc-99m sestamibi 和 Tc-99m tetrofosmin（Tc-99m 半衰期 6 小時，140 KeV）藉由通過細胞膜進入粒線體，大多經由肝臟系統代謝，無再分布能力，評估壓力態與休息態之前皆需注射藥物，因此可分不同時間進行檢測，通常四小時後再進行休息態的斷層心肌灌注掃描。由於 Tl-201 有較長半衰期，故利於運送供應，Tc-99m sestamibi 和 Tc-99m tetrofosmin 則是利用商品化的套組自行標誌藥物。非侵入式的核醫心肌灌流照影對於病人接受輻射劑量小，可重覆檢查，因此適合做為心臟相關疾病的診斷或預後評估，茲將 Tl-201、Tc-99m sestamibi 和 Tc-99m tetrofosmin 三種商品化產品進行特性比較，如圖六。



Property	^{99m}Tc-sestamibi	^{99m}Tc-tetrofosmin	^{201}Tl thallous-chloride
Availability	Kit preparation with heating	Kit preparation at room temperature	Long half-life makes supply convenient
Imaging protocol	Separate injections at stress and rest (if a rest study is deemed necessary)		Stress and rest data from single injection
Imaging flexibility	Stress and rest on same or different days		Stress imaging must begin immediately
Image quality	Optimal for gamma cameras		Low emission energy, low count rate

圖 六、Tl-201 chloride、Tc-99m sestamibi 和 Tc-99m tetrofosmin 特性比較（作者摘錄）

想獲得理想的核醫心臟影像定量，需要包括以下幾點條件：示蹤劑（Tracer）的吸收與灌流成正比，訊號雜訊比值高（signal to noise ratio），影像對比強度與示蹤劑劑量成比例增加，給藥後短時間即可進行造影，簡易的數學計算分析模式。但是臨床上卻難以如願，如下圖七，不同的示蹤劑吸收劑量與心肌灌流量的關係多呈向上的拋物曲線，只有 ^{15}O-water 比較接近理想的線性關係。

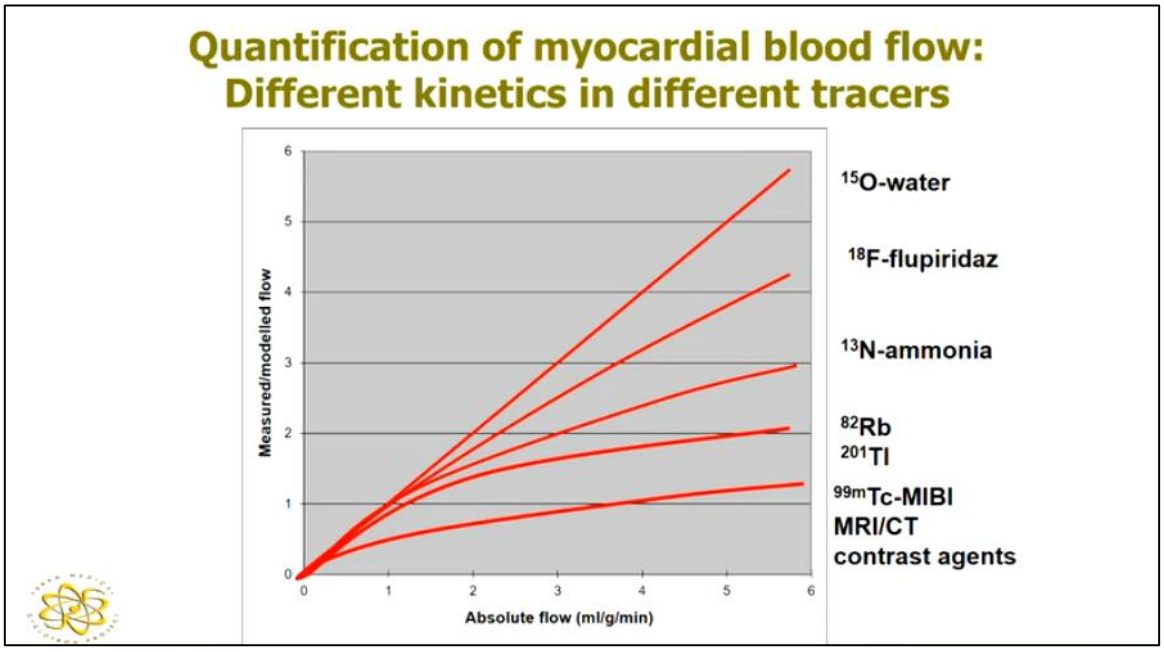


圖 七、示蹤劑的吸收與心肌灌流關係圖（作者摘錄）

冠狀動脈疾病（Coronary artery disease）是世界上死亡的主要原因，心肌灌注影像（Myocardial perfusion imaging，MPI）對於冠狀動脈疾病的診斷和預後追蹤是相當重要的非侵入式檢查。F-18 標誌的 MPI 疏水性造影劑分為銨離子型與磷離子兩大類（如圖八）。例如 AlJammaz Iu.研究團隊以 F-18-FDG 作為輔基可於 20 分鐘內僅需一步驟合成 F-18-FDG-rhodamine，不需 HPLC 純化即可得放化純度 98% 的成品，動物實驗中注射 60 分鐘後，大鼠心臟的生體分布顯示高攝取率（>11% ID / g）。Zhengxing Zhang 研究團隊則是將原本需四步驟才能合成的 F-18-FBnTP，利用硼酸酯作為前驅物並加入銅做為催化劑，可簡化合成步驟且提高放化純度。

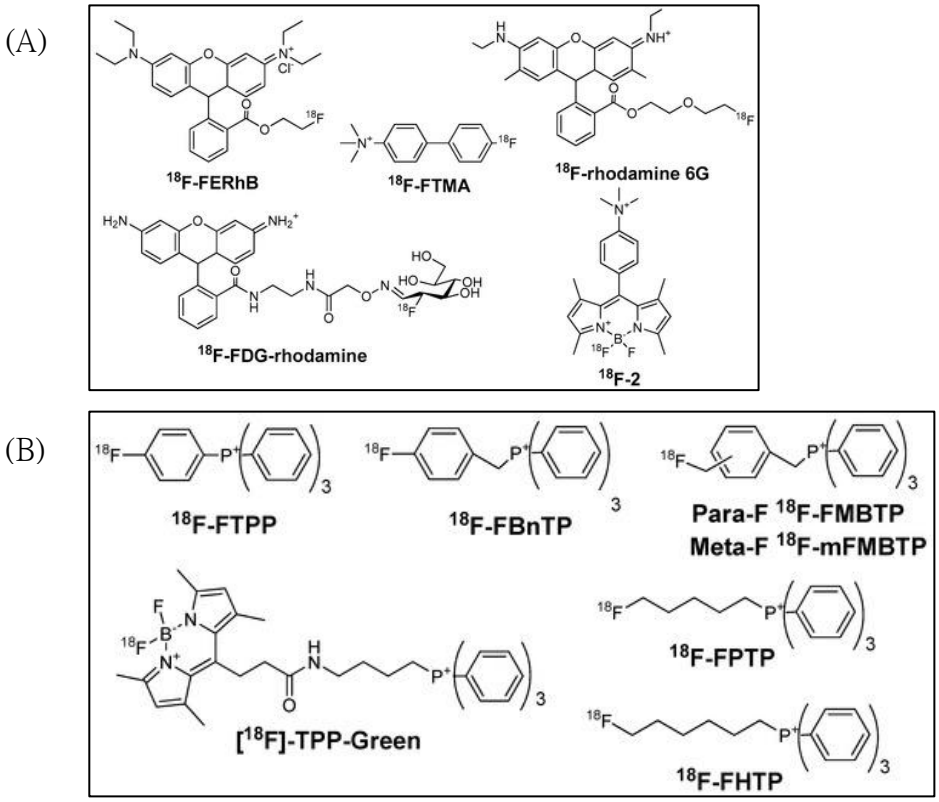


圖 八、(A)F-18 銨離子型造影劑；(B)F-18 磷離子型造影劑（作者摘錄）

^{18}F-flurpiridaz 是研發進展最快的心臟造影劑，目前已進入臨床第三期，臨床試驗展現令人振奮的成果。另外幾種 F-18 標記的放射性造影劑如 F-18-FBnTP，F-18-FTTP，F-18-FHTP 和 F-18-Fmpp2 在臨床前研究中也顯示出各自不同的特性，但大部分仍需進一步研究以符合臨床診斷標準。（如圖九）

Probes	^{18}F-FDG-Rhodamine	^{18}F-FBnTP	^{18}F-FTTP	^{18}F-mFMBTP	^{18}F-Flurpiridaz	^{18}F-Fmpp2
Class	ammonium cation	phosphonium cation	phosphonium cation	phosphonium cation	MC-1 inhibitors	MC-1 inhibitors
Charge	cationic	cationic	cationic	cationic	neutral	neutral
Log P	−1.64 ± 0.03	–	1.78 ± 0.05	1.05 ± 0.01	–	1.73 ± 0.05
RCY (%)	97.0 ± 1.9 (based on ^{18}F-FDG)	62 ± 1.4 (NDC)	10–15 (EOS)	50 (DC)	25 (DC)	58 ± 7.1 (DC)
Heart Uptake (%ID/g)	11.24 ± 1.97 (rat)	–	1.51 ± 0.04 (rat)	27.39 ± 1.46 (mice)	9.5 ± 0.5 (mice)	27.15 ± 3.58 (mice)
Heart/Liver Ratio	21.2 (rat)	1.2 (dog)	8 (rat)	4.84 (mice)	8.3 (mice)	3.96 (mice)
Heart/Blood Ratio	28.10 (rat)	16.6 (dog)	75.5 (rat)	23.82 (mice)	–	10.29 (mice)
Time point (min) *	–	60	30	30	60	30
Current status	rats	dogs	rabbits	dogs	Clinic trial (Phase III)	pigs
References	26	21, 32, 37	39	44	53	62

* Time point means the time point of heart uptake and heart/liver ratios in Table 1.

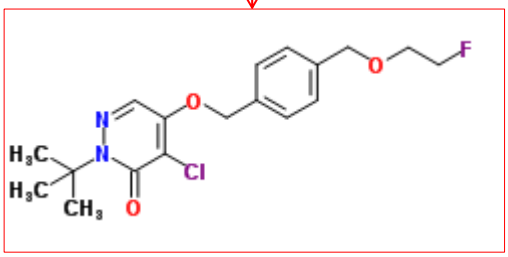


圖 九、F-18 標記的放射性造影劑比較表及 F-18-flurpiridaz 結構(作者摘錄）

急性心肌梗塞（acute myocardial infarction， AMI）發作之後，會伴隨著組織傷害發生，如發炎、水腫，或是壞死的心肌被疤痕組織所取代。MRI 磁振造影時，激發脈衝與氫原子核旋進頻率產生共振，當脈衝關閉後磁性由橫向磁距衰減為 T2 弛緩效應（T2 relaxation），以 T2 作為影像對比種類的 T2 權重核磁造影（T2-weighted MRI），常用來評估水腫範圍作為嚴重程度的指標；禁食後的 FDG 累積也常被用於診斷心肌炎；除了結構上的異常外，還可以透過 late gadolinium enhancement（LGE）CMR technique（LGECMR）的技術來幫助診斷各類的心肌組織病變。來自德國 Nuklearmedizinische Klinik und Poliklinik 的 Christoph Rischpler 研究團隊則是利用 FDG PET/MRI 及 Tc-99m sestamibi SPECT 等不同模式的影像，對 13 位患者進行綜合評估，實驗結果顯示 Area at risk (APECT)與 Inflammation (FDG) 間存在中度相關性，而 Scar (LGE)的結果似乎獨立於其他檢驗方式，目前仍需更多臨床試驗以證實此結果。（如圖十）

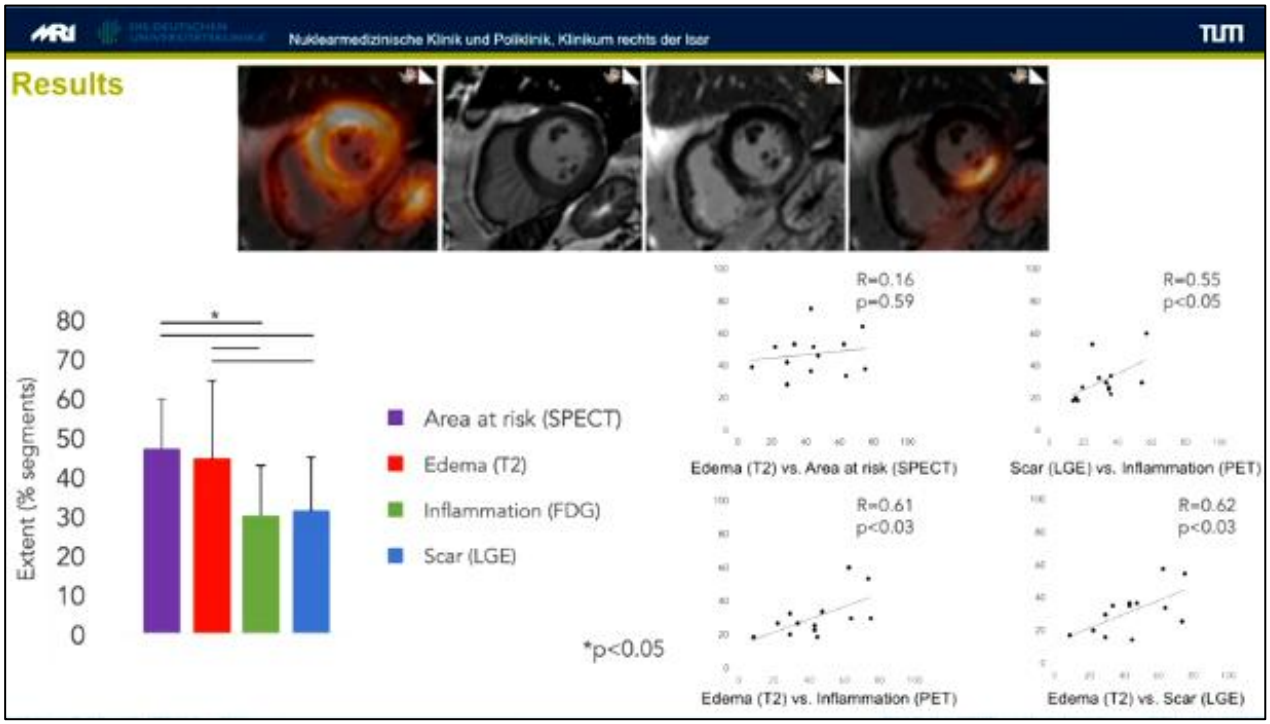


圖 十、急性心肌梗塞患者不同影像評估結果比較（作者摘錄）

（六） 新穎雙功能診療核醫藥物的發展

診療（Theranostic）包含了治療（therapeutics）及診斷（diagnostics），正確診斷疾病並給予患者適合的治療，標靶藥物標誌不同射源以結合標的物以進行診斷或治療，也正是目前核子醫學所追求的精準醫療。（如圖十一）

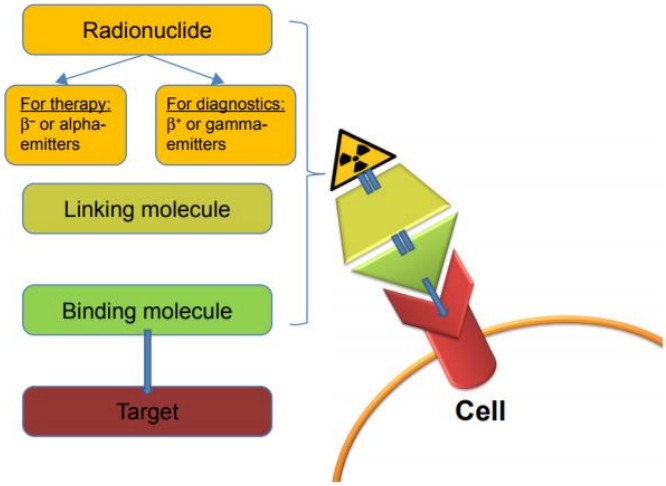


圖 十一、核醫標靶藥物示意圖（作者摘錄）

目前用於治療的三種輻射能量分別是 α 粒子、β 粒子及歐傑電子（auger electron emitter），但通常不適用於診斷。在疾病治療前需先進行腫瘤位置及給藥劑量的評估分析，或是治療後的後續追蹤監測，故可先挑選治療核種適用配對的診斷核種作為預先檢測，如表五所建議之配對核種（Isotope pairs），兩者不一定是相同的元素，但診斷核種的半衰期都較短，如此可減少病患接受的輻射劑量。如圖十二之 A 圖及 B 圖便是分別以 370 MBq (10 mCi)的 I-123 與 5550 MBq (150 mCi)的 I-131 進行甲狀腺的診斷與治療。

表 五、治療與診斷配對核種（Isotope pairs）

Therapeutic Isotope	Imaging “Surrogate(s)”
I-131 (t1/2 = 8 d)	I-124,123 (t1/2 = 4.176 d, 13 h)
Y-90 (t1/2 = 2.7 d)	Y-86/In-111/Ga-68/Zr-89

	(t1/2 = 14.74 h/2.8 d/1.2 h/ 78.4 h)
Lu-177 (t1/2 = 6.7 d)	In-111/Ga-68/Zr-89 (t1/2 = 2.8 d/ 1.2 h/ 78.4 h)
Re-186 (t1/2 = 3.7 d)	Tc-99m (t1/2 = 6 h)
Br-77 (t1/2 = 2.4 d)	Br-76 (t1/2 = 16.2 h)
Cu-67 (t1/2 = 2.6 d)	Cu-64 (t1/2 = 12.7 h)
Sc-47 (t1/2 = 3.35 d)	Sc-44,43 (t1/2 = 3.97 h, 3.89 h)
Ac-225 (t1/2 = 10 d)	Y-86/In-111/Ga-68/Zr-89/Sc-44,43 (t1/2 = 14.74 h/2.8 d/ 1.2 h/78.4 h/3.97 h, 3.89 h)
As-77 (t1/2 = 38.83 hr)	As-72 (t1/2 = 26 h)
Tb-161 (t1/2 = 6.9 d)	Tb-155,152 (t1/2 = 17.5 h, 5.32 d)
Th-227 (t1/2 = 18.72 d)	Zr-89 (t1/2 = 78.4 h)
Pb-212 (t1/2 = 10 hr)	Pb-210 (t1/2 = 22.3 y)

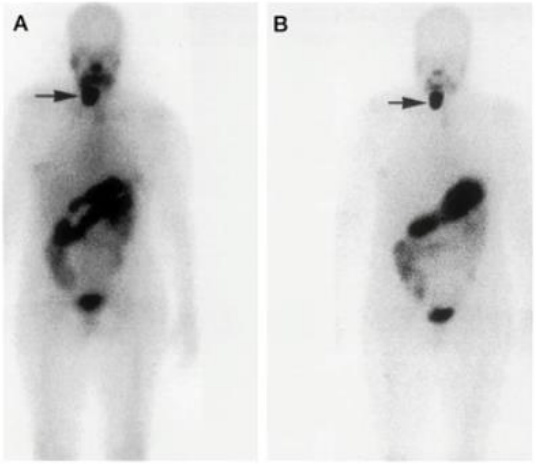


圖 十二、(A) 370 MBq (10 mCi) I-123 造影圖；(B) 5550 MBq (150 mCi) I-131 造影圖（作者摘錄）

神經內分泌腫瘤（neuroendocine tumors，NETs）在接受胜肽接受體標靶放射治療（Peptide Receptor Radionuclide Therapy，PRRT）治療之前會先進行體抑素的核醫掃描（In-111 octreotide scan）檢查來確認是否為體抑素受體陽性。同為體抑素的標靶藥物 DOTATATE 分別標誌 Ga-68、In-111 及 Y-90，與 In-111 octreotide 比較在腫瘤分布的情形，可看出不同核種會影響同一標靶分子在腫瘤的累積代謝。（如圖十三）

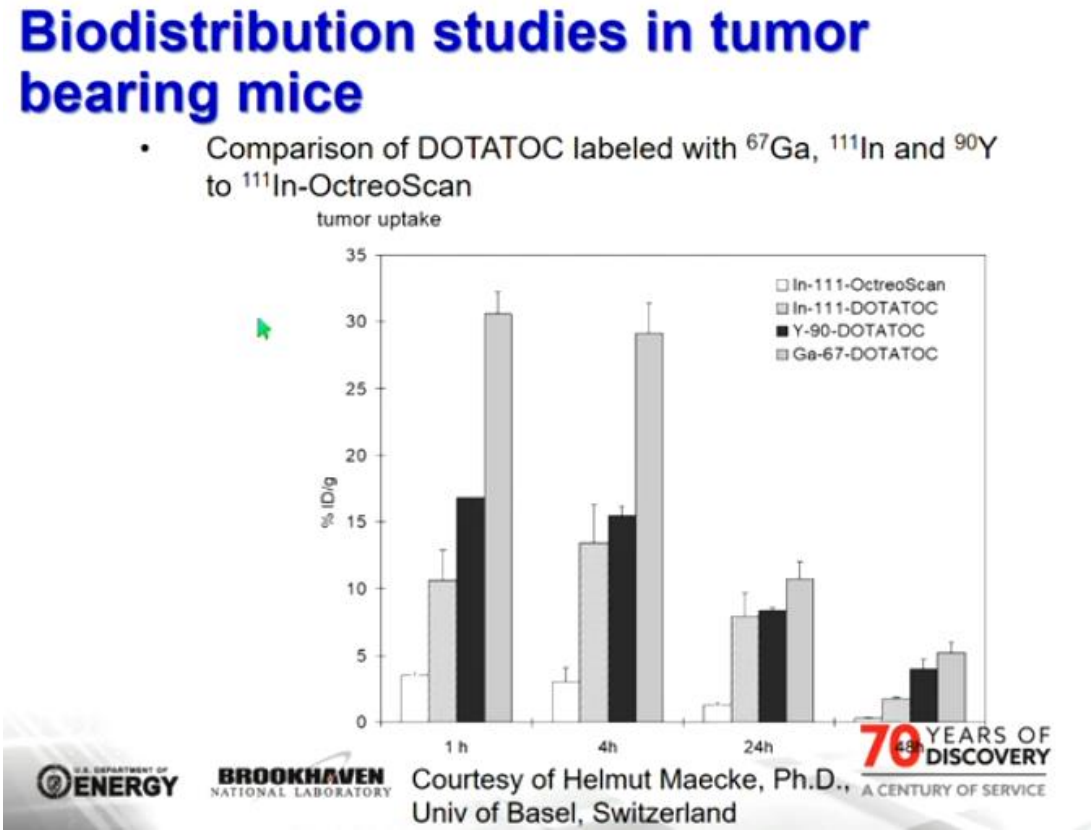
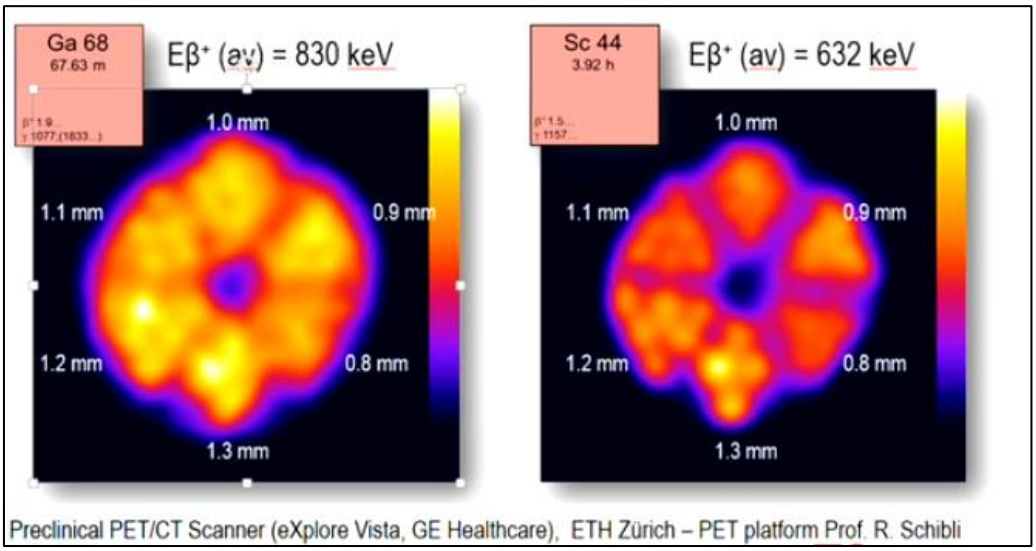


圖 十三、不同射源(Ga-67、In-111、Y-90)標誌 DOTATOC 及 In-111-OctreoScan 在腫瘤小鼠的生體分布（作者摘錄）

即使都屬短半衰期的診斷用核種，彼此間也有不同的放射能量差別，進而會影響到最終影像的解析度，如 Sc-44 的 $E\beta^{+}$(AV) β^{+}的平均能量低於 Ga-68，在 PET 影像的解析度 Sc-44 優於 Ga-68。來自瑞士 Center for Radiopharmaceutical Sciences ETH-PSI-USZ, Paul Scherrer Institut 的 Christoph A. Umbricht 研究團隊，便提出若改以 Sc-44 標誌 PSMA-617，其標靶能力近似 Lu-177-PSMA-617，肝腎

清除率較 Ga-68-PSMA-617 及 Ga-68-PSMA-11 更佳，且 Sc-44 半衰期 4.04 小時較Ga-68更長一點，是適合臨床使用的診斷用核種，目前已進入人體臨床試驗。(如圖十四)

(A)



(B)

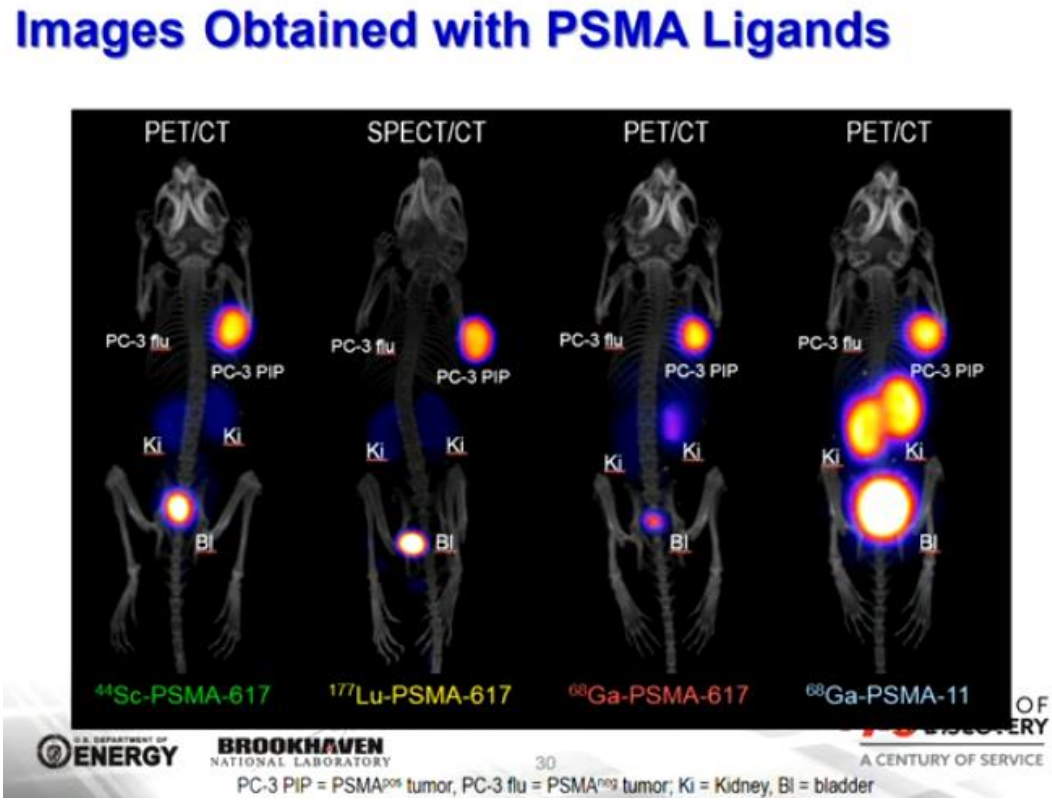


圖 十四、(A)Ga-68 與 Sc-44 的 β^+的平均能量比較；(B)PSMA-617 分別標誌 Sc-44、Lu-177 及 Ga-68 與 Ga-68-PSMA-11 於前列腺癌小鼠模式照影圖（作者摘錄）

（七） 失智症造影劑

失智症（Dementia）是一種通稱，描述當大腦受到多種退化性疾病和非神經性退化症的影響時，造成患者日常功能及認知的喪失。阿茲海默症（Alzheimer's disease，AD）是失智症最常見的原因，約佔了六到七成，是一種發病進程緩慢、卻隨時間不斷惡化的持續性神經功能障礙，致病機轉主要為大腦內類澱粉斑塊（β-amyloid plaque）的沉積，以及神經細胞內神經纖維纏結 Tau 蛋白（neurofibrillary tangles）的產生。其他不同原因產生的失智症，例如：路易氏體失智症（Dementia with Lewy bodies，DLB）、額顳葉型失智症（Fronto-temporal lobar dementia，FTLD）、進行性核上麻痺症（Progressive supranuclear palsy，PSP）、皮質基底核退化症（corticobasal degeneration，CBD）、慢性創傷性腦病（chronic traumatic encephalopathy，CTE）等，如何與 AD 行鑑別診斷是目前的挑戰。

DLB 是僅次於 AD 第二常見的神經性退化性失智症，目前原因仍舊不明，通常在腦部的某些特定區域可找到異常的路易氏體（Lewy-Bodies）沉積。除波動性（fluctuating）認知功能及行動障礙，也會出現幻視及類巴金森氏症症狀，此外，快速動眼睡眠行為障礙（Rapid eye movement sleep behavior disorder）、對於抗精神病劑（antipsychotics）嚴重敏感，以及在腦部基底神經節的 SPECT/PET 影像中多巴胺轉運蛋白的低攝取，皆是臨床上的特徵。FTLD 是牽涉到腦部額葉、顳葉漸漸萎縮的一種腦部退化性疾病，在年紀小於 65 歲者，FTLD 已成為排名第二的失智原因，其中以 40~64 歲發生比率最高。常見有行為、認知或語言發生變化的人格轉變。

核醫影像在評估早期 AD，PET 造影結果比 SPECT 更好，比其他的 CT、MRI 造影，PET 影像能更早發現 AD 的早期變化，也可用於鑑別其他失智症。一般而言，FDG 的 PET 核醫影像在 AD 患者大腦頂葉後部和顳葉有不等程度地降低，有時候額葉也會降低，FDG 分布可能呈現區域不對稱；DLB 的 FDG-PET 影像呈

現枕葉（Occipital lobe）低代謝率，常出現 cingulate island sign 特徵，即後扣帶（Posterior cingulate）比起前楔葉（(Precuneus）及楔狀核（Cuneus）有較高的葡萄糖代謝率；FTLD 則表現在前額葉的葡萄糖代謝降低，行為常表現出原發性進行性失語症（primary progressive aphasia，PPA）。(如圖十五)

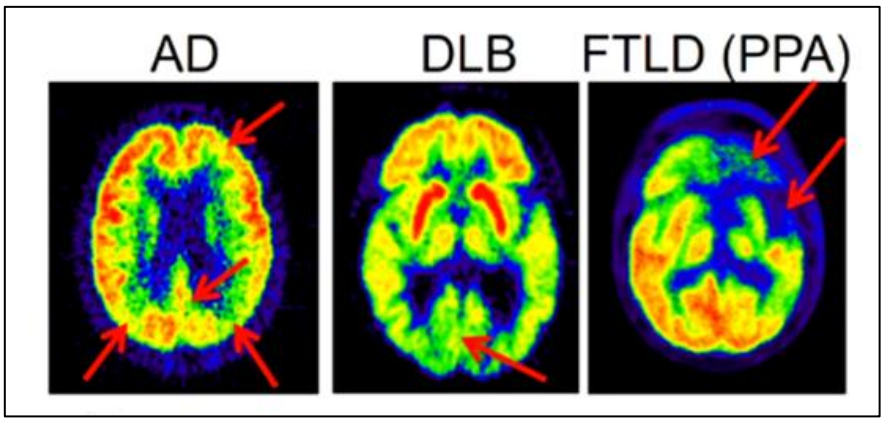


圖 十五、AD、DLB 及 FTLD 典型 FDG-PET 影像（作者摘錄）

Tau 蛋白的聚積是許多神經退化性疾病的指標，來自英國倫敦 Institute of Nuclear Medicine and Department of Chemistry, University College London 的 KerstinSander 研究團隊，利用 F-18-AV-1451 的 PET 影像用於失智症評估，共有 33 名不同神經退化性失智症受試者，結果顯示 F-18-AV-1451 對於阿茲海默症具高度特異性結合能力。（如圖十六）

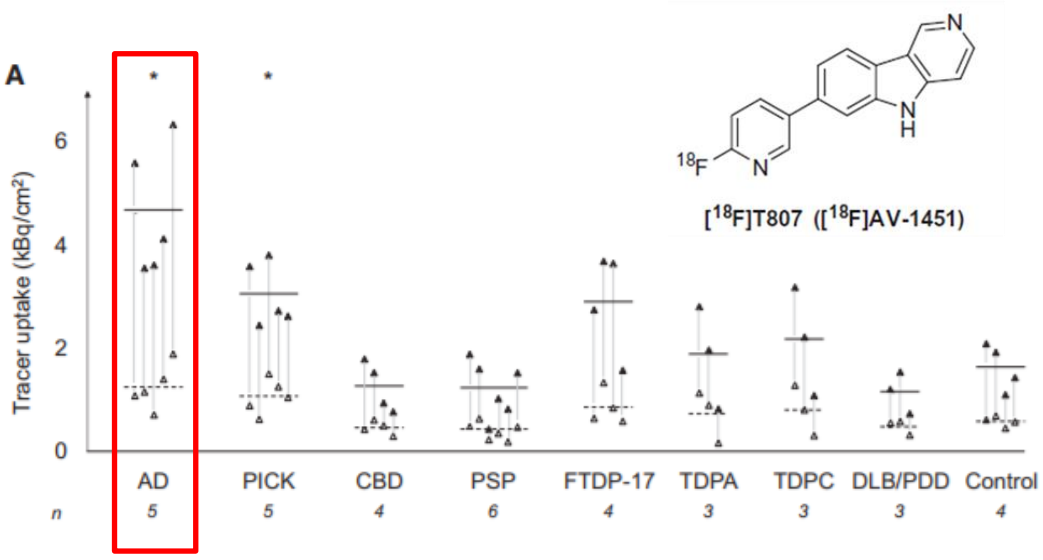


圖 十六、F-18-AV-1451 對不同類型失智症之結合力比較（作者摘錄）

腦內類澱粉（amyloid β (Aβ) protein）的累積是 AD 重要的發病機轉之一，英國曼徹斯特 Institute of Brain, Behaviour and Mental Health, University of Manchester 的 Christopher Kobylecki 研究團隊對於 8 位額顳葉型失智症（FTD）及 10 位阿茲海默症（AD）患者進行 F-18-florbetapir 的正子照影，並與 10 名健康受試者（Control）進行比較，臨床試驗結果顯示 AD 患者的總皮質灰質區的 florbetapir 吸收高於 FTD 組及對照組，AD 組額葉、頂葉、枕葉、扣帶迴皮質（Cingulate gyrus cortex）及中央皮質下區域的 florbetapir 吸收亦高於 FTD 組，只有一名特例 FTD 患者有高出平均的皮質 florbetapir 吸收，故 F-18-florbetapir 的 PET 影像可提供 AD 作為鑑別診斷之用。（如圖十七）

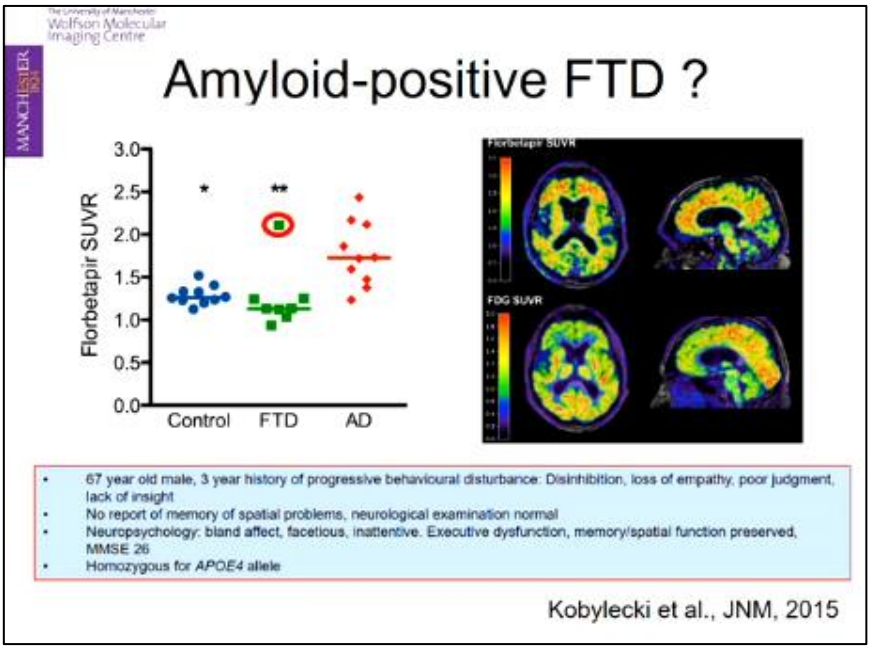


圖 十七、F-18-florbetapir 於 Control、AD 及 FTD 的 PET 影像（作者摘錄）

失智症患者通常是在出現相關臨床症狀之後才被醫生診斷出來，不過此時病人的大腦已經累積了太多不可逆的損傷，且目前缺乏有效改善的藥物，因此難以期望現有的治療能對病程有所回復。核子醫學能在早期藉由分子影像提早診斷，將有助於協助制定治療方針，並可降低疾病併發症的風險。臨床上對於不同類型的退化性失智症可藉由 PET 和 SPECT 核醫影像進行鑑別，配合醫師診斷及臨床行為表現，能更準確地及早診斷。

（八） 阿法粒子放射治療

放射性原子核經阿法衰變產生由兩個質子及兩個中子組成且不帶任何電子的阿法粒子，具強電離能力，但因射程短、透能力較弱，用一般紙張即可阻擋，故相較貝他粒子及加馬射線更易於防護。阿法粒子在核醫放射治療方面越來越受重視，目前常用的放射性同位素包括 At-211、Bi-213、Ac-225、Ra-223 及 Th-227 等。

雖然阿法粒子易於阻擋防護，但在臨床前動物試驗中，仍可觀察到對生理造成影響的副作用，如骨髓中白血球數量降低、腎臟廓清率下降等。以圖十八為例，可知放射性核種發射 α emitters 與 β emitters 相對距離，放射距離短的阿法粒子（小於 0.1 公厘）對周圍細胞組織所造成的傷害大幅減少。

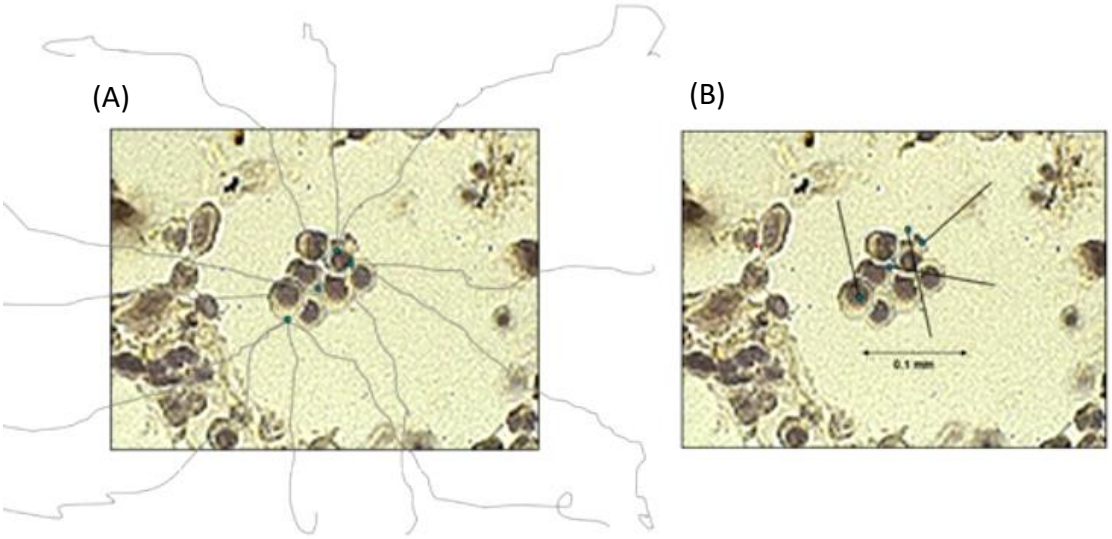


圖 十八、(A) β emitters；(B) α emitters（作者摘錄）

來自瑞典哥德堡 Stig Palm 博士的團隊以 OVCAR-3 卵巢癌的小鼠動物模式，比較了兩種不同活度的 Bi-213 標誌單株抗體 MX35 的療效，MX35 能辨識卵巢癌特異性過量表現的蛋白 sodium-dependent phosphate transport protein 2B（NaPi2b），藉由 Bi-213 釋出阿法粒子破壞癌細胞，經腹腔注射給藥治療八周後觀察腫瘤大小變化，並評估藥物毒性對體重及白血球數量的影響，結果顯示較高

劑量的 9 MBq/mL Bi-213-MX35 組別腫瘤抑制效果較低劑量組（3 MBq/mL）更好，且實驗過程中並無觀察到藥物毒性所造成的副作用。（如圖十九）

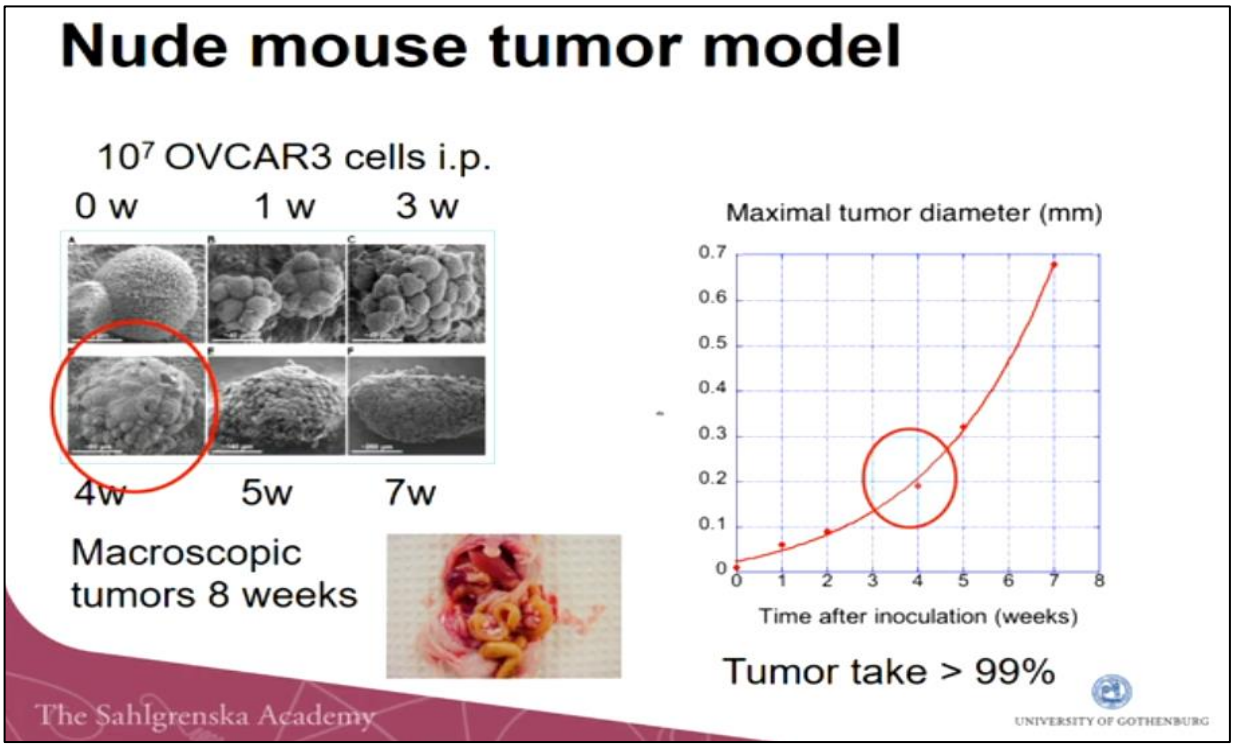


圖 十九、Bi-213-MX35 對 OVCAR-3 卵巢癌小鼠療效試驗（作者摘錄）

另一篇同樣是關於抗體標誌阿法粒子用於治療卵巢癌的動物療效評估，來自瑞典 Department of Radiation Physics, Sahlgrenska Academy, University of Gothenburg 的 Tom Bäck 研究團隊是將 MX35-F(ab')2 的單株抗體片段標誌 At-211 後以尾靜脈注射給藥，觀察 OVCAR-3 腫瘤小鼠的藥物治療劑量，並評估治療後的長期存活率，研究結果顯示療效與藥物劑量成正比，實驗中完全治癒腫瘤的劑量為 12.4 Gy 及 16.4 Gy，作者考慮先前皮下腫瘤實驗中曾探討相對生物效應（relative biological effectiveness，RBE）為 5 的結論，提出要完全清除腫瘤至少需要 10Gy 以上是合理的劑量。（如圖二十）

Characteristics of Study Groups

Group	Mice (*n*)	Tumors (*n*)	Injection (MBq)			Total activity (MBq)	Median survival (wk)	Total absorbed tumor dose (Gy)	TFF
			1	2	3				
1	10	20	1.34	1.46	1.10	3.90	11	16.4	100%
2	10	20	0.87	0.63	0.77	2.27	28	9.5	45%
3	10	20	0.36	0.46	0.38	1.20	*N.D.*	5.0	5%
4	8	15	0.00	0.00	0.00	0.00	*N.D.*	0.0	0%
5	10	20	1.53	1.43	—	2.96	16	12.4	100%
6	10	20	1.02	0.60	—	1.62	40	6.8	20%
7	10	17	0.50	0.45	—	0.95	*N.D.*	4.0	42%
8	10	20	0.00	0.00	—	0.00	*N.D.*	0.0	0%
9	10	20	1.10	—	—	1.10	44	4.6	0%
10	10	20	0.77	—	—	0.77	*N.D.*	3.2	0%
11	10	20	0.38	—	—	0.38	*N.D.*	1.6	0%
12	10	20	0.00	—	—	0.00	*N.D.*	0.0	0%

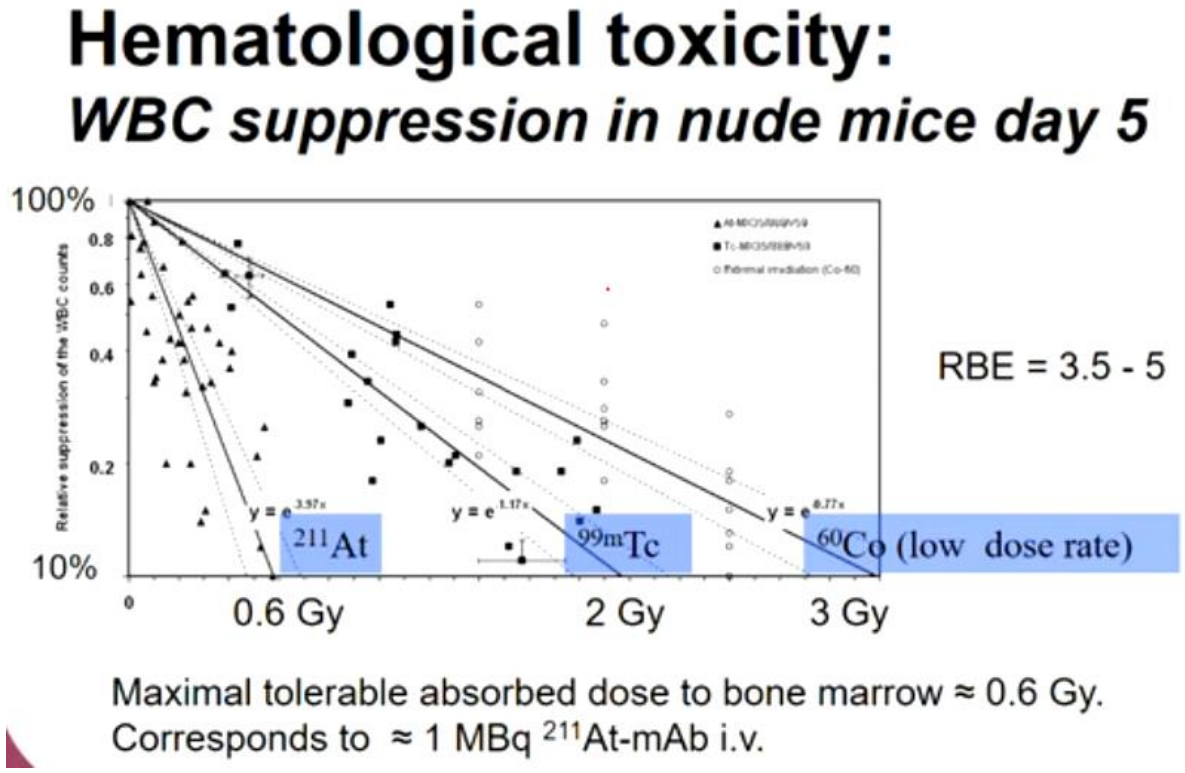


圖 二十、單株抗體 MX35 及 MX35-F(ab')2 用於卵巢癌小鼠之動物療效評估（作者摘錄）

（九） 前列腺癌放射標靶診療

本屆歐洲核醫年會中，前列腺癌的治療也是其中一個受到高度關注的題目。前列腺癌是中老年男性最常見的癌症之一，在美國癌症檢出率甚至排名第二位，根據台灣衛生福利部統計，前列腺癌增加速率連續 10 年蟬聯第一，已位列國人男性十大癌症第五位，大於 90%的去勢抗性前列腺癌（mCRPC）患者都發現有骨轉移，在 2015 年六月衛福部核准的「鐳 223 放射治療」亦是阿法粒子放射療法，作為有骨轉移之前列腺癌患者治療及減緩骨疼痛之用，過去前列腺癌主要是透過荷爾蒙療法或化學治療來控制癌細胞，但鐳 223 可放出高能量且直線能量轉移（linear energy transfer，LET）的 α 粒子，利用鐳與鈣的原子結構類似可聚積在骨骼中，能夠在大幅減少傷害正常細胞的情況下，精準有效的破壞骨轉移病灶內的癌細胞群，且因射程距離短，不需特殊輻射防護，是前列腺癌治療的新選擇。

今年許多獲獎的研究多與前列腺特定膜抗原(PSMA)用於前列腺癌的診療相關。PSMA 為一穿膜蛋白，在前列腺癌細胞大量表現，尤其是在低分化、轉移性和雄激素非依賴型前列腺癌細胞，其他細胞組織幾乎沒有，是理想的標靶分子，目前 PSMA 標靶藥物可標誌上不同的放射性同位素，例如 Ga-68、Cu-64 進行 PET 造影或 Tc-99m、In-111 進行 SPECT 造影診斷，標誌上 Lu-177 進行核種標靶治療。

來自德國海德堡 Department of Nuclear Medicine, University Hospital Heidelberg 的 C. Kratochwil 研究團隊，進行了 14 名去勢抗性前列腺癌骨轉移晚期病人經 Ac-225-PSMA-617 治療後的臨床療效評估，希望能找到最合適的藥物劑量及給藥準則。將患者以二或四個月的給藥間隔予以分組，臨床試驗結果顯示若單次給予 Ac-225-PSMA-617 劑量超過 100 kBq/kg，將會導致嚴重的口乾症（xerostomia），故以此劑量作為限值，但四個月只給予單次的組別，血清前列腺特異抗原（Prostate-specific antigen，PSA）生化檢查無持續下降的趨勢，改以間隔兩個月給藥則可提高治療成效;若劑量調降至 50 kBq/kg，雖無毒性反應報告，

但抑制腫瘤效果差。因此建議八週療程期間給予每次 100 kBq/kg 的 Ac-225-PSMA-617 可在療效與副作用間取得平衡。（如圖二十一）

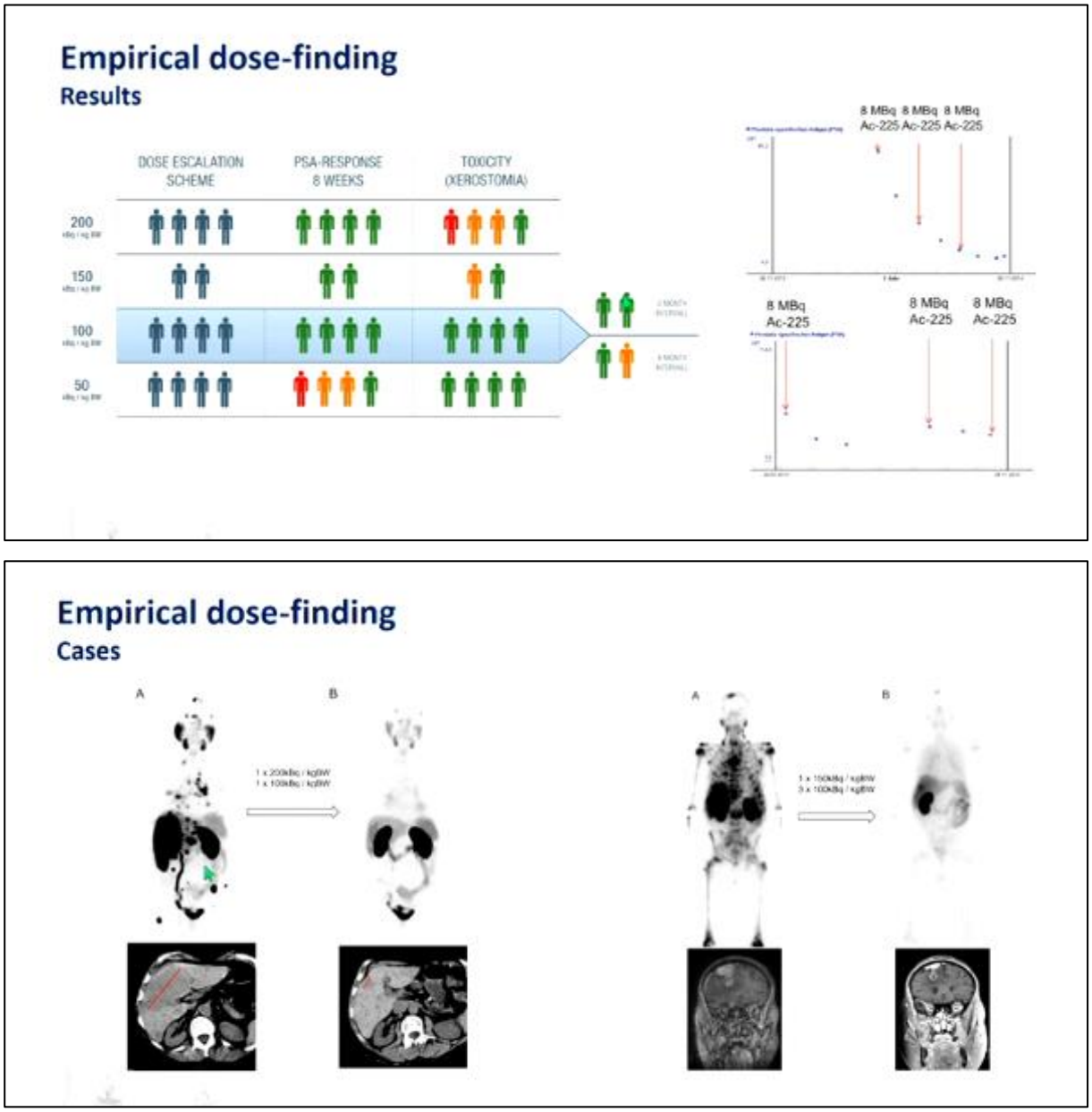


圖 二十一、Ac-225-PSMA-617 臨床療效評估（作者摘錄）

另一篇同樣來自於德國海德堡 Department of Radiation Oncology, University Hospital Heidelberg 的 Florian Sterzing 研究團隊，則是以 Ga-68-PSMA-11 作為前列腺癌的造影劑，針對前列腺癌患者的 PET/CT 影像進行分期並協助醫生訂定為病患量身打造的放射線療程。研究分析共 57 例患者的檢查報告，包含骨骼掃描、CT 及 MRI 影像，搭配上 Ga-68-PSMA-11 造影後 50.8%的治療計畫因而改變，尤其

可術前確認前列腺癌淋巴結轉移範圍，幫助骨盆腔淋巴結的強度調控放射治療(Intensity-Modulated Radiation Therapy，IMRT)更精準切除已轉移的淋巴結，減少不必要的組織細胞損傷。（如圖二十二）

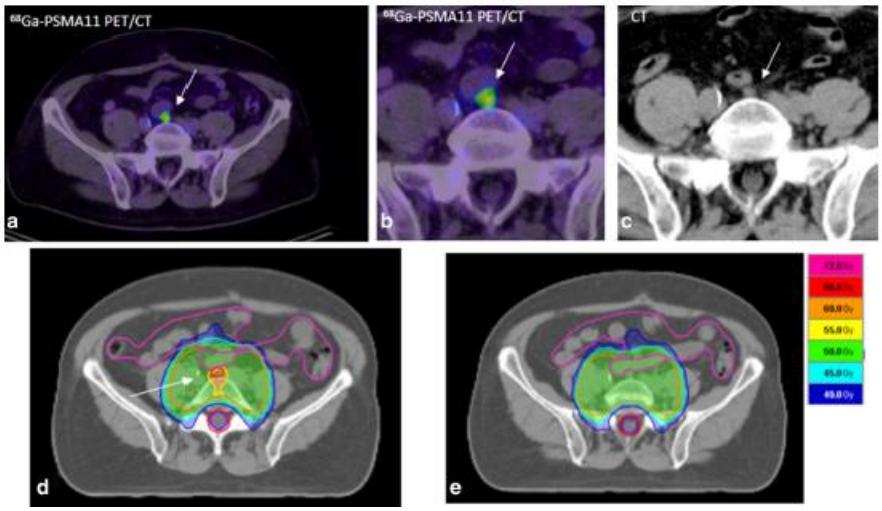


圖 二十二、Ga-68-PSMA-11 骨盆腔 PET 影像（作者摘錄）

當 PSMA-11 或 PSMA-617 與癌細胞結合後進入細胞內，標誌在其上的放射性同位素便可滯留腫瘤細胞內成像或進行治療。相較於傳統影像學及生理學的檢查，PSMA 分子診療劑的敏感性與特異性明顯提高，因此對於體積較小且 PSA 數值較低的前列腺癌轉移患者而言，診斷應用價值更大；此外，亦可用於鑑別前列腺癌來源的轉移腫瘤病灶。

三、心　得

本次國外公差參加第30屆歐洲核醫學年會國際研討會，見識各國專家於核子醫學領域的最新研發結果，參與研討會各場次之專題報告，交換心得並收集國際最新相關資訊，收穫相當豐富，心得敘述如下：

(一) 本次相當榮幸能有此機會與台灣核醫界頂尖醫師與專家學者同行與會，包括成功大學醫學系系主任暨成大醫院核子醫學部主任姚維仁醫師（教授）、台大醫院核子醫學部主任顏若芳醫師（教授）、國防醫學院生物及解剖科研究所馬國興教授、馬偕醫院吳明哲主任、清華大學莊克士教授、長庚大學魏孝萍教授等核醫藥物的專家學者等。希望未來在於藥物開發之方向能與產業界相互交流，考量臨床應用價值，提供符合醫療所需、極具診斷與治療關鍵價值之核醫藥物。

(二) 核醫診療藥物已走向精準醫療，配合放射性同位素標誌的小分子藥物或胜肽抗體，分子影像核醫藥物的開發都與標靶診療相關，個人化的醫學是未來趨勢所在。常見同一標靶分子標誌不同射源後，即可進行診斷或治療，在臨床醫療應用上更為靈活。

(三) 近年來隨著新型儀器與新藥物的研發，核醫藥物影像技術也與時俱進，分子影像是非常直觀的非侵入式診斷，能在疾病早期就可看到分子層級的變化，好的醫學影像除了標靶性佳的核醫藥物研發，也需要配合良好的儀器與影像分析重建軟體，是從生醫到機電資訊跨領域合作的成果。

(四) 經過全球核醫界的示警，Tc-99m短缺的問題已在各國的努力下有了改善，未來呈現增加的趨勢，Tc-99m以發生器的方式供應，未來還是核醫藥物的主流。

(五) 心肌造影劑Tl-201氯化亞鉈有逐漸減少的走向，反之，Tc-99m MIBI逐步走揚。

(六) 中國大陸參加人數與發表論文篇數都逐年增加，今年發表的論文篇數有60幾篇，台灣約20篇，中國在產品的發展也非常快速，共有四個中國設的展覽攤位，包含核醫藥物、輻射屏蔽設備器材、核醫影像設備的晶體與藥物合成前驅物化學品等，台灣核醫領先的優勢已消失。

(七) Ge-68/Ga-68發生器今年在核醫年會上大放異彩，Ga-68發生器的廠商攤位上擠滿人群，會場的兩個廠商生意特別好，其中Eckert & Ziegler還提供了大會獎項。Endocyte, Inc. Oct.2.2017發布取得ABX Ga-68/Lu-177 PSMA-617的獨家授權，預計將於2020年完成人體臨床試驗，獲得藥證上市。

(八) 歐洲核醫年會、美國核醫年會與世界分子影像年會等都是核醫領域最大型的會議，參加人數與論文發表眾多，且許多重要資訊皆在這幾個會議發布，今年的歐洲核醫年會有159個口頭發表場，分別在10個以上的會議室進行討論，個人無法全部涉及，只能選擇研究相關的參與。

四、建議事項

本次參加第30屆歐洲核子醫學會研討會，對獲取核醫藥物研究新知、國際研發現況及未來發展方向，皆有豐碩收穫，綜合本次公差結果，對本所核醫藥物發展有以下建議。

(一) 國際會議海報論文發表的數量及內容皆代表各國的研發軟實力，應多鼓勵所內研發人員踴躍投稿並參與國際研討會，與國外學者廠商相互交流，增加國際合作的機會；且建議大型會議參與人數至少兩人以上，因場地幅員廣大且同時舉辦各種演講，可從不同主題的會議多方收集新知，帶回更全面的資訊。

(二) 本次研討會常見核種，在診斷方面有F-18、In-111、Ga-68，治療方面則有Y-90、Lu-177及Ra-223。同位素的生產研製是本所的優勢所在，若能好好保養使用迴旋加速器及各式發生器，精進合成設備，定能對核醫藥物研發有所助益。

(三) 新藥研發首先需了解市場需求，建議多從產業化及臨床應用加以了解，配合開發或解決臨床醫療所遭遇的問題與難處。除了研究全新的藥物，也可以朝改良現有藥物的缺點著手，如增強標靶能力或降低周圍組織器官的副作用等。

五、附　錄

附錄一：發表於 30th 歐洲核醫年會_POSTERs 論文

A method of DOTA-SP90 with ^{111}In labeling, has stabilityand potential for breast cancer imaging

S. Lee, S. Lo, Y. Huang, M. Chen, M. Li, C. Chang

Institute of Nuclear Energy Research, Taoyuan, TAIWAN.

Background: A new targeting peptide SP90, was identified by phage display, and has improved can binding the cell surface of breast cancer. We use SP90 peptide linked with 1,4,7,10-tetraazacyclododecane-N,N´,N´´,N´´´-tetraacetic acid (DOTA) as an new precursor. This precursor can be radiolabel with different kind of radionuclide for diagnosis or therapy purpose. The aim of this study was to find an ^{111}In labeling method of DOTA-SP90, and has good stability for breast cancer animal model imaging.

Method(s): Quality control of DOTA-SP90 precursor were >90% by High-performance liquid chromatography (HPLC). DOTA-SP90 precursors were dissolved in 1M Sodium acetate pH6. ^{111}InCl3 in 0.01N HCl was from Institute of Nuclear Energy Research. The reaction mixture were performed in 300 μL volumes, heating at 95℃. The labeling yields of >95% were achieved within 10min. The stability of ^{111}In-DOTA-SP90 product in normal saline and rat plasma were analyzed at 0hr, 1hr, 2hr, 4hr, and 24hr. The radiochemical purities of ^{111}In-DOTA-SP90 in normal saline were analyzed by radio-HPLC, in rat plasma were analyzed by radio instant thin-layer chromatography (ITLC).

Result(s): The radiochemical purities of ^{111}In-DOTA-SP90 in normal saline after 0hr, 1hr, 2hr and 4hr were 98.5%, 98.4%, 97.7% and 95.6%. The radiochemical purities of ^{111}In-DOTA-SP90 in rat plasma after 0hr, 1hr, 2hr, 4hr were all >95%.No matter in normal saline or in rat plasma after 24hr, the radiochemical purities all reduced to 70%. ^{111}In-DOTA-SP90 has stability in plasma after 4hr, this time can be used for breast cancer animal model imaging timing and enough to complete the cancer binding imaging.

Conclusion: We demonstrated that ^{111}In-DOTA-SP90 has good stability in normal saline and rat serum. ^{111}In-DOTA-SP90 show specific binding ability of cancer cell in several breast cancer animal models. ^{111}In-DOTA-SP90 has potential to become a new radiopharmaceutical for breast cancer imaging.

Dynamic in vivo molecular imaging of ^{18}F-INER1577 in transgenic mice

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Background: Epigenetic mechanisms mediated by histone deacetylases (HDACs) is involve in many diseases, including various neurodegenerative disorders and may offer new therapeutic opportunities. This is the reason why HDAC inhibitors (HDACIs) have been studied and shown in many research and treatment of neurodegenerative diseases. Because of many illustrate potentials of HDACis in diagnostic various neurodegenerative diseases, we assessed a novel inhibitor, ^{18}F-INER1577, which can permeate blood-brain barrier (BBB) highly.

Method(s): ^{18}F-INER1577 is a radiolabeled derivative of benzamide (4-((dimethylamino) methyl)-N-(4-((2-fluoroethyl)amino)-[1,1'-biphenyl]-3-yl)benzamide), as a PET imaging agent for estimating HDAC activity in SAMP8/SAMR1(five months age) transgenic mice model of Alzheimer's disease(AD) and SD (Sprague Dawley) rat. At first, we use ^{18}F-INER1577 to do the permeability test of the bloodbrain barrier (BBB) in the SD rats. The senescence-accelerated prone SAMP8 mouse (in comparison with aged SAMR1 mouse) is a model of age-related cognitive goes down with relevancy to variation of the gene expression and protein abnormalities in AD. ^{18}F-INER1577 has been synthesized in ~3 % yield (EOS) in a synthesis time of 60 min from EOB. Despite the moderate radio chemical yield, final radioactivity and radioactivity concentration values (1.870.3GBq and 180MBq/ml, respectively) should be sufficient for putative in the SAMP8/ SAMR1 transgenic mice.

Result(s): *In vitro* studies showed that ^{18}F-INER1577 inhibited not only HDAC 1,2,3,6,8 enzymes but inhibited growth of MCF-5 and 4T1 which are breast cancer cell line. In our research, ^{18}F-INER1577 has successfully passed the BBB in SD rat. Then we use PET-CT to find that regional INER-1577 uptake differences between the neocortex and hippocampus (0.45%ID/g in whole brain, 0.52%ID/g in neocortex and 0.54%ID/g in hippocampus at 20 min after drug injected, n=3, %ID/g means radioactivity per injected dose per body weight). For regional differences in HDAC distribution, the most striking observation in SAMP8/SAMR1 transgenic mice model showed that high bio-distribution ranging from SAMP8/SAMR1 transgenic mice than SD rat model.

Conclusion: We synthesized a novel inhibitor ^{18}F-INER1577 which may be a HDACs imaging agent. We can assess radiotracer accumulation and density of HDAC in the SAMP8/ SAMR1 transgenic mice which displays selectivity for HDAC1,2,3,6,8 enzymes. It is the first time to use this tool to measure density of HDAC I which target isoforms 1, 2, 3, 6 and 8. Moreover, PET imaging with ^{18}F-INER1577 may help the understanding of HDACs mediated epigenetic mechanism of normal and neurodegenerative pathological processes.

Keywords: Epigenetic mechanism; PET; histone deacetylases; neurodegenerative diseases

Cytotoxicity, In vitro binding and imaging evaluation of radiolabeled-DOTA-SP90 in 4T1 breast cancer model

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Introduction: Targeted delivery of drugs to tumors represents a significant advance in cancer diagnosis and therapy. A new targeting peptide (SP90), which is capable of binding specifically to the cell surface of breast cancer cells, is identified by phage display system. This study investigated the cytotoxicity of ^{177}Lu-DOTA-SP90 and in vitro binding and SPECT/CT imaging of ^{111}In-DOTA-SP90 in 4T1 mammary cancer cell line.

Methods: SP90 was labelled with ^{111}In or ^{177}Lu in Institute of Nuclear Energy Research. Cytotoxicity assay was performed in 96-well plates. Each well was seeded with 1.5 x 103 cells. At 4 h after cell seeding, ^{177}Lu or ^{177}Lu-DOTA-SP90 (1 mCi,0.5 mCi,0.25 mCi,0.125 mCi and 0.0625 mCi) were added to each well of 96-well plates, respectively. After 48 h incubation of ^{177}Lu or ^{177}Lu-DOTA-SP90, the medium was replaced with fresh medium. Then, the cells were incubated at 37°C for 24 h. Cell viability was evaluated with alamarBlue assay. The binding assay of ^{111}In-DOTA-SP90 in 4T1 and CL1-5 cells was determined using a γ-counter. The 4T1 and CL1-5 cells were seeded in 24-well plates. After 24 hours incubation, 0.1 μCi of ^{111}InCl3 or ^{111}In-DOTA-SP90 was added to the control well or to SP90 wells at intervals of 0.5, 2, 4, and 24 hours. In animal study, tumor xenografts were performed in 6-wk-old female BALB/c mice by subcutaneous injection of 2 x 10^6 4T1 cells. At 14 days after tumor inoculation, nanoSPECT/CT imaging was performed at 0.5, 2, 4, and 24 hours after injection of ^{111}In-DOTA-SP90.

Results: The labeling efficiency of ^{177}Lu-DOTA-SP90 was more than 90%. The significant changes were found in the viability of 4T1 cells incubated with ^{177}Lu-DOTA-SP90 in 0.125, 0.25, 0.5 and 1 mCi group. No significant change of viability in 4T1 cells were observed in each ^{177}Lu group. In vitro binding assay showed that compared with control groups, significant high-binding affinity of ^{111}In-DOTA-SP90 in 4T1 cells. The high tumor-to-organ ratios for the ^{111}In-DOTA-SP90 (at 2 h after injection: tumor-to-muscle ratio, 7.6; and tumor-to-liver ratio, 2.3) were confirmed by nanoSPECT/CT images in the subcutaneous 4T1 tumor model.

Conclusion: This study revealed that ^{177}Lu- DOTA-SP90 could improve the cytotoxic effect, and ^{111}In-DOTASP90 also showed the high-binding affinity in 4T1 mammary tumor cell line. The nanoSPECT/CT imaging demonstrated that ^{111}In -DOTA-SP90 could accumulate in tumor sites. These results suggested that potential benefit and advantage of ^{111}In-DOTA-SP90 was suitable as a diagnostic tracer for the imaging of breast cancer.

Theranostic probe Lu-177-DOTA-NIR790 for multimodal diagnosis and therapy of cancer

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Introduction: Cancer-targeted theranostic probe labeled radionuclides has been developed to provide multi-modalities for NIR fluorescence (NIRF) and nuclear imaging and for photothermal therapy (PTT) and radiotherapy of cancer.

Methods: In this study, we prepared NIR dye-based probe DOTA-NIR790, which could be chelated with Lu-177 for nuclear imaging and radiotherapy of cancer. In addition, the dye allowed the probe to have multi-functions in NIR imaging and photothermal therapy.

Results: Animal experiments confirmed that ^{177}Lu-DOTA-NIR790 could target to tumor for SPECT imaging and near-infrared fluorescence imaging as cancer detection. The SPECT/CT images showed a high detection capability for deep tumor, and NIRF images showed a better tumor-targeted image in the superficial tumor. The ^{177}Lu-DOTANIR790 also delayed the tumor growth by beta-emission. After laser irradiation, the tumor temperature could be effectively increased to about 48.6℃, resulting in tumor ablation.

Conclusion: The cancer-targeted theranostic probe (^{177}Lu-DOTA-NIR790) had been developed to provide multi-modalities for NIR fluorescence and SPECT imaging and for PTT and radiotherapy of cancer.

Preclinical evaluation of non-invasive imaging molecules of growth differentiation factor-11 for aging-related diseases' uses

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Purposes: The increasing levels on health-care budget of governments that is owing to neurodegenerative diseases accompanied with aging have been defined in Europe and Taiwan. According to recent studies, scientists have evaluated genes and proteins associated with aging, including growth differentiation factor 11 (GDF-11) which has been defined its capability of improvements on muscular function when treated in aged mice. However, the distribution of GDF-11 in whole body and central nervous systems still needs more evaluation. Here we have tried to develop radiolabeled non-invasive imaging molecules of GDF-11 that can be used to clarify the biological mechanisms of GDF-11 in mice.

Materials and Methods: GDF-11 was first conjugated with DTPA under room temperature for 24 h and purified by centrifuge; the original and final molecular weights of molecules were both checked by a MALDI TOF/TOF. After radiolabeled with In-111, the radiochemical purity (R.C.P.) and stability tests in PBS and serum were investigated. ^{111}In-GDF-11 was then intravenously (i.v.) or intraventricularly (i.b.) injected into both normal and neurodegenerative mice for SPECT/CT imaging at 1, 4, 24 and 48 h.

Results: The R.C.P. of ^{111}In-GDF-11was checked as >95%; results of stability tests in PBS and serumwere found as >90% within 120 h. Results of SPECT/CT imaging showed significant liver uptake in whole body in 48 h. After i.b. injection of ^{111}In-GDF-11, the collection was found mainly in hippocampus, thalamus, cerebellum and olfactory bulb region at 48 h, which is similar to the distribution of intrinsic GDF-11 RNA that is defined by in situ hybridization in previous studies (ALLEN BRAIN ATLAS).

Conclusions: In this study, radiolabeled imaging molecules of growth differentiation factor-11 (^{111}In-GDF-11) were successfully developed for non-invasively monitoring the biological mechanisms in our preclinical evaluation. For several potential uses of GDF-11, more studies in aging-related diseases can be evaluated through the uses of these novel molecules in further preclinical and clinical research in the future.

Brachytherapy treatment for hepatocellular carcinoma in Rats with Biodegradable Microspheres following intra-arterial Chemoembolization

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Institute of Nuclear Energy Research, Taoyuan City, TAIWAN

Introduction: The global incidence of liver cancer is increasing and has a poor prognosis, particularly when the tumor is unresectable. Transcatheter arterial chemoembolization (TACE) is a way of delivering cancer treatment directly to a tumor through minimally-invasive means that affords significant reductions in systemic toxicity. The aim of this study was to investigate the effects of biodegradable microspheres (Re/DOX@MS) on hepatocellular carcinoma in F-344 rats by intra-arterial Chemoembolization.

Methods: In the experiment, we used biodegradable and biocompatible polymer Poly(D,L-lactide-co-glycolide)(PLGA) to prepare micron particles. Through double emulsion, the microspheres contain water-soluble polymers, Poly(vinylsulfonic acid, sodium salt) solution (PVSA). Doxorubicin is absorbed in microspheres by ionic exchange process, resulting in slow release and ^{188}Re-tin-colloid is embedded to fill the pores of microspheres, leading to brachytherapy. The effects of Re/DOX@MS were evaluated through ex vivo and in vivo using bio-distribution, NanoSPECT/CT imaging and ultrasonography.

Results: Experimental results show that 50mg PVSA/PLGA microspheres absorbed 2.5mg doxorubicin within an hour. Microspheres were embedded with ^{188}Re-tin-colloid and performed in a rat hepatocellular carcinoma model. NanoSPECT/CT imaging and bio-distribution showed the microspheres were still in the liver after 72 hours. The tumor growth was more profoundly inhibited by treatment with Re/DOX@MS than others by ultrasonography during 4 weeks observation period.

Conclusion: To conclude, the present study is to develop a novel biodegradable drug delivery system that investigates the feasibility of Re/DOX@MS combined with chemotherapy and radiotherapy for transcatheter delivery to liver tumors. Transcatheter arterial embolization of Re/DOX@MS is a potential agent for treatment of liver cancer. In the future, the drug delivery system for cancer therapy could maximize the effects on hepatocellular carcinoma.

附錄二：30th EANM 歐洲核醫年會議程表

Programme Overview Saturday, October 21, 2017

	Hall A,B,C	Meeting Room	Hall E1	Hall E2
08:00 - 08:30				
08:30 - 09:00				
09:00 - 09:30				
09:30 - 10:00				
10:00 - 10:30				
10:30 - 11:00				
11:00 - 11:30		**EANM Advisory Council Meeting**		
11:30 - 12:00				
12:00 - 12:30				
12:30 - 13:00				
13:00 - 13:30				
13:30 - 14:00			**EANM Delegates Assembly**	
14:00 - 14:30				
14:30 - 15:00				
15:00 - 15:30				
15:30 - 16:00				
16:00 - 16:30				**EANM Members Assembly** (first call 16:00)
16:30 - 17:00				
17:00 - 17:30				
17:30 - 18:00				
18:00 - 18:30				
19:30 - 20:30	**EANM Opening Ceremony**			

Hall F2	Hall K1	Hall K2	Hall G1	Hall G2
Pre-Symposium 1 Physics/Dosimetry Monte Carlo Simulation / Image Reconstruction – Part I	**Pre-Symposium 2** Oncology/ Radionuclide Therapy/EWALT Integrated Approach for the Diagnosis and Treatment of Primary Liver Tumors (HCC & CCC)	**Pre-Symposium 3** Dosimetry/ Radiation Protection Clinical Introduction of New Radiotherapeutics: Challenges and Opportunities	**Pre-Symposium 4** Neuroimaging/ Drug Development/ Radiopharmacy Tau Imaging in Humans	**Pre-Symposium 5** Radiopharmacy Validation & Risk Assessment
Pre-Symposium 6 Physics/Dosimetry Monte Carlo Simulation / Image Reconstruction – Part II	**Pre-Symposium 7** Oncology/ Radionuclide Therapy PET Imaging for Response Assessment of Immune Modulation and Therapy	**Pre-Symposium 8** Drug Development/ Neuroimaging The Contribution of Imaging in the Exploration of Autism	**Pre-Symposium 9** Translational Molecular Imaging & Therapy/ Radiopharmacy/ Drug Development Bioorthogonal and Click Chemistry for Molecular Imaging	**Pre-Symposium 10** Cardiovascular/ Inflammation & Infection Role of Nuclear Medicine in the Detection of Infection of Cardiac Prosthesis or Devices

Programme Overview Sunday, October 22, 2017

	Hall A	Hall B	Hall C	Hall E1	Hall E2
08:00 - 08:30	101 **CME 1** Physics Challenges and Solutions for MR-Based Attenuation Correction of PET CME	102 **Joint Symposium 1** Oncology/ESTRO Molecular PET Imaging in Adaptive Radiotherapy: Focus on Current Trends, Challenges and Solutions	Technologists' Opening 103 **CTE 1** Technologists/ SNMMI Quality Control and Protocol Standardisation - Tech Guide Launch	104 **Do.MoRe** Radionuclide Therapy - Miscellaneous (RIT & Bone Palliation)	105 **M2M** α-Therapy
08:30 - 09:00					
09:00 - 09:30					
09:30 - 10:00					
10:00 - 10:30	201 **Plenary 1 incl. Marie Curie Lecture** Theranostic Developments for Prostate Cancer		203 IN HALL A **Plenary 1 incl. Marie Curie Lecture** Theranostic Developments for Prostate Cancer		
10:30 - 11:00					
11:00 - 11:30					
11:30 - 12:00	301 **CME 2** Inflammation & Infection/ESVS Vascular Graft Infection CME	302 **Joint Symposium 2** Radionuclide Therapy/ENETS Establishing a Position for PRRT in the Multidisciplinary Treatment of NETs	303 **CTE 2** **Interactive** Technologists/EARL Technologist Role in Research and EARL Accreditation	304 **Do.MoRe** Modeling & Radiobiology	305 **M2M** Antibodies
12:00 - 12:30					
12:30 - 13:00					
13:00 - 14:30					
14:30 - 15:00	401 **CME 3** Cardiovascular How to Perform Myocardial Perfusion Imaging According to EANM Recommendations CME	402 **Joint Symposium 3** Thyroid/ETA-CRN Update Thyroid Cancer Beyond I-131	403a **Mini Course 1** Technologists Cardiology: Pitfalls & Artefacts	404 **Do.MoRe** Radiopeptides for Therapy	405 **M2M** New Targets
15:00 - 15:30					
15:30 - 16:00			403b **Mini Course 2** Technologists/ Inflammation & Infection Inflammation: Pitfalls & Artefacts		
16:00 - 16:30					
16:30 - 17:00	501 **CME 4** Oncology PET in Multiple Myeloma CME	502 **Joint Symposium 4** Dosimetry/Radiation Protection/ICRP/ICRU Radiological Protection for Patients Receiving Radiopharmaceutical Therapy	403c **Mini Course 3** Technologists **Interactive** Bone and Joint: Pitfalls & Artefacts	504 **Do.MoRe** SPECT Quantification	505 **M2M - Featured** Combination Therapies
17:00 - 17:30					
17:30 - 18:00					

Hall F1	Hall F2	Hall K	Hall G1	Hall G2	e-Posters
106 **Pitfalls & Artefacts 1 - ICC*** Neuroimaging/ Physics/EFOMP Pitfalls and Artefacts in Visual vs. Quantitative Reading		108 **Committee Symposium 1** Inflammation & Infection/ Drug Development ^{68}Ga-Tracers for Infection Imaging		110 **Joint Symposium 16** Neuroimaging/JSNM Educating Referring Physicians and Recognising Their Needs	**e-Poster Walks** E-PW01, E-PW02, E-PW03
306 **Pitfalls & Artefacts 2 - ICC*** Cardiovascular Pitfalls and Artefacts with CZT Cameras	307 **Clinical Oncology** We Want a New Drug		309 **Do.MoRe - Featured** Photodynamic Therapy & Molecular Imaging – The Perfect Couple?	310 **Conventional & Specialised Nuclear Medicine** Benign Thyroid & Parathyroid Diseases	
EANM Young Daily Forum	**Industry Sponsored Symposium**	**Industry Sponsored Symposium**	**Industry Sponsored Symposium**		
406 **Teaching Session 1 - ICC*** Applied Cross Sectional Anatomy and Correlative Imaging – Head and Neck	407 **Clinical Oncology** Rapid Fire Session Prostate		409 **Neurosciences** Imaging Amyloid and Amyloidogenesis	410 **Conventional & Specialised Nuclear Medicine** Pulmonology & Nephrourology	
506 **Teaching Session 2 - ICC*** Applied Cross Sectional Anatomy and Correlative Imaging – Foot and Ankle	507 **Clinical Oncology** NET, a Classic!	508 **Cardiovascular System** Myocardial Function, Metabolism & Perfusion - From Preclinical to Clinical Practice	509 **Neurosciences** Imaging Neurotransmission Systems in Parkinson	510 **Conventional & Specialised Nuclear Medicine** Paediatrics	

Programme Overview

Monday, October 23, 2017

	Hall A	Hall B	Hall C	Hall E1	Hall E2
08:00 - 08:30	601 **CME 5** Radiopharmacy/ Drug Development/ Radionuclide Therapy/ SNMMI Theranostics and Companion Drugs CME	602 **Joint Symposium 5** Cardiovascular/ESMI Imaging Cardiac Remodelling	603 **Technologists** Oral Presentations 1	604 **Do.MoRe** PSMA Therapy	605 **M2M** Optical/ Multimodality Imaging
08:30 - 09:00					
09:00 - 09:30					
09:30 - 10:00					
10:00 - 10:30	701 **Plenary 2** Hot Topics in Nuclear Cardiology!		703 **IN HALL A** **Plenary 2** Hot Topics in Nuclear Cardiology!		
10:30 - 11:00					
11:00 - 11:30					
11:30 - 12:00	801 **CME 6 - Interactive** Bone & Joint Skeletal Scintigraphy Today - Accurate Diagnosis of Bone Disease with Therapeutic Impact CME	802 **Joint Symposium 6** Cardiovascular/EACVI Fast-Track Cardiac Imaging: Is There an Ideal One-Stop Shop?	803 **Technologists** Oral Presentations 2	804 **Do.MoRe - Featured** Harmonization of Hybrid Molecular Imaging	805 **M2M** Peptides
12:00 - 12:30					
12:30 - 13:00					
13:00 - 14:30					
14:30 - 15:00	901 **CME 7** Radionuclide Therapy/Thyroid Safety Aspects in Radionuclide Therapy CME	902 **Symposium 7** Bone & Joint Painful Hip Arthroplasty	903 **CTE 3** Technologists Prostate Imaging and Therapy	904 **Committee Symposium 4 Do.MoRe** Validation of Quantitative Imaging, Dosimetry & Estimates of Uncertainty	905 **M2M** SPECT/CT & SPECT/MRI
15:00 - 15:30					
15:30 - 16:00					
16:00 - 16:30					
16:30 - 17:00	1001 **CME 8** Radionuclide Therapy/ Radiopharmacy/ Dosimetry Clinical Trial Design for Radionuclide Therapy CME	1002 **Joint Symposium 8** Neuroimaging/EANO High Grade Glioma	1003 **CTE 4** Technologists/ CAMRT Radionuclide Production	1004 **Do.MoRe** Dosimetry in Thyroid Disease	1005 **M2M** PET/CT
17:00 - 17:30					
17:30 - 18:00					

Hall F1	Hall F2	Hall K	Hall G1	Hall G2	e-Posters
606 **Pitfalls & Artefacts 3 - ICC*** Oncology/ Inflammation & Infection/Bone & Joint Pitfalls and Artefacts in Abdomen and Pelvis	607 **Clinical Oncology** Rapid Fire Session What's New? Texture Analysis and More!		609 **Committee Symposium 2** Neuroimaging PET/MR - Making it Clinical	610 **Conventional & Specialised Nuclear Medicine** Musculoskeletal (Benign)	**e-Poster Walks** E-PW04, E-PW05, E-PW06, E-PW07, E-PW08
806 **Pitfalls & Artefacts 4 - ICC*** Paediatrics Pitfalls and Artefacts - FDG-PET Imaging in Children	807 **Clinical Oncology** Women's Only	808 **Committee Symposium 3** Inflammation & Infection/ Neuroimaging Neurological Autoimmune Disorders	809 **Tomorrow's Experts Session** Best-Ranked Papers from the Under-30s	810 **Committee Symposium 6** Thyroid Update on Ablative Therapies in Thyroid Nodules	
EANM Young Daily Forum	**Industry Sponsored Symposium**	**Industry Sponsored Symposium**	**Industry Sponsored Symposium**		
906 **Teaching Session 3 - ICC*** Applied Cross Sectional Anatomy and Correlative Imaging – Spine	907 **Clinical Oncology** It's in the Blood	908 **Cardiovascular System** Cardiac Sarcoidosis & Amyloidosis	909 **Neurosciences** Imaging Neurodegeneration in Alzheimer's Disease by TAU and FDG Imaging	910 **Conventional & Specialised Nuclear Medicine** Infection & Inflammation	
1006 **Teaching Session 4 - ICC*** Applied Cross Sectional Anatomy and Correlative Imaging – Abdomen & Pelvis	1007 **Joint Symposium 18** Oncology/ESMO Treatment Landscape in Metastatic CRPC	1008 **Cardiovascular System** Cardiac Sympathetic Innervation - 123I-mIBG & Arrhythmias		1010 **Committee Symposium 5** Radiation Protection CT-Optimisation of Hybrid Imaging	

Programme Overview

Tuesday, October 24, 2017

	Hall A	Hall B	Hall C	Hall E1	Hall E2
08:00 - 08:30 08:30 - 09:00 09:00 - 09:30	1101 **CME 9** Paediatrics/ Inflammation & Infection FDG PET in Paediatric Infections CME	1102 **Joint Symposium 9** Physics/EFOMP New Developments in CT Technology	1103 **Technologists** Technologist e-Poster Sessions 1, 2, 3, 4	1104 **Do.MoRe** Preclinical & Clinical Dosimetry	1105 **M2M** Automation & Production
09:30 - 10:00					
10:00 - 10:30 10:30 - 11:00 11:00 - 11:30	1201 **Plenary 3** Radiobiology of Molecular Radiotherapy		1203 **IN HALL A** **Plenary 3** Radiobiology of Molecular Radiotherapy		
11:30 - 12:00 12:00 - 12:30 12:30 - 13:00	1301 **CME 10** Neuroimaging Brain PET and SPECT in Dementia - Beyond Alzheimer's Disease CME	1302 **Joint Symposium 10** Thyroid/ESES/IFCC Diagnosis and Treatment of Hyperthyroidism	1303 **Technologists** Oral Presentations 3	1304 **Do.MoRe** Radiation Protection	1305 **M2M** Prostate Cancer Targeting
13:00 - 14:30					
14:30 - 15:00 15:00 - 15:30 15:30 - 16:00	1401 **CME 11** Paediatrics/ Oncology/ SIOPEN SSR Imaging and Therapy in Children CME	1402 **Joint Symposium 11** Cardiovascular/EACVI Quantification of Myocardial Blood Flow	1403 **CTE 5** Technologists Gastrointestinal Imaging	1404 **Do.MoRe** Dosimetry/ Physics/AAPM PET Auto-Segmentation: Review and Evaluation Strategies - Insights from AAPM Task Group No. 211	1405 **M2M** Nanoparticles
16:00 - 16:30					
16:30 - 17:00 17:00 - 17:30 17:30 - 18:00	1501 **CME 12** Translational Molecular Imaging & Therapy/ Oncology/Neuroimaging 18F-DOPA and Radiolabelled Choline PET in Recurrent Glioblastoma CME	1502 **Joint Symposium 12** Oncology/EORTC PET Criteria for Response Assessment: Quo vadis PERCIST?	1503 **CTE 6** Technologists/ Dosimetry Imaging, Reconstruction and ROI Analysis Techniques for Dosimetry	1504 **Do.MoRe** Rapid Fire Session Radionuclide Therapy, Miscellaneous	1505 **Joint Symposium 15** M2M/ESMI Best of European Molecular Imaging Meeting - EMIM 2017

Hall F1	Hall F2	Hall K	Hall G1	Hall G2	e-Posters
1306 **Pitfalls & Artefacts 5 - ICC*** Oncology Pitfalls and Artefacts of PET in Neuroendocrine Tumours	1307 **Clinical Oncology** Cured or Not Cured?			1310 **Do.MoRe** Clinical Dosimetry for 90Y Radioembolization	**Technologist e-Poster Sessions** (08:00-09:30) E-TPW1, E-TPW2, E-TPW3, E-TPW4 **e-Poster Walks** (08:30-09:30) E-PW09, E-PW10, E-PW11, E-PW12
1306 **Pitfalls & Artefacts 6 - ICC*** Dosimetry Pitfalls and Artefacts in Pre- and Post-Therapeutic Imaging	1307 **Clinical Oncology** Bad Brain	1308 **Cardiovascular System** Myocardial Perfusion PET - 13N-Ammonia and 15O-Water		1310 **Do.MoRe** Detector Technology	
EANM Young Daily Forum	**Industry Sponsored Symposium**	**Industry Sponsored Symposium**	**Industry Sponsored Symposium**		
1406 **Teaching Session 5 - ICC*** Applied Cross Sectional Anatomy and Correlative Imaging – Cross Sectional CT and PETCT for the TNM Staging of Lung Cancer	1407 **Clinical Oncology** Rapid Fire Session Mix it Up, please!		1408 **Neurosciences** Rapid Fire Session Imaging Brain Physiology in Predinical & Clinical Models	1410 **Do.MoRe** Thyroid Cancer - Clinical	
1506 **Teaching Session 6 - ICC*** Correlative Imaging for Nuclear Medicine Specialists: Interactive Live Radiology and Nuclear Medicine Quiz Using the Experior Medical System	1507 **Clinical Oncology** In the Air & Beyond	1508 **Cardiovascular System** Myocardial Perfusion SPECT: Quantification & Artificial Intelligence		1510 **Do.MoRe - Featured** PET/MRI	

Programme Overview Wednesday, October 25, 2017

	Hall A	Hall B	Hall C	Hall E1	Hall E2
08:00-08:30 08:30-09:00 09:00-09:30	1601 **CME 13** Dosimetry/ Radionuclide Therapy/ Radiation Protection Treatment Planning for Radionuclide Therapy, How Simple Can it Be?	1602 **Joint Symposium 13** Paediatrics/SNMMI Standartisation of Diuresis Renography in Children		1604 **Do.MoRe** Image Reconstruction	1605 **M2M** Radiolabelling Methods
09:30-10:00					
10:00-10:30 10:30-11:00 11:00-11:30	1701 **CME 14** Dosimetry/ Radiation Protection/ Translational Molecular Imaging & Therapy Alpha Particle Dosimetry, Does High LET Lead to High RBE?	1702 **Joint Symposium 14** Oncology/ESSO Head & Neck Cancer	1703 **CTE 7 Interactive** Technologists/ Paediatrics Practical and Technical Aspects of Paediatric Nuclear Medicine	1704 **Do.MoRe** Molecular Imaging Artefacts & Corrections	1705 **M2M** CNS/ Neurotransmission/ Brain Targets
11:30-12:00 12:00-12:30 12:30-13:00 13:00-13:30	1801 **Awards Ceremony** (11:45 - 12:15) **Plenary 4** Highlights Lecture (12:15 - 13:15) **Closing Ceremony** (13:15 - 13:20)		1803 **IN HALL A** **Awards Ceremony** (11:45 - 12:15) **Plenary 4** Highlights Lecture (12:15 - 13:15) **Closing Ceremony** (13:15 - 13:20)		

Hall F1	Hall F2	Hall K	Hall G1	Hall G2	e-Posters
I606 **Pitfalls & Artefacts 7 - ICC*** Oncology Pitfalls and Artefacts in PSMA PET Reading	I607 **Clinical Oncology** Anything Goes	I608 **Cardiovascular System** Myocardial Perfusion PET - 82-Rubidium		I610 **Do.MoRe** Dosimetry in Diagnostic Nuclear Medicine	
	I707 **Clinical Oncology** PSMA - Saving Nuclear Medicine	I708 **Cardiovascular System** Atherosclerotic Plaque Imaging			