

# Department of Nuclear Medicine

## (Seoul National University Hospital)

### 1. Introduction

#### ABOUT US

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The Department of Nuclear Medicine at Seoul National University Hospital is committed to improving health through excellence in patient care, research, and education. Based on the knowledge about functions of the organs and nature of diseases, we provide superb medical services for diagnosing and treating a variety of diseases. To develop more effective strategies to conquer diseases, we are actively pursuing biomedical research through close collaboration between physicians and scientists. In addition, we manage training programs for future physicians and scientists, not only for intramural members but also for international applicants. Twelve faculty members, 50 nuclear medicine technologists, 40 researchers, 15 nursing or administrative members are working in patient care and research.

From 2002 to 2006, former Professor Myung Chul Lee had been the president of World Federation of Nuclear Medicine and Biology (WFNMB) and Prof. June-Key Chung had been the secretary general of WFNMB. With our experience of rapid development, we are trying to dedicate ourselves to the worldwide expansion of nuclear medicine, especially in the developing countries. For that purpose, we are actively participating in the program of WFNMB, ARCCNM (Asian Regional Cooperative Council for Nuclear Medicine), ASNM (Asian School of Nuclear Medicine), ASMI (Asian Societies of Molecular Imaging), and so on. At present, we are the only cooperative site of IAEA (International Atomic Energy Agency) for the education and training of nuclear medicine, and we are managing fellowship and international scholarship programs.

#### PATEINT CARE

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As a world-leading group in the field of nuclear medicine, we provide state-of-the-art medical services in diagnosing and treating disease;

- Diagnostic Imaging

Using diverse radioactive tracers, nuclear medicine can visualize the status of diseases and monitor effect of a treatment through medical imaging in living body. For diagnostic imaging, we currently have 8 gamma cameras, 2 SPECT/CT scanners, 3 PET/CT scanners, and 1 PET/MR scanner.

## 1. PET

PET (positron emission tomography) is an imaging tool using positron-emitting radiotracers. Various PET tracers have been developed and are in use. With an adequate radiotracer, cancer lesions, viable myocardium, and metabolic status of brain can be diagnosed. At present, we can offer various PET tracers with active support of radiopharmacy.

- $^{18}\text{F}$ -FDG: For glucose metabolism
- $^{18}\text{F}$ -FLT: For nucleic acid metabolism
- $^{18}\text{F}$ -FP-CIT: For DA transporter
- $^{11}\text{C}$ -Methionine: For amino acid metabolism
- $^{11}\text{C}$ -Acetate: For fatty acid metabolism
- $^{11}\text{C}$ -PIB: For amyloid plaques in Alzheimer's disease
- $^{68}\text{Ga}$ -RGD: For angiogenesis
- $^{13}\text{N}$ -Ammonia: For myocardial perfusion
- Etc.

## 2. Gamma camera, SPECT, and SPECT/CT

A gamma camera is a traditional imaging tool in nuclear medicine, using diverse radiotracers labeled with gamma-emitters such as  $^{99\text{m}}\text{Tc}$ ,  $^{201}\text{Tl}$ ,  $^{123}\text{I}$ . SPECT (single photon emission computed tomography) is a reconstructed gamma camera image to show 2-D tomographic images. A wide range of gamma camera imaging is available in our department.

- Bone scan
- Myocardial perfusion SPECT (/CT)
- Brain perfusion SPECT (/CT)
- Thyroid scan
- Renal scan
- Liver scan
- Hepatobiliary scan
- White blood cell scan (for infection)
- Parathyroid scan (SPECT/CT)
- Salivary gland scan
- Lymphangiography
- Spleen scan
- Etc.

#### ■ Diagnostic Laboratory

In aid of diagnosis, our department operates a diagnostic laboratory using radiotracers, in which approximately 700,000 cases of laboratory studies are performed in a year. Assays using radiotracers can provide extremely sensitive and accurate results. RIA (radioimmunoassay) and IRMA (immunoradiometric assay) studies are performed to measure very small amounts of biological materials such as hormones and tumor markers. In addition, some important functional parameters of living body such as GFR (glomerular filtration rate) can be measured in the laboratory.

- Thyroid hormone (T3, T4, TSH, Tg, TgAb, etc.)
- Sex hormone (LH, FSH, etc.)
- Viral markers (HBV, HCV, etc.)
- Tumor markers (AFP, CEA, PSA, etc.)

#### ■ Radioisotope Therapy Clinic

Radioisotope therapy is a kind of cancer therapy using radiopharmaceuticals that emit destructing radiation. Targeted radiopharmaceuticals can be accumulated in cancer tissue and destruct them by radiation. The Radioisotope Therapy Clinic of our department has been in operation for more than 50 years. The most important target of radioisotope therapy is thyroid cancer, at present. However, we are trying to expand the scope of radioisotope therapy by developing novel therapeutic radiopharmaceuticals.

At present, clinics for outpatients and 3 therapy rooms are in operation for several diseases.

- Thyroid Cancer
- Palliation of metastatic bone pain
- Lymphoma
- Neuroendocrine tumors
- Etc.

### **RESEARCH**

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We are pursuing many research programs not only for the purpose of academic development but also for the purpose of enhancing the quality of medical services. As one of the world's best research centers, our department has made every endeavor to develop innovative methods in diagnosis and therapeutics of diseases. As a result, we present 20~30 research articles in the Annual Meeting of the Society of Nuclear Medicine in USA every year, by which we are within the top three nuclear medicine research groups in the world. We have diverse research laboratories, which all work in close cooperation with each other.

#### ■ Clinical Nuclear Medicine

- General nuclear medicine
- PET oncology with new tracers
- Nuclear cardiac imaging for ischemic heart disease and atherosclerosis
- Neuroimaging for Alzheimer disease, vascular diseases, and movement disorder
- Radioisotope therapy
- Innovative medical fusion imaging (PET/MRI)
- Translational research of molecular imaging

#### ■ Radiochemistry

- Development of new PET tracers for tumor using angiogenesis and hypoxia
- Development of new PET tracers for ischemic heart disease
- Development of  $^{99m}\text{Tc}$ -based radiopharmaceuticals
- Development of therapeutic radiopharmaceuticals
- Improvement in compounding methods (developing kits)

#### ■ Nuclear Medicine Physics

- Development of new imaging devices (PET/MRI, animal SPECT)
- Enhancement of image reconstruction (new algorithms)
- Tracer kinetics analysis for new imaging agents
- Radiation dosimetry

#### ■ Molecular Imaging and Nanomedicine

- Reporter gene imaging for gene or protein expression
- Gene therapy using radioisotope
- Development of biomarkers for targeted imaging and therapy (miRNA, aptamer)
- Application of nanoparticle carriers in vivo
- Cell trafficking imaging



## **INTRODUCTION TO KOH CHANG-SOON FELLOWSHIP PROGRAM**

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The Koh Chang-Soon Memorial Projects honor the memory and pay tribute to the late professor for his contribution to the development and emergence of nuclear medicine in Korea. The late Professor Koh established nuclear medicine and taught his trainees the spirit of "challenge and harmony". His teachings were an inspiration to his students over the years and they are entirely indebted to Professor Koh for the present success and the future of nuclear medicine in Korea.

International fellows are trained for a period of 1 week to 1 year in 'IAEA Collaborating Center for Nuclear Medicine' in Seoul National University, which was established and named by IAEA in 2004. A new opportunity of international fellowship started in 2010, which supported three consecutive visiting scholars. The International Fellowship Program was entitled as 'Koh Chang-Soon Fellowship', which supports physicians, scientists or engineers in the field of nuclear medicine.

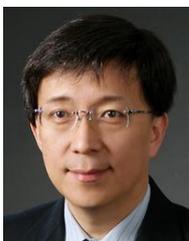
## 2. Faculty Members for Education & Training

Part	Name	Title	Specialty
MD	Chung, June-Key	Professor, Former chairman	Oncology, Thyroid, MI
	Lee, Dong Soo	Professor, Chairman	Neurology, Cardiology, MI
	Kang, Keon Wook	Associate Professor	Oncology, MI, Nanomedicine
	Cheon, Gi Jeong	Associate Professor	Oncology, Therapy, MI
	Paeng, Jin Chul	Associate Professor	Cardiology, Therapy, MI
PhD	Jeong, Jae Min	Professor	Radiopharmacy
	Lee, Jae Sung	Associate Professor	NM Physics
	Youn, Hyewon	Associate Professor	MI, Molecular biology
	Lee, Yun Sang	Assistant Professor (Research)	Radiopharmacy
	Kang, Hye Jin	Assistant Professor (Research)	Cognitive science
	Hwang, Do Won	Assistant Professor (Research)	Molecular imaging
	Kim, Mi Jeong	Assistant Professor (Research)	Molecular imaging

Medical College			Hospital
Co-affiliation	Co-affiliation	Research	Clinical
3	3	4	2
 Lee DS	 Chung JK	 Jeong JM	 Paeng JC
	 Cheon GJ	 Lee YS	 Youn HW
 Kang KW	 Lee JS	 Kim MJ	 Kang H

**LEE, Dong Soo, M.D., Ph.D., Professor & Chairman**

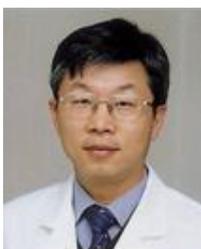
- Dr. Lee has been doing clinical researches in nuclear neurology and brain mapping and clinical nuclear cardiology researches. His main achievement ranged from establishment of efficacy of gated SPECT in the evaluation of bypass graft surgery or new treatment modality such as intracoronary autologous bone marrow stem cell therapy, via application of mapping technology to the pre-operative evaluation of epilepsy patients using FDG PET or ictal SPECT, to the application of PET studies in the understanding of brain pathologies in profound deafness. His recent researches extended from the above clinical ones into the topics of pre-clinical molecular imaging studies such as cell differentiation imaging in vivo using microPET/ microMRI and optical imaging methods. Adopting the very recent progresses of nanotechnology, he has just started to do in vivo nano-imaging studies. 'MicroRNA imaging in vivo' is just one example of these pursuits. He works with two research professors, SH Kim and HW Yoon, two post-docs and dozens of PhD candidate students and MD students.



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**CHUNG, June-Key, M.D., Ph.D., Professor**

- An internationally recognized expert in the field of nuclear medicine, Dr. Chung has pioneered numerous techniques for developing new and powerful in vivo molecular imaging tools and anti-cancer therapies. His clinical and research work also has led to numerous peer-reviewed journal articles in nuclear medicine. Major research projects are related to visualize endogenous or exogenous tumor-related gene or protein expression including p53, HIF-1a, hTERT and microRNAs using nuclear or bioluminescence reporter genes such as sodium iodide symporter (NIS), thymidine kinase (TK), dopamine receptor (D2R) and luciferases. He has a particular interest on radionuclide gene therapy using NIS, which can uptake several therapeutic radionuclide such as  $^{188}\text{Re}$ ,  $^{131}\text{I}$ . In addition, the development of new radio-immunotherapy to enhance the effects of cancer DNA vaccines by utilizing radioiodine gene therapy is another subject of his recent research.



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**JEONG, Jae Min, M.D., Ph.D., Professor**

– Our major research field is development of new radiopharmaceuticals labeled with positron emitters, gamma emitters and beta emitters. Radiopharmaceuticals are used for imaging functions of organs or tissues such as metabolism, receptor distribution, and blood flow. Recent developments of radiopharmaceuticals are closely related with molecular imaging and nanomedicine. In addition, we also develop therapeutic radiopharmaceuticals labeled with beta emitters such as Re-188, Y-90 and Lu-177.



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**KANG, Keon Wook, M.D., Ph.D., Professor**

- As a nuclear medicine physician and molecular imaging scientist, he teaches nuclear medicine oncology in both clinical and research aspects. He and his colleagues perform translational research on molecular imaging and molecular targeted therapy using multifunctional nano-particles through *in vivo* imaging and clinical trials, especially on cancer. His group participates *in vivo* validation of new drugs and drug delivery system using multimodal *in vivo* imaging as well as clinical studies using PET and SPECT. He also facilitates international collaboration involving the academic, research, and industrial sectors.



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**LEE, Jae Sung, Ph.D., Associate Professor**

- The research goal that we pursue is to develop the technologies with which we can acquire the biologically relevant and clinically useful information from human body and living animals. The current research interests of my laboratory included, but are not limited to, novel medical imaging systems, i.e. hybrid PET-MRI scanner, and advanced biomedical image analysis technologies. We are especially focusing on the radiotracer imaging modalities, such as positron emission tomography (PET) and single photon emission computed tomography (SPECT).



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### 3. Education & Training Program

#### # 1 (Long-Term for 1 Year)

Month	Purpose	Training Items	Remarks
1	- Adaptation - Introduction	1. Introduction of each Labs in SNUH NM 2. Basic Image Readings (full-time) (including general scan and PET) 3. Structured Lectures by Faculty 4. Experience on Technical Affairs (PET center)	Participation in ① Routine Conferences ② Classes of Gr. School (option)
2	- Expertise	1. Image Reading (part-time) (with charge, mentor-supporting) 2. Advanced Training on Specific Subject (chosen by the trainee)	Participation in ① Routine Conferences ② Classes of Gr. School (option)
3-5	- Expertise - Research	1. Image Reading (part-time) (with charge, mentor-supporting) 2. Research Affairs (chosen by the trainee) - Clinical Research - Basic / Translational Research	Participation in ① Routine Conferences ② Classes of Gr. School (option) ③ Specific Lab Meeting
6	- Expansion of Experience	1. Research Affairs (chosen by the trainee) - Writing of original research paper 2. Tour to Major NM Centers in Korea - SNUBH - NCC - Others (AMC, SMC, etc)	Participation in ① Routine Conferences ② Classes of Gr. School (option) ③ Specific Lab Meeting
7~12	- Research	1. Research Affairs (chosen by the trainee) - Writing of original research paper	Participation in ① Routine Conferences ② Classes of Gr. School (option) ③ Specific Lab Meeting

## # 2 (Long-Term for 6 Months)

Month	Purpose	Training Items	Remarks
1	- Adaptation - Introduction	1. Introduction of each Labs in SNUH NM 2. Basic Image Readings (full-time) (including general scan and PET) 3. Structured Lectures by Faculty 4. Experience on Technical Affairs (PET center)	Participation in ① Routine Conferences ② Classes of Gr. School (option)
2	- Expertise	1. Image Reading (part-time) (with charge, mentor-supporting) 2. Advanced Training on Specific Subject (chosen by the trainee)	Participation in ① Routine Conferences ② Classes of Gr. School (option)
3-5	- Expertise - Research	1. Image Reading (part-time) (with charge, mentor-supporting) 2. Research Affairs (chosen by the trainee) - Clinical Research - Basic / Translational Research	Participation in ① Routine Conferences ② Classes of Gr. School (option) ③ Specific Lab Meeting
6	- Expansion of Experience	1. Research Affairs (chosen by the trainee) - Writing of original research paper 2. Tour to Major NM Centers in Korea - SNUBH - NCC - Others (AMC, SMC, etc)	Participation in ① Routine Conferences ② Classes of Gr. School (option) ③ Specific Lab Meeting

### # 3 (Short-Term for 2 Weeks)

Week	Purpose	Training Items	Remarks
1-2	<ul style="list-style-type: none"> <li>- Introduction</li> <li>- Experience</li> </ul>	<ol style="list-style-type: none"> <li>1. Introduction of each Labs in SNUH NM</li> <li>2. Basic Image Readings (full-time) (including general scan and PET)</li> <li>3. Structured Lectures by Faculty</li> <li>4. Experience on Technical Affairs (PET center)</li> <li>5. Topics               <ol style="list-style-type: none"> <li>1) Basic Knowledge on PET                   <ul style="list-style-type: none"> <li>- PET instrument and physics (lecture and discussion)</li> <li>- PET radiochemistry (lecture and discussion)</li> <li>- Radiation protection and related regulations (observation)</li> <li>- Practical PET procedures (observation)</li> </ul> </li> <li>2) Oncological application of PET                   <ul style="list-style-type: none"> <li>- Normal PET findings and artifacts (lecture and discussion)</li> <li>- Image reading of oncological PET images (observation and participation)</li> <li>- Clinical decision making with application of PET (participation to inter-departmental clinical conferences)</li> <li>- Oncological PET with non-FDG tracers (lecture and discussion)</li> </ul> </li> </ol> </li> </ol>	Participation in ① Routine Conferences ② Classes of Gr. School (option) ③ Specific Lab Meeting

## 4. Routine Schedule in Clinical Practice

Time	Mon	Tue	Wed	Thu	Fri
08:00 ~ 09:00 (Conference)		Lit. Review / Case Review	Mini Symposium	Staff Lecture	Research Meeting
09:00 ~ 10:00	Pre-reading	Pre-reading	Pre-reading	Pre-reading	Pre-reading
10:00 ~ 12:00	Reading with Faculty	Reading with Faculty/ RI Therapy Clinic	Reading with Faculty / RI Therapy Clinic	Reading with Faculty	Reading with Faculty
12:00 ~ 13:00	Lunch	Lunch	Lunch	Lunch	Lunch
13:00 ~ 15:00	Pre-reading / RI Therapy Clinic	Pre-reading	Pre-reading	Pre-reading / RI Therapy Clinic	Pre-reading
15:00 ~ 17:00	Reading with Faculty	Reading with Faculty	Reading with Faculty	Reading with Faculty	Reading with Faculty
17:00 ~					

## **5. Assistance for Application to Training/Fellowship Program**

### **(1) Homepages**

Seoul national university hospital	<a href="http://www.snuh.org/english/">http://www.snuh.org/english/</a> ,
SNUH cancer hospital	<a href="http://cancer.snuh.org/">http://cancer.snuh.org/</a>
Department of Nuclear Medicine, SNUH	<a href="http://nm.snu.ac.kr/emain.php">http://nm.snu.ac.kr/emain.php</a>
Information of Korea	<a href="http://www.visitkorea.com/">http://www.visitkorea.com/</a>
Information of Seoul	<a href="http://www.visitseoul.net/">http://www.visitseoul.net/</a>
Korean Society of Nuclear Medicine	<a href="http://www.ksnm.or.kr/eng/">http://www.ksnm.or.kr/eng/</a>
ARCCNM	<a href="http://www.arccnm.org/">http://www.arccnm.org/</a>

### **(2) Administrative Help at Department of Nuclear Medicine, SNUH (Contact Point)**

\*. Secretary for International Affairs, Dept. of Nuclear Medicine, SNUH

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- Fax: +82-2-745-7690
- E-mail: lee.amy0121@gmail.com

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- Dr. Cheon, Gi Jeong (Associate Professor)
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