AFOMP Newsletter

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Asia-Oceania Federation of Organizations for Medical Physics

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Vol.10 No.01– Jan 2018

From the desk of editor

"Wish you all very happy, healthy and prosperous new year 2018 "

Wish all your academic and professional plans for the year gets fulfilled.

The year gone 2017 was very fruitful for AFOMP. The organization has grown from 19 countries to 20 with inclusion of Myanmar in the federation. It is very welcome decision of AFOMP and MEFOMP to come together and an MOU is signed between AFOMP and MFOMP for benefit of members and furthering the scientific collaboration . In 2017 we had very successful organization of 17th AOCMP at Jaipur and IOMP—IDMP celebration on 7th November in conjunction with AOCMP at Jaipur. With efforts of Dr. Howell Round and team the document for ethics of Medical Physics profession was finalized and approved for AFOMP.

The AFOMP newsletter is being continuously brought out. This issue of AFOMP newsletter contains very good article from Dr. J.K Bhagat on **"Technological Advancements of Imaging: Nuclear to Molecular"**, article by Prof. Slavik Tabakov about **"Global number of medical physicists, its growth 1965-2015 and predictions for the future"** is quite informative, article by Prof. M. Rehani on **"Is the Future of Medical Physics Secure?"** analyses the situation scientifically and article by Prof. Tae Suk Suh **"The Activities and Roles of AFOMP"** puts the light on activities of AFOMP in addition the news letter contains the report of 17th AOCMP, IDMP celebration.

Medical Physics is continuously evolving and to keep update of recent knowledge in the field we have to participate in academic activities. In 2018 we have two important conferences, World Congress on Medical Physics & Biomedical Engineering **WC2018** at Prague during 3-8 June 2018 and 18th **AOCMP 2018** at Kuala Lumpur, Malaysia during 11-14 November 2018. Hope you all take benefit of it.

Further I request all the office bearers of NMO's to put the newsletter on the website and circulate to your member, also give the feed back to improve the newsletter.

Prof. Arun Chougule
Editor, AFOMP Newsletter
Vice President, AFOMP

Prof. Dr.Arun Chougule

INSIDE THIS ISSUE

18th Asia-Oceania Congress of Medical Physics & 16th South-East Asia Congress of Medical Physics

www.aocmp2018.com

11 – 14 November 2018

Connexion Convention & Event Centre
Bangsar South City , Kuala Lumpur, Malaysia

A Sustainable Future for Medical Physics

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Abstract Submission Deadline

Registration Opens
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Abstract Notification
Full Paper Submission

Proceedings Publication

Nov 2017 — **Mar 2018** — **Jul 2018** — **Aug 2018** — **Sep 2018** — **Oct 2018** — **11-14 Nov 2018** — **Mar 2019**

Travel Grants Application Open

Early Bird Registration Deadline

Standard Registration Deadline

11-14 Nov 2018
AOCMP-SEACOMP 2018

AFOMP Presidential Message

I am pleased to greet all of medical physicists in Asia-Pacific regions as a President of the Asia–Oceania Federation of Organization for Medical Physics (AFOMP). I would also like to thank AFOMP members for making great efforts in the field of medical physics in 2017.

Many activities have been accomplished by AFOMP in 2017. One major activity was to hold the 17th Asia–Oceania Congress of Medical Physics (AOCMP) which was held in Japur, India during Nov. 3-7, 2017, which was very successful. I would like to take this opportunity to thank Prof. Arun Chougule, the Organizing Chair of AOCMP 2017 and AMPI for coordinating this wonderful Congress. Furthermore, I express my sincere gratitude to all members of the federation for making this congress possible. Here are some of the highlights from this year's achievements. Prof. Howell Round and AFOMP PDC have developed the AFOMP Code of Ethics. AFOMP newsletter was published in June 2017. The AFOMP website has undergone some improvements and will be newly designed by a professional company by next year. The Physica Medica (European Journal of Medical Physics; official journal of EFOMP) published the Focus Issue of the Asia-Oceania Congress on Medical Physics (AOCMP 2016). AFOMP membership by Myanmar was approved by AFOMP Council. The Memorandum of Understanding (MoU) that MEFOMP become members of AFOMP was approved in AFOMP Council Meeting, and the MoU was finally signed by both Presidents of AFOMP and Middle East Federation of Organization of Medical Physics (MEFOMP) on December 12, 2017. Lastly, AFOMP had also many activities in collaboration with international bodies such as IOMP, IAEA, WHO, etc. this year.

The role and status of medical physicists in the AFOMP continue to gain increasing recognition in scientific societies. The AFOMP will strive to build a strong relationship between sub-regional organizations in the Asia-Oceania region and international bodies.

The 18th Asia-Oceania Congress of Medical Physics (AOCMP) will be held in Kuala Lumpur, Malaysia from 11 to 14 November 2018, in conjunction with the 16th South-East Asia Congress of Medical Physics (SEACOMP). I hope all of you can join this meeting and make your great contribution to the medical physics community next year

Finally, I wish all of you a Merry Christmas and a Happy New Year.

Sincerely,

Tae Suk Suh, President of AFOMP

Is the Future of Medical Physics Secure?

Madan M. Rehani, PhD,

*Vice-President, IOMP, **Director** of Global Outreach for Radiation Protection, Massachusetts General Hospital, Harvard Medical School, Boston, USA*

Is there a good future for me as a medical physicist? This is a question that haunts most young colleagues not only in early career but also at later stages. At the outset, it must be understood that the same question is faced by all others- be it a radiation oncologist, a radiologist, a medical oncologist and practically everyone. The degree may vary, but not too much. When we are in pain, our feeling of suffering makes us focus so much on ourselves that we forget about million others who are going through the same. Realization that you are not alone does make a difference in reducing the intensity of feeling. For example, the artificial intelligence is coming in a big way and computers will take over the job of radiologists in reporting images. In earlier years ultrasound got into the hands of several clinical specialists and cardiac CT created opportunities for cardiologists to own CT. In his presentation at the GPU Tech Conference in San Jose in May 2017, Curtis Langlotz, Professor of Radiology and Biomedical Informatics at Stanford University, mentioned how he received an e-mail from one of his students saying he was thinking about going into radiology but does not know whether it is a viable profession anymore. In recent years, radiation oncology has become increasingly absorbed with technological advances. This increasing emphasis on technology, together with other important changes in the health-care economic environment, now places the specialty of radiation oncology in a precarious position. New treatment technologies are evolving at a rate unprecedented in radiation therapy, paralleled by improvements in computer hardware and software. If radiation oncologists become simply the guardians of a single therapeutic modality they may find that time marches by and, while the techniques will live on, the specialty may not [1].. Life is a continuous process of making oneself and one's work indispensable.

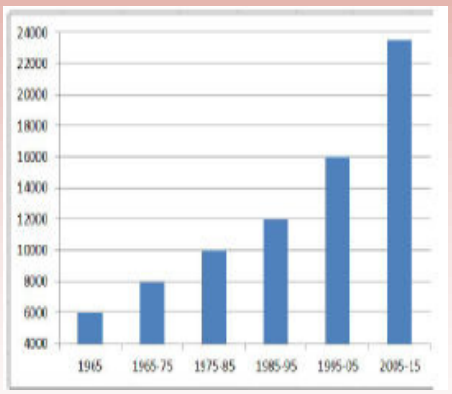
Next, the success depends as much on the individual as the prospects available to ride the ladder. If an individual is a dedicated worker and has a positive outlook, he/she will find his/her way to success at various stages and reach the top. Our lack of faith in our self can be a bigger obstacle than opportunities.

Upcoming technological environment

It is estimated that Self-Driving Cars Could Save 300,000 Lives Per Decade in America [2]. If driverless cars deliver on their promise to eliminate the vast majority of fatal traffic accidents, the technology will rank among the most transformative public-health initiatives in human history. It seems we are entering into an era where human errors are seen as the major hurdle in safety and cause for accidents. Previous publications analyzing the radiation oncology overexposures had also led to similar conclusions [4,5]. The future of radiation oncology in cancer care was recently the focus of debate involving 150 scientists from the world's leading clinics and research institutions.

If one goes by the data on number of medical physicists globally, as collected by IOMP [3], then the answer is yes

How much are medical physicist paid in USA?



The AAPM Salary survey of 2015 shows that the typical average salary for medical physicist with PhD degree and no certification in US$ was 138k (rounded) for radiation oncology physicist with median years of experience of 5 years, 150k for diagnostic radiology physicist with median years of experience of 16 years and 160k for nuclear medicine physicist with median years of experience of 22 years. The figures for those with certification are higher by 10-30%. Data is available also for those with only master's degree with and without certification. The average starting salary for medical physicists in radiation oncology is 104k for those with □aster's degree without certification.

Typical daily consulting fee for MS without certification is 967, and PhD without certification is $1444 and hourly rates range 187-203. The increase in median salary from 2014 to 2015 was 2.9% for MS and 5.2% for PhD. Those who reported change in employer shoed 13.3% increase. A majority (76%) of medical physicists specify radiation oncology as their primary discipline.

In short, for a person with a forward and positive outlook there are always opportunities to adapt to newer developments and not only survive but thrive in any specialty.

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Technological Advancements of Imaging: Nuclear to Molecular

Dr. (Brig.) J.K. Bhagat, Senior Consultant & Head, Nuclear Medicine & PET Imaging
Kan Singh Shekhawat, RSO Nuclear Medicine & PET Imaging Department BMCHRC, Jaipur, Rajasthan

"The best way to predict the future is to invent it" ALAN KAY

Nuclear Imaging: SPECT/SPECT-CT

Nuclear imaging is also called gamma imaging, single photon emission computed tomography (SPECT), also allows visualization of functional information about a patient's specific organ or body system. As this tracer decays, it emits gamma rays, which are then detected by a gamma camera. An essential tool in nuclear medicine, a sophisticated substitute for the X-Ray, the gamma camera can be used in planar imaging to acquire 2-dimensional images, or in SPECT imaging to acquire 3-dimensional images coupled with CT, SPECT/CT has greatly improved neuroendocrine tumors diagnosis and staging using somatostatin receptor scintigraphy (SSRS) by improving detection sensitivity and localization of tumor foci [8].

Other tumor- seeking agents like meta-iodo-benzyl-guanidin (MIBG) and sestamibi labeled with single photon emitters such as indium-111, iodine-123 or technetium-99m. MIBG is a specific agent for neuroblastoma as well as of pheochromocytoma and other paragangliomas also behave in same manner [9]. It still plays a major role in staging and follow-up of children with neuroblastoma, where it can also be used for radionuclide therapy [10].

As a general rule, scintigraphic images lack accurate anatomic landmarks for precise localization and characterization of findings, despite the fact that specific radiopharmaceuticals are used for assessment and diagnosis of specific disease processes.

These considerations explain why morphologic (CT) and functional imaging modalities (SPECT and PET) are complementary and not competing techniques, especially if precise image registration is made possible by using a single imaging unit combining the emission based data with the transmission based data (CT), which also serves to correct the emission data for tissue attenuation) (Fig.1) this is Called image co-registration.

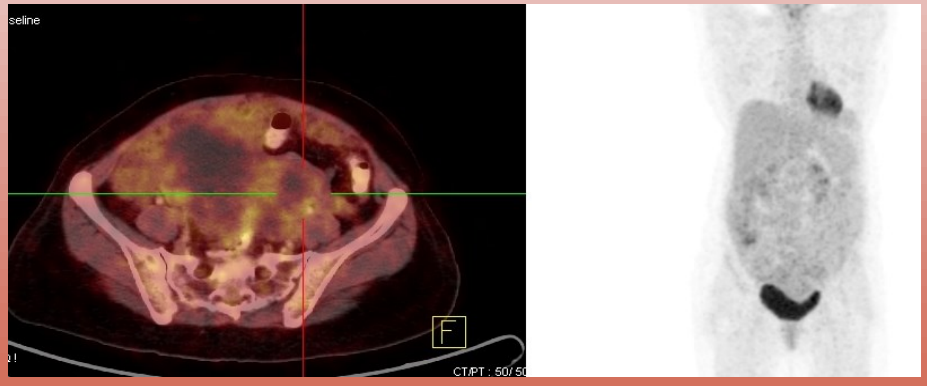

FIG. 1: Female 35 years old, with a neuroendocrine tumor (Pheochromocytoma).The PET-CT – study shows an increased tracer uptake that is difficult to localize. The CT study shows no anatomical abnormalities. However, PET-CT allows one to localize the uptake in the left adrenal gland.

Simultaneous recording of CT and SPECT allows distinguishing tumor foci from normal tissue uptake such as in the gallbladder, kidney, spleen (including accessory spleens) and excretory pathways (urinary tract and intestines). It helps also to separate uptake due to activated lymphocytes and increased vascular permeability in inflammatory changes from tumors.

Molecular Imaging: PET CT

The last decade has witnessed significant advances in medicine, particularly in the understanding of pathological processes at the molecular level, aided by the development – in parallel – of ever more sophisticated diagnostic imaging technologies. The increase of chronic diseases worldwide, including cancer, has spurred the development of a new biomedical research discipline, called Molecular Imaging, enabling the visualization, characterization, and quantification of biological processes taking place at the cellular and sub cellular levels. The images produced with molecular imaging reflect cellular and molecular pathways and mechanisms of disease present in the context of the living subject. Biologic processes can be studied in their own physiologically authentic environment instead of by in vitro or ex vivo biopsy/cell culture laboratory techniques.

One of the most striking advancements of imaging technologies has been the introduction of Positron Emission Tomography (PET), which has its foundations in the early 1930s, when Nobel Laureate Otto Warburg, a medical doctor and one of the twentieth century's leading biochemists, observed an increased use of glucose, a process called glycolysis, in rapidly growing tumors [1 and 2]. Fifty years later, some first experiments showed the increased incorporation in tumors of the glucose analogue fluoro-deoxyglucose (FDG) labeled with fluorine-18 [3] (F18-FDG). This eventually led to the incorporation of in-vivo imaging of enhanced tumor glucose consumption using Positron Emission Tomography (PET) [4], for many types of cancers, involving all steps of cancer management, namely:

⇒ Staging (assessment of the extent of disease prior to initiation of treatment).

⇒ Response evaluation (assessment of treatment response during or after therapy).

⇒ Restaging (assessment of the extent of disease following initial therapy or when recurrence has been confirmed).

⇒ Detection of recurrence (assessment of the presence of cancer following clinical and/or biochemical suspicion of recurrence) and Follow-up during or after cytostatic therapy (surveillance in the absence of clinical evi-

dence of recurrence).

Also driven by the discipline of nuclear medicine - a branch of medicine that uses radioisotopes labeled biologically active molecules called radiopharmaceuticals in the diagnosis and treatment of disease these rapid developments in diagnostic methods and analysis have led to a paradigm change in the treatment of patients with cancer, from standard to personalized treatment.

As a result of this change, the process of diagnosing and treating disease is shifting from a single specialist interacting with a patient to a multidisciplinary approach that retains a focus on the patient. Nuclear medicine faces a parallel evolutionary shift—from imaging function at the organ/tissue level to detecting changes at cellular and molecular levels. In this context, nuclear medicine is being coupled with other imaging modalities such as Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) to improve diagnostic accuracy and optimize patient care.

Medical Imaging Technologies and Hybrid Imaging

Imaging modalities such as CT and MRI will remain first line modalities in the investigation of cancers. However, when a PET study is used in the diagnosis of cancer patients it can cause changes in therapeutic decisions in 30% to 40% of the cases [5].

Diagnosis and characterization of disease by both CT and MRI imaging is based on morphologic criteria such as size, texture and tissue attenuation. CT and MRI provide information regarding changes in organ size and tissue density, as well as their precise spatial localization and topographic landmarks. PET imaging, on the other hand, is based on the bio-distribution of a radioactive agent over time and space, enabling visualization of dynamic physiological and pathophysiological processes that define the functional characteristics of disease.

Due to inherent characteristics of nuclear medicine images and their limited resolution power, it is difficult to define the precise anatomical location of diseases, making the interpretation of studies a complex process. To overcome this limitation, the molecular and functional imaging provided by PET and the anatomical imaging provided by CT, have been merged into "hybrid imaging" using combined scanners such as PET/CT [6] while prototype PET/MRI scanners are already in development [7]. These hybrid modalities allow in a single diagnostic procedure a combined evaluation of function and structure, while obtaining the most from each modality. The introduction of hybrid imaging offers the possibility to re-examine the diagnostic process, the order in which

studies are performed, as well as the construction of the therapeutic pathway (Fig. 2).

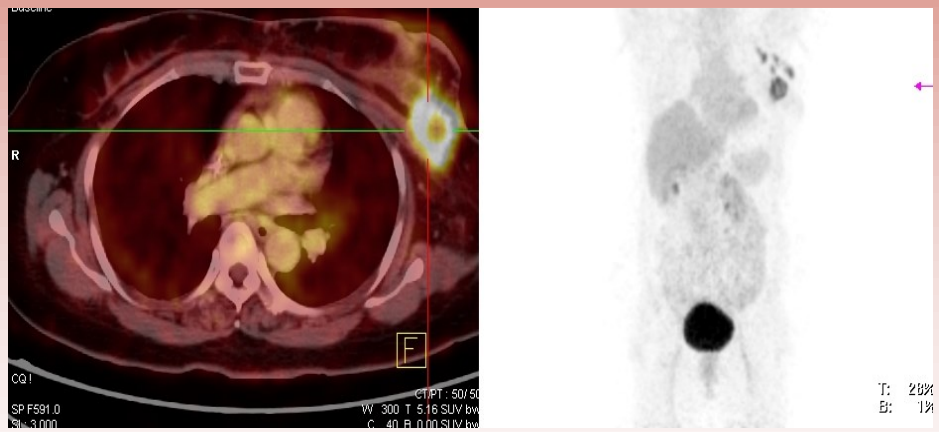

FIG.2: Female 62, with recurrence of breast cancer; PET shows an area of increased uptake in the LEFT breast. The CT cannot characterize the nature of the lesion. The combined PET / CT can locate recurrence and ensure that there is no bone extension thus changing the treatment option.

D. Key Technological Advancements of Molecular Imaging and Their Clinical Utilization

D.1. PET/CT Scanning

PET produces a three-dimensional picture of functioning processes in the human body, allowing for the evaluation of tissue metabolic activity. In PET a positron emission radionuclide or tracer able to track a specific biologic process at molecular level is injected into the patient. As these radioactive tracers decay, they emit positrons, which are then detected using a PET scanner. The resulting images will help distinguish between normal and abnormal cellular/molecular activity.

Positron emitters are radionuclide's like fluorine-18, carbon-11, oxygen-15 and nitrogen-13, which in their non-radioactive state are normal constituents of all biologically active molecules (fluorine is a suitable substitute for hydrogen) and are therefore potentially suitable to label any molecule without altering its metabolic pathway.

A simple way to describe the tumor growth process is that tumor need to divide, multiply and invade the neighboring structures or tissues and spread to distant sites, a process called metastasis. To grow and metastasize, tumors require energy and the utilization of glucose – the fuel used by the body to produce energy - provides the necessary elements for this activity. While normal cells use glucose, there is an increased consumption of glucose within tumor cells.

Labeled with fluorine -18, a glucose analogue like FDG is used as a tracer, both because flourine-18 is quick to decay, thus limiting patients' radiation exposure and because it is a natural indicator of cellular metabolic state, particularly increased in cancer cellular deposits and therefore easily detectable In diagnosing cancer with PET/

CT, the most commonly used biologically active model is F18-FDG, a glucose analogue labeled with a radioactive element, the positron emitter fluorine-18, which allows the evaluation of glucose metabolism in normal and abnormal cells.

D.2. Role of PET/CT in Cancer management

The introduction of FDG-PET (Fluorodeoxyglucose-PET) has definitively changed the therapeutic approach to patients with non small lung cancer (NSCLC) [I-11] (Fig. 3) and plays a major role in the initial evaluation of other tumors such as lymphomas [12], nasopharyngeal carcinomas [I-13], carcinomas of the uterus and cervix [14] (Fig. 4), and gastrointestinal stromal tumors (GIST) [15].

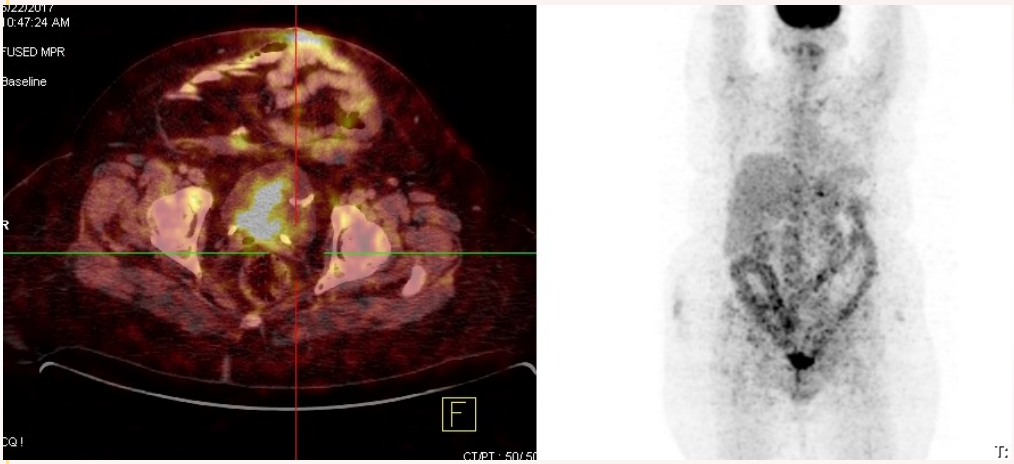

Fig. 3. Female 43 years old, with Ovarian Cancer who had a PET/CT study to evaluate restaging post treatment (surgery & chemotherapy).

It is also currently used for the detection of distant diseases in head and neck, colorectal, ovarian and small cell lung cancer as well as in locally advanced breast cancer and melanoma. Besides determining the stage, initial PET/CT can be used to assess the degree of FDG avidity of the tumors. It has been shown that in several tumor types the intensity of FDG uptake is correlated to the aggressiveness of the tumor [16]. In other tumors, such as lymphomas, particularly low-grade non-Hodgkin lymphomas (NHL) or GIST, it is important to evaluate the uptake intensity before treatment. In fact, some of these tumors are not FDG avid and consequently FDG-PET is not useful for evaluating treatment responses or detecting recurrence. In these cases it is important to use other radiotracers.

There is evidence that complete disappearance of FDG uptake during the early course of treatment of lymphomas independent of the presence of residual tumors on computerized tomography (CT) is an excellent indicator of favorable prognosis [17]. Persistent FDG uptake, on the other hand, indicates poor response and consequently a

high risk disease that might need more aggressive treatment. Similar observations have been made in other tumors, in particular NSCLC [18].

On the other hand, many oncologists tend to no longer administer complementary radiotherapy in young patients with complete metabolic response, as assessed by PET/CT, after chemotherapy of Hodgkin's disease, especially in female patients with mediastinal involvement, to avoid late second cancers. These medical practitioners adopt the principle of precaution, because - despite the great improvements of external beam radiation therapy in recent years - the incidence of unilateral or bilateral breast cancer is significantly increased in patients having previously been treated with radiotherapy for Hodgkin's lymphoma.

D.3. Assessing Tumour response to therapy

Advances in the understanding of tumor biology have allowed for identifying targets involved in tumor proliferation, invasion and metastases that are addressed by newly developed drugs. These treatments are expensive and often have substantial toxic effects. It is therefore important to have tools to identify those patients who might benefit from treatment at an early stage. Tumor volume measurements using conventional tools like CT scanning sometimes may prove inaccurate because volume changes do not occur early enough. In some instances tumors might even grow initially in spite of responding to the treatment.

Nuclear medicine methods allow imaging and quantifying of the functional state of the tumor and therefore offer excellent surrogate markers of early response assessment [I-19]. Again, the most frequently used method today is FDG-PET. Several studies have shown a rapid decrease of FDG uptake in cancer cells after treatment with small molecule inhibitors of tyrosine kinase. A relationship between FDG uptake decrease and selective inhibition of oncogenes has also been shown.

The first tumors in which the relationship between FDG accumulation and treatment response was used to guide therapy were GIST treated by the tyrosine kinase inhibitor imatinib, a drug with distinct target specificity. Dramatic decrease of FDG uptake was observed in these patients within the first days after the start of treatment. However, as soon as FDG uptake was no longer blocked, the treatment appeared no longer efficient necessitating either an adjustment of the dose or a change of the inhibitor.

This model has since been translated to other molecular therapies targeting specific processes at cellular/tissue level; in particular epidermal growth factor inhibition and inhibition of angiogenesis. These treatments have

resulted in improved survival and symptom control of patients with NSCLC, but failed to improve outcomes when tested in large randomized trials. These results underline the importance of possessing a tool that allows for appropriately selecting the right patients for a therapy that is cytostatic rather than tumouricidal. This is especially true because many cancers today are considered chronic progressive diseases that need continuous cytostatic treatment.

It is crucial to have methods for following these patients in order to know if they still respond to the drug, especially since these drugs need to be administered in the optimal biological dose in order to keep the balance between efficacy and side effects, usually late in development and often irreversible. In addition, due to the high costs of these new therapies, they need to be restricted to patients most likely to benefit from them. FDG -PET is the first and most widely distributed of these surrogate markers of tumor response (Fig. 5).

Other compounds are either in development stages or undergoing clinical testing. These include markers of cellular proliferation (F-18 fluorothymidine), amino acid transport (F18-fluoroethyltyrosine) or angiogenesis, i.e. production of new vascular tissue to ensure blood supply to the tumor. Such markers may ultimately not only serve to monitor targeted tumor therapy but also to assess target expression and heterogeneity, in order to select the most appropriate treatment for the individual patient.

Flourine-18 labeled radiopharmaceuticals and radiolabeled peptides [20] also play an important role in the management of patients with neuroendocrine tumors. These peptides mostly target somatostatin receptors over expressed by these tumors. They may be labeled with single photon emitting nuclides such as indium-111 or the positron emitter gallium-68. This radionuclide is particularly interesting because it is a generator product and therefore available when needed even in centers not equipped with a cyclotron. PET-images obtained with such gallium-68 labeled peptides are normally of superior quality because of the very low background in normal tissues (except kidneys and spleen), that allows the revealing of sub centi metric lesions as long as the receptor density is elevated [21].

D.4. Radioguided Minimally Invasive Surgery using SPECT/CT

The increase in the detection of occult lesions has led to the development of new localization methods using radiopharmaceutical products. The use of these products can be used to perform a "thrifty" (less-aggressive) surgical excision and, to simultaneously carry out the biopsy of the sentinel node in cases, for example, of breast cancer.

Many studies clearly show the advantages of the Radioguided surgery method i.e. its effectiveness and attractiveness to surgeons. The sentinel node technique as well as the improved localization on fused SPECT-CT imaging [22] has stimulated the interest of surgeons in radioguided surgery beyond sentinel node dissection.

SPECT-CT has proven to be very helpful in precisely identifying sentinel nodes especially in malignant melanoma of the trunk and head and neck area where drainage is much less predictable than in the breast area or in mel-anoma of the limbs. Somatostatin analog uptake may be localized intra operatively in non-enlarged lymph nodes as well as in the pancreas where no definite nodular structure had been identified preoperatively.

It is routinely used in many centers for minimal invasive resection of parathyroid adenomas. It may also be very helpful in identifying residual tumor bearing neck nodes after a previous neck dissection for thyroid carcinoma. Looking to the future, nuclear medicine is now beginning to experiment with radioguided minimally invasive surgery and PET probes are currently being developed, besides gamma probes, to take advantage of the high contrast of PET radiopharmaceuticals [23].

D.5. Targeted Radionuclide Therapy

Radionuclide therapy is the treatment of diseases by intracavitary, intravenous, oral, or other routes of administration of sealed and unsealed radiopharmaceuticals and is characterized by the selective delivery of radiation doses to target tissues and by limited toxicity and few long-term effects. The treatment may be systemic or applied loco-regionally. In the first case, it combines the advantage of being selective like external beam radiotherapy or brachytherapy with that of being systemic like chemotherapy. The basis of successful radionuclide therapy is a good and selective concentration and prolonged retention of the radiopharmaceutical at the tumour Site.

Nuclear medicine offers the unique possibility to study distribution, uptake and biokinetics of trace amounts of the compound labeled with a single photon or positron emitter before using it for therapy after labeling with a beta emitter. Dosimetry has made great progress recently with the widespread availability of SPECT coupled or not to CT (SPECT-CT) that allows one to precisely compute three-dimensional radionuclide distribution over time, as well as volume measurements of tumors and normal organs [28].

D.6. Bone pain palliation in metastatic cancers using radiopharmaceuticals

Radionuclide bone therapy refers to the treatment of bone metastases using specific tumour seeking radiopharmaceuticals. Unlike radionuclide tumor therapy, where the radiopharmaceutical is incorporated into or fixed to the tumor cell, this form of bone therapy targets the reactive osteoblastic reaction in the normal bone directly adjacent to the metastasis, which is generally the cause of pain [24]. Bone therapy can also include the treatment of primary bone tumors', e.g. osteosarcoma, where the bone-seeking radiopharmaceutical behaves like a tumor-seeking agent, targeting the tumor-produced osteoid of not only the primary tumor and its skeletal metastases, but also the extra-osseous metastases. Finally, it should be mentioned that palliative therapy of painful bone metastases with samarium-153 lexidronam [25] or strontium-89 chloride [26] offers complete or partial pain relief to a majority of patients with diffuse bone metastases, in particular from prostate cancer, and can substantially improve the quality of life of these patients.

D.7. Radiolabeled peptides

Radiolabeled peptides are not only used for diagnosis, staging and follow-up but also for the treatment of patients with neuroendocrine tumors. Labeled with yttrium -90 or lutetium-177, somatostatin analogs have been widely used for targeted radiotherapy [I-27]. Even if these tumors are not very radiosensitive, remarkable therapeutic effects have been obtained. While complete responses are only rarely observed, most patients experience stabilization of their disease, often for prolonged time periods, as well as disappearance/improvement of neuroendocrine symptoms. These treatments are well-tolerated and can be repeated several times, though the dose to the kidneys, as the critical organ, must be closely monitored to avoid delayed kidney failure.

The example of somatostatin analogs in neuroendocrine tumors is in line with the long experience of nuclear medicine in imaging and the efficient treatment of benign and malignant thyroid disorders. Other therapeutic applications include the treatment of NHL with iodine-131 or yttrium-90 labeled monoclonal antibodies directed against the CD20 or CD22 antigens of B-cells [29]. A single administration of the yttrium -90 labeled ibritumomab tiuxetan in a consolidation setting after first-line therapy of follicular NHL has shown a high conversation rate of partial to complete, including molecular, response and an approximately two years prolonged progression free survival in comparison with the corresponding group of controls.

D.8. Radionuclide therapy with Alpha emitters

Another approach is to target isolated tumor cells and preangiogenic micro metastases with monoclonal

antibodies labeled with alpha emitters such as bismuth-213 or astatine-211[30]. Targeted high-LET (Linear Energy Transfer) alpha-emitting antibodies offer significant potential advantages in the treatment of diffuse micro metastatic or small volume disease. The interest in alpha-emitters is predicated on the extreme high radio toxicity of alpha particles. For example, it requires only 1-5 alpha particles passages through a cell nucleus to inactivate a tumor cell in contrast to several thousand for the same level of cell kill using a beta source. This is extremely attractive when working with isolated cells, or micro metastases where the amount of targeting may be extremely small, or when using antibodies e.g. M195, for which there is only a limited number ($5{\cdot}10^4$) of antigens per cell.

Further, the very short range of alpha particles (< 90 Nm) means that a larger portion of the radiation energy will be deposited in the tumor cells, effectively sparing normal tissues. Promising results have been obtained in leukemia or in bone marrow ablation [31] or, after intraperitoneal administration, in ovarian carcinoma [32], but most of these therapies are still experimental and need further confirmation and research.

D.9. Radiotherapy Planning

More recently, a new potential use of PET/CT has been suggested and evaluated, namely its use as an aid to the treatment of cancers using external radiation beams [I-33]. Indeed, during radiotherapy planning FDG-PET/CT has been shown to be useful to better delineate the biologically active tumor volume.

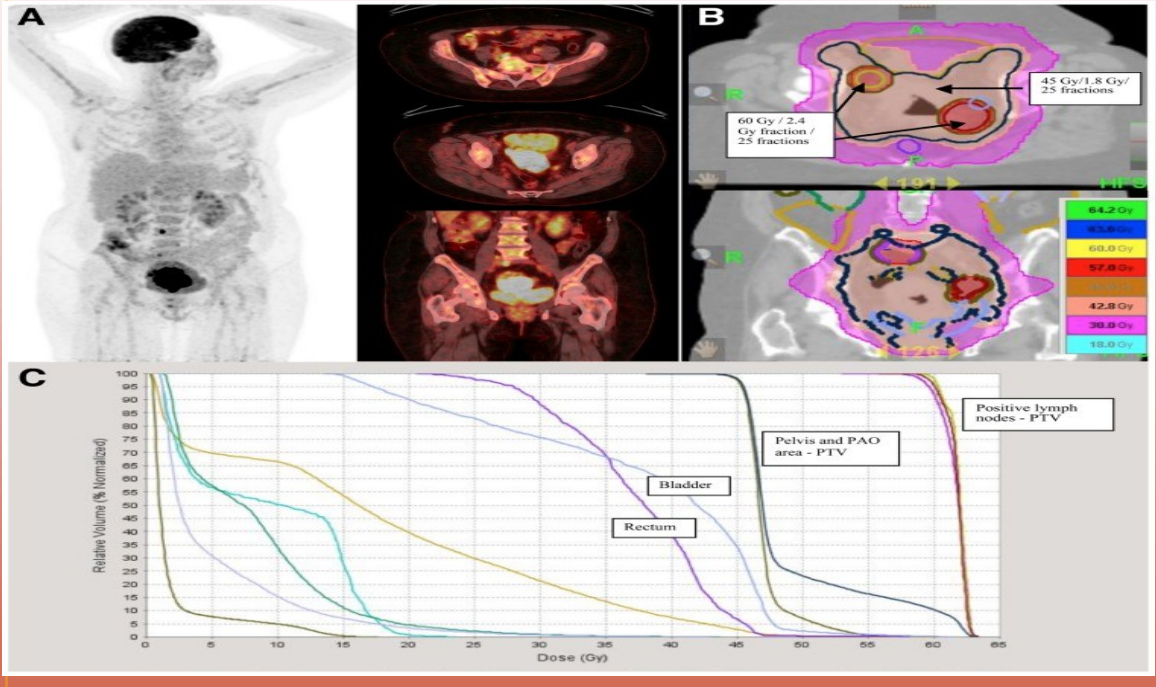

Fig.4. Planning for radiotherapy fields based on images from PET/CT in a patient with advanced-stage lung carcinoma.

To study brain tumors [34], FDG is most often replaced by either carbon-11 or flourine-18 labeled amino acids, as FDG is normally concentrated in the normal brain and therefore is less adequate for distinguishing tumor tissue from normal structures. PET also serves to demonstrate the poorly perfused, partially necrotic central parts of the tumor that might need an additional boost as hypoxia is known to decrease the efficacy of radiation. Several publications address the question of imaging hypoxia [35] before and during external beam radiotherapy to adapt the dose to the changing conditions. These are interesting approaches that are also attempting to tailor the treatment to the individual patient's needs in order to improve tumor control, while diminishing toxicity to normal surrounding structures and acute and late side effects. However, long-term results are not yet available to definitively evaluate the outcome i.e. the therapeutic efficiency or toxicity of these approaches.

Conclusion

The key technological innovation of nuclear to molecular is utilization of PET-CT molecular imaging into advanced imaging and is in the interrogation of biologic processes in the cells of a living subject in order to report on and reveal molecular abnormalities that form the basis of disease. This is in stark contrast to the classical form of diagnostic imaging where documented findings show the end effects of these molecular alterations typically via macroscopic and well-established gross pathology. Molecular imaging includes the field of nuclear medicine along with various other fields that together offer an array of different strategies to produce imaging signals.

Whereas nuclear medicine uses radiolabeled molecules (tracers) that produce signals by means of radioactive decay only, molecular imaging uses these as well as other molecules to image via means of sound (ultrasound), magnetism (MRI or magnetic resonance imaging), or light (optical techniques of bioluminescence and fluorescence) as well as other emerging techniques. Molecular imaging with radiolabeled tracers along with PET/CT and SPECT/CT currently plays a pivotal role in the management of patients with cancer. It assists in choosing the most appropriate therapy by refined staging, it evaluates the response to both chemotherapy, be it cytotoxic or cytostatic, and radiotherapy, and finally it contributes to the early detection of recurrence.

Furthermore, molecular imaging with PET/CT and SPECT/CT will strengthen personalized medicine by better characterizing the extent, the biological features and the response of the tumors. Intra-operative probes assist minimal invasive surgery for the removal of sentinel nodes and tumor-involved structures, which may present unremarkable morphological changes.

In addition, it offers efficient treatment by targeted radiotherapy of thyroid diseases, neuroendocrine tumors and non-Hodgkin's lymphoma as well as pain palliation in patients with diffuse bone metastases. New approaches with alpha particles are also under investigation

Finally, the use of PET-CT for the definition of biological tumor volumes and "dose painting" in radiotherapy planning holds promise for less toxic but more efficient tumor control, although long-term confirmation is stil required

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GLOBAL NUMBER OF MEDICAL PHYSICISTS, ITS GROWTH 1965-2015 AND PREDICTIONS FOR THE FUTURE

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I. INTRODUCTION

Medical physicists have a very important role in contemporary medicine, mainly associated with the safe and effective clinical application of various medical imaging and radiotherapy equipment. This way it is only natural to see the growth of the number of medical physicists with the increased use of this equipment.

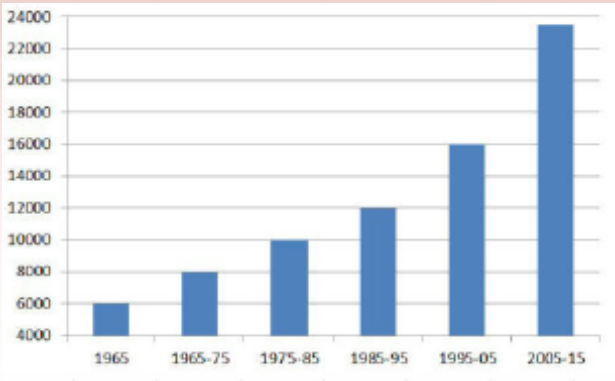

Fig.1 Growth of medical physicists globally in the period 1965-2015 – per decade (IOMP data)

Medical physicists work mainly in hospitals, but also in Universities, Research Institutions, Regulatory bodies, Industry, etc. Due to this reason it is possible to only estimate the global number of medical physicists at the time. However, the data from various medical physics societies, collected by the International Organization for Medical Physics (IOMP), presents a good source for this purpose. The IOMP archive data on Fig.1 shows the growth of the profession in the past 50+ years.

II. GLOBAL NUMBER OF MEDICAL PHYSICISTS 1965-2015

The history of IOMP has been subject of previous publications [1, 2]. For the purposes of this paper we shall make a brief summary here below. IOMP has been formed in 1963 by 4 National Organisations – from the UK, USA, Canada and Sweden. In the next two years new Medical Physics Societies joined the Organization – namely from East Germany (DDR), Hungary, Israel, Poland and South Africa. As per the IOMP data, around the time of IOMP formation there had been about 6,000 medical physicists globally. Outside this statistics would be the small number of professionals in countries where medical physics societies had not yet been formed, as well as non-members of national societies, hence it would not be possible to have a more accurate number of the medical physicists globally at this period.

Further, IOMP data shows that during the first decade of the Organization (1965-1975) the global number of medical physicists (members of national societies) increased to about 8,000. During this period new national societies joined IOMP – namely: West Germany, Brazil, Finland, France, Greece and Mexico. In the next decade 1975-1985 the global number of medical physicists (members of national societies) increased to about 10,000. During this period the new national societies joining IOMP are from: Netherlands, New Zealand, Ireland, Norway, Italy, Japan, Spain, Austria, Belgium, Denmark, India, Switzerland and Thailand. The growth of approximately 2,000 professionals per decade continued also in the next period 1985-1995, when the global number of medical

physicists (members of national societies) increased to about 12,000. This was a very active decade for IOMP, with 30 new member societies joining the Organization (one is uniting two existing societies – Germany). The new national societies joining IOMP in this decade were from: Nigeria, People's Republic of China, Columbia, Turkey, Australia, Hong Kong, Philippine, Sri Lanka, Malaysia, Cyprus, Argentina, Bulgaria, Ghana, Republic of Korea, Romania, Yugoslavia, Tanzania, Germany (united); Moldova, Pakistan, Russia, Slovenia, Sudan, Trinidad & Tobago, Algeria, Indonesia, Iran, Jordan, Panama, Venezuela, Zimbabwe. This way about 30 years after the formation of IOMP the global number of medical physicists doubled. The period 1995-2005 included 18 new member societies to the IOMP family – namely from Cuba, Estonia, Georgia, Lithuania, Morocco, Ukraine, Zambia, Ecuador, Portugal, Bangladesh, Chile, Egypt, Nepal, Republic of Taiwan, Singapore, Uganda, Mexico and Mongolia. However in this period the growth per decade doubled (to 4000) and by 2005 the global number of medical physicists reached about 16,000. This period also marks extensive development of medical physics education and training. Many countries established new MSc (or related) University courses. For example, after the International Conference in Medical Radiation Physics Postgraduate Education (Budapest, 1994, [3]) almost all countries from Eastern Europe developed their own medical physics education courses. This period was the introduction of e-learning in medical physics (www.emerald2.eu) and the opening of a number of educational web sites [4]. Obviously this has influenced the professional growth. This argument is supported by the developments in the next decade.

The strong emphasis on education and training continued also in the decade 2005-2015 [5]. The number of new member societies joining IOMP in this period was relatively small, from: Croatia, Cameroon, Czech Republic, Arab Emirates, Macedonia, Lebanon, Peru, Qatar, Saudi Arabia, Vietnam and Iraq. However the global growth of medical physicists was the largest so far – an increase of around 8000 per decade. During 2016 the global number of medical physicist reached 25,000. During 2005-2015 we had again a double increase of the number of medical physicists globally. This way about 50 years after its establishment IOMP data shows more than quadrupling of medical physicists globally. During this period the strongest growth of the profession was in Asia (now over 130% increase) and this was supported by many Educational Workshops - including two large ones, satellite to the World Congresses in Sydney and Seoul (focused on establishment of MSc courses).

As a further argument for the importance of education/training for the profession, we have to underline that half of all medical physicists are from USA and UK - members of the AAPM and IPEM – the largest medical physics societies with best developed education, training and professional development. During the 2005-2015 decade

e-learning in medical physics developed very strongly and availability of teaching materials through Internet supported many colleagues from low-and-middle income countries [5]. These colleagues also received strong support from the ICTP International College on Medical Physics, where in the period after 1999 about 1000 medical physicists from 82 such countries passed intensive courses [6]. The ICTP College became a place where new lecturers in medical physics were trained. All these colleagues received free e learning and other teaching materials, which had allowed them to start courses in their own countries. Currently about 20 new MSc courses have been established by graduates of the ICTP College. This was also supported by the IOMP Model Curriculum and the special IAEA Guides on education and training.

III. CURRENT GLOBAL DISTRIBUTION OF MEDICAL PHYSICISTS AND PREDICTIONS OF THE GLOBAL TASK FORCE ON RADIOTHERAPY FOR CANCER

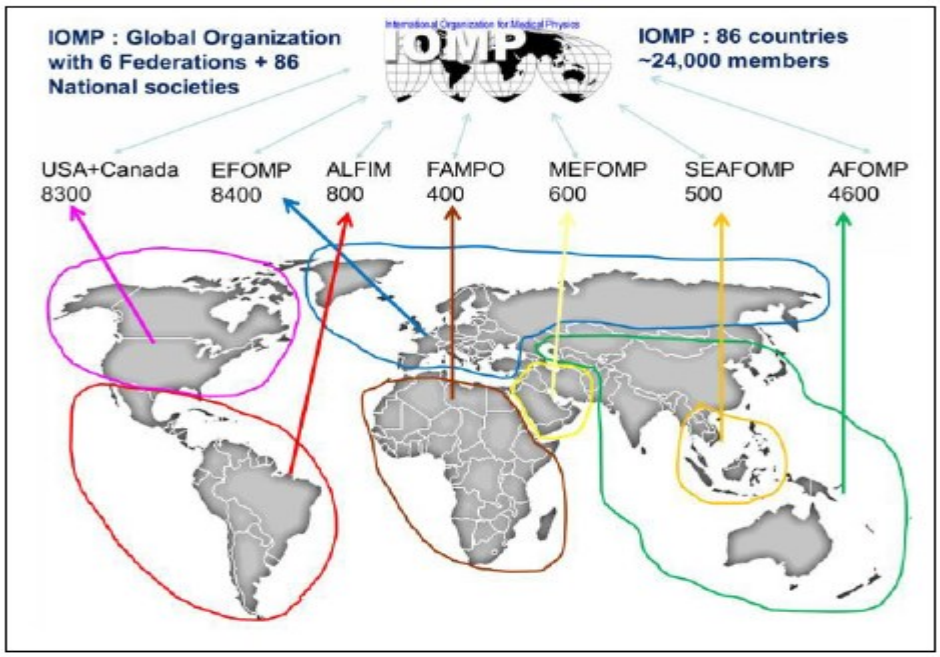

Fig. 2 Approximate number of medical physicists in the world in 2015 – IOMP data per Federation/Regional Organizations

The approximate distribution of medical physicists around the world is quite uneven, as shown in Fig. 2, where the number is shown per IOMP Regional Organisations (Federations, formed by IOMP to support the profession in their continents/regions). Obviously additional work is necessary to support the increase of medical physicists in Latin America, Asia and Africa in particular. A number of projects are supporting the professional development in these continents, especially through the IAEA, which developed packages of materials and Guides for education and training courses [7]. To help with the dissemination of education, training and professional related information, IOMP launched in 2013 a special free online e- Journal Medical Physics International (www.mpijournal.org), which quickly established itself as one of the most accessed Journals in the profession. Currently the MPI Journal web site has between 10000 and 23000 visits per month (the original data of this paper is from the Dec 2016 issue of MPI). Further, IOMP formed in

2015 a new body – Regional Coordination Board, aiming to assist the international coordination of the efforts for harmonised development of the profession. The Board includes the leads of all Regional Organisations (Federations) of IOMP and the largest medical physics societies. The Board has held several meeting and has supported a number of joint activities [Fig.3]. These concerted activities will be very important for the coming two decades, where we shall have to expect further very strong increase of the global number of medical physicists. The recently published report [8] of the Global Task Force on Radiotherapy for Cancer estimates that, only for the needs of Radiotherapy by 2035, the global number of newly trained medical physicists will be of the order of: 17,200 (for High-income countries); 12,500 (for Upper-middle-income countries); 7,200 (for Lower-middle-income countries); 2,400 (for Low-income counties). Adding the needs for medical physicists contributing to Medical Imaging (there is a current project about this at the moment) will result in approximately tripling the global number of medical physicists in the next two decades (2015-2025 and 2024-2035). Without doubt an important role in the increase of medical physicists will have the recent achievement of IOMP (under the IUPESM) – the listing of occupation "medical physicist" is the ISCO-08. This international recognition of our profession by the International Labour Organization (ILO) as an unique occupation will be of great help in countries where the profession had not been recognised in the past [9].

IV. CONCLUSION

The huge challenge of significant increase of the number of medical physicists in the next two decade, discussed in the previous paragraph, will need special attention and actions. In the first place this will be the further development of education and training – something of special importance for a dynamic profession such as medical physics. We as profession will need to specially emphasize activities as sharing teaching expertise and materials, developing of new e-learning activities and more effective education methodologies [10].

Fig. 3 Regional Coordination Board meeting at ICMP Bangkok, 2016 – IOMP ExCom plus some of the leads from IOMP Regional Organisations

Another very important action is continuing discussions in all IOMP Regional Organizations on the subject – such as Topical Conferences, Workshops and other activities – for example the successful IOMP School, launched in 2016 at ICMP in Bangkok will be also organised at the AOCMP 2017 in Jaipur and the WC2018 in Prague. Further this can be supplemented by the establishment of Regional Training Centres, what would be of great help especially for smaller countries. The activities of

ICTP can be used as a model in such development, while IAEA has several projects in this direction. Today it is impossible to even imagine contemporary medicine without the sophisticated Medical Imaging and Radiotherapy equipment. Due to this reason, when the high-level UNESCO World Conference "Physics and Sustainable Development" (Durban, South Africa, 2005) discussed the main topics of applied physics in the 21st century, one of the highlighted topics was "Physics and Health"(Presented by IOMP). This year the question will also be discussed at the WHO Fourth Global Forum on Human Resources for Health. This way increasing the medical physics workforce is not simply a professional need, it is also of main importance for the development of global healthcare. This importance will be also underlined in the newest IOMP project "History of Medical Physics" [11]

The current 17th Asia-Oceania Congress of Medical Physics (AOCMP 2017), which takes place together with the 38th Annual Conference of the Association of Medical Physicists of India (AMPICON) in Jaipur, India (4 -7 November 2017) are some of the important steps ahead in our professional growth.

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A

The Activities and Roles of AFOMP

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President, AFOMP, Organization of AFOMP

Asia–Oceania has a diverse cultural, social, educational, and economical background. Around 60% of the world's population resides in Asia and Oceania and speak hundreds of languages and dialects. Geographically, Asia comprises five sub-region, North East, South East, Central, South, and Middle East. Currently, the AFOMP includes Oceania and sub-regions of Asia: Middle East and South East organize the MEFOMP and SEAFOMP separately as one regional organization IOMP, similar to the AFOMP.

The Asia–Oceania Federation of Organization for Medical Physics (AFOMP) was formed to act as one of the regional branches of the International Organization of Medical Physics (IOMP), and was announced in July 2000 during the Chicago World Congress on Medical Physics and Biomedical Engineering (WC 2000). The formation of the AFOMP aims to provide a solid platform for close collaboration and mutual support among its members, particularly in the promotion of education and training, standard of practice, and professional status of medical physicists in its affiliated regions. Furthermore, the AFOMP aims to facilitate and encourage cross-regional collaboration and interaction on every aspect of medical physics, These are the current AFOMP officers and the former Presidents of the AFOMP.

There are 19 countries associated with the AFOMP. MEFOMP countries will be also members of AFOMP soon.

Nation	Organization	Nation	Organization
Australia	ACPSEM	Mongolia	MSMPI
Bangladesh	BMPA/BMPS	Nepal	AMPN
Hong Kong	HKAMP	New Zealand	ACPSEM
India	AMPI	Pakistan	POMP
Indonesia	IMPA	PR. China	CSMP
Vietnam	VAMP	Philippines	POMP
Japan	JSMP	China (Taiwan)	CSMP
Korea	KSMP	Singapore	SMPS
Malaysia	MAMP	Iran	IAMP
Thailand	MPCT		

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AFOMP activities The AFOMP is involved in several activities. The main activities are annual official congress (AOCMP), publication of Policy statement, AFOMP newsletter, AFOMP website, and the AFOMP official journal.

1) **The Asia-Oceania Congress of Medical Physics (AOCMP)** - One major role of the AFOMP is to hold the AOCMP every year. It has been held 16 times since the first one, which was held in Bangkok, Thailand, in 2001. The 17th AOCMP will be held in Jaipur, India in 2017. There were several memorable and traditional events in the AOCMP.. In particular, the AOCMP meetings were held in conjunction with sub-regional organization of AFOMP such as South East of Asia Congress of Medical Physics (SEAFOMP) or the Korea-Japan Joint Meeting on Medical Physics (KJMP).

Year	City	Nation
2001	Bangkok	
2002	Gyeongju	
2003	Sydney	
2004	Kuala Lumpur	
2005	Kyoto	
2006	Seoul	
2007	Huangshan	
2008	Ho Chi Minh City	

Year	City	Nation
2009	Chiang Mai	
2010	Taipei	
2011	Fukuoka	
2012	Chiang Mai	
2013	Singapore	
2014	Ho Chi Minh City	
2015	Xi'an	
2016	Bangkok	

2) AFOMP Policy statement One of the main activities of the AFOMP has been to develop the AFOMP policy statement. Five AFOMP policy statements have been developed thus far. Some of them were published in the Australasian Journal of Physics & Engineering Science in Medicine (APESM), which is one of the official journals of the AFOMP.

Policy Statement

1 The roles, responsibilities and status of the clinical medical physicist in AFOMP

2 Manpower requirement for radiation therapy physicists

3 Recommendations for the education and training of medical physicists in AFOMP countries

4 Recommendations for continuing professional development systems for medical physicists in AFOMP countries

5 Career progression for clinical medical physicists in AFOMP countries

3) AFOMP - The first issue of the AFOMP newsletter was published by Tae Suk Suh, the former editor as an e-version in december 2007. The format and contents of the AFOMP newsletter have been improved by a new

editor, Arun Chougule, who has been in appointment since 2013.

4) AFOMP website – The AFOMP website was initially developed in 2007, improved several times, and, recently, newly designed by a professional company, making it ready for use. The current AFOMP website will be totally updated to improve many functions and utilize new IT technology soon. Many colleagues have made great contributions by volunteering as AFOMP webmasters.

5) AFOMP official Journals – Three journals have been officially endorsed by the AFOMP: the Biomedical Imaging and Interventional Journal (BIIJ), Australasian Physics & Engineering Science in Medicine (APESM), and Radiological Physics and Technology (RPT).

Medical Physics in AFOMP region –There is a shortage of medical physicists worldwide, especially in the Asia region. The reason for this is that there are fewer education and training programs for medical physicists in Asia. The most difficult part of medical physics is in the area of clinical training. Therefore, there were fewer qualified medical physicists and more transfer of qualified medical physicists to more advanced countries. The lack of recognition of the medical physics standards of practice is a common issue problem in many Asian countries. Most of the Asian countries do not have accreditation or certification systems for the medical physicists. The IAEA data for Asian countries with educational, clinical training, and proper accreditation process in the field of medical physics shows that most parts of Asia do not have clinical trainings or accreditation programs. The work of Education in of medical physics in the Asian region has been supported by the IAEA or the IOMP. The most clinical centers placed in the Asian region cannot afford the time and investment in the clinical training of physicists. A joint approach with regional professional bodies has fostered clinical and scientific meetings to encourage clinical practice and to transfer skills and maintain communication among between professionals. One example was the UNDP project supported by the Korean FDA. The UNDP projects provided a one-month clinical training opportunities in Korea to medical physicists in developing countries in Asia. The IAEA also provided many clinical training programs to the medical physicists in Asia through various types of projects.

Medical Physics professional avenues and challenges – The role and status of medical physicists in the AFOMP region has gradually improved and is being recognized by related societies. However, the importance of medical physics and necessity of accreditation have not been recognized by the governments or general public yet. A well-prepared strategy and a strong action plan are crucial for the AFOMP to move forward. First, the AFOMP should provide its members with many opportunities to strengthen the educational, training, and professional

development of medical physicists through specially designed programs. AAPM has designed special workshops to support medical physics in Asia for several years. The AFOMP will take steps to encourage such special workshops within the AFOMP.

Second, the AFOMP should promote research and quality of knowledge through the international congress or scientific journals. As discussed before, there are three official AFOMP journals. The well-known medical-physics -related journals such as "Medical Physics" and "JACMP" are the official journals of the IOMP. Recently, Physics Medical, an EFOMP official journal, is also being considered to be regarded as an official journal of IOMP. The official AFOMP journals should become the official IOMP journals in near future.

Third, the AFOMP will share information about useful publications, libraries, and data with the IOMP, IAEA, WHO, etc. One of the possible approaches is to utilize sharing networks such as online access to medical physics journals or the HINARI libraries supported by the WHO. In order to provide medical physicists in the developing countries easy access to medical physics related journals, the IOMP professional relation committee (PRC), and publication committee (PC) have found out how HINARI can be accessed, and subsequently inform physicists in the developing countries about its usage, and encourage editors in national or regional journals of medical physics to join HINARI.

Fourth, the AFOMP should promote guidelines of practice standards and accreditation for medical physicists in the AFOMP region while supporting the AFOMP members with regard to legislative and regulatory issues in collaboration with the IMPCB and IAEA. One of main roles of the IMPCB is the accreditation of national medical physics certification boards. In 2015, the IMPCB accredited the certificate Board in Korea and Hong Kong for the first time. The AFOMP will support the AFOMP countries for preparing them for accreditation from the IMPCB.

Fifth, the AFOMP will promote a strong relationship and exchange of information with sub-regional organizations in Asia– Oceania such as Far East Asia, South East Asia (SEAFOMP), South Asia, Central Asia, Middle East Asia (MEFOMP), and Oceania.

Sixth, The AFOMP should develop a close relationship with international bodies such as the IOMP, IAEA, WHO, and IMPCB to organize projects, events, and important meetings. To raise awareness of our profession, the IOMP announced Nov. 7 as the International Day of Medical Physics (IDMP). This is an excellent opportunity to promote the role of medical physicists in the world. The AFOMP countries have organized many events for the IDMP since the initiation of IDMP in 2015.

Celebration of 5th International Day of Medical Physics (IDMP) ,November 7, 2017

"Poster competition on Biography of Marie Curie-Sklodowska" ,

Nupur Karmaker and Rashed Al Amin , Dhaka,Bangladesh

Introduction: Since 2013, International Organization of Medical Physics (IOMP) has celebrated the International Day of Medical Physics in the birthday anniversary of Marie Curie to respect her contribution on medical physics. In this year, IOMP announced the "Celebration of 5th International Medical Physics day", on 7th November, 2017. The theme is "Providing a Holistic Approach to Women Patients and Women Staff Safety in Radiation Medicine" as a special issue in the 150th birth anniversary of Maria Curie-Sklodowska. In different parts of the world, every medical physics society celebrates this special day for highlighting the life of Marie Curie and her scientific achievements on the discovery of radioactivity that impacts hugely on various developments of medical physics. Bangladesh Medical Physics Society (BMPS) was formed for professional and educational development in medical physics, promote awareness, and create professional position in government hospitals and research institute. From 2009, BMPS has been arranging annual conference, international conference (after every 3 year), lots of seminars, workshops to motivate young medical physicist and women in medical physics. Every year several activities were done for the celebration of IDMP. BMPS has started IDMP activities from the beginning of the year till 7 November 2017. In this year, BMPS arranged a poster competition on "Biography of Marie Curie" to respect her outstanding performance and contribution of medical physics. This fruitful program co-organized by Department of Medical Physics and Biomedical Engineering (MPBME), **Gono Bishwabidyalay (University).** This poster competition was coordinated by **Nupur Karmaker** and **Mr. Rashed Al Amin**.

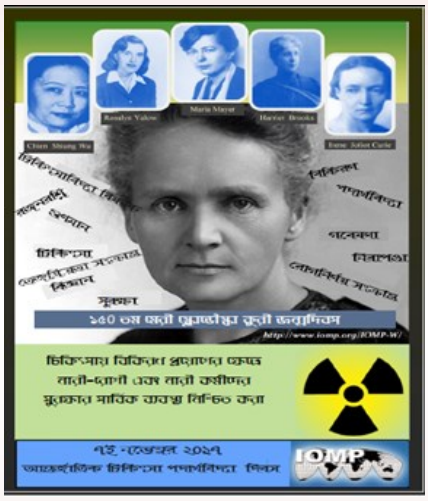

Fig 01: IDMP poster in Bangle Language

Purpose of this poster competition Purpose of this program is to develop knowledge on Marie curie and her contribution in medical physics study, engage and inspire in high quality research, gain experience in presentation of scientific papers, develop the skills in effective communication for scientific work, rise up and development of female medical physicist in Bangladesh.

Opening ceremony of Poster competition It was held on 2 PM, 10th February 2017 at Department of Medical Physics and Biomedical Engineering (MPBME), Gono Bishwabidyalay (University), Savar, Dhaka, Bangladesh. About 11 female students participated in this poster competition. The posters were displayed in the gallery. Prof. Dr. Golam Abu Zakaia, Prof. Dr. Hasin Anupama Azhari, Dr. Kumaresh Chandra Paul, Md. Akhtaruzzaman played an important role for judgment/ evolution of the poster presentation. They asked different questions and share their medical physics knowledge to students. They submitted their own evolution paper for each poster

Fig 02: Poster competition participants with judges

competitor. According to poster evolution, three posters selected for first, second and third posters.

Prize giving and Closing ceremony The titles of first, second and third posters were **"Biography of Marie Curie and her Contributions for Medical Physics" (Lubaba Azad Tasin, Jhinuk Akter and Zarin Tasnim Chowdhury)**, **"Biography of Marie Curie" (Rehana Akter** Lina and **Shamima Afroz Zisly** and "The life of Marie Curie and the Science of radioactivity"**(Jannatul Ferdous)**. Prof. Dr. Golam Abu Zakaia and Prof. Dr. Hasin Anupama Azhari have given the prize and certificate to competition winners (Fig 03). They presided and discussed the development of the medical physics study and inspire the future women medical physicists in Bangladesh.

Acknowledgement We are specially thankful to **Prof. Dr. Golam Abu Zakaria** who established medical physics subject in Bangladesh and gave us a chance to study in this field. We are grateful to **Prof. Dr. Hasin Anupama Azhari** who inspires to male and female students to keep up medical physics for the next generation and produce qualified medical physicist in Bangladesh. We express our gratitude to Bangladesh Medical Physics Society (BMPS) and Department of Medical Physics and Biomedical Engineering (MPBME), Gono Bishwabidyalay (University), Savar, Dhaka, Bangladesh and our colleagues, contributors, coordinators, judges and participants for their nice cooperation.

Fig 03: Prize giving and closing ceremony

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IDMP Celebration Report 2017,Jaipur, Rajasthan

Prof. Arun Chougule, Miss Rajni Verma
Department of Radiological Physics, SMS Medical College, Jaipur

This year the International Organization for Medical Physics (IOMP) has celebrated International Day of Medical Physics (IDMP) in Jaipur "Pink City" of India on 7 th November, 2017, the fourth day of 17th Asia Oceania Congress of Medical Physics (AOCMP) and 38th Annual Conference of Association of Medical Physicists of India (AMPICON) 2017. Every year IDMP day is celebrated as testimony of very important date in the history of Medical Physics, as on "7th November" 1867, great scientist Maria Sktodowska-Curie was born in Poland. She had discovered the phenomena of Radioactivity, which has opened gates of **Physics** to **Medicine** and with this, field of **Medical Physics** has enhanced in healthcare. Marie Curie was the only scientist to win Nobel Prizes in multiple scientific disciplines (Physics & Chemistry) in the history of Nobel prizes.

Garlanding the photograph of great Scientist Marie Curie

She is a winner of the Nobel Prize in Physics in 1903. This year's IDMP celebrations is special as we are celebrating **150th** birth anniversary of Marie Curie. So, this year IOMP has appropriately chosen the theme of IDMP day as **"Medical Physics: Providing a holistic approach to women patients and women staff safety in radiation medicine"** to recognize and appreciate the contribution of women in Medical Physics and provided the opportunity to understand and tackle the concerns and hazards of the use of ionizing radiation in healthcare from women's perspective.' This year's IDMP day celebration in Jaipur started in pink morning with inaugural ceremony by lightening of lamp and remembering almighty, it is followed by garlanding the photograph of great Scientist Marie Curie.

Lightening of lamp

After garlanding, the day started with floral welcome of our eminent guest for the day Prof. Slavik Tabakov and Prof. John Damilakis, Dr. Virginia Tsapaki. After all inaugural addresses IDMP poster was released to spread awareness among general public. This year as part of the IDMP celebrations, a series of events and lectures planned to spread awareness about Women patient and Women staff safety in Radiation Medicine. This IDMP celebration webcasted live from Jaipur along with the live webcasts from the IAEA and the WHO.

As part of celebration a public awareness rally was organised basically by female students and conference

participants were also invited to attend a rally. The rally was flagged off by Prof. Slavik Tabakov and Prof. Arun Chougule followed by balloon rising.

This rally was proven a great step to reach out to common public raising awareness about the role of Medical Physics in Healthcare as well as the contribution of Medical Physicists in Medicine especially Women Physicists. Over 400 delegates from various countries participated in this IDMP rally. The participants carried banners, posters and placards which illustrated the Physics applications in different aspects of modern healthcare and also showcased the highlights of the unspoken contributions of women Medical Physicists.

The rally went to the Albert hall, historical monument of Jaipur. The whole programme covered by local/national electronic & print media and other various forms of social media. The scientific session covering the medical education in MEFOMP, AFOMP and other regions was very well attended. The live streaming of 02 hours session

about the radiation safety of women radiation worker and the women patient was the key of this programme and is very well received across the globe.

In the end, Prof. Arun Chougule, Chairman Organizing Committee thanked all the participants for attending the conference. The valedictory function came to a conclusion with feedbacks from the participants. All the participants gave their thanks to the organizing team by standing ovation for successfully organizing the symposium with a great success.

Glimpses

A report on AOCMP-AMPICON 2017, Jaipur, Rajasthan (India)

Prof. Arun Chougule, Miss Rajni Verma
Department of Radiological Physics, SMS Medical College, Jaipur

More than 850 delegates from 30 countries attended the **"17th Asia Oceania Congress of Medical Physics (AOCMP) and 38th Annual Conference of Association of Medical Physicists of India (AMPICON) 2017"**. The congress was hosted and organized by the Department of Radiological Physics, SMS Medical College & Hospital, Jaipur, "Pink City" during 4th to 7th November 2017. The main organizing professional bodies of the conference are Asia-Oceania Federation of Organizations for Medical Physics (AFOMP) and Association of Medical Physicists of India (AMPI). This scientific event was Co-sponsored by the International Organization of Medical Physics (IOMP), American Association of Physicists in Medicine (AAPM) and endorsed by Middle East Federation of Organizations of Medical Physics (MEFOMP). This was the first time that an AFOMP annual scientific meeting held in India. The theme of the conference was "Advances in Medical Physics: Shaping the future of modern healthcare". The main aim of the conference was to promote the interdisciplinary research at global level. This resulted in participation of delegates from all the continents in the world and the total number of visitors for conference website (aocmp-ampicon2017.org) was more than 2,30,000.

This scientific event played a vital role in disseminating knowledge and discussing new avenues in Medical Physics. The conference was focused on the new emerging trends in Medical Physics, Radiotherapy, Nuclear Medicine, Diagnostic Radiology, Biophysics, Biomedical engineering, Radiobiology, Radiation safety and regulations, Medical physics training and education. In context of the theme of the conference, the following key scientific sessions were planned by the scientific committee of the conference:

Proton & Heavy ion Therapy, Modern Medical Imaging, Affordable therapy technologies, Advanced Medical Research, Monte Carlo & Special Algorithms, Latest CT Technologies Electron Beam Therapy & Special Procedures, High Tech Radiotherapy and challenges, Radiation incidents and accidents in medicine Nuclear Medicine & Radiobiology Radiological and Nuclear Emergencies Brachytherapy Modern RT Techniques & Planning , New Developments in Photon Brachytherapy, Dosimtery and Quality Assurance Materials and equipment for Research in Medical Physics Radiobio photonics & Normal Tissue Protection- A Firewall Small Field dosimetry Medical Physics Research & Biomedical Engineering Radiobiology Diagnostic Dose Reference Levels (DRLs),e-Learning resources in Medical Physics ,Medical Physics Training and Education,Female Medical Physicist: Global and Regional perspective, Radiation Protection and Imaging of Women Patients

This International conference provided a perfect forum to fulfil the objective, foster knowledge up gradation and encouraged exchange of ideas. There was a comprehensive scientific programme planned in 42 sessions including 1 Oration, 1 keynote presentation, 37 invited talks by the eminent speakers, 90 oral papers, 257

posters, 2 special panel discussions, 30 mini-symposiums talks, 12 IOMP School talks, 4 CMPI teaching talks, 13 IDMP talks, 3 Trade talks and 1 Lunch symposium. The scientific proceedings of the congress have been published in the Journal of Medical Physics (JMP) November 2017 as a dedicated special issue (available at: www.jmp.org.in)

The program started with an inaugural function which was headed by honored chief guest Dr Raja Babu Panwar, Hon'ble Vice Chancellor, Rajasthan University of Health Sciences (RUHS) presided by Dr U S Agarwal,

Welcome of delegates of AOCMP AMPICON 2017

Dignitaries on the Dias

Principal & Controller, SMS Medical College, Jaipur, India. Our guest of honor was Prof Slavik Tabakov, President IOMP and special guests for the inaugural function were Dr D S Meena, Medical Superintendent, SMS Medical College, Jaipur and Prof Tae Suk Suh, President AFOMP. This international conference was inaugurated by Dr. Raja Babu Panwar with lighting the lamp. The function started with Goddess Saraswati Vandana.

Welcome address by Organizing Chairman

This was followed by welcome address by Prof Arun Chougule, PHOD, Department of Radiological Physics, SMS Medical College & Hospital and Organizing Chairman of the event and introductory address to the participants by Dr D S Meena. A brief overview about the Association of Medical Physicists of India (AMPI) activities was given by Dr. V. Subramani, Secretary AMPI. This was followed by the release of abstract CD and Souvenir of the conference. Prof Arun Chougule, President AMPI briefed about the important milestones in his presidential remark. The AFOMP newsletter, abstract book of conference and Medical Physics Gazette were released during the inaugural function. The welcome and introductory addresses were delivered by President AFOMP and President IOMP. Thereafter, the trade exhibition was also inaugurated by Dr Raja Babu Panwar. More than 30 trade participants put their stalls to

Media coverage at Inauguration

diplay/demonstrate their equipments/products. The inaugural session ended with a tea break.

During the scientific sessions followed in four parallel session/ four halls, the speakers spoke on diverse topics in Medical Physics ranging from SBRT/ SRS, IGRT, VMAT, 4 D Ultrasound, Molecular Imaging and radiobiology. Several specific sessions have been designed to address specific issues relevant to the Indian and Asia-Pacific region and collaborative efforts with other regions (MEFOMP) and global organizations (IOMP). A session dedicated to particle therapy for cancer treatment featured participation by Japan and Europe leaders in targeted particle therapy, including Alejandro Mazal (France), Atsushi Kitagawa (Japan), Shigekazu Fukuda (Japan), Yoshinori Sakurai (Japan). A keynote presentation on 'preparedness for radiological and nuclear emergencies' delivered by Manu Thandra (India). AMPI's Dr Ramaiah Naidu Memorial Oration-2017 was delivered by PGG Kurup (India). The speakers were very happy that the audience interacted after every presentation.

Invited talk by Prof Alejandro Mazal

In the evening of Day 1 (Nov 4), the felicitation programme was arranged to honour former AMPI presidents and secretaries and present AFOMP, IOMP and AAPM office bearers who attended the conference. The felicitation was done by Dr. Raja Babu Panwar, Hon'ble Vice Chancellor, RUHS in coordination with Arun Chougule, President AMPI. The felicitation honours were bestoved on Dr. U Madhvanath (Mumbai, India), Prof. P S Negi (Punjab, India), Dr. Kanta Chokra (Mumbai, India), Dr. A S Pradhan (Mumbai, India), Prof. S K Koul (Kashmir, India), Dr. Ravi Kumar Kher (Mumbai, India), Dr. D D Deshpande (Mumbai, India), Dr. Challapali Srinivas (Mangalore, India), Dr. S D Sharma (Mumbai, India) Dr. M Ravikumar (Bengaluru, India), Prof.Tae Suk Suh (Seoul, Korea), Dr. Howell Round (Hamilton, New Zealand), Prof. Slavik Tabakov (London, UK), Dr.Virginia Tsapaki (Athens, Greece),Dr. John Damilakis (Crete,

Felicitation ceremony

Greece),),Dr. Melisa Martin (CA, USA). This was followed by the Rajasthani folk dances, art forms and music by the folk artists. They performed various folk dance forms to depict enriched culture of Rajasthan. The main dance art forms performed were Chari dance, Kalbelia, Bhawai dance, Ghoomar, Mayur, Chirmi, Banjara and Fire dance with unique combination of Shanai and Tabla rhythms. The delegates charmed with these folk dance and musical performances.

The organizers have arranged a cultural evening dedicated to the delegates to perform and showcase their traditional art forms on Day 2 (Nov 5) evening during the banquet dinner at a very beautiful and elegant hotel Haveli. This was proven an ideal step for achieving the goal of international integration and to nurture the harmony of various independent cultures when the performances performed by the participants from Korea, South Africa and India. The performances were applauded by the audience.

Rajasthan is one of the most tribally diverse, artistically decorative and architecturally magnificent regions in India. Jaipur is the capital of Rajasthan and reminder of a rich and romantic past that speaks of heroism, honor and chivalry. Jaipur is a beautiful city surrounded by many magnificent historical and natural attractions, including two of India's most famous UNESCO World Heritage Sites, the Taj Mahal and Agra Fort. There were several City tours also arranged for the delegates to visit Amber, Jaigrah, Narhargarh fort, Jal Mahal, City Palace, Hawa Mahal, Jantar Mantar, Albert hall. A full day Agra, Taj Mahel, Fatehpur Sikri Tour was arranged for the delegates after the conference on 8th November. In this manner, this conference put their effort to provide great scientific feast to delegates as well as social, cultural and tourism bonanza.

To raise awareness of Medical Physics profession, the International Organization for Medical Physics (IOMP) celebrates annually the International Day of Medical Physics (IDMP) on November 7. The day was chosen in recognition of the pioneering research work on radioactivity of Marie Sklodowska -Curie who, on that

day in 1867, was born in Poland. On 7th November 2017, 150th birth anniversary of Marie Sklodowska Curie is being celebrated as 5th International Day of Medical Physics (IDMP). This year 150th birth anniversary of Madam Marie Curie celebrated at Jaipur, India along with conference on 7th November. This year's celebration is dedicated to women with the theme "**Medical Physics: Providing a Holistic Approach to Women Patients and Women Staff Safety in Radiation Medicine**" and provided the opportunity to understand and tackle the concerns and hazards of the use of ionizing radiation in healthcare from women's perspective. As part of the IDMP celebrations, this year also we arranged a public awareness rally. A series of events and lectures were delivered to spread awareness about Women patient and Women Staff Safety in Radiation Medicine. Conference participants were also invited to attend a rally on 7th Nov. This rally was proven a great step to reach out to common public raising awareness about the role of Medical Physics in Healthcare as well as the role of Medical Physicists in Hospitals especially Women Physicists. The IDMP rally was flag hosted by Prof Slavik Tabakov, President IOMP with leaving balloons in the air. Over 400 delegates from various countries participated in this IDMP rally. The participants carried banners, posters and placards which illustrated the applications of Physics in different aspects of modern healthcare and also showcased the highlights of the unspoken contributions of women Medical Physicists. The rally went to a historical monument of Jaipur Albert hall. The whole programme covered by local/national media in regional (Rajasthani), Hindi and English languages in electronic, printed media (Dainik Bhaskar, Rajasthan Patrika, Jaipur Times, Times of India) and other various forms of social media. The key highlights of IDMP rally was telecasted on television by regional electronic media (ETV news, Zee news). The IDMP rally was live webcasted internationally by the IOMP. The most important part of this conference 'IDMP celebration with Rally' was ended with a grand success. This IDMP celebration was webcasted live from Jaipur along with the live webcasts from the IAEA and the WHO.

The closing ceremonies featured with various awards and grants to awardees including AFOMP, awards, AMPI awards, ICTP partial grants and early bird registration awards. The AFOMP Best Paper Awards for three top best paper presentations in the conference: Dohyeon Kim (Korea), Josmi Joseph (India), Naonori Hu (Japan). The award consists of Certificate of award and cash prize. The AFOMP Best Poster Award for the three top best poster presentations: Yong Jin Kim (Korea), Zakiya Al Rahibi (Australia), P. Venkatranam (India). The award consists of Certificate of award and cash prize. AMPI Best Paper Award given to Naveen Kumawat (Delhi, India). The award consists of Certificate of award and cash prize. AMPI Best Poster Award given to Deepak Shrotriya (Jhansi, India). The award consists of Certificate of award and award money. AMPI Meritorious Medical Physicist Award given to

Teerth Raj Verma (Lucknow, India). This award carry a cash prize of Rs.10000/- and a citation. AMPI Dr M S Agarwal Young Investigator Award given to S. A. Yoganathan (Lucknow, India). The award consists of Certificate of award and award money. The ICTP Partial Travel Grant awarded to five participants from OEA countries of Asia and award consist of Euro 200 each. These awards were sponsored by the ICTP. The ICTP Partial Travel grants were given to Md Hafiz Zin (Malaysia), Kanchan P Adhikari (Nepal), Md Nahid Hossain (Bangladesh), Surendra B Chand (Nepal), Jayapramila Jayamani (Malaysia). Early bird registration lucky draw winner's awards given by the organisers. First 200 Early bird registrations were selected for the lucky draw and 3 registrations were randomly selected among the lot. The winners are: Rani Maria Antony (Manipal, India), Rifa K T (Calicut, India), Shrutisikha Goswami (Guwahati, India).

Winners of AFOMP awards

ICTP Partial Travel Grant Awardees

In the end, Prof. Arun Chougule, Chairman Organizing Committee thanked all the participants for attending the conference. The valedictory function came to a conclusion with feedbacks from the participants. All the participants gave their thanks to the organizing team by standing ovation for successfully organizing the conference with a great success. We gratefully acknowledges the active participation, cooperation and support of the organizations including AFOMP, AMPI, IOMP, AAPM, ICTP and MEFOMP and all individuals involved in this conference.

Remembrance

Late Prof. Kiyonari Inamura

It was shocking news to me from his son Hidenari Inamura on 24 Nov. 2017 that Prof. Kiyonari Inamura is no more and his soul heavenly passed away on 23 Nov. 2017 after few days of hospitalization. I personally have known Prof. Inamura almost for over 2 decades and I found him very gentle, dedicated individual and human being with par excellence. His contribution to the Medical Physics is enormous and is spanned over more than 5 decades. He was the third president of AFOMP. He actively participated in almost all AFOMP meetings, IOMP meetings, Japan and Korea meetings. He was first to register for AOCMP-AMPICON 2017 & he was highly enthusiastic to participate & deliver mini symposium on "*New horizon of medical physics and synergetic effect with medical engineering and information science*" during AOCMP 2017 held at Jaipur from 4th to 7th November 2017.

Before few days to the conference, I got the message that his health is not good. However, he was hopeful to get recovered and promised that he will join the conference at Jaipur. Unfortunately that didn't happen due to ill health.

On behalf of Department of Radiological Physics, SMS Medical College & hospitals, Jaipur and Association of Medical Physicists of India (AMPI), I pray to ALMIGHTY, may his soul rest in Peace and I pray the love of God enfold his family during this difficult time to bear this irreparable loss. We will all carry on the torch he has enlightened within us with his mission for empowerment of the Medical Physics. This will be a real tribute to the greatest soul.

Dr. Arun Chougule
PHOD, Department of Radiological Physics
SMS Medical College & Hospital, Jaipur
President, AMPI
Vice President AMPI

Calendar of Events 2017-18

5 – 7 Jan 2018	**Current Trends in Radiation Medicine/Medical Physics** Karachi, Pakistan https://docs.google.com/forms/d/e/1FAIpQLSdTq-Lf6rZ3c8MKNTSva_dMmqnB6ufgyc8m1NHPY6W071Bbhw/viewform
1 – 3 Feb 2018	**Int. Conf. on Molecular Imaging and Theranostics in Prostate Cancer** Valencia/Spain http://focusmeeting.eanm.org
3 – 5 Feb 2018	**World Congress on Cancer (WCC-2018)** MGMC&H , Jaipur, India https://www.mail.nii.res.in/~cancer/index.htm
28 Feb – 4 Mar 2018	**European Congress of Radiology - Vienna** Vienna, Austria https://www.myesr.org
10 – 12 Mar 2018	**3rd International Conference on Medical Physics in Radiation Oncology and Imaging (ICMPROI)-2018** Bangladesh Institute of Administration and Management, Dhaka, Bangladesh http://www.bmpsbd-icmproi.org
20-24 April, 2018	**ESTRO 37** Barcelona, Spain events@estro.org
3 – 8 Jun 2018	**The World Congress on Medical Physics and Biomedical Engineering IUPESM** Prague, Czech Republic www.iupesm2018.org
09-10 August, 2018	**5th International Conference on Medical Physics and Biophysics** Madrid, Spain https://medicalphysics.conferenceseries.com/
23 – 25 Aug 2018	**2nd European Congress for Medical Physics** Denmark http://ecmp2018.org/
1-4 Oct 2018	**World Cancer Congress 2018** **Kuala Lumpur,Malaysia** http://worldcancercongress.org/
15 – 18 Oct. 2018	**Int'l Conference on Monte Carlo Techniques for Medical Applications (MCMA2017)** Metropolitan City of Naples, Italy https://agenda.infn.it/conferenceDisplay.py?confId=12594
26-27 Oct. 2018	2nd ESTRO Physics Workshop Science In Development
29-30 Nov. 2018	6th GEC -ESTRO Workshop Brussels, Belgium
06 Dec. 2017	Digital Health Summit Brussels, Belgium http://www.cocirehealthsummit.org
06-09 Dec. 2018	ESTRO MEETS ASIA 2018 Singapore

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World Congress on Medical Physics & Biomedical Engineering

June 3–8, 2018
Prague, Czech Republic
www.iupesm2018.org

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Czech Society for Biomedical Engineering and Medical Informatics
Member of Czech Medical Association JEP
Prague, Czech Republic

Czech Association of Medical Physicists
Prague, Czech Republic

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Main Topics

1 Diagnostic Imaging
2 Image Processing
3 Information Technology in Healthcare
4 Modelling and Simulation
5 BME and MP Education, Training and Professional Development
6 Patient Safety
7 Accreditation and Certification
8 Health Technology Assessment
9 Biosignals Processing
10 Biomechanics, Rehabilitation and Prosthetics
11 Minimum Invasive Surgery, Robotics, Image Guided Therapies, Endoscopy
12 Diagnostic and Therapeutic Instrumentation
13 Micro- and Nanosystems, Active Implants, Biosensors
14 Neuroengineering, Neural Systems
15 Biomaterials, Cellular and Tissue Engineering, Artificial Organs
16 Assistive Technologies
17 Biological Effects of Electromagnetic Fields
18 Clinical Engineering
19 Radiation Oncology Physics and Systems
20 Dosimetry and Radiation Protection
21 Advanced Technologies in Cancer Research and Treatment
22 Biological Effects of Ionizing Radiation
23 Nuclear Medicine and Molecular Imaging

Important Dates

September 1, 2017
Call for Abstracts opens

September 1, 2017
Registration opens

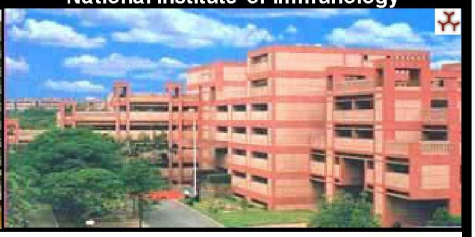
~~**November 15, 2017**~~
Abstract Submission Deadline

DEADLINE EXTENDED
January 31, 2018

February 20, 2018
Authors Notification of Abstract Acceptance

January 31, 2018
Full Papers Submission Deadline

Mahatma Gandhi Medical College and Hospital | NCI-All India Institute of Medical Sciences | National Institute of Immunology



WORLD CONGRESS ON CANCER [WCC-2018]

Venue: Mahatma Gandhi Medical College and Hospital, Jaipur, India; February 3-5, 2018

WCC is being jointly organized by the Mahatma Gandhi University of Medical Sciences and Technology (MGUMST) Jaipur, National Cancer Institute-All India Institute of Medical Sciences (NCI-AIIMS), New Delhi and National Institute of Immunology, New Delhi under the auspices of the Indian Society for the Study of Reproduction and Fertility (ISSRF).

Theme: Cancer is the culmination of somatic genetic alterations that cluster around the acquisition of key traits-limitless replicative potential, suppression of apoptosis, invasion and insensitivity to growth regulatory signals. Thus dissecting the specific molecular anatomy of a tumor is likely to be critical for the development of more specific, efficacious and safer cancer treatments that can be based on an individual tumors oncogenic mechanism. The congress will address current and future therapeutic modalities targeting tumor antigens, on emerging trends, recent advances, new approaches and future approaches in the field of cancer vaccine, early detection and diagnosis, biomarker discovery, tumor biology & therapy. WCC will provide a platform to get associated with leading oncologists, doctors, scientists, academicians, specialists & business associates coming around the world.

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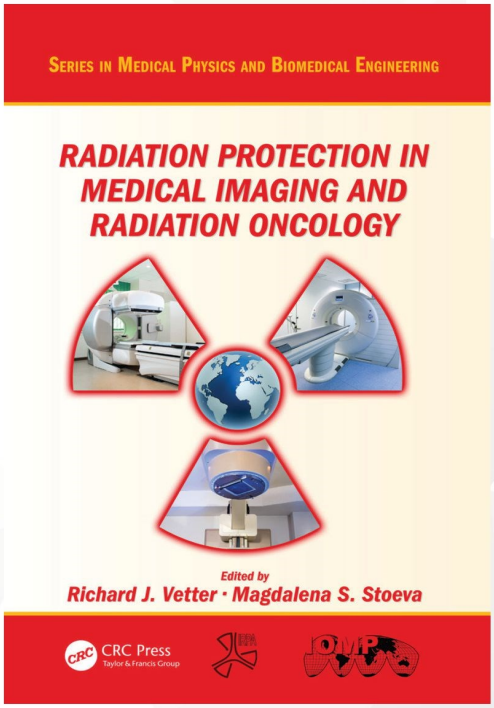

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