European Science Foundation

Standing Committee for the European Medical Research Councils (EMRC)

ESF EMRC EXPLORATORY WORKSHOP

Developments in European radionuclide therapy dosimetry

FINAL REPORT

Zentrum Operative Medizin (ZOM)
Seminarraum 2+3

Würzburg, Germany, 15 - 17 June 2006

Convened by:

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Executive summary

Nuclear medicine makes a significant contribution to the health, health care and quality of life of European citizens, particularly in major clinical areas such as cancer and cardiovascular disease. Every year in Europe, over 10 million patients benefit from a nuclear medicine procedure, 90% of which are diagnostic (PET, SPECT) and 10% therapeutic. These radionuclide therapies (or targeted radiotherapy or molecular targeted therapy, TRT) will increase in importance and number the coming years, in particular with the introduction of new molecules and radiopharmaceuticals, including radio-immunotherapy, through rapid developments in molecular biology and medicine. TRT (e.g. radio-immunotherapy) with new radiopharmaceuticals coupled to beta- or alpha-emitting isotopes are promising forms of radiotherapy for the treatment of different forms of cancer. Patient-specific dosimetry for these therapies today lacks of a standardisation of the underlying methods, harmonized clinical protocols and good correlation to clinical findings.

In order to overcome these problems and in order to harmonize the scientific basis of TRT, two committees of the **European Association of Nuclear Medicine** (EANM), i.e. the **Therapy Committee** (Chair: B. Brans, The Netherlands) and the **Dosimetry Committee** (Chair: M. Lassmann, Germany) closely collaborate interdisciplinary in this matter, joining basic physics with practical medical applications. The main purpose of the proposed workshop is to bring together the leading experts on TRT and Dosimetry from Europe. Topics of the workshop are:

- The present status of clinical TRT trials throughout Europe
- The present status of dosimetry for TRT trials throughout Europe
- Development of clinical protocols including dosimetry for therapy trials
- Development of a Network for clinical trials related to TRT
- European harmonisation of patient specific dosimetry and clinical trials
- Exploration of new concepts of TRT Dosimetry
- Preparation of grant applications for further EU programs

This workshop was a joint collaborative effort of both committees. Its intention was to identify the most important therapies, to invite the leading European experts in these fields, to establish the requirements for protocols for obtaining high quality radiation dose estimates for tumours and therapy related toxicity as well as to initiate a "network of experience" from these "standards of radionuclide dosimetry" across Europe.

The topics of the workshop focussed upon the five most important targeted radiotherapies:

- **Radioiodine Therapy of Thyroid Cancer**
- **mIBG Therapy**
- **Peptide Therapy**
- **Therapy of Haematological malignancies**
- **Loco-regional Therapy of Solid Tumours**

In a series of expert lectures these topics were covered by clinicians and by dosimetrists. As general conclusions priorities of further dosimetry research/methodology were identified:

- **Increase European cooperation**

- **Form working groups (see below)**
- **Start grant applications**
- **Increase standardisation**
- **Form database containing results on organ and treatment specific doses (e.g. kidneys)**
- **Increase cooperation with other experts: radiobiology, external radiotherapy**

In addition, the urgent need of further **pre-clinical dosimetry/radiobiology research** is seen by the participants.

Another result of the workshop was to establish informal working groups which are supposed to collect information and put together recommendations on:

a) Internet Information (Therapy/Dosimetry)
b) Whole Body/ Blood Dosimetry (Marrow Toxicity)
c) Minimum Data Requirements (Therapy/Dosimetry):
d) Organ/Tumor Dosimetry
e) PET based Dosimetry

The deadline for a first draft was set to be the EANM Annual congress in Athens 2006 (End of September).

Publication of the results

A summary of the discussions and of the scientific contents of the workshop will be published in the blue pages of the **European Journal of Nuclear Medicine and Molecular Imaging**.

Workshop can be seen as networking platform that will enable new joint projects within Europe.

Based on the contacts and exchange of information about current research interests, several joint projects will be carried out and grant applications will be prepared.

Most of the participants will also participate in a COST action on "**TARGETED RADIONUCLIDE THERAPY"**

Scientific content of the event

Targeted Radiotherapies (TRT) will increase in importance the coming years throughout Europe. Patient-specific dosimetry for these therapies today lacks of a standardisation of the underlying methods, harmonized clinical protocols and good correlation to clinical findings.

This workshop was a joint collaborative effort of the EANM Therapy and Dosimetry Committees. Its intention was to establish the requirements for protocols for obtaining high quality radiation dose estimates for tumours and therapy related toxicity as well as to initiate a "network of experience" from these "standards of radionuclide dosimetry" across Europe.

In **two introductory lectures** by Dr. Brans (Heerlen) and Dr. Bardiès (Nantes) raised fundamental questions concerning dosimetry from the nuclear medicine physician's perspective (Dr. Brans) and from the radiation dosimetrist's perspective (Dr. Bardiès).
In particular Dr. Brans stated that individualized medicine is indeed the future and may be associated with huge cost-savings and increase of effectiveness. In the medical oncology world this realization is also illustrated by a recent editorial in the J Clin Oncol on the shortcoming of the chemotherapy per m^2 body-surface dosing principle. Although absorbed dose uncertainty and risk for under- or overdosing is an everyday reality in radionuclide therapy, it is tempting to increase the complexity of physical dosimetry methods. However, we should also be looking at a wider scope of supplementary techniques that may help us to improve the predictability of our therapy and hence effectiveness. Principally and firstly, these may be methods that study the radiation distribution on a more cellular level than gamma-camera's can do and this may be called "biological" (micro)dosimetry. Alternative methods may be looking at functional rather than physical changes that may be detected through imaging or bio-samples. This is in analogy to the role of FDG-PET scanning in oncology diagnosis and therapy evaluation. These may be biomarkers such as proteins, RNA or cell changes observed on cytology. Alternatively, imaging with tracers such as annexin-SPECT may be very promising and should be further developed. In this line of thinking, also the increasing dynamic quantitative and modelling possibilities of PET as a quantitative tool have to be explored.
Dr. Bardiès pointed out that patient specific dosimetry is still limited by the determination of activity variation in space and time. Quantitative imaging is still largely performed with SPECT devices with a poor spatial resolution and mostly designed for Tc-99m imaging. A large variety of clinical protocols are proposed in the literature, most of them relying on a certain degree of empirical set-up, which limits their relevance. This makes it very difficult to define standard protocols (that can be implemented in various nuclear medicine departments) and to assess activity determination uncertainties. In addition, Dr. Bardiès addressed some very general questions that need to be solved in the near future:
1) Since targeted radiotherapy relies (mostly) on beta emitters to deliver a specific radiation dose, and because the electron range is inferior the spatial resolution of most molecular imaging devices, it is not granted that even a 'perfect' dosimetric study at the voxel-scale will enable dose-effect link assessment.
2) Toxicity assessment is another part of the rationale for sound dosimetric studies. In that context, indexes like total body dose might be sufficient to predict potential toxicity. This deserves to be investigated since this index can be easily determined on a patient specific base.
3) Radiation dose is one of many parameters that condition patient's response to a treatment. Patient's pathology, previous treatments, inherent variability between patients or tumour response should also be taken into account. Isolating the absorbed dose as the relevant parameter that condition

the patient's response to therapy may not be possible, or may be possible in a restricted number of cases.

4) What level of sophistication should we aim for? Is it preferable to define 'standard' protocols that can be implemented in most Nuclear Medicine departments (knowing that the price to pay will probably be a less than satisfactory quantitative imaging)? Should dosimetric clinical trials be restricted to a small number of Nuclear Medicine departments that can invest in 'heavy' acquisition/processing techniques?

Discussion in this section:

- In the discussions there was a great deal of concern on the amount of resources available for the development of radionuclide therapy dosimetry techniques.
- Physicists should get enough support from nuclear medicine physicians.
- Cooperation with physicists of departments of Radiotherapy might be an opportunity, as exemplified by the British Institute of Radiology.

In the general use of dosimetry several positions were discussed:

- Dosimetry is only useful for borderline toxicity determination, for example in high-dose myeloablation therapy.
- Dosimetry is also important for tumour dosimetry, for example in the use of dose-escalation with assessment of dose-response relation.
- Dosimetry is useful on all levels.

In five more specific sessions the workshop was focussed upon the five most important therapies:

- **Radioiodine Therapy of Thyroid Cancer**

During this session the present dose concept for the determination of the activities of I-131 to be administered for the treatment of differentiated thyroid cancer were introduced by Dr. Luster (Würzburg) covering the clinical aspects and Dr. Lassmann (Würzburg) covering the dosimetry:

a) Fixed Activities

b) Lesion-based Dosimetry including PET with I-124 and the use of recombinant human TSH.

The objective of remnant or lesion dosimetry is to determine the radioiodine activity that delivers the recommended dose of radiation to ablate thyroid remnant or to treat metastatic disease while minimizing the risk to the patient. The doses are traditionally considered to be 300 and 80 Gy respectively.

c) Bone Marrow Limited Approach

In the classic approach, the blood is considered the critical organ that is irradiated either from the particles emitted from activity in the blood itself, or from the emissions originating from activity dispersed throughout the remainder of the body. The rate of haematological complications increased when exceeding a blood dose of 2 Gy. Therefore, the maximum treatment activity is calculated as the activity of I-131 that would deliver a dose of 2 Gy to the blood compartment.

In a recent publication this method has been further refined taking individual patient parameters into account. The authors found wide variations in the blood dose for individual patients and decreased blood dose for patients after radioiodine therapy after the use of rhTSH.

Discussion in this session:

- Radioiodine has been used for over 50 years, largely unchanged. Still, we have not established a dose-response relation to be used in everyday practice. Therefore we need new approaches.

- I-124 may be the best possible chance for dosimetry.
- Technical issues of PET-based dosimetry were discussed (see peptide therapy).

- **mIBG Therapy**

Two speakers addressed this topic. Dr Mark Gaze (UCL, London, UK) introduced clinical aspects of I-131 mIBG + topotecan for the treatment of neuroblastoma. Dr Glenn Flux (Royal Marsden Hospital, London UK) covered the dosimetric elements of this and similar treatments. This study is currently the basis for an ESIOP supported multi-centre European trial and is the first such trial to administer activities on a patient-specific basis according to dosimetry. The treatment aims to deliver a total of 4 Gy whole body dose in two fractions. The first fraction uses a simple formula to deliver activity as a function of the patient's weight. Following the first administration the whole-body dose is calculated and the second delivery is given such that the total absorbed dose is 2 Gy. The study is initially aimed at patients who either suffer relapse following standard chemotherapy treatments or at primary refractory patients.

Discussion following the presentations tended to focus on several main strands.

1. The feasibility of carrying out such a study was discussed extensively particularly in a multi-centre context. This treatment involves a number of aspects that require multi-disciplinary skills which may be difficult to find in any one centre. It was considered that to attempt this at a European scale is particularly ambitious. However, such a study could be facilitated with the level of support and networking that is becoming possible in Europe, as demonstrated by this workshop. Nevertheless, during the course of the workshop a centre in France expressed an interest in joining the study.
2. It was noted that this study would generate a different set of problems in different European countries, due to a lack of Europe-wide protocols and guidelines governing the treatment of patients with radionuclides. For example, radiation disposal limits varied widely from country to country, as do release criteria, so that patients would be retained for varying amounts of time depending on national regulations. In some centres this may make the treatment less feasible due to patient/staff inconvenience or costs.
3. The aspect of treating according to absorbed dose estimates was noted. This concept adheres to the European directive Euratom 97/43. It has been shown in a number of studies that fixed activities can deliver a wide range of absorbed doses and it was therefore evident that treatment according to a fixed absorbed dose would result in a range of activities being administered. Inevitably, this will lead to many patients receiving much larger activities than would otherwise be the case.

Discussion in this session:

- In the ESIOP 2+2 Gy protocol, the big advantage is a high standardised whole-body dose.
- However, no strong correlation of whole-body dose and tumour dose has been found. More data are needed to address the issue of aiming at the minimal effective dose and/or maximum tolerable dose, or how to combine these endpoints.

- **Peptide Therapy**

Dr. Kwekkeboom (Rotterdam) introduced his results concerning the treatment with radiolabeled somatostatin analogues ([Lu-177-DOTA0,Tyr3]octreotate). From January 2000 to December 2004 he treated 403 patients (1350 administrations), most with GEP tumours. Serious side-effects consisted of 2 renal insufficiencies (1probably unrelated to the therapy), 1 hepatic failure in a patient with rapidly growing diffuse liver metastases who died shortly after his first therapy cycle and 1 temporary failure in a patient who resumed therapy with half doses and did well, as well as 3 cases of myelo-dysplastic syndrome, one of which was probably unrelated. Hematologic grade 3/4 toxicity occurred after 3% of administrations.

Tumor response was studied in 131 Patients with GEP tumours were treated up to a cumulative dose of 22.2-29.6 GBq and who had sufficient follow-up. A complete remission was found in 3 (2%) patients, partial remission in 32 (26%), minor response (tumour diameter decrease of 25-50%) in 24 (19%), stable disease (SD) in 44 (35%), and progressive disease (PD) in 22 (18%) patients. Higher remission

rates were positively correlated with high uptake on pre-therapy somatostatin receptor imaging and a limited number of liver metastases, whereas PD was significantly more frequent in patients with a low performance score and extensive disease. Median time to progression in 103 patients who either had SD or tumour regression was more than 36 months.
Strategies to improve this type of treatment may consist of chemosensitisation, the use of combinations of radionuclides, as well as efforts to upregulate receptor expression. Another point of great interest is the individual tailoring of the maximum dose to the patients. In our current practice, we assume that the administration of 29.6 GBq [[Lu-177-DOTA0,Tyr3]octreotate results in a fixed red marrow dose of 2 Gy for all patients. From more recent experiments, we know that this absorbed dose varies.
In a second presentation, Dr. Walrand (Brussels) presented results of a dose escalation study Y-90-SMT-487 (Y-90-octreother), which included dosimetry estimation. He showed that the parameters determining the irradiation delivered to the kidneys had a huge variability inter patients. The long term follow-up of the kidney function showed that there was no correlation between the creatinine clearance lost and the dosimetry computed only with these 2 parameters. Using the Linear Quadratic Model (LQM) in order to take into account the variation of the dose rate induced by this fractionation, a correlation was seen with a sharp separation between the patients having a clearance lost per year lower to 15% or higher than 25%. In parallel, the study showed that In-111-octretide cannot be used as a surrogate of the Y-90-octreother.
The same studies showed a clear visualisation of the red marrow region at 24h post injection: spine, pelvis, elbows, and shoulders. In patient having a « normal red marrow » before treatment, the delivered irradiation to the red marrow estimated assuming that the red marrow behaved as the remainder of the body, or as the plasma, was too much lower to explain the platelet drop at the nadir (4 weeks after treatment). Meanwhile, the irradiation delivered to the red marrow estimated using the uptake measured in the Y-86-octreother PET scan, correlated well the platelet nadir count.

Discussion in this session:
- The problem of Y-86 and voxel-based analysis is the noise in the small voxel parts.
- Proper correction factors have to be made, on the basis of realistic, anthropomorphic phantoms.
- BED or biological effective dose is an important development.
- Which parameters (for example α/β) can we derive from cell and animal experiments to apply to design of human dosimetry studies/therapies?
- The neo-adjuvant indication of radiopeptide therapy is highlighted, several examples of excellent results and complete remissions of bulky tumours.
- Do we know all there is on the possible cellular competition with cold octreotide therapy. Imaging studies are based on relative uptake, not absolute!

- **Therapy of Haematological malignancies**

Dr. Tennvall (Lund) introduced two approved radiopharmaceuticals, Zevalin® (IDEC Pharmaceuticals, San Diego, CA and Schering AG) and Bexxar® (Glaxo SmithKline) for the treatment of B-cell lymphoma. Both are directed against CD20, albeit not against the same epitope. They are both approved for the treatment of /relapsed or refractory follicular/low-grade or transformed B-cell lymphoma including rituximab-refractory follicular B-cell lymphoma in the US but only Zevalin is approved in the EU and only for follicular lymphoma. The Zevalin regimen is Y-90 labelled ibritumomab, the rituximab parental mouse antibody, which is administered following a pre-load with unlabelled rituximab to improve dose distribution. In US and Switzerland a scintigraphy with $^{In-111}$ labelled ibritumomab for verifying targeting is mandatory prior to therapy. The Bexxar regimen consists of I-131 labelled murine tositumomab, and unlike Zevalin, the same murine antibody i.e. unlabelled tositumomab is used for pre-load. Two further radiopharmaceuticals are evaluated in clinical trials, viz. epratuzumab, Lymphocide®, (Immunomedics Inc) a Y-90 labelled humanised antibody directed against the B linage restricted

antigen CD22, and Lym-1, Oncolym® a murine antibody directed against an aberrant HLA-DR10 antigen (Peregrine Pharmaceuticals Inc). Lym-1 has been labelled with I-131, Y-90 and Cu-67. All these radiolabeled Mab but epratuzumab are murine antibodies. Beside these four agents there are other antibodies being radiolabelled for scientific purposes foremost rituximab radiolabeled with I-131, Y-90 or Lu-177.
Dr. Strand (Lund) introduced dosimetry techniques for Y-90 and I-131 labeled antibodies for radioimmunotherapies. Dosimetry in targeted radionuclide therapy (TRT) is somewhat questionable, due to the limited number of published data supporting any dose-effect relationship for either tumour response or normal tissue toxicity (i.e. bone marrow).. In lymphomas correlations between absorbed dose and duration of thrombocytopenia have been reported as well as tumour dose-response.
In the treatment of lymphomas different radionuclides with different emission spectra are used as pure beta emitters (Y-90) as well as beta-emitters emitting also photons (I-131). Complicated emission spectra can affect the ability of quantification.
Dosimetry is based on quantification of the activity in organs/tissues and on several measurements to obtain the cumulated activity or the residence time. Methods used for activity quantification are planar imaging or SPECT. Both have to be quantitative. Also hybrid methods exist combining conjugate views with single quantitative SPECT imaging. The use of PET for TRT dosimetry requires access to long lived positron emitters as I-124 and Y-86.
For the bone marrow dosimetry, blood based methods, external whole body counting and imaging of bone marrow are applied. An important factor that can affect the accuracy in activity quantification for planar imaging in normal organs and tumors are overlapping organs and background selection. One factor that affects the tumor absorbed dose is the possibility of tumor volume shrinkage during therapy. In nude mice inoculated with human lymphomas, a very heterogeneous activity and corresponding absorbed dose distribution can be seen.

Discussion in this session:
- The lack of dosimetry in the Zevalin protocol is unsatisfactory from the dosimetrists' point of view (particularly the basic methodology developed by Wiseman et al. needs heavy improvement).
- There is a concern that pre-dosing with cold antibodies may be counterproductive for small tumours.
- Pre-therapy dosimetry is essential for myeloablative therapy.
- An important factor influencing bone marrow dose is tumour involvement of the bone marrow.
- The blood-marrow ratio is variable according to time and molecule.

- **Locoregional Therapy of Solid Tumors**

Dr. Lambert (Gent) presented data on therapy of brain malignancies and of locoregional treatment of liver tumors. In locoregional treatment for liver tumours, mainly two groups of radiopharmaceuticals dominate. First radiolabeled Lipiodol was discussed, mainly its application in hepatocellular carcinoma. Randomized clinical data are available for the use of I-131 labelled Lipiodol. However radioprotection limits are a major drawback and no activity escalation study could be performed. For Re-188 labelled Lipiodol data on a phase I clinical trial were presented. For normal organ dosimetry (TD5/50??) the problems related to the presence of liver cirrhosis in this patient population was addressed. Secondly, the use of radiolabelled microspheres was introduced. In particular, clinical data concerning Y-90 glass and resin spheres were presented. These microspheres are applicable in primary as well as secondary liver tumours.
Some important differences between both types of commercially available spheres were addressed including varying dosimetric approaches. Particularly the question of lung toxicity following intra-arterial radionuclide therapy for liver tumours has been addressed.

On the third day, in a **common discussion session**, open questions and research related question were addressed that should be resolved within the next years (see next chapter) and that cover the main topics. As general conclusions priorities of further dosimetry research/methodology were identified:

- **Increase European cooperation**
- **Form working groups (see below)**
- **Start grant applications**
- **Increase standardisation**
- **Form database containing results on organ and treatment specific doses (e.g. kidneys)**
- **Increase cooperation with other experts: radiobiology, external radiotherapy**

In addition, the urgent need of further **pre-clinical dosimetry/radiobiology research** is seen by the participants.

Assessment of the results, contribution to the future direction of the field, outcome

Providing opportunity to acquire new personal contacts.
The workshop started with introduction of the participants and an introduction to the goals of the ESF, given by Dr. Storto. It continued through the first day with a set of introductory lectures and the first specific topic. The evening concluded with an informal get-together where the participants continued to socialise.
The second day continued with state-of-the-art lectures on therapy/dosimetry, covering the remaining subjects. After the lectures there was ample time for scientific discussions which usually were continued throughout the coffee breaks. At the evening there was a formal conference dinner outside the city.
On the third day there was a general discussion on open questions in the field of targeted radiotherapy (dosimetry) which should be addressed in the near future. The meeting concluded with a common lunch.
The workshop was based on a very intensive information exchange and discussions. On one hand this was enabled due to limited number of participants, and on the other hand the schedule provided the necessary frame for it.

Exchange of the research ideas from the various scientific fields and outlining further research direction in the area of targeted radiotherapy and dosimetry
As general conclusions priorities of further dosimetry research/methodology were identified:

- **Increase European cooperation**
- **Form working groups (see below)**
- **Start grant applications**
- **Increase standardisation**
- **Form database containing results on organ and treatment specific doses (e.g. kidneys)**
- **Increase cooperation with other experts: radiobiology, external radiotherapy**

In addition, the urgent need of further **pre-clinical dosimetry/radiobiology research** is seen by the participants.

For the specific topics a set of questions was formulated that should be addressed in further research:

- **B-cell Lymphoma therapy**
  When is dosimetry pre-therapy necessary?
  Should planar imaging be supplemented with SPECT?
  How should tumour shrinkage be accounted for?
  Which bone marrow dosimetry should be used?
  Which isotope combinations are appropriate?
- **Therapy of differentiated thyroid carcinoma**
  When is dosimetry useful?
  Do we have to aim to further decrease activity doses?
  Does the „first strike“strategy needs further consideration?
  How can we avoid stunning?
  The possible use of I-124?
  How can we account for dosimetry of very small lesions?
  How should we study the further introduction of rhTSH?
  When should we use the blood/bone marrow dose?
  Can we build a common database?
  Do some patients need very high doses?

- **Radiopeptide therapy**
  Which further isotope combinations will be used for therapy and dosimetry?
  Does SMT need to be combined with other treatment modalities?
  How to perform tumour dosimetry?
  Relevance of bone marrow dosimetry?
  Different isotopes for different sized tumours?
  Are controlled studies now necessary?
- **I-131 mIBG therapy**
  How can we proliferate the 2+2Gy protocol for neuroblastoma across Europe?
  Do we need carrier free I-131 mIBG?
  How should we do dosimetry in adult patients?
  How can we perform tumour dosimetry?
  Is there a need for I-124 mIBG?
  Should I-131 mIBG therapy be used in first line?
- **Liver cancer therapy**
  How should we perform tumour dosimetry?
  How to avoid pneumonitis in Lipiodol therapy?
  Should we use different isotopes for different sized tumours?
  How should we account for liver cirrhosis in liver dosimetry?

As a results of the workshop informal working groups were established (see above) which are supposed to collect information and put together recommendations:

a) Internet Information (Therapy/Dosimetry):
   Bardiès
b) Whole Body/ Blood Dosimetry (Marrow Toxicity)
   Flux, Glatting, Giammarile, Chiesa, Teule
c) Minimum Data Requirements (Therapy/Dosimetry):
   Lassmann, Bardies, Kwekkeboom, Scheidhauer
d) Organ/Tumor Dosimetry
   Lambert, Marti, Konijnenberg
e) PET based Dosimetry
   Brans, Walrand, Lammertsma/Lubberink (proposed), Glatting

The deadline for a first draft was set to be the EANM Annual congress in Athens 2006 (End of September).

Publication of the results
A summary of the discussions and of the scientific contents of the workshop will be published in the blue pages of the European Journal of Nuclear Medicine and Molecular Imaging.

Workshop can be seen as networking platform that will enable new joint projects within Europe.
Based on the contacts and exchange of information about current research interests, several joint projects will be carried out and grant applications will be prepared.
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Final Programme

Thursday 15 June 2006

Morning	*Arrival*
13:00	**Opening**
	Speakers:
	M.Lassmann
	B. Brans
	Chr. Reiners
	G. Storto
13:45 - 14:45	Chair: **C. Reiners / M. Lassmann**
	Introduction to the workshop
	The nuclear medicine physician's perspective (**B. Brans**)
	The radiation dosimetrist's perspective (**M. Bardiès**)
14:45 – 15:15	*Coffee Break*
15:15 - 17:00	Chair: **Speakers**
	Haematological malignancies: Current status and clinical questions related to therapy dosimetry (**J. Tennvall**)
	Dosimetry techniques for Y-90 and I-131 labelled antibodies for TRT (**S. Strand**)
	Discussion and consensus forming of therapy / dosimetry protocols
17:15	*Guided Tour, Department of Nuclear Medicine*
19:30	*Informal meeting*

Friday 16 June 2006

08:30 - 10:15	Chair: **Speakers**
	Thyroid carcinoma: Current status and clinical questions related to therapy dosimetry (**M. Luster**)
	Dosimetry techniques for I-131 therapy of thyroid carcinoma (**M. Lassmann**)
	Discussion and consensus forming of therapy / dosimetry protocols
10:15 – 10:45	*Coffee Break*

10:45 - 12:30	Chair: **Speakers**
	Peptide Therapy: Current status and clinical questions related to therapy dosimetry (**D. Kwekkeboom**)
	Dosimetry techniques for peptides for TRT (**S. Walrand**)
	Discussion and consensus forming of therapy / dosimetry protocols
12:30-13:15	*Lunch Break*
13:15-15:00	Chair: **Speakers**
	mIBG Therapy: Current status and clinical questions related to therapy dosimetry (**M. Gaze**)
	Dosimetry techniques for I-131-mIBG therapy (**G. Flux**)
	Discussion and consensus forming of therapy / dosimetry protocols
15:00 – 15:30	*Coffee Break*
15:30-17:15	Chair: **Speakers**
	Locoregional Therapies: Current status and clinical questions related to therapy dosimetry (**B. Lambert**)
	Dosimetry techniques for solid tumor TRT (**M. Monsieurs**)
	Discussion and consensus forming of therapy / dosimetry protocol
19:00	*Departure for Conference Dinner at the hotel (Bus)*
00:00	*Return*

Saturday 17 June 2006

09:00-11:00	**Further development of protocols** (subgroups)
	Discussion in subgroups
11:00 – 11:30	*Coffee Break*
11:30	**Conclusions and Future Perspectives** (Report of the subgroup results)
12:30	*Closing Remarks*
12:45	*Lunch*
Afternoon	*Departure*

List of Participants

Convenor:

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Statistics

Countries of origin:

France: 3

The Netherlands: 4

Belgium: 4

Spain: 1

Great Britain: 2

Sweden: 2

Finland: 1

Italy: 2

Germany: 5

Age
Between 30 and 40: 8
Between 40 and 50: 13
Over 50: 3