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Trends in Radiation Dosimetry: preliminary overview of active growth areas, research trends and hot topics from 2011-2015

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Abstract. The themes and trends of the radiation dosimetry research field were bibliometrically explored by way of co-occurrence term maps using the titles and abstracts text corpora from the Web of Science database for the period from 2011 to 2015. Visualisation of similarities was used by way of the *VOSviewer* visualization tool to generate cluster maps of radiation dosimetry knowledge domains and the associated citation impact of topics within the domains. Heat maps were then generated to assist in the understanding of active growth areas, research trends, and emerging and hot topics.

1. Introduction

Bibliometric indicators such as the h-index are popular metrics used to evaluate researcher performance [1]. Undertaking bibliometric studies of published research papers allows individuals to deduce trends in a specific research field over a specific period and in so doing enable conclusions to be drawn regarding different subfields or research areas [2]. A bibliometric analysis of the radiation dosimetry literature was undertaken from the Web of Science database to investigate the themes and trends of the radiation dosimetry research field to generate cluster maps of knowledge domains and the associated citation impact of topics within the domains. The methodology used so-called term maps to visualize the radiation dosimetry research field. A term map is a two-dimensional representation of a research field in which strongly related terms are located close to each other and less strongly related terms are located further away from each other with the term map providing an overview of the structure of a field. Different areas in a map correspond with different subfields. The term maps were used to assist in the understanding of active growth areas of the radiation dosimetry field and associated research trends and emerging hot topics such as 3-D dosimetry [3, 4]

2. Methods

Titles and abstracts text corpora, corresponding to 5357 publications, was downloaded from the Web of Science database for the period from 2011 to 2015 (figure 1). Title and abstract information for each publication was merged into a single text corpus file for the period under consideration and analysed using the *VOSviewer* visualization tool (www.vosviewer.com) [5-7]. With an emphasis on visualization, the computer program employs a text mining function and associated natural language processing to identify relevant noun phrases in combination with a unified mapping and clustering approach to examine network co-citation data and the co-occurrence of scientific terms. The interactive functionality of the program provides an accessible and hands-on way to explore networks of bibliometric data such as citation counts and/or the co-occurrence relationships among key terms and concepts.

3. Results

3.1 Co-occurrence of terms

Figure 2 shows a co-occurrence cluster map of terms. Each term is represented by a circle, where the diameter of the circle and size of its label represent the frequency of the term, its proximity to another term indicates the degree of relatedness of the two terms, and its colour represents the cluster to which it conceptually belongs. The terms are spatially interrelated in multidimensional space and the figure is limited to a 2-D representation with some relationships between terms not be readily apparent. The map can be seen to contain 5 clusters of co-occurring terms. The red cluster appears more related to dosimetry associated with linear accelerators and treatment planning systems, the green cluster appears more related to dosimetry instrumentation, the yellow cluster appears more related to clinical aspects of dosimetry, the blue cluster appears more related to radiation exposure and dose, and the purple cluster appears more related to radionuclides. Figure 3 shows a co-occurrence term density cluster map.

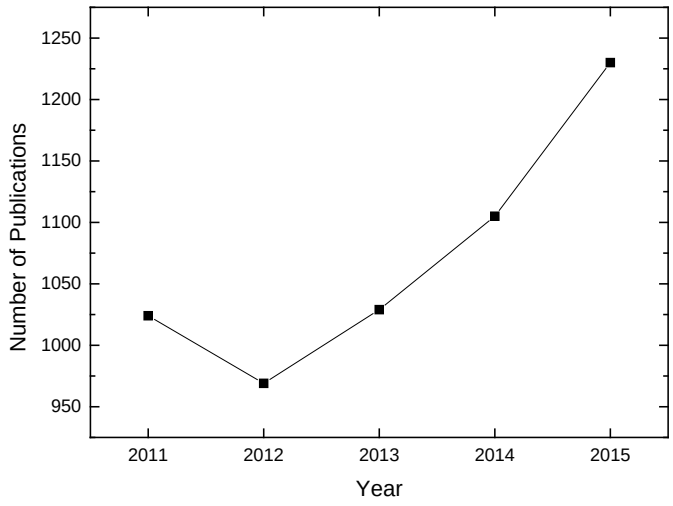

Figure 1. Publications downloaded from the Web of Science database for the period from 2011 to 2015.

3.2 Highly cited terms

Figure 4 is a coloured heat map indicating the relative citation impact of the terms relative to an average citation impact of 1.0 for all publications in the map. Presented data is normalised to take into account the year of publication as older publications have more opportunity for being cited. Red indicates an above average citation impact, blue a below average citation impact and green an average citation impact. Figure 4 clearly indicates that more highly cited publications occur on the right of the figure.

4. Discussion and Conclusions

A number of research topics in the 5-year period have shown significant active growth and are considered to be emerging or hot topics.

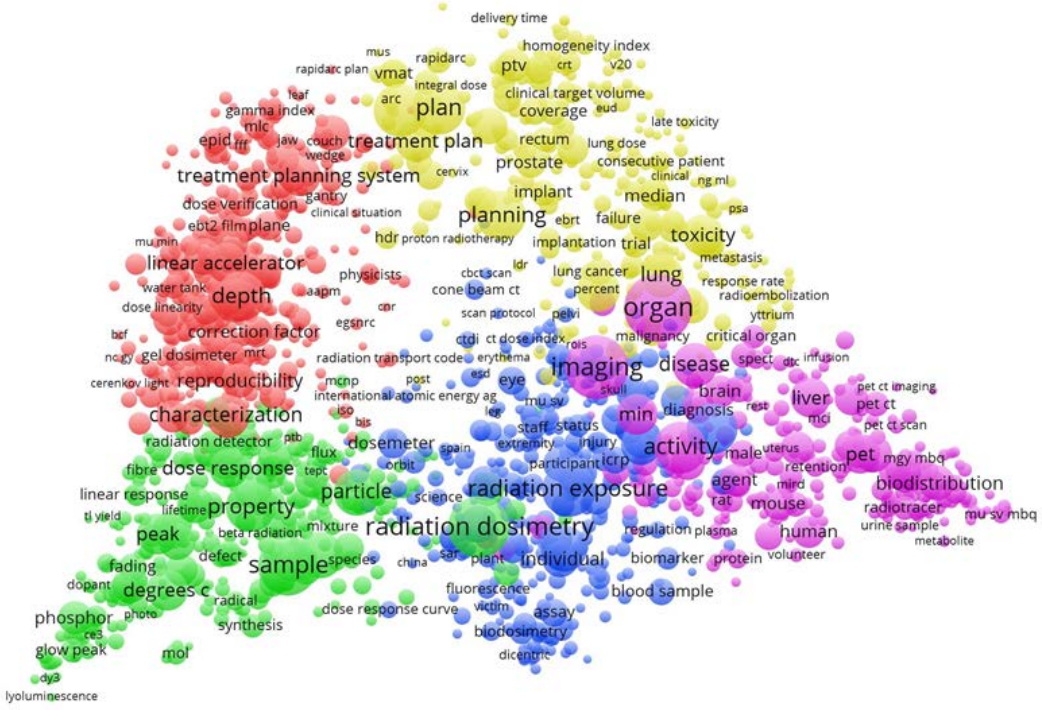

Figure 2. VOSviewer co-occurrence term map.

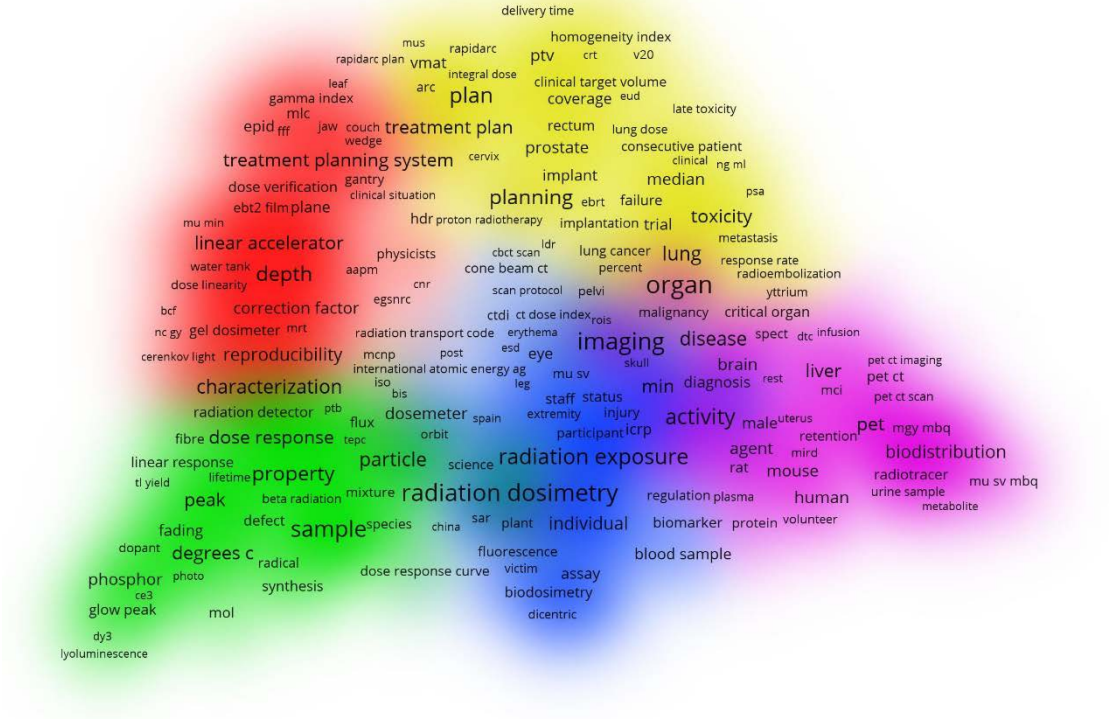

Figure 3. VOSviewer co-occurrence term density cluster map.

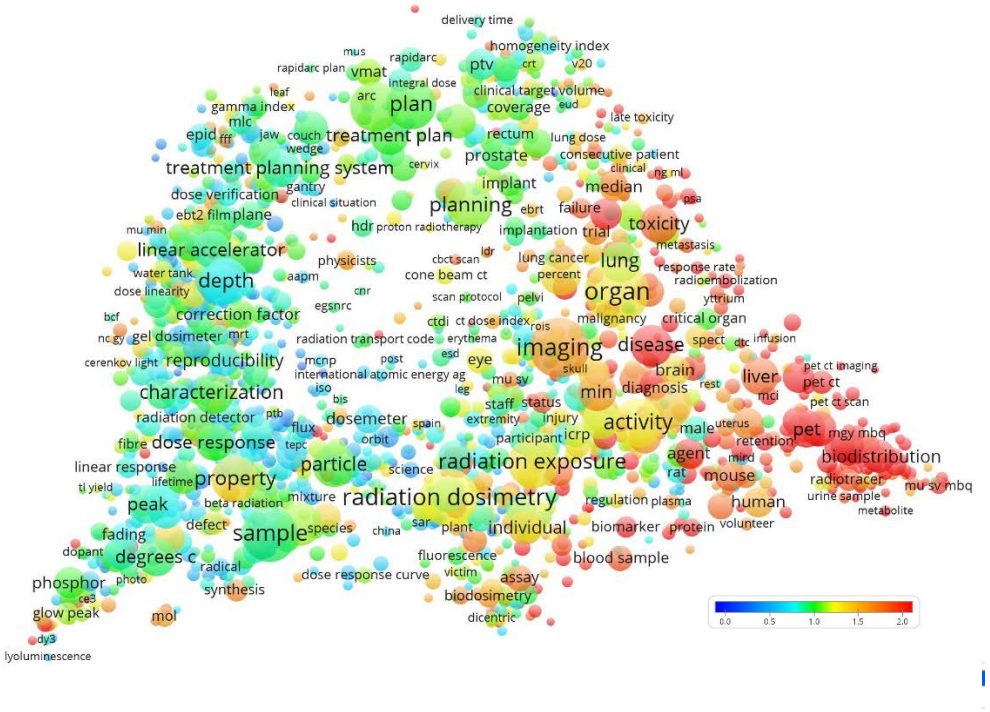

Figure 4. VOSviewer co-occurrence citation impact heat map

The variation in the citation impact across Figure 4 is noticeably with topics on the right of the figure having greater impact in the purple (radionuclides) domain and decreasing through the yellow (clinical aspects of dosimetry) and blue (radiation exposure and dose) domains. There are significant variations in citation practices with, for instance, much larger reference lists in molecular biology than in mathematics resulting in publications in molecular biology on average being cited more frequently than publications in mathematics [8]. This variation in citation practice may account for aspects of that observed in the purple domain.

Further work is continuing beyond this preliminary investigation of active growth areas and research trends to consider the past development of research areas in radiation dosimetry [9-11] with the aim of further identifying current and potential future so-called ‘hot research topics’.

5. References

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