



TRENDS IN BIOMEDICAL RESEARCH

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Interview

Biomedical research is constantly evolving and new trends arise every year. Targeted cancer strategies, monitoring vital signs of patients with the use of wearables and gene editing or therapy are popular topics worldwide in the last years. Furthermore, the use of deep-learning and artificial intelligence in research has greatly increased and they have also made their entrance in biomedical research. Besides changes in popular topics, changes in conservative trial designs occur more and more as well, which additionally leads to the use of new trial designs, such as an n=1 trial, where every patient is used as its own control. These popular topics and changes all have one corresponding factor: they have a personalised aspect. To find out which research topics are very popular in the Radboudumc and its research institutes, and which ones will become a trend in the upcoming years, we asked dr. Alain van Gool, dr. Paul Smits, dr. René Bindels and dr. Jan Kremer, for their opinion on this subject.

Personalised medicine

Many of you already know that personalised healthcare and innovation are the key elements of the Radboudumc strategy. Personalised healthcare research starts with understanding the disease with the need of the patient as a starting point. It aims at closing the gap between the priorities of the doctor (aims for the best possible treatment), researcher (aims to unravel a certain mechanism for a better therapy) and patient (aims at getting a better quality of life). Dr. Alain van Gool (professor personalised healthcare and head of the Translational Metabolic Laboratory) states that in the last years, technology has rapidly progressed. Nowadays, patients can easily be differentiated based on their molecular biomarkers, adding to the 'precision' in personalised healthcare. However, there is still a lack of options to actually treat these different patients with personalised therapies. Besides the more obvious drug therapies, treatments can also include adaptations in diet or a better balance between work and private life. Dr. van Gool emphasizes that, in terms of personalised healthcare, we are not there yet but progress is expected, particularly in the holistic approach bridging molecule to patient. This personalised healthcare approach in the Radboudumc is unique and is expected to lead to more efficient care and decrease of healthcare costs.



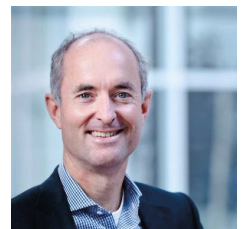
Dr. Alain van Gool



Dr. Paul Smits



Dr. René Bindels



Dr. Jan Kremer

European Reference Networks

The Radboudumc also plays a role in European Reference Networks (ERN), where it is a center of expertise for fourteen rare disorders in Europe such as for rare liver disease, endocrine conditions, and haematological diseases. By combining knowledge and expertise in the Radboudumc with knowledge from other centers, patients will get the most accurate diagnosis and the best treatment possible for their specific disease. In the upcoming years, patient groups from different hospitals (national and international) can be combined into a bigger cohort and can also be used for research purposes, such as gaining a better understanding of the origin of the disease or for designing better drug targets. These ERNs are therefore an example of a perfect mix of diagnostics and research and how this can be carried out more efficiently.

Impressive research within the Radboudumc and its institutes

According to dr. Paul Smits (professor clinical pharmacology, dean and vice chairman of the board from the Radboudumc), the research theme 'Infections diseases and global health' is one of the research themes that impresses worldwide with their research in innate immunology, fungi, tuberculosis and malaria. Dr. Mihai Netea even was awarded

the NWO-Spinozapremie (the highest Dutch award in science) in 2016 for his outstanding research on innate immunity. This research theme, therefore, is clearly distinctive in their field in comparison with other national and international research institutes. Besides this theme, also the Donders Institute with their research on Parkinson (coordinated by dr. Bas Bloem), the Department of Genetics with their research on mental defects (coordinated by dr. Han Brunner) and oncology with their research on dendritic cell therapy (coordinated by dr. Carl Figdor, NWO-Spinozapremie award winner in 2006), are strong players in their field.

Future trends

Dr. Smits suspects that research with the use of for example wearables and artificial intelligence will take a great leap. This will lead to a high patient- and community participation and will lead to more and more big data research and innovations. These topics are already very popular worldwide and are currently finding their way in research in the Radboudumc. Dr. René Bindels (scientific director of the RIMLS and professor physiology) feels that besides the earlier mentioned subjects, also deep learning, nanotechnology and the broader use of immune

therapies and cancer diagnostics will become more popular in the next years. He emphasizes, however, that a big part of future trends will rely on curious researchers with accidental discoveries, such as the discovery of penicillin by Alexander Fleming in 1928. Dr. Jan Kremer (professor patient-centeredness and gynaecologist) shares his view that big discoveries are often found by coincidence. He also thinks that more multidisciplinary research has a great potential and that currently, we do not use it enough. Research with collaborations in for example alpha and beta sciences or on the borders of research fields can lead to new, creative perspectives and can lead to the use of mixed research methods such as the combination of quantitative and qualitative research. Also, it is necessary to use new research methods now we know that averaging

patients does injustice to the patient's context. This context is very important in personalised research and is certainly a necessary factor for carrying out good quality patient-centered research.

Conclusion

The Radboudumc and its institutes certainly have enough high-quality research, especially due to the unique aspect of personalised healthcare. The main message that these prominent doctors give is that we cannot entirely predict the future trends. So, that is why we advise you, as a student, to embrace your curiosity and be open for multidisciplinary collaborations in your future career.

CORRECT ANSWERS TO THE EXAM QUESTIONS

Answer question 1:

B. Hyperplasia

When residing at high altitude for several weeks, the body responds to the lower levels of oxygen in the air by producing Erythropoietin (EPO). EPO stimulates the red blood cell production in the bone marrow. In this process of acclimatization, the amount of haemoglobin in the blood increases as well. This increases the amount of oxygen that can be carried by the blood, explaining the improvement in sports performances. The production of more cells, such as in this case, is called hyperplasia. Hypertrophy is the increase of volume of an organ or tissue due to enlargement of the cells it consists of, without cell proliferation. Metaplasia is the reversible transformation of cells from one differentiated cell type to another, which may be part of a normal maturation process but is also considered to be an early phase of carcinogenesis. Dysplasia is an abnormal development of cell growth and differentiation and is a term used in pathology for an irreversible precancerous stage in cells and tissue [1].

During the exam, 61% of the participants answered this question correctly.

Answer question 2:

A. Bundle of His

The electrical activity of the heart can be recorded in an electrocardiogram (ECG). A normal heart rhythm produces four entities. The QRS-complex represents the ventricular depolarisation and the P-wave represents atrial depolarisation. A patient with a total AV block can still have an escape rhythm, but this will originate from the next pacemaker cells in the conducting system of the heart. As the QRS-complex is still normal, the signal needs to come from the Bundle of His. The QRS-complex would be distorted if the signal originated from different pacemaker cells, as the ventricles would not depolarise in their common way. If the signal would originate from the left bundle, the right bundle or the Purkinje fibres, the right and left ventricles would not depolarise at the same time, which would result in an abnormal QRS-complex [2].

During the exam, 47% of the participants answered this question correctly.

The exam questions can be found back on page 9 in this journal.

References

1. Junqueira, L. et al. *Functionele histologie*. (Reed Business, 2014).
2. Boron, W. & Boulpaep, E. *Medical physiology*. (Elsevier, 2017).

