

Researchers of the Month 2014



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1. What are your personal perspectives as a researcher?

The ultimate goal of my research is to contribute to the health care continuous improvement namely through the appropriate use of medical imaging resources. This includes DICOM data mining, secondary use of radiology data and radiology continuous quality improvement in terms of focus on the patients, radiation protection and processes optimization.

2. In your opinion, what are the biggest challenges in your area of research?

The biggest challenge is the development of translational and clinical research supported in partnerships between the scientific community and the health care providers. This requires trust relationships and political willing to translate the knowledge and expertise added value of research units such as the Institute of Electronics and Telematics Engineering of Aveiro (IEETA). This can promote opportunities and synergies to improve health care delivery.

On the other hand, it seems necessary to establish a strategy for medical imaging at University of Aveiro (UA), where the M.Sc. in Medical Imaging could be the cornerstone. For that is important to promote and activate partnerships such as the one that existed in the past with Siemens Medical Solutions, which was fundamental for the prestige of the Health Sciences School of the University of Aveiro. By doing this, the University of Aveiro could aspire to be recognized for its excellence in medical imaging. International recognition will be therefore more attainable both in research and teaching at post-graduate levels.

3. Where are the strengths of the UA in your opinion?

One of the main strengths of UA is its organizational matrix, were, in the case of Medical Imaging, promotes the skills integration from different areas of expertise, which can have a huge potential.

4. Could you give one idea to improve research in the UA?

As someone who has worked most of his life in a hospital environment, I think that is necessary to create stronger links with the community in which University of Aveiro operates (UA should go out more often), namely through the assertive dissemination of the existing resources in the clinical research arena.



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1. What are your personal perspectives as a researcher?

My first commitment as a researcher of the University of Aveiro (UA), and as a member of the Department of Education (scientific area of Psychology), is to improve the Behavioral Sciences in a lab and field experimental perspective. In the last two decades, Psychology at the University of Aveiro has been widely recognized both at the national and international levels, with experimental psychology as the tenet of the work developed both in basic and applied psychology domains.

From the standpoint of the philosophy of knowledge, “subjectivity” relates to the properties of a subject who knows. On the contrary, “objectivity” relates to the properties of an object of knowledge. In the field of subjectivity there are individual differences, while in the field of objectivity there is an intersubjective agreement. However, when there is intersubjective agreement about a property of a subject (e.g., a preference), this property (subjective) becomes objective. Therefore, psychology can be a science in its own right since researchers are conceptually and methodologically rigorous (precise concepts, universal terms, validated measurements, experimental paradigms, and adequate mathematical analysis). Psychology

has to be clearly distinguished from common sense and, therefore, must be empirically validated (evidence based psychological practice). On the other hand, psychological phenomena (e.g., consciousness) have an epistemological and ontological status that is distinguishable (but not separates) from the physical, chemical, biological and social phenomena.

So, as researcher in this area, I think that it is vital to perform robust behavioral experiments in the real world and in the laboratories (e.g., cognitive and affective neuroscience, biofeedback, and so on), to build mathematical models and theories (not only statistical models), to run randomized clinical trials, follow-up studies, and to test hypotheses about the relationships between psychological phenomena and social and biological (not only neuroscience) phenomena – social psychology and psychobiology. My conviction is that we should not restrict our research and practice to applied settings. The investigation of basic psychological phenomena is critical to the extent that there is not a good practice without a solid theory.

To ensure that psychology is a science in its own right and useful to the mankind, we have to supervise research projects (including PhD theses), we have to strive for competitively funded projects, we have to publish our studies in scientific journals with blind peer review and international metrics (impact

factors, number of citations, H-index, etc.), preferably in a teamwork context and framed in a research center evaluated by independent international panels (...)

2. In your opinion, what are the biggest challenges in your area of research?

From the perspective of the entities that fund scientific research, as well as the Portuguese Agency for Evaluation and Accreditation of Higher Education (A3ES), Psychology is a social science and with little relevance, compared to the exact, life, health sciences, and engineering.

Thus, under the current economic situation of the country, with increasing budget cuts, the sustainability of psychology at UA (teaching and research) is at risk. However, the problem may be overcome if the UA explores its matrix structure. The scientific production of the psychology group of UA has been increasing, as well as the capture of funded projects.

3. Where are the strengths of the UA in your opinion?

The main strength of the University of Aveiro is its matrix structure, which enables an efficient management of resources and a rapid resolution of the problems of all kinds. Furthermore, UA is a new University and the structure of the campus facilitates communication between teachers and non-teaching employees, as well as students and visitors.

4. Could you give one idea to improve research in the UA?

The departments of the University of Aveiro should collaborate more to jointly organize meetings with internal referees (monthly?), where researchers of different areas present their projects and results. The UA could also have a proof-reading to help researchers to publish their papers and to submit research proposals. Many universities nowadays have this type of service, considering the current context in which internationalization is increasing.



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1. What are your personal perspectives as a researcher?

Do better research and the industry field. Continue and reinforce the ability not only to produce, but also, and with a special emphasis, to transfer the obtained knowledge to other generations of researchers and practitioners.

2. In your opinion, what are the biggest challenges in your area of research?

The re-industrialization of Europe and Portugal is at the present political agenda due to its crucial importance to the economic development. Manufacturing has a huge importance in the re-industrialization process, given its applicability in the production of components to the automotive, aeronautics and aerospace industry as well as other advanced industries. As a consequence, the development of modern manufacturing needs to incorporate more and deeper scientific knowledge through the findings of a deep laboratory experiment, related with modeling, simulation and optimization, using complex and sophisticated computational and statistical methods. It is a great challenge to achieve lean manufacturing. The development and implementation

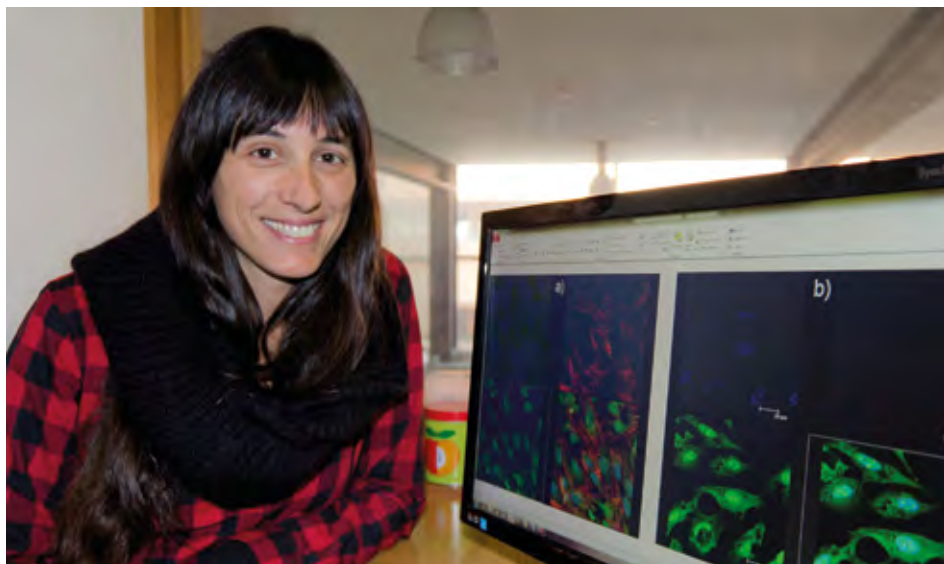
of methods and sustainable manufacturing technologies (taking into account environmental, economic and social issues) also constitute a major challenge to this research area.

3. Where are the strengths of the UA in your opinion?

The university dynamics, the quality and scientific and professional abilities of its human resources, its innovative campus as well as the strategic location of Aveiro city (with excellent communication and transport infrastructures between the North and South of Portugal), are strengths of UA. The good position of UA in the major international "rankings" is another relevant and very positive issue with a great importance for all those who are seeking to the university as a place where they can develop their studies and research.

4. Could you give one idea to improve research in the UA?

Valuing researchers and research results in an objective way, is crucial to maintain the motivation and improve performance of all those that are involved and committed in the research area.



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1. What are your personal perspectives as a researcher?

Throughout my scientific career, I have sought to successfully join interdisciplinary knowledge, from physics to biology, by actively pursuing complementary formation, including 10 years of mobility experience in different European laboratories in order to work with high level biomedicine and materials experts to acquire new and mandatory knowledge for my scientific aims (...) Following this strategy, my current priorities as a researcher, are to make use of this acquired knowledge to establish a multidisciplinary team favoring national and international synergies, while initiating collaboration among expert groups in Europe through membership of excellence networks in bioengineering. Such activities will, ultimately, strengthen the individual position and generate professional stability. The research team I am building up will promote cooperation and will boost European Science and technology in an emergent state-of-the art area such as Nanomedicine.

2. In your opinion, what are the biggest challenges in your area of research?

The application of engineered nanomaterials in research, development, and commercial

products is widespread and has been growing rapidly. Nevertheless, there is currently no information or legislation, regarding the safety and toxicity requirements for nanoparticles. Every nanosystem has different features concerning size, shape and surface properties, and needs to be investigated for achieving an optimized prototype that could be used in therapies without human body accumulation risks or any environmental impact.

Moreover, the application of these nanosystems for fighting against cancer is a potential future strategy to revolution the therapies that we accept as common, but which are mostly inefficient and carry more adverse effects than beneficial. Therefore, the design and understanding of how these nanosystems could be used in an innovative manner to control human tumoral processes, is one of the main keys to create new efficient therapies. Nevertheless, we cannot forget that although academic institutions, governments, and industrial facilities are expending significant resources in the pursuit of nanomaterial technologies to be applied in Medicine, there is still a limitation concerning the number of new products that are successfully introduced into the marketplace. So academic-industry links must be created and strengthened in order to successfully transfer the knowledge from universities to real applications.

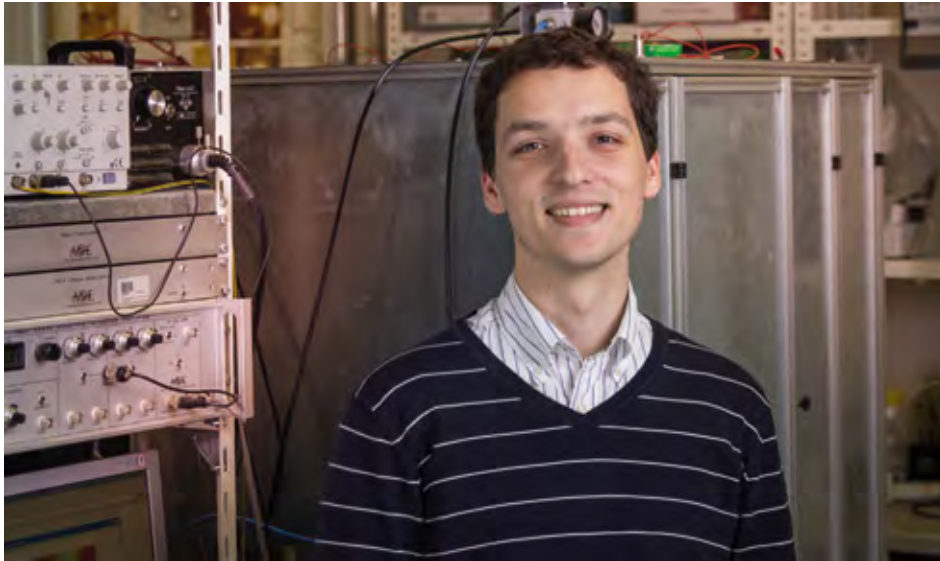
3. Where are the strengths of the UA in your opinion?

That is question I have been asked several times when I decided to move back here for creating a new research team and a new laboratory. The University of Aveiro has always supported me from the very beginning of my scientific career and I have always found here, a young and innovative environment that supports young researchers to develop their talents. The University of Aveiro offers a highly internationally oriented and interdisciplinary platform that facilitates multidisciplinary science. Moreover, it is a very active University in terms of scientific dissemination, so creating internal collaborations is highly accessible. The entire university infrastructure, scientific and administrative, that surrounds and supports us as researchers, is perfect for helping us to develop science.

4. Could you give one idea to improve research in the UA?

One of the most important ways of supporting science is taking care of the scientific researchers (...) Frequently, researchers that have invested huge efforts in creating new research lines and supporting them during many years end up leaving because of their precarious future without permanent or long-term contracts. This fact is a serious issue and it is stopping the faster and continued development of science.

Moreover, now that we are confronting an economic crisis which directly affects us and our opportunity of getting funding for performing our research, we have to, more than ever, get conscious that money should be attracted from European funding. The University of Aveiro is doing a good effort on spreading information, and is helping us in all administrative matters very efficiently. But we are competing with European universities that have specific professional offices for assisting researchers in writing projects and analyzing future failures. As a suggestion, the UA should create a strong European office with scientific qualified personnel able to assist all researchers interested in writing projects, without having to depend on the FCT contact points which have to assist all Portugal.



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1. What are your personal perspectives as a researcher?

As a researcher working on the Surface Engineering and Corrosion Protection group, SECOP (CICECO-DEMaC) one of my main goals is to continue well-established activities in the field of smart coatings for high performance applications, a field of high interest among materials scientists as well as industry, for which I have been contributing in recent years as a researcher of UA. Currently, our group is internationally recognized by the work in self-healing coatings for corrosion protection, as well as impact-and corrosion-sensitive coatings for vehicle applications. Furthermore, the development of nanostructured materials for controlled release of active substances is a topic transversal to different areas of science and engineering. As a result, I am leading activities in collaborative projects (FP7, QREN) within fields that go from sensors for food packaging to development of multifunctional paper. Personally, my aim is to strengthen networking with groups, nationally and internationally, through participation in several H2020 and industrial-based projects so that these recent R&D activities find a sustainable growth in the forthcoming years.

Together with “materials-based” objectives I find of the utmost importance that design of new materials takes into account the use sustainable resources, and at the same time the toxicity of generated nanomaterials when released in the environment is investigated. This integrative vision is already being applied in our activities in collaboration with other groups from UA as well as in the frame of international partnerships. Within our group, one of my goals is to assist the formation of highly motivated MSc, PhD and Post-Doc researchers to work in this challenging area, retaining enough critical mass to keep high-level research in the group. Ultimately, this generated knowledge will be accessible to students that would like to take a post-graduate degree in our university.

2. In your opinion, what are the biggest challenges in your area of research?

In the field of smart coatings for protective applications the main challenge is to be able to adapt lab-designed systems for industrial testing and validation. There are hundreds of works reporting remarkable responses under controlled conditions but in the majority of cases serious validation cannot be done because several points are not considered, namely:

- lack of integrated vision on the conditions that a coating must withstand under service life;

- correlation between (lab) electrochemical testing and accelerated standard tests;
- feasibility of the upscaling of promising nanomaterials;
- compatibility between new functional nanoadditives and conventional coating technologies;

3. Where are the strengths of the UA in your opinion?

UA combines high level scientific staff with young and motivated researchers. These are, in my opinion, the main ingredients to achieve a balanced and sustainable growth of the institution on its main objectives: education and research.

4. Could you give one idea to improve research in the UA?

Researchers and professors are quite often overloaded with financial and administrative issues, in addition to their scientific and academic responsibilities. One simple suggestion is to consider hours of managerial/administrative staff in the budget of projects. That would allow the hiring of people to closely monitor a set of projects, in order to increase the level of support to researchers and facilitate the role of administrative personnel in the central services. In some cases this could maximize the level of project execution (and income), without significantly compromising the budget of the institution.



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1. What are your personal perspectives as a researcher?

It is an enormous privilege to do what one likes while being paid for that. This is how I picture my research. I was 7 years old when I saw men walking on the moon. Mesmerized by this event I decided to be a scientist, an unlikely endeavour being in a poor country estranged from Europe. I took a degree in Physics and Chemistry that included a lot of maths, philosophy, psychology and sociology as it was aimed at high-school teachers. This was a blessing because it gave me a room with a very broad view over the World. Eventually, in 1985, I got a position at the Chemistry Department, University of Aveiro, and started giving lab classes and tutorials. Those days, there were no lab facilities to do decent research towards a Ph.D. (in Aveiro or almost anywhere else in the country). This is how, in 1988 by the hand of Prof. Júlio Pedrosa, I turned out in the University of Cambridge (UK) to meet Jacek Klinowski my Ph.D. mentor and life's personal trainer. Nothing would be the same after, for me. Coming down from Cambridge I was committed to show that excellent research might be done even in obscure places. I was successful enough in getting a European project to finance my group and the solid-state NMR spectrometer Aveiro had bought in the

frame of CIENCIA programme. In 1994, I co-authored a Nature paper and came out of obscurity. Until 2002 it was just hard work and the sheer pleasure of doing research, day after day, building up my group. But for some reason this did not seem enough to me. I wanted to put Aveiro on the map of Science and for that I needed to gain critical mass. This is when my group and others in Aveiro came together and started a Materials Science and Engineering institute known as CICECO, initially with over two hundred people (now four hundred). We got the special status of 'Associated Laboratory' and could hire researchers, buy equipment and start spinning our wheels. Twelve years have passed and CICECO is now one of the main European institutes of its kind. In summary, the small step for a man on the moon lead to my personal giant leap of creating CICECO. However, what really excites me is doing research and learning. I used to be a chemist or a physicist but now I do not know anymore what I am as so many other fields attract my attention. This, in the end, is the joy of Science.

2. In your opinion, what are the biggest challenges in your area of research?

Here are some of the challenges of my present research. As I often turn to nature (particularly minerals) to conceive new solids, can I make materials that outperform natural ones, and how? Can understanding of how water clusters form (and their nature) in sim-

ple solids provide clues as to how clusters of water molecules influence the reactivity of proteins or enzymes? How do we engineer light-emitting metal centres (lanthanides) in order to obtain efficient materials, for example, for optical communications or for sensing temperature, pH and molecules? How do we engineer nanosystems capable of (simultaneously) working as contrast agents for magnetic resonance, optics and thermal imaging? The structure and dynamics of some very important materials are difficult to characterise because of poor crystallinity, disorder and defects. How do we combine various experimental tools (NMR, diffractions) with computer modelling in order to accomplish that?

3. Where are the strengths of the UA in your opinion?

Very low bureaucracy, swift action, easy flow of information and a pragmatic attitude to solving problems, mixed with a vision for the future, have been the main strengths of UA. These assets are not for ever and we must be vigilant not to kill the chicken and lose to our competitors. Particularly in times of crisis, it is very tempting to find (cold) comfort in the greasy hands of bureaucracy. I am afraid some among us are giving in.

4. Could you give one idea to improve research in the UA?

There is only one way of improving UA's research: hire the best possible people; and because we are not rich, hire the most promising young people around. Give them some seeding money and a lot of freedom to act. Assess their work after a decent period of time (4-5 years) and keep the best. We already do this, to a certain extent, but we are not doing nearly enough and our agenda must be clearer and bolder. This is not easy. What really matters is never easy.



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1. What are your personal perspectives as a researcher?

Like any mathematician I would like to found my own mathematical school, i.e. getting students and fellow researchers to understand and follow my approach to Mathematics. I also would like to find the right balance between „Pure“ and „Applied“ research. This means on one hand creating a method in terms of an abstract theory while on the other hand looking into the practical implementation. Usually, mathematical algorithms have the problem that they are either too theoretical (work only with academic examples) or that they have no theoretical justification (seems to work if one looks at examples, case studies). Getting both sides right, i.e. developing a method which is justified by a mathematical theory and works well in practical cases happens not that often.

2. In your opinion, what are the biggest challenges in your area of research?

There are several. Probably the biggest challenge is the large gap between the increasingly sophisticated methods used by the specialists and the standard methods normal researchers know from their mathematical education. This leads to a lack of communication and dissemination of ideas as well as increasingly hard efforts of young researchers to catch up with the experts. Apart from that there is the curse of dimensionality (anything being done in 3D and higher requires very high computational costs) and the focus on algebraisation in favor of geometric calculations. This leads to an unhealthy imbalance between the two approaches.

From a pure scientific point of view the biggest challenge looks to me the construction of a function theory over higher non-commutative structures. Nowadays, it is well known how to do it for simple symmetries, like $SU(2)$, but other cases remain difficult.

This has connections with many problems, for instance, in extending Hörmander's principal symbol calculus to a full symbol calculus.

3. Where are the strengths of the UA in your opinion?

In the first place we have many young researchers with high motivation. At least in the Department of Mathematics there are no pre-determined areas of Science which allows our researchers to look out for new areas and explore new opportunities. There is a large support from colleagues and administration which allows researchers to pursue top-level research within the constraints of a „small“ university with limited resources. It also has a beautiful campus and a nice ambience which makes it easier to invite top-level researchers for short research stays.

4. Could you give one idea to improve research in the UA?

At the research day one should not only speak about results, but also about problems. Presenting a kind of „collection“ of problems which are currently considered hard problems or problems in „standby“ from each research center could lead to a bigger interaction between researchers from different areas.



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1. What are your personal perspectives as a researcher?

As a researcher, my main personal perspective is that the results of my research contribute to increase the scientific knowledge that should be used to develop new products designed to make people's lives easier and safer. This way, I always keep in mind that working in the lab must be performed for developing cost-effective solutions to implement a new processing method, or insert a new product (materials/components) in the industry in a short or long term, taking in account questions such as minimizing the scrap/waste and ensuring the worker's safety. Furthermore, the research in a specific field should be carried out in collaboration with multidisciplinary teams, experts in the field or in other research topics from around the world. My career has been conducted following these principles. I started to work as a research fellow in the metal porous and metallic foams field, my main specialisation, in the well-renowned Fraunhofer-Institut in Bremen, guided by the most expert Scientist in this field, Prof. Dr. John Banhart. Together, we started a pioneer research work on laboratory studies about kinetics of the metallic foaming process, achieving my doctoral degree with the thesis entitled "Metallic Foams: Production, Characterisation and

Numerical Simulation". Since this pioneer laboratory work, my research has mainly focused on the development of structural components based on Al-alloy foams and their manufacturing methods including the design of efficient equipment and tools for industrialising the process. Some successful cases are the outcome of the collaboration with an industrial Portuguese company (MJamaral) and international RTD entities (e.g. University of Maribor and Technical University of Berlin). One example of this is an efficient automated continuous production line (7 m x 1.5 m x 1 m) for manufacturing components based on metal foams (...).

2. In your opinion, what are the biggest challenges in your area of research?

My main research field is in the metallic foams, which are light-weight, recyclable, non-inflammable materials having an excellent energy absorption and a good sound absorption used in different industrial sectors (e.g. transport industry and building construction). The development of light metallic foams started in the 90s. Nowadays, a number of processing techniques is available that allow us to produce a variety of metallic foams. Also, there is clearly a commercial and military interest of the companies, funding agencies and research institutes. However, the main reason that such materials are not used in large-scale is due to their high price. The challenge of future process development is not only to improve the foam properties but also to further reduce costs to make them competitive in relation

with the alternative products (...). One of the biggest challenges is the development of new processes to join the foams with the other materials promoting a strong chemical bonding during the foam formation to produce structures based on foams with a stable and predictable mechanical performance, as well as to eliminate the additional joining step which is one of the main cost drivers of multi-material-design in the automotive industry. Another challenge is to develop graded foam-filled thin-wall structures aiming towards a better crashworthiness performance.

3. Where are the strengths of the UA in your opinion?

The University of Aveiro has several strengths which is a blend of education, research, scholarship, and professional accomplishment. The main strength of the UA is the people which are energized, dynamic and enthusiastic people comprised by excellent professors, scholars, researchers and professionals. Another strength is the wide offer of courses in areas ranging from music to sciences and engineering, as well as a friendly alumni, a powerful business model which promotes innovation by exploiting the knowledge produced at UA and its transfer to the business sector and/or by supporting the protection of intellectual property and its respective commercial exploitation or by supporting the establishment of technology-based companies. Furthermore, the way that the campus was constructed, concentrating all the department buildings together, allows for easier communication, collaboration and cooperation between all staff. Also, the UA is integrated in a very nice city (Portuguese Venice) located in the centre (middle) of Portugal with very good roads and railway accesses, with one of the most important Portuguese business frames around. The UA offers high-quality graduate programs.

4. Could you give one idea to improve research in the UA?

The improving of the research in the UA is to promote the research career offering more permanent posts instead of short fixed-term research contracts, also ensuring the career progression.