Unique competencies developed through collaborative networks: synergies of the 4Cs

Sneha Saha, Peter van der Sijde, Ellen Langemeijer, Steve Briddon, Jacqueline E. van Muijlwijk-Koezen & Martine J. Smit

Creativity, Critical thinking, Cooperation & Communication

Adobe Stock © *picture-waterfall*

In today's fast-paced and constantly evolving job scenario, it's more important than ever to have a clear set of competencies that will enable an increase in performance and productivity in scientific research and development (R&D). Competencies are the building blocks of success, providing individuals and organisations with the knowledge, skills and attitude needed to achieve their respective goals. It is important to understand the status of the competencies to provide insights into how new ideas are generated, and solutions are developed and implemented in the context of an emerging scientific domain.

This communication focuses on the views of the 16 early-stage researchers (ESRs) who are involved in scientific research organised by the training network ONCORNET2.0 (ONCOgenic Receptor Network of Excellence and Training). This is a Marie Skłodowska-Curie Action (MSCA)-funded Innovative Training Network (ITN), a network for excellence focusing on two oncogenic G protein-coupled receptors (GPCRs); the classical chemokine receptor, CXCR4, and the atypical (β-arrestin biased) chemokine receptor, ACKR3.

Within our network, we have been using a multi-faceted, collaborative approach coupled with state-of-the-art technologies to modulate and unravel the roles of these oncogenic GPCRs (ONCORNET, 2021).

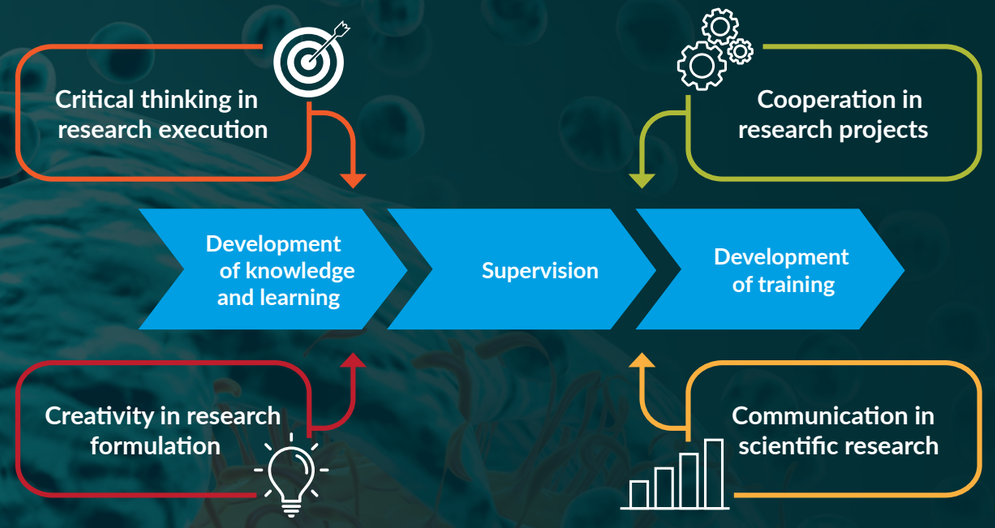

Figure 1: Development of competencies in an emerging domain. The 4Cs framework.

Here, we present the ESRs' experience of developing their competencies during their appointment.

The value of interaction

Exploring the views of the scientific workforce of this ITN will help to enhance the research network and further strengthen the ties of its participating organisations. This contribution aims to present the value of the interactions among the multidisciplinary work packages accomplished by the ESRs in this network. It aims to describe the synergies of 4Cs (Creativity, Critical Thinking, Cooperation and Communication) in the context of multidisciplinary work packages. These four dimensions were identified in terms of workplace performance by the detailed study of Lamri and Lubard (2021) and are used to explore the views of ESRs in the framework of the ITN for the period between 2020 and 2023. The objective was to generate insights about the benefits of competencies and, additionally, to raise awareness about the integration of scientific knowledge at a structural level within the European Innovation Capacity in a competitive learning environment within emerging technologies.

As new technologies emerge, there is a need for research that explores their potential applications and limitations, as well as their impact on R&D processes and outcomes. The novelty of fundamental oncogenic GPCRs research was a unique opportunity to develop knowledge in the emerging domain and prepare the ESRs by equipping them with the necessary competencies. Previously, the ONCORNET 1.0 project (2015–2018) was set up with the goal of generating knowledge at the boundaries between the disciplines with a multidisciplinary approach. The scientific information in the previous project was processed as it successfully trained 15 ESRs and delivered tools and technologies to target the oncogenic GPCRs , CXCR4 and ACKR3. Consequently, ONCORNET2.0 was built to train the next generation of multidisciplinary GPCR scientists by using these unique tools to further unravel the contribution of these GPCRs to tumour progression. This helped to focus on the effectiveness of managing knowledge across the disciplines and, in particular, draw out domain-specific knowledge in fundamental and translational GPCR research.

Areas of focus

Learning and development of knowledge which focuses on the identification of CXCR4/ACKR3 modulators, their interactome and monitoring of structural changes through functional characterisation of these receptors in various translational cancer model systems. It involved the design, synthesis and pharmacological characterisation of photoactivatable small-molecule ligands and (multivalent) nanobodies and imaging of CXCR4/ACKR3 using labelled nanobodies. Additionally, the objective was to study the spatial and temporal organisation of CXCR4, ACKR3 and their interaction with EGF receptors co-expressed in multiple model systems. Changes in (onco)signalling were monitored using photo-switchable ligands, nanobodies and receptor FRET/BRET-based (CXCR4/ACKR3, beta-arrestin) sensors to determine the kinetics of receptor activation and signalling interactions important for a systems biology approach.

Development of skills focusing on different transferable competencies such as media training, writing skills, personal development and drug discovery simulation in industrial settings were addressed in the workshops. Adequate supervision and support were provided at all levels to facilitate learning and development of knowledge by the principal investigators, supervisory board and the ESRs themselves. Furthermore, online technology forums were held to train and educate in advanced technologies and to generate new ideas and implement them during the pandemic period. This helped all participants to stay updated with the latest research developments.

4C framework

Using the 4Cs framework, we developed a survey and elicited responses from the participating ESRs which was carried out during the workshop in February 2023. The experiences of the ESRs are described under the subheadings based on the 4Cs framework.

Creativity

The majority of the ESRs indicated that there was ample space for creativity in their daily research. This showed that they were open to change and motivated to innovate in a challenging learning environment. They worked creatively across different areas of activity, such as the experimental design of new modulators and the creation of novel biosensors and model systems. They had the ability to work independently on their projects, and this helped them to learn to prioritise the scientific experiments that could lead to interesting and relevant results. They expressed their freedom to be creative within the boundaries of the project.

> “We are creating a novel biosensor for CXCR4 and planning an experiment for this; for me, this can give one a chance to be creative.”

Critical thinking

Most of the ESRs indicated they had sufficient resources to address critical research problems in their research project. They had to break away from conventions, employing originality of thought to generate new ideas while remaining relevant to the project. Depending on the nature of the problem, they relied on literature searches and taking considerable steps to learn more about the studied GPCRs in cancer. This helped them to solve complex research problems. An important characteristic of this critical thinking was understanding the basics of how and why certain experiments failed. It encouraged the ESRs to reflect on their learning with an academic and industrial viewpoint that would enhance their decision-making for the future. This made learning from previous experiences valuable by bridging the gap between theory and practice in this emerging domain.

> “Trying different approaches, trying different troubleshooting, doing literature research and asking for help from colleagues and then relying on creativity, patience and perseverance (and trying to break down why they didn’t work in the first place) helps me tackle critical questions.”

Cooperation

As part of the ONCORNET2.0 project, the ESRs had the opportunity to work with fellow ESRs from other universities. They did so by visiting each other’s laboratories, working on distinct collaborative projects, and doing experiments with common project goals. They were interested in keeping up with new research in the field, working in teams through progress meetings with supervisors and ESRs, while also undergoing training on scientific topics and transferable skills.

Some ESRs considered secondments an excellent way to cooperate and learn actively via joint tasks, which deepened their understanding of shared projects. They stated that they also had the chance to cooperate with technicians, colleagues in the lab and also with bachelor and master students in their respective projects.

Secondments at industrial project partners provided experience within a company environment, culture and other ways of decision-making processes. This cooperation was achieved by sharing of ideas and expertise and exchanging information related to their research topic.

> “I cooperate with my colleagues by constantly managing my usage time, equipment and material. Presenting interesting data which would benefit others, sharing of lab duties and responsibilities, paying attention to the place that my scientific output can complement that of colleagues and contribute to a productive research path.”

Communication

The majority of the ESRs confirmed that they could communicate about their research both within and outside the consortium, and their level of communication was reasonably good in most parts. Everyone received feedback on their research communication process during their work period. They had the chance to discuss relevant ideas in an emerging scientific domain of cancer and proposed solutions to address the research questions. It was based on conferences, meetings, lectures and secondments. They did so via presentations, posters and research articles in scientific seminars, conferences, attending online workshops, and face-to-face meetings. Several researchers had the chance to communicate at young scientist seminars, e.g. Forum for Young Scientists (FYS) seminars at Vrije Universiteit Amsterdam, while a few also mentioned social media platforms such as Twitter.

> “I do communicate at different levels. Passively, by paying close attention to any relevant data which is generated by colleagues. Actively, by proposing and participating in joint activities which could deepen our scientific understanding of our shared projects.”

Image: ONCORNET2.0 consortium - Workshop at the University of Nottingham July 2022.

In summary

The main points of this report are that ESRs of this ITN network worked creatively at all levels of the inter-organisational network and in different areas of scientific research. Excellent levels of cooperation and communication were achieved within the ONCORNET2.0 consortium, as expressed directly by the current cohort of ESRs.

A final reflection based on this 4C framework would be to compare the outcome of the earlier generation of ONCORNET with the current generation of researchers in ONCORNET2.0 on a long-term basis.

In the future, it would be useful to determine more about domain-specific knowledge in terms of:

- What types of challenges in disciplines are being faced by the research team?
- What is required to develop adequate common knowledge?
- How do the current capacities and abilities need to be coordinated to address the novelty in GPCR cancer research more effectively?

Such insight would encourage further research on the contributions of the work packages, which focus on identifying modulators through functional characterisation to in vivo cancer models.

Conclusion

In conclusion, developing the 4Cs of competencies is essential for success in today’s society. By encouraging ESRs to work creatively, think critically, and cooperate and communicate within and outside the research platform, ONCORNET2.0 has significantly contributed to improving scientific productivity. It has been fruitful in providing training opportunities that encourage collaboration and teamwork for the next generation of researchers. We conclude that, by exploring the importance of developing competencies in a research setting, ESRs are well-equipped for scientific R&D. Additionally, they are able to enhance their own performance and have the potential to achieve greater success in their careers to the benefit of individuals, research networks and scientific organisations as a whole.

References

ONCORNET (2015 - 2024) *ONCOgenic GPCR Network of Excellence and Training- Innovative Training Networks (ITN). Available at:* https://oncornet.eu/.

Lamri, J. and Lubard, T. (2021) ‘Creativity and Its’ Relationships with 21st Century Skills in Job Performance’, *Kindai Management Review*, *9*, *pp.* 1–17. Available at: https://www.kindai.ac.jp/files/rd/research-center/management-innovation/kindai-management-review/vol9_6.pdf.

ONCORNET2.0

PROJECT SUMMARY

The ONCORNET2.0 (ONCOgenic GPCR Network of Excellence and Training) consortium (2020–2024) aims to consolidate an international training network of early stage researchers (ESRs) focused on drug discovery for oncogenic GPCRs. The project methods span a wide range of techniques and disciplines aimed at furthering our understanding of two receptors heavily involved in oncogenic processes.

PROJECT LEAD

The project coordinator of ONCORNET2.0 is Prof. Martine J. Smit (Professor Target and Systems Biochemistry, VUA). Martine Smit coordinated ONCORNET1.0, has received personal (NWO-Vidi/Vici) and public-private funding. Her expertise focuses on modulating and unravelling the signalling properties of human and viral chemokine receptors. She is supported by Prof. Jacqueline van Muijlwijk (educational research chair and vice dean education, VUA), Dr Ellen Langemeijer (project manager, VUA) and Prof. Steve Hill (UNOTT) as confidential advisor to support and advise ESRs.

CONTACT DETAILS

Ellen Langemeijer, Project Manager
De Boelelaan 1108, 1081 HZ Amsterdam, Netherlands
+31 20 5987540 (voicemail only)
e.v.langemeijer@vu.nl
www.oncornet.eu
@ONCORNET1

MARIE CURIE ACTIONS

FUNDING

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie Innovative Training Networks (MSCA-ITN) grant agreement No. 860229.