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Title Page

Early-Career Complementologists (ECCO)– Past Achievements and Future Directions.

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6

1 **Abbreviations**

2	COVID-19	Coronavirus disease 2019
3	ECCO	Early-Career Complementologists
4	ECN	European Complement Network
5	ECRs	Early Career Researchers
6	EFIS	European Federation of Immunological Societies
7	ICS	International Complement Society
8	PIs	Principal investigators
9	yEFIS	The EFIS Young Immunologist task force

10

1 “The secret of change is to focus all of your energy, not on fighting the old, but on building the new.”

2 — *Socrates*

4 **1. ECCO: a working group for early-career complementologists**

5 In 2019, the Early-Career Complementologists (ECCO) was officially established as a new working
6 group for early-career researchers (ECRs) in the complement field (Poppelaars et al., 2022). A year
7 prior, two groups of dedicated young complementologists had separately come up with the idea to start
8 a collective network to support ECRs within their field. By joining forces, ECCO was founded a year
9 later. The current ECCO committee is comprised of seven ECR representatives and is gender-balanced
10 (the authors of this article). The main mission of ECCO is to link all ECRs whose research activities
11 involve investigating the complement system. To do so, ECCO seeks to establish a platform for
12 networking, support, and promotion of these scientists. Moreover, ECCO would like to serve as the
13 voice of ECRs in the complement field. ECCO is recognized and supported by the International
14 Complement Society (ICS) and the European Complement Network (ECN), the two largest complement
15 system societies led by scientists from academic, clinical and other branches. The launch of the ECCO
16 task force fits within the expansion of associations of young immunologists within Europe (Schober et
17 al., 2020). In recent years, thirteen new associations have been established for ECRs within national
18 immunology societies (Bechara et al., 2021). These national associations of young immunologists are
19 united under the European Federation of Immunological Societies (EFIS), named young EFIS (yEFIS)
20 (Costas-Ramon et al., 2020; Schober et al., 2020). However, it is important to acknowledge that
21 associations of ECRs are nothing new as they have been around for more than 15 years. Examples
22 include the World Association of Young Scientists (WAYS, launched by UNESCO in 2004) and the
23 Global Young Academy (GYA, launched by the Global Network of Science Academies in 2010). A
24 unifying feature of these young scientist groups is that they aim to advocate for ECRs by sharing their
25 perspectives and by engaging in active dialogue with senior members of their respective societies to
26 find solutions for the challenges faced by ECRs. Secondly, the goal of these young scientist groups is
27 to boost the visibility of ECRs by organizing training events, specific research sessions featuring ECRs
28 during the yearly conference of their society as well as social events to network.

29 Alongside existing efforts of the ECN and ICS to accommodate the needs and challenges of ECRs
30 (e.g., teaching days, training and early career awards, and travel grants for ECRs at the annual society
31 meetings), there are several important initiatives that should ideally be advanced by the ECRs
32 themselves when considering the current situation. Furthermore, the need and motivation for an ECRs

working group are plentiful. Firstly, since ECRs make up a large portion of the complement field, the ECN and the ICS should also provide embedded support for these young scientists. During the European Complement Meeting 2019 in Madrid, 1 in 5 attendees was an ECR. Secondly, an ECCO working group will enable ECRs to share their view with policymakers, predominantly the ECN and ICS. This can then be used as a guide to improve research environments and support networks that better nurture and retain talent. Thirdly, and perhaps most importantly, a working group stimulates ECRs to assess the barriers or difficulties in their career path and to actively contribute to finding solutions. Conclusively, as ECRs will become the next generation of scientific leaders in the complement field, recruiting, retaining, and cultivating them will not only help ECRs but the entire complement research field. In this special issue of Molecular Immunology for the 18th European Meeting on Complement in Human Disease, we want to give an update on ECCO activities thus far and present the future plans of the ECCO working group.

2. Reflections on past achievements.

Since 2019, ECCO has organized and participated in various activities to support and engage ECRs in the complement field. During the COVID-19 pandemic, ECCO established a strong social media presence as a strategy to reach a large and diverse complement community with the main focus on ECRs. ECCO is currently operating on four major social media platforms; Twitter (@EccoComplement), ResearchGate (<https://www.researchgate.net/project/ECCO-An-initiative-to-support-early-career-researchers-in-the-complement-field>), Facebook (www.facebook.com/EarlyComplement), and LinkedIn (early-career-complement-society-ecco). Twitter is the leading social media platform for scientific news as well as scientific discussions, and during the pandemic more and more researchers, journals, and institutions started using this platform. ECCO, therefore, uses Twitter to promote and inform about its actions and complement-related research. As of August 2022, we have over 279 followers and we aim to continue to grow. ECCO also wanted to have an informal channel to offer peer support, and we accordingly also maintain an ECCO page on Facebook. ECCO also has a community page on LinkedIn to help facilitate global networking, especially during these times with minimal in-person meetings and events. On these platforms, ECCO reports about science, professional events (e.g., conferences and seminars), job openings, fellowships, funding opportunities for ECRs, and social activities. In addition, ECCO uses these social media platforms to give recognition to ECRs as well as increase the visibility of their work. For example, every week ECCO showcases a research article by an ECR, and every month ECCO features an ECR as “Scientist of the month”. Although our target audience is ECRs, we

1 invite all mid-career and established researchers in the complement field to follow our social media
2 platforms, especially our Twitter and LinkedIn, since this will increase interactions between ECRs and
3 senior members within the complement field.

4 ECCO also collaborates with other ECR organizations such as yEFIS, as well as with expert
5 societies such as the ECN and the ICS. By working with other immunology associations, ECCO wants
6 to develop interdisciplinary collaborations and yEFIS regularly features ECCO updates and activities in
7 their newsletters. Furthermore, the website of the ICS ([www.complement.org/early-career-complement-](http://www.complement.org/early-career-complement-investigato)
8 [investigato](http://www.complement.org/early-career-complement-investigato)) and the ECN (www.ecomplement.org/early-career-complementologists.html) have a
9 specific page for ECCO. Another example of a collaboration between ECCO, the ICS, and the ECN is
10 the “ECCO – Ph.D. Journal Article Award”, which recognizes a scientific publication in the complement
11 field by a (former) Ph.D.-student. To avoid a narrow evaluation of academic impact, this prize is not
12 awarded based on conventional metrics such as impact factors or citations but rather looks at quality,
13 creativity, and originality. At the 28th International Complement Workshop, ECCO awarded this prize
14 for the first time. Likewise, ECCO will award their “ECCO – Ph.D. Journal Article Award” again during
15 the upcoming 18th European Meeting on Complement in Human Disease set to take place in Bern,
16 Switzerland in August 2022. Another important action recently undertaken by ECCO is the
17 establishment of a free registered membership to facilitate direct contact with ECRs
18 (<https://bit.ly/ECCOmembership>). Membership is open to all early-career scientists worldwide with an
19 interest in the complement system, from Master students, PhD students, and Post-Docs to Early-Career
20 Faculty, as long as they are no longer than 6 years post-PhD. As of August 2022, we have 81 members
21 and we ask all remaining ECRs in the complement field to register. Altogether, through these activities,
22 ECCO aspires to find solutions via a bottom-up approach, complementing the existing efforts of the ECN
23 and the ICS.

25 **3. Survey on the challenges and needs of ECCO members**

26 While the pandemic has created new opportunities for certain research areas (Norton et al., 2020), the
27 negative impacts on science have been significant and widespread (Levine and Rathmell, 2020; Termini
28 and Traver, 2020a). Recent reports have shown, that the COVID-19 pandemic has limited researchers'
29 access to laboratories and other on-campus university facilities (Servick et al., 2020), that research
30 productivity has declined sharply (Myers et al., 2020), that scientific collaborations have decreased (Fry
31 et al., 2020), and that key resources and public attention have diverted away from other research
32 priorities (Saini et al., 2020). These reports raise serious concerns about the long-term impact of the

COVID-19 pandemic on the future of ECRs and the funding landscape. Available evidence suggests that the pandemic has disproportionately affected ECRs (Chirikov et al., 2020; Johnson et al., 2020; Kent et al., 2020; Termini and Traver, 2020b). A recent survey of 362 university-based scientists by Johnson *et al.* revealed that ECRs and female scientists faced more hardship during the pandemic than other groups (Johnson et al., 2021). These differences have worsened already existing disparities and could alter career trajectories. Simply put: ECRs are faced with significant challenges and these have only worsened with time. Moreover, these negative effects may last beyond the end of the COVID-19 pandemic. To counteract these problems, different efforts and initiatives are underway to help ECRs (Bielczyk et al., 2020; Gibson et al., 2020; Stapleton et al., 2020).

In order to help improve conditions for ECRs, it is important to identify their problems. In our previous ECCO paper, we discussed the obstacles and challenges of ECRs and identified three general unmet needs; mentor and peer support, working conditions, and the imbalance between career interests and prospects (Poppelaars et al., 2022). However, the information on these challenges was based on existing published literature. The purpose of the current report is, therefore, to provide a synopsis of the challenges and needs of ECRs in the complement field. We surveyed 52 ECRs (= max. 5 years post Ph.D.) whose research focuses on the complement system (Figure 1). The survey consisted of four parts: 1) general needs and challenges, 2) mentoring, supervision and peer support, 3) working conditions, and 4) career interests and prospects. We asked the survey responders several open questions together with scoring various statements on a scale from 1 (fully disagree) to 5 (fully agree). Below, we discuss the results of our survey. The full overview of the questionnaire and answers can be found in the supplementary data. ECCO continues to collect data on the needs and challenges of ECRs in the complement field, and we encourage all remaining ECRs to participate in the survey (<https://forms.gle/2aSwQwTKBR6Ez9QR7>). However, it's important to mention the limitations of our questionnaire. First of all, we cannot exclude the possibilities of certain biases in our survey, such as a sampling bias and/or nonresponse bias. Furthermore, in addition to our open questions, we presented our responders with various statements which could lead to a response bias. Lastly, the answers of our questionnaire were not compared to a cohort of other early-career professionals.

3.1. General needs and challenges

When asked whether ECRs in the complement field face significant obstacles and/or challenges in their research, almost half (46%) of respondents agreed with that statement. Respondents who encountered obstacles/challenges were also more likely to have unmet needs in their research jobs. This suggests

that if these needs are met, the challenges and obstacles faced may be lessened. When asked for further details, over 40% of respondents identified 'lack of resources and funding', 'extreme workloads and/or constant pressure for productivity', and 'uncertainty of career prospects' as being the primary obstacles/challenges they faced. To a lesser extent (>25% of respondents) 'pressure to publish', 'lack of fair financial compensation', and 'challenges related to the COVID-19 pandemic' were also identified as significant challenges faced by ECRs in the complement field. There were several common overlaps between the faced obstacles, for example, >50% of respondents who identified 'extreme workloads/constant pressure for productivity' as a challenge/obstacle they faced also identified 'pressure to publish', and "uncertainty of career prospects" as additional issues (Figure 2).

3.2. Mentoring/supervision and peer support

It has long been recognized that ECRs are building their careers under increasingly difficult conditions and that this situation requires immediate action ("Early-career researchers need fewer burdens and more support," 2016). As stated in the previous editorial, there is no question that supervision and mentoring are essential to ECRs. There is no question that supervision and mentoring are essential to ECRs. Unsurprisingly, there is extensive literature demonstrating that mentorship strongly predicts the later success of an ECR (Ma et al., 2020; Malmgren et al., 2010). Furthermore, a graduate survey by *Nature* revealed that mentorship added more to ECRs' satisfaction with their Ph.D. project than any other factor (Woolston, 2017). It has also been shown that effective supervision has a positive impact on the ECRs' productivity, self-efficacy, and professional confidence, while it also prevents emotional exhausting and burnout (Devine and Hunter, 2016; Hemmings, 2012; Taylor, 2012). In our survey, 70% of ECRs in the complement field felt they received adequate supervision (agree or fully agree), whereas only 10% felt they did not (Fig. 3A). Additionally, when asked if they received appropriate mentorship concerning for instance career guidance, the majority answered 'Yes'. (55%) (Fig. 3B). Overall, responders were thus positive about the mentoring and supervision they received. Nevertheless, it is also important to focus on the responders that had unmet needs regarding mentoring and supervision, an example of those answers is: "The extreme pressures and workload as well as constantly decreasing funds that are directed at my supervisor are also reflected to my work, by long revision delays and chains of short contracts for a long project.". Supervisors face increasing pressure due to changes in funding and higher education policy. In the United States, funding success rates are less than half of what they were in 1980 (Fochler et al., 2016; Müller, 2014). This burden on principal investigators (PIs) is also impacting ECRs, especially when PIs change their faculties or depart academia altogether (Forrester,

2022). Other examples in our survey of unmet needs regarding mentoring and supervision were: “My mentor is extremely hard on me and unfair.”, “It would be nice to have another mentor in addition to my supervisor.”, “I would love to be connected with an investigator more experienced in complement research.”, “A proper postdoc for supervision since I’m directly supervised by a professor who is often very busy.”.

Peer support is also known to positively affect the academic output of ECRs (Margaret K. and Shannon, 2021). However, peer support is unfortunately not universal among ECRs and alternative forms, such as peer networks, have therefore attracted increasing attention. Only a third of responders indicated that they receive adequate peer support through colleagues within their department/institution. The responders listed several reasons for lacking peer support: “We have a very small group so there are really no other postdocs to talk to.”, “I’m the only PhD-student working on complement.”, “Peer support from research colleagues is lacking due to the small nature of complement research in our department.”. A recent article from Merga and Mason described the importance of peer support even in the absence of adequate supervision, especially concerning motivation, inspiration, ideas and advice, as well as emotional support (Margaret K. and Shannon, 2021). In our survey, when asked what kind of peer support would help, the responders mentioned: “more post-docs”, “more Ph.D. colleagues in my group”, “simply discussion about the methods (not only looking at the results’ graph)”, “Better access to complement researchers in our institution/beyond and better support from our home immunology department.”. Although adequate mentoring, supervision, and peer support are all crucial for ECRs, our survey revealed that ECRs in the complement field have more unmet needs regarding peer support and responders found it important to connect with other ECRs in the complement field.

3.3. Working conditions

Over 70% of ECRs in the complement field indicated that they face high workloads to advance their career and fulfill expectations from supervisors, research institutions, and funding organizations. In accordance, when asked “On average, how many hours is your workweek?”, 27% of ECRs in the complement field reported that their weekly work hours exceed 55 hours. Previously, a survey by the Global Young Academy found that ECRs worked roughly 55 hours per week (Friesenhahn and Beaudry, 2014). Working long hours comes however with certain risks. A recent study by World Health Organization (WHO) reported that working 55 hours or more weekly is associated with higher health risks when compared to a 35-40 hour workweek (Pega et al., 2021). Furthermore, burnout rates among ECRs are alarming (Primack et al., 2010). The self-reported high workload of ECRs in the complement

field is paralleled by the self-reported challenge to maintain a healthy work-life balance, which more than 80% of responders experienced. Half of the ECRs in the complement field reported that they “fully agreed” with this statement, which adds more concern to the issue. It is important to note that the consequences of heavy workload on young professionals also have far-reaching social impacts, such as the delay in childbearing, which is already seen in developed countries (Vollset et al., 2020). In line with global trends, over 73% of ECRs in the complement field found that their work limits or adds uncertainty to family planning. Remarkably, only 14% of responders found that their workload distribution and responsibilities were somewhat unfair, and strong unfairness was not reported. Almost half of the ECRs in the complement field agreed or strongly agreed that demands were fair, which likely indicates either that a high workload is expected within academia or that the ECR status with challenging working conditions is viewed as a transient phase the young academic enters by choice. Our results also seem to be in line with an earlier report by the Global Young Academy that concluded that young scientists are highly motivated and passionate about doing research, despite being faced with major challenges (Friesenhahn and Beaudry, 2014). According to ECRs in the complement field, working in academia does not come without its challenges. 45% of responders indicated that they do not receive fair financial compensation for their work, while a third finds that they receive fair financial compensation. These results stress that policy makers, funding agencies and the research community urgently need to find solutions to alleviate financial and workload burden for ECRs. Importantly, institutions present a varying scope of opportunities for ECRs in the complement field (Figure 4). Most responders felt that their working environment is inspiring and that it supports their growth at least to some degree, yet 12% “fully disagreed” with this. Half of the ECRs in the complement field found the evaluation and promotions in their job fair and to at least some degree transparent, while a quarter of the responders disagreed that this was the case. Transparency is vital concerning academic standards in research, promotion criteria, and assessment procedures. Fairness is crucial in terms of responsibilities and workload distribution of ECRs. The challenges in maintaining a healthy work-life balance by ECRs have been further accentuated by the COVID-19 pandemic (Fien et al., 2022). This is also reflected in the ECCO community as iterated by a responder: “the pandemic and having to balance this with having young children. Working from home, due to no/limited opening of kindergartens, it cuts me from well needed hours in the lab.”. Furthermore, the responders listed several challenges ranging from “difficulty to combine clinical duties with a scientific career” to “lack of or uncertainty of funding”, which was the most frequently mentioned obstacle. Limited contracts, lack of positions and infrastructure also received multiple mentions.

3.4. Career interests and prospects

The landmark paper by Ghaffarzadegan *et al.* determined that in the United States, there is approximately one faculty position for every six Ph.D. graduates in the biomedical science field (Ghaffarzadegan et al., 2015). When asked about career prospects, our survey respondents reported that their main concerns included lack of available funding opportunities and uncertainty about the feasibility of continuing work in the complement field. When provided with the following statement: “The future looks bright for my career prospects”, ECRs in the complement field were very divided. Most responders scored this statement as neutral (40%), compared to 37% who agreed and 23% who disagreed. Regarding funding opportunities, half of the responders felt that there are not enough opportunities to pursue. Lack of funding was therefore one of the most commonly mentioned challenges for ECRs in the complement field. We also asked responders if they believe it is feasible to continue working in the complement field. Once again, ECRs in the complement field were very split in their response and the most common answer was neutral (38%). More respondents stated that it was achievable to continue (31% agreed, and 6% fully agreed) than those expressing it being unattainable (21% disagreed, 4% fully disagreed), still, both answers were frequently mentioned. When participants were asked about the area they aspire to work in, 67% chose academia, 25% industry, and 8% were distributed among other answers such as a medical career or “still deciding” (Figure 5). This is interesting since international surveys reported much higher numbers of Ph.D. candidates that spired a job in academia (Ghaffarzadegan et al., 2015; Woolston, 2017). This also stimulates the ECCO working group to create more opportunities for ECRs in the complement field to learn and interact with industry. For this section, we concluded by asking the participants what their biggest obstacles are in pursuing their career interests and what the complement field could do better to recruit, retain and cultivate talent. Regarding career obstacles, some examples of the answers were: “Uncertainty”, “Low Salary”, “Research Positions in the industry focused on complement”, and “Healthy work-life balance”. Regarding strategies to support ECRs in the complement field answers included: “Early Career Grants”, “More meetings for PhD-students”, and “Connect Biotech to Ph.D. students”. In summary, the largest concerns for ECRs in the complement field surrounding career prospects include a lack of available funding sources and uncertainty surrounding their ability to stay in the complement field, while most respondents reported a desire to work in academia in the future. Noteworthy, these combined challenges create a scientific environment that drives ECRs to be conservative over being ambitious. More specifically, since ECRs are often evaluated on past performances such as the number of

1 publications, they are pushed to select scientific projects that will generate several papers rather than
2 research topics that embark on an open question. Overall, there is, therefore, a need for ECRs to have
3 the freedom to pursue findings with significance, rather than doing projects that only lengthen their
4 publication lists.

6 **4. Conclusions and future outlook**

7 ECCO promotes diversity and equality in science. We, therefore, urge ECRs from Africa, Asia, Oceania,
8 and South America to join the ECCO committee to ensure a more inclusive approach involving all
9 regions, not just North America and Europe. In the past, ECCO hosted a scientific meeting for ECRs in
10 Luxembourg with the help of Dr. Xavier Dervillez (Senior research scientist, Luxembourg Institute of
11 Health, Luxembourg). As countries continue to lift their COVID-19 restrictions, ECCO is considering
12 organizing in-person meetings or events again in the future. Nevertheless, we also intend to host
13 webinars and online workshops to reach a broader audience worldwide and enable easy access to
14 ECRs who don't have the financial support to travel. ECCO will continue to collaborate with other ECR
15 associations such as yEFIS as well as expert societies such as the ECN and ICS, to boost
16 interdisciplinary and international collaborations. In addition to the "ECCO – Early Career Journal Article
17 Award", we are looking into potential additional awards or honors for ECRs in the complement field.
18 Furthermore, ECCO wants to improve and boost interactions among ECRs, because we can learn a lot
19 from each other as well as gain peer support. We are, therefore, planning to look into further options to
20 promote interactions and networking among ECRs in the complement field to share information, skills,
21 and potentially material by generating a discussion/interactive platform. Considering the importance of
22 funding in science, we want to assist ECRs in identifying possible funding opportunities by creating a
23 newsletter, or perhaps a database for grant options. Overall, through these plans, we intend to improve
24 the visibility of the work of ECRs, boost collaborations between ECRs, and provide recognition as well
25 as support to ECRs worldwide.

26 ECRs represent the next generation of leaders in science, possessing unique ideas, creativity,
27 and talents to innovate the field of complement research. The complement community, from individual
28 researchers to organizations and funders should aim to inspire and cultivate ECRs. Only through these
29 collaborative activities can we address the challenges faced by ECRs, and ensure that ECRs have
30 opportunities to excel, realize a healthy work-life balance and meet their career goals. Moreover, we
31 urge ECRs to identify and examine the barriers in their career path and to be actively involved with
32 ECCO to find solutions and create support networks. Whether it be through informal meetings, webinars,

1 mentoring sessions, or social media, acknowledging and recognizing the distinct challenges and needs
2 of ECRs is the first step in solving these problems together with improving research communities that
3 best serve ECRs.
4

1 **Conflict of Interest**

2 The authors declare that the research was conducted in the absence of any commercial or financial
3 relationships that could be construed as a potential conflict of interest.

5 **Author contributions statement**

6 All authors were involved in writing the manuscript and editing the final manuscript. All authors read and
7 approved the final manuscript.

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