

# How do National Career Systems Promote or Hinder the Emergence of New Research Lines?

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**Abstract** Early career researchers are faced with the expectation of their scientific communities to conduct independent research, which is reflected in the development of independent new research lines. This change must take place under conditions that vary between national career systems. Case studies for a chair system (Germany) and two tenure systems, one with strong hierarchies (the Netherlands) and one with flat hierarchies (Australia) were conducted. The career conditions created by universities and funding agencies during this transition phase towards independence are systematically compared for two fields, molecular biology and history. Despite their different structures functional equivalents lead to similar outcomes: Only a small group of the potential elite had sufficient ‘protected space’ to start new research lines without delay. The majority of early career researchers encountered limitations of their ‘protected space.’ Differences between the systems occurred due to the increasing importance of the external funding system for the creation of ‘protected space’: researchers were better off in a rich funding landscape with higher grant success rates.

**Keywords** Academic careers · Early career phase · National career systems · Knowledge production

## Introduction

The production of novelty is the central imperative of the science system, as e.g., Merton’s (1973 [1957]) norm of originality or Kuhn’s (1963) notion of an essential tension between the need to offer new knowledge and the necessity to embed this

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knowledge in the scientific community's state of the art illustrate. So far, the conditions under which researchers can deviate from their existing research have been mainly looked at with a focus on particularly radical or influential changes (Heinze et al. 2009; Laudel and Gläser 2014). However, thematic change is a ubiquitous phenomenon. It happens at least once in most academic careers because early career researchers need to establish themselves as independent members of their scientific communities (NRC 2005; Puljak and Sharif 2009; Böhmer and Von Ins 2009), a status passage which usually involves moving away from the topics they investigated under supervision. Additional thematic changes occur when researchers follow opportunities provided by new knowledge, new opportunities to collaborate, or various pressures exercised through the governance systems they are embedded in. This is why investigating the conditions under which researchers change the directions of their research can contribute to our understanding of both the epistemic dynamics of science and the ways in which it is influenced by science policy.

The conditions under which new lines of research emerge, and particularly the conditions under which early career researchers are able to begin such lines, are partly shaped by academic careers. Careers operate as channels through which authority over research content is exercised by two processes, namely, the creation of positions and the selection of academics for these positions. The actors involved in these processes decide which researchers are provided with opportunities to conduct research and what these opportunities are in terms of time horizons, autonomy, and discretion over resources (Laudel and Gläser 2008; Whitley 2014).

The aim of this paper is to identify causal mechanisms through which the early stages of the academic career shape opportunities for a researcher to develop or take up new lines of research. In order to become independent members of their communities, researchers need to decide autonomously about the content of their research. But how is this still possible given the global trends towards temporary positions, more casual and project-based employment, later tenure, and more evaluations? In particular, the trend towards prolonged postdoctoral phases with little prospects of a tenured position has been frequently reported (Stephan and Levin 2001: 682–683; NRC 1998, 2005; Åkerlind 2005; Cantwell 2011; Lam and de Campos 2014; NAS 2014).

The increasing internationalization of career patterns notwithstanding (Crawford et al. 1993; Ackers and Gill 2009), career systems still are highly nationally specific and path dependent (Musselin 2004, 2010; Finkelstein 2014). This makes it possible to exploit the variation of national career systems in a search for causal mechanisms that link institutional conditions for careers to changes in the content of research. The empirical research presented here is a comparative study of early career researchers in Australia, the Netherlands, and Germany. Since career patterns and their impact on changes in research content are also likely to vary between fields, I compared early careers in molecular biology and history.

In the following sections, I first provide a review of the state of the art on the impact of careers on research content and the conceptual framework of the study. After presenting the methodology, I compare the three career systems and the change of lines of research by early career researchers in molecular biology and

history in these career systems. Conclusions address the mechanisms found and implications for the distribution of opportunities to innovate in different career systems.

## Conceptual Framework

### *The Impact of Careers on Research Content*

The question addressed by this article is located at the intersection of two large literatures, namely, research on academic careers and research on the impact of conditions for research on epistemic choices. Since it is impossible to do justice to these literatures in the confines of one article, I focus on the main ideas on which this article draws. To begin with the rapidly growing literature on academic careers, we note that only a very small proportion of this literature is devoted to the impact of careers on the content of research. Following the lead of the general career theory in which they are embedded, most studies are interested in career satisfaction or general ‘attainments’ (see the general review by Hermanowicz 2012 and the reviews on careers and gender by Zuckerman 1991; Fox 1995 and Prpić 2002). Studies that include research content do so with an emphasis on research performance, which is measured by publications, citations, or co-authorships (e.g., Reskin 1979; Long and McGinnis 1985; Miller et al. 2005; van Balen et al. 2012). Some of these studies link research performance to specific independent variables such as mobility or funding programs for early career researchers (e.g., Melin and Danell 2006; Hornbostel et al. 2009; Zubieta 2009; Jacob and Lefgren 2011; Cañibano et al. 2011). These perspectives are in line with the interest of general career theory in the success of careers but also follow this interest in their exclusion of the content of work.

Studies of academic careers also follow general career theory in their traditional focus on organizations. The embeddedness of academic careers in the production of scientific knowledge and the specific role of scientific communities has been either entirely neglected (e.g., by Bowden 2000; Huisman et al. 2002; Robin and Cahuzac 2003; Gaughan and Robin 2004) or has been treated as a ‘context’ of the organizational careers of academics (Duberley et al. 2006). In contrast, early studies of careers by sociologists of science investigated links between the early career phase and a possible elite phase and thus contributed to our understanding of longitudinal structures. Thus, it was shown that the scientific elite selects and directs early career researchers in particularly promising research areas and increases the likelihood that these researchers become elite themselves (Mulkay 1976: 446–454; Zuckerman 1977: 99–100).

The difficulties involved in capturing the complexity of institutional influences on academic careers might be a reason why only few attempts were made to compare academic career systems and their effects. Gaughan and Robin (2004) used survey and CV data in an investigation of causes for the success of early careers in France and the US, which they defined as acquisition of a permanent academic position. They included the prestige of research organizations and the type of funding of PhD positions (public vs. industry funding) as institutional influences.

Pezzoni et al. (2012) compared career progress in France and Italy by measuring productivity, institutional affiliations, co-authorships with star scientists, and co-authorships with full professors from the same university. Both studies found commonalities of and differences between the two career systems but could neither theoretically describe the differences nor explain how they produced the observed effects.

A second literature addresses the impact of conditions under which research is conducted on epistemic choices. The very first laboratory studies observed that research is decision-impregnated, and showed the adaptation of epistemic choices to circumstances to be a ubiquitous phenomenon that is constitutive for the social construction of scientific knowledge (Latour and Woolgar 1986 [1979]; Knorr-Cetina 1981). This research tradition of science studies, which continues until today, undoubtedly reaches the highest resolution in the study of entanglements of conditions and epistemic choices. It is therefore uniquely suited to explore the conditions under which researchers work, the meaning they give to their work, and the epistemic choices they make. A recent study that applied this high resolution to the study of a career phase showed how postdocs in molecular biology try to control epistemic risks of their research, e.g., by working on one safe and one high-risk project in parallel. The study observed the emergence of “effectiveness and mainstream orientation as key virtues” (Felt et al. 2012: 22; see also Müller 2014b, par. 28, 32). The pressure to publish makes postdocs trade the supervision of their group leader’s PhD students for co-authorships (Müller 2014a: 342–343). Concerning responses by postdocs to epistemic and social uncertainties, Sigl described interactions between research content and the project form, e.g., social uncertainties resulting from the situation that a research process could not be finished in the time frame prescribed by the project (Sigl 2016: 349).

A comparison of studies of research groups in the biosciences illustrates a trade-off faced by science studies. In-depth studies of entanglements of social and epistemic aspects of research must sacrifice breadth and vice versa. For example, the study of power relationships and control strategies in a research group by Owen-Smith (2001) identifies patterns of interaction but cannot reach the maximum level of detail when it comes to epistemic practices. The same applies to Hackett’s (2005) study of group structures. Given the current average size of science studies projects, such projects appear to be suited to either the study of patterns at the highest level of detail or the study of trans-situational patterns such as careers. Identifying meso-level patterns requires comparing cases beyond the single laboratory, field, or country.

### *A Comparative Framework for Studying the Impact of Careers on Research Content*

My discussion of the state of the art demonstrates that a study of causal mechanisms linking national career patterns to the emergence of new lines of research in the early career phase must strike a specific balance between breadth and depth. It must pay more attention to research content and epistemic choices than studies of academic careers usually do. At the same time, a level of aggregation is needed at which a study of longitudinal structures, comparisons of national career patterns and

of field-specific epistemic practices becomes feasible. I address this dilemma by singling out epistemic choices that are strategic in the sense of opening up new paths (and path dependencies) for the researcher. Decisions on research problems, empirical objects, approaches and collaborations can be identified in the plethora of everyday decisions made by researchers, can be discussed in interviews, and can thus be exploited for comparative studies.

The conceptual framework applied in this investigation links a theoretically grounded comparison of career systems to a comparative approach to research content by identifying the mechanisms operating in academic careers. Thus, the conceptual starting point of this investigation considers careers as containing mechanisms that link two sets of qualitatively different conditions, namely, institutions and knowledge. To develop a sufficiently complex concept of careers, I will draw on theoretical considerations that have been developed and applied in the investigation of academic careers from a sociology of science perspective (Gläser 2001; Laudel and Gläser 2008; Gläser and Laudel 2015a). Building on insights from the Chicago School of Sociology (Barley 1989), on research on professional careers (Dalton et al. 1977; Zabusky and Barley 1997), the model analytically distinguishes between three interrelated careers of a researcher:

- (1) The *cognitive career* consists of thematically connected problem-solving processes in which findings from earlier projects serve as input in later projects. These connected problem-solving processes constitute one or several distinct ‘research trails’ (Chubin and Connolly 1982).
- (2) The *community career* consists of specific stages of role expectations of researchers in their scientific community. An *apprentice* learns to conduct research while working under the direction of others. PhD students are usually apprentices, in some cases this stage may extend to early postdoctoral phases. A *colleague* conducts independent research, i.e., autonomously decides on problems to solve, on approaches to problem solving, and on ways to communicate results to the scientific community. A *master* additionally acts as a supervisor of apprentices. A member of the *elite* additionally shapes the direction of the knowledge production of their community.
- (3) The *organizational career* is a sequence of organizational positions that provide the material basis for conducting research (salaries, infrastructure and resources) and are tied to expectations concerning the conduct and outcomes of research.

National career systems (the independent variable) can be understood as the system of national institutional rules that shape academic careers. The rules are developed, implemented and maintained by a variety of actors, including the state, funding agencies and research organizations, as well as more diffuse social context such as national scientific communities. National career systems create specific patterns of organizational careers, i.e., typical sequences of positions in research organizations.

The dependent variable describes a change in the early career researcher’s cognitive and community careers, namely, the emergence of new lines (trails) of research. A new line of research is a series of interconnected problems the researcher has not previously worked on. The major change in the community career is that the

work on the new line of research is expected to be independent in that researchers select goals and approaches themselves. This does not preclude negotiations, especially in highly collaborative research that is conducted in groups. However, in contrast to PhD students and postdocs working on the group leader's lines of research, early career researchers working on their own lines have the authority to accept or disregard suggestions concerning the research that is now 'theirs.'

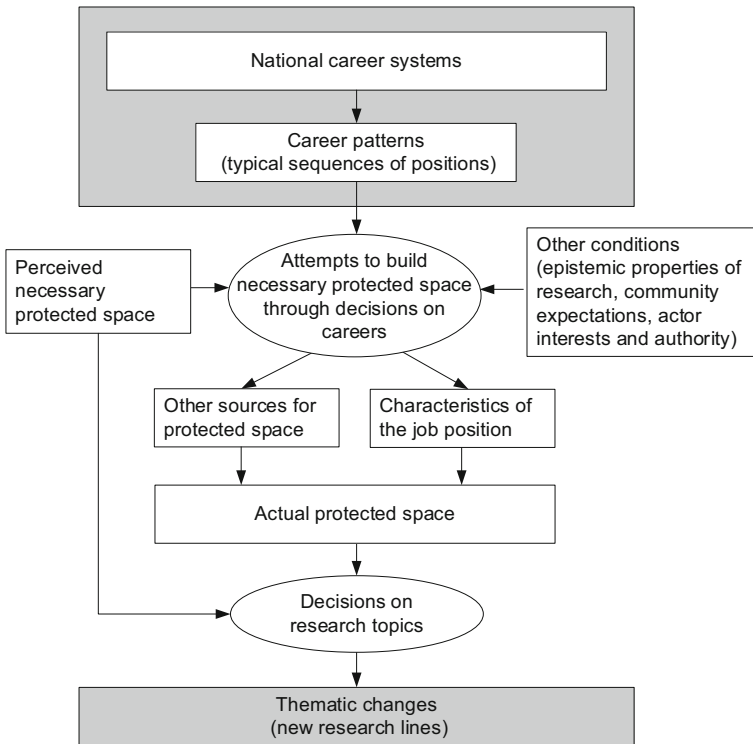
Beginning new lines of research is risky because previous knowledge cannot be used to the same extent as in the continuation of existing lines of research, and because the community does not recognize a researcher's expertise in the new area and might be reluctant to grant the necessary resources. It is thus likely to be successful only under specific conditions, which are shaped by the organizational career.

The ways in which different career systems provide these conditions can be compared with the concept of *protected space*. Protected space is defined as the space of possible research problems that a researcher can autonomously select and pursue. Autonomy means the absence of hierarchical intervention or reputational consequences that would endanger future research (Gläser et al. 2014: 302; Whitley and Gläser 2014: 8). It is thus not equated with the absence of external pressures but instead refers to the impossibility for external actors to prescribe problems or approaches, and the possibility to engage in work that does not reduce the researcher's reputation to a level where they are not trusted with the community's resources or collaboration anymore. Whitley, Gläser and colleagues introduced two dimensions of protected space, namely, the *time horizon* for which a researcher has autonomous discretion over resources and the *amount of resources* at the discretion of the researcher, which includes personnel over which the researcher has authority. If the role of protected space for thematic changes in research is to be considered, the *range of topics* to which the control of research capacity for a specific time horizon applies must be added as a third dimension. Size and shape of the protected space necessary for starting a particular line of research depend on epistemic characteristics of this research and its relation to prior work.<sup>1</sup>

From this definition follows that all researchers have some protected space because research cannot be fully prescribed and standardized. Even dependent researchers such as PhD students or closely supervised postdocs have some discretion over resources, albeit for a limited time and often in a narrow thematic spectrum determined by supervisors. In this case, protected space is granted by those who have discretion over research themes and resources (mainly group leaders and professors), and remains contingent on their decisions. Independent researchers build protected space through their choice of positions, negotiating access to resources and acquiring resources through grants. A researcher's opportunities to build protected space can be expected to strongly depend on their organizational

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<sup>1</sup> Although it includes major factors influencing opportunities to begin new lines of research, the concept protected space is not intended to comprise all conditions for thematic change. In particular, it excludes opportunity structures provided by local configurations of knowledge and collaborative relationships that might trigger the emergence of new lines of research. This is possible for the question at hand because the emergence of ideas for new lines of research is excluded from analysis. My question is restricted to the impact of career systems on the opportunity to begin new lines of research, however conceived.



**Fig. 1** Causal relations between national career systems and thematic change

position and the conditions of research defined by it. The latter include a degree of formal autonomy, discretion over resources, and the eligibility for grants.

The mechanisms translating conditions provided by national career systems in opportunities to start new lines of research can be expected to operate in researchers' attempts to build the protected space they believe necessary for such a thematic change (Fig. 1).

The early career phase is of particular interest for an investigation of conditions under which new lines of research can be started. In this phase, the scientific community expects a researcher to become independent, i.e., to move from being an apprentice (conducting research under the supervision of a mentor) towards being a colleague (conducting autonomous research). This transition is very likely to be connected with the initiation of a new line of research (Laudel and Gläser 2008).

## Methods and Data

I draw on empirical material from three empirical investigations. The main source of data is a comparative study of the impact of national career systems in Germany, the Netherlands and Australia on early career researchers' opportunities to develop

**Table 1** Overview of conducted interviews (in brackets: number of interviews from the secondary study)

	Careers in different research areas	
	History	Molecular biology
<i>National career institutions</i>		
Germany	10	9
Netherlands	8	9
Australia	10 (3)	14 (4)
	60 (7) total	

independent lines of research. Data from this investigation are complemented by a study of early career and mid-career researchers who received funding by the European Research Council (Laudel and Gläser 2014). In these two studies, I conducted 60 semi-structured interviews with early and mid-career researchers at German, Dutch and Australian research organizations (mainly universities) between 2007 and 2011. The research age of informants varied between three and seven years after the PhD. To capture field-specific career differences, I studied careers in two different fields: molecular biology as a science field and history as a humanities field.

The two fields differ in their epistemic characteristics and social structures of research. Molecular biology is an experimental field that is characterized by medium codification of knowledge, medium reliance on technology in research, and rapid methodological progress. These properties are largely responsible for the high specialization of molecular biologists and the resulting group structures and collaboration networks (Knorr-Cetina 1999; Owen-Smith 2001; Hackett 2005). Learning is usually not completed with the PhD but extends into the postdoc phase, which is often supervised (Knorr-Cetina 1999; Hackett 2005; Müller 2014a). By contrast, history is a field whose knowledge is weakly codified, whose methods are observational and scarcely based on technologies, and in which personal perspectives play a crucial role in the formulation of research questions and decisions on what counts as evidence. The field's research is highly individualized, and the independent formulation of research questions begins with the PhD project or immediately thereafter at the latest (Gläser et al. 2010).

In addition to the two studies described above, I utilized interviews with Australian academics from a previous project on the impact of evaluation-based funding on Australian university research (Gläser and Laudel 2007; Gläser et al. 2010). The study included molecular biology and history, which made it possible to use seven interviews for extending the Australian case. Table 1 gives an overview of the interviews.<sup>2</sup>

<sup>2</sup> Due to the combination of data from several studies, the interviews were conducted across a rather long period of time, and some of them almost ten years ago. This is not a problem because the aim of this article is to provide a *theoretical* account of links between conditions and effects rather than up-to-date *descriptions* of current career systems. Nevertheless, recent checks of national career systems in the three countries confirm that the conditions observed in this study still hold.



Interviewees were asked about their research, their careers and conditions under which they carried out their research. Identifying new lines of research and types of research is a difficult task. Therefore, the interviews were carefully prepared by gathering internet information, reading researcher's publications and by applying an individual-level bibliometric analysis of the interviewee's publications to prompt extensive narratives about their research (Gläser and Laudel 2015b). The interviews were analyzed by qualitative content analysis which extracts information into theoretically and empirically derived categories (Gläser and Laudel 2013).

## **National Career Patterns and Protected Space in Germany, Australia, and the Netherlands**

In this section I describe positions held by the investigated researchers in each career system and the typical protected space they provide. I also include career patterns, i.e., sequences of positions that frequently occurred empirically. This analysis differs from other comparisons of academic systems (e.g., Teichler and Höhle 2013; Kreckel and Zimmermann 2014) in its inclusion of typical positions irrespective of their funding source and in its comparative approach. Instead of comparing the protected space formally ascribed to the positions, I compare the actual protected space they provide for research as empirically observed in this study. Findings from interviews were supplemented by information on formal aspects of positions collected from documents on career systems.<sup>3</sup>

Australia, Germany and the Netherlands show interesting differences in their national academic employment systems. Academic employment systems can be categorized as chair systems, tenure systems or tenure-track systems depending on the path to tenure they provide.<sup>4</sup> Chair systems are characterized by late tenure and an academic's formal dependence from a chair holder in the (long) period between the PhD and becoming a professor. Germany is a typical representative of the chair system. In contrast, Australia has a tenure system that is characterized by a short probation period, early tenure and internal promotion. The Australian system is characterized by flat hierarchies; academics on all university positions are formally independent. The Netherlands have a tenure system too, but combine it with

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<sup>3</sup> The focus on career patterns that were observed in the empirical investigation explains the absence from the discussion of other funding sources than research councils. None of the interviewed researchers used funding from private foundations or industry. The role played by private foundations varies between countries. It is very limited in Germany but significant in the UK or the US. Since their funding practices often resemble those of the research councils, it is unlikely that any specific career patterns could emerge from their actions.

<sup>4</sup> The term "tenure model" is often used both for systems that provide early tenure without significant probation periods and for systems with long and rigorous probation periods, after which tenure might or might not be granted (see e.g. Altbach 2000 or Enders and Musselin 2008). I follow a suggestion by Kreckel (2008: 17) who distinguishes the former "tenure model" from the latter, which he terms "tenure-track model."

elements of a chair system because strong *de-facto* dependencies from professors exist: the latter control university resources and the supervision of PhD students.<sup>5</sup>

### Germany

The two most frequent types of positions for German early career researchers are postdoctoral positions and university positions for Research and Teaching Associates. Postdoctoral positions are research-only positions that are funded by either universities or external funding agencies. In the sciences, they are frequently funded by group leaders from grants or recurrent funding. Early career researchers can also apply for postdoctoral fellowships, which mostly fund postdoctoral stays abroad. The protected space provided by positions funded by group leaders and fellowships hardly differed. Postdocs receive a salary or stipend but no resources for research. The resources they need to conduct research are controlled by the group leader. The range of topics for their project is limited by the project for which they are recruited or by the research interests of their group leader.

Academic standard positions at German universities below the level of tenured professorships are fixed-term positions for Research and Teaching Associates (*Wissenschaftlicher Assistent*). The maximum term of such a position and thus the time horizon of its protected space is six years. Research and Teaching Associates are not formally autonomous but are assigned to professors who direct the associate's research (Waaiker 2015: 49). Therefore, the range of topics of their protected space is limited by their professor's research interests, and they have no discretion over recurrent funding. Their time for research is reduced by teaching duties, which amount to four contact hours per week plus the accompanying meetings with students, exams, and administration.

This long period of formal dependence of Research and Teaching Associates was seen as a problem by science policy and motivated the introduction of the *Junior Professorship* in 2002 (Pritchard 2006). Junior professors are appointed for six years with a mid-term evaluation. They are formally independent and autonomously decide on their teaching and research. The resources they receive for research vary considerably between universities and within universities between institutes. Some junior professors do not receive any recurrent funding, while others receive resources and even positions for PhD students.

Another attempt to increase the independence of young researchers is the introduction of positions for junior research group leaders. Junior group leaders have temporary research-only positions and receive funding for positions, equipment and consumables. They are also formally autonomous. These positions are funded by science departments at universities or by external funding agencies.

Additional positions provided by external funding agencies, the most important of which is the *Deutsche Forschungsgemeinschaft* (DFG), include the DFG's "Temporary Positions for Principal Investigators" which are equipped with

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<sup>5</sup> The Dutch system has been gradually changed by extending probationary periods to five or six years and introducing more rigorous evaluations (Fruijtier and Brok 2007). It is thus moving towards a tenure-track system. The effects of these changes were too recent to be detected in this empirical study.

**Table 2** Early career positions observed in molecular biology and history in Germany

Employment situation	Autonomously controlled research capacity		Time horizon of protection	Range of topics	Authority
	Discretion over resources (personnel, equipment, etc.)	Time for research			
Postdoc in a research group	None (dependent on group leader)	100%	Usually 2 years	Determined by group leader or PI	Funding agency/university
DFG Temporary Positions for Principal Investigators	Some material support	100%	3 years	Self-determined	Funding agency
Emmy-Noether group leader	ca. two PhD positions, some equipment and material support	100%	5 years	Self-determined	Funding agency
Feodor Lynen fellowship	Some material support	100%	1–2 years	Self-determined	Funding agency
Casual teaching positions	None (only access to infrastructure)	Very little	ca. 1–2 years	Self-determined	University
Research and Teaching Associate	None, dependent on professor	Reduced by teaching	Usually 6 years	Determined by professor	University
Junior professor	Varies, sometimes start-up funds	Reduced by teaching	6 years	Self-determined	University

resources but do not usually include funding for additional positions. For historians, the *Feodor Lynen Fellowship* of the Alexander von Humboldt Foundation was an important externally funded independent position. This fellowship with a time horizon of one to two years targets the early career phase (up to four years after the PhD). It requires international mobility because it only funds stays abroad. Sometimes, historians were casually employed on teaching contracts or other supporting work, which provided very little protected space. These historians could use the infrastructure but could only do research in the time beyond the contract.

Table 2 summarizes the main types of positions in the two fields and their characteristics in terms of protected space. The research capacity could be extended through external grant funding, mainly from the DFG. At the time of data collection the success rate for the most common grant was still high, around 40% of proposals were funded (DFG 2011: 173).

### Australia

The Australian career system also features many postdoctoral positions and fellowships for early career researchers. The protected space for postdocs was the same as in the German system. Fellowships were funded by external funding

**Table 3** Early career positions observed in molecular biology and history in Australia

Employment situation	Autonomously controlled research capacity		Time horizon of protection	Range of topics	Authority
	Discretion over resources (personnel, equipment, etc.)	Time for research			
Postdoc in a research group	None (dependent on group leader)	100%	Usually 2 years	Determined by group leader or PI	Funding agency/university
Independent fellowship	Close to none	100%	Usually 3 years	Self-determined	Funding agency/university
Casual teaching positions	None (only access to infrastructure)	Very little	ca. 1–2 years	Self-determined	University
Lecturer	No personnel, varying material and technical support	Strongly reduced by teaching	Unlimited	Self-determined	University

agencies and by universities. They included small amounts of resources for research.

The Australian university entrance position is that of a *lecturer*. A lecturer becomes tenured after a probation period of about two years. Tenure is rarely denied, and the denial requires a special justification. In contrast to the German and Dutch systems, academics on these entrance positions are formally and factually independent, which means that the time horizon of their protected space is unlimited and the range of topics is self-determined. However, research capacities are low because Australian universities provide hardly any recurrent funding for any of their academics (Gläser and Laudel 2007). Only small amounts of start-up funding are made available. Furthermore, teaching loads are very high and can reach 12 contact hours per week.

The scarcity of lecturer positions made many historians take up *casual teaching positions* which provided very little protected space for research. Table 3 summarizes positions and protected space in the Australian sample. Researchers could extend their protected space by acquiring grants from the Australian Research Council (ARC). However, the chances were small due to low success rates of about 20% (ARC 2010: 2). Success rates for collaborative projects with industry were considerably higher but these projects constrained the range of topics available to a researcher.

### *The Netherlands*

As in the other two systems, postdoctoral positions are important building blocks of early careers in the Netherlands. Fellowships for independent research are provided by the Dutch research council (*Nederlandse Organisatie voor Wetenschappelijk Onderzoek*, NWO). Researchers can fund their own position for three years by a Veni fellowship if they obtained their PhD less than three years ago. Although Veni fellows do not receive additional resources for research, they can convert the

**Table 4** Early career positions observed in molecular biology and history in the Netherlands

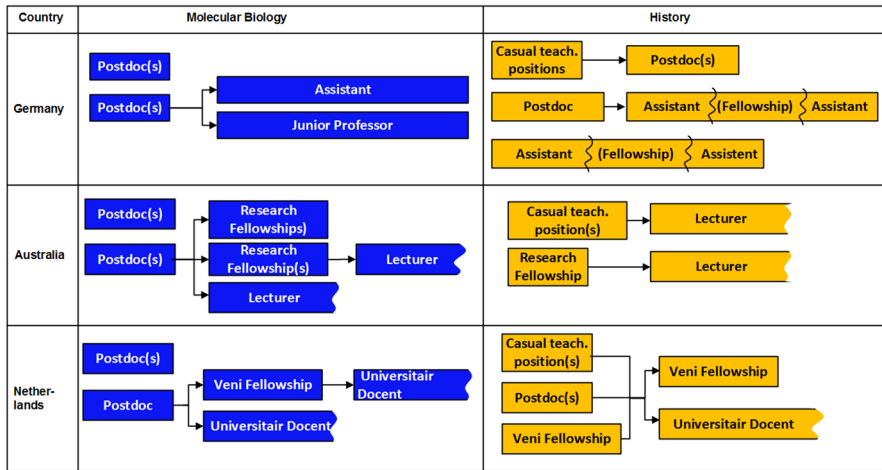
Employment situation	Autonomously controlled research capacity		Time horizon of protection	Range of topics	Authority
	Discretion over resources (personnel, equipment, etc.)	Time for research			
Postdoc in other's group	None (dependent on group leader)	100%	Usually 2–3 years	Determined by group leader or PI	Funding agency/university
Veni fellowship	No research personnel, little material support	100%	3 years	Self-determined	Funding agency
Vidi group leader	ca. 1 position, material support	100%	5 years	Self-determined	Funding agency
Casual teaching positions	None (only access to infrastructure)	Very little	ca. 1–2 years	Self-determined	University
Tenured position below professorial level (UD)	None, dependent on professor sometimes: start-up funding	ca. 40% Reduced by teaching	Unlimited	Constrained by organizational context	University

fellowship money in resources for research if they are appointed to a university position during their fellowship. The Vidi fellowship is a five-year group leader position which – in contrast to the Veni fellowship – includes discretion over resources for research (NWO 2008).

The academic entrance position is the *Universitair Docent* (UD). A UD usually obtained tenure after a two-year probation period. There are little resources allocated to a UD position. UD's have no discretion over recurrent funding. In some cases universities provided start-up funds of varying size. Teaching loads are determined by universities and faculties. As a rule, 40% of the time are formally reserved for research (de Weert 2001). The range of topics an UD could work on was limited by expectations of the organization, especially the expectation to collaborate with colleagues from the department. Dutch historians also held casual teaching positions. As in Germany and Australia, they faced the problem of having very little protected space on these contracts. Table 4 provides an overview of positions in the Dutch system, in which I included Vidi fellowships although I did not observe them in my sample. Research capacities could be extended by project grants, the main source of which is the NWO. The success rate for individual project grants is rather low at 25% (NWO 2011).

#### *Comparison of Career Patterns in the Three Systems*

The three career systems vary not only in the types of positions they provide (particularly with regard to tenure) but also in characteristic sequences of positions



**Fig. 2** Career patterns in molecular biology and history observed in the three countries (sinuous lines indicate the interruption of a position by a fellowship)

through which researchers move (Fig. 2). The German career system stands out because no permanent positions exist for German early career researchers.

In all three countries, molecular biologists began their careers with a postdoctoral position. After one or more postdoctoral positions, careers in Germany continued on university positions (Research and Teaching Associate or Junior Professor). In Australia and the Netherlands, postdoc positions were followed either by fellowships or by permanent university positions.

A common feature of early careers in history is the role of casual employment. Individual fellowships are most widespread in the Netherlands, where they have a time-horizon of three years in contrast to the fellowships in Germany and Australia, which usually lasted only one year. Again, German early career researchers continued on fixed-term positions, while their Australian and Dutch colleagues eventually moved to permanent positions at universities.

A comparison of the three career systems reveals interesting variations of the protected space afforded by the various positions. The protected space for early career researchers in the German chair system has always limited time-horizons due to the fixed-term contracts. On most positions, the range of topics is limited by formal dependencies from professors. Only Junior Professors and Junior Group Leaders have a protected space whose range of topic is not constrained by other actors. Research and Teaching Associates and some Junior Professors have no discretion over resources but may extend their protected space by external grants. Some Junior Professors and all Junior Group Leaders have discretion over resources.

The Australian tenure system provides long time horizons by granting early tenure but only little resources because there is no recurrent research funding at universities and success rates of external funding are low. The range of topics is largely self-determined. The Dutch tenure system also provides long time horizons.

Research capacities are low, and the range of topics is constrained due to the UDs' dependency on professors and low success rates of grant applications.

The formal provision of protected space by the three career systems does not simply translate in the actual protected space available to researchers. Instead, it is a condition for actions of early career researchers who actively construct protected space for their new lines of research. In these actions, I could identify four mechanisms through which protected space is produced in the three career systems. *Searching a position* refers to a process of looking for open positions and applying for them, i.e., selecting a position that offers the required protected space. In contrast, *creating a position* refers to a sequence of actions through which researchers develop research plans and apply for funding for their own positions (and sometimes additional resources). In these cases, a funding agency decides whether the position is created. *Negotiating protected space* describes a mechanism operating for incumbents of early career positions at universities, who can create protected space by negotiating the range of topics and access to resources with those controlling it (group leaders or heads of departments). Finally, *extending protected space* describes the acquisition of resources through competitive project funding. These mechanisms and their effects are discussed in more detail in the following two sections.

## Starting New Lines in Molecular Biology

The necessary protected space for beginning new lines of research in molecular biology is determined by the time and resource demands of biomolecular projects. Most research processes in molecular biology take up three years or less and use generic infrastructure and equipment. This means that new lines of research can be started within this time horizon, and can be followed with the same equipment. Additional scientific and technical research personnel are necessary because experiments are labour intensive. Consequently, funding for positions is the most important resource, followed by funding for consumables. The new lines of research must, of course, fall into the range of topics of the protected space.

Careers in the investigated countries followed an internationally common pattern by starting with a PhD and being followed by postdoctoral employment (e.g., Knorr-Cetina 1999: 221–227; Stephan and Levin 2001 for the US). The dominant mechanism in this first phase is *searching a position*. The mechanism operates under the condition of abundant postdoc positions worldwide. A second operating condition is the epistemic variety of these positions. Many positions exist for each specialty within molecular biology. This makes it possible for researchers to choose positions according to their research interests, i.e., to match the range of topics to their interests.

That means that you can take the calcium imaging to look at the activity of nerve cells. That's what I wanted to do. [...] And then I looked around which labs are doing this. And then I picked one where I thought that I could do it there properly. (German biologist)

I did a postdoc in the US actually. [...] The purpose of me going there was to really hone my biochemical skills because I was working on what's called biophysics before that. So I didn't know that much biochemistry and given the nature of my topic and given what I thought I wanted to do, I really wanted to get some biochemical skills and bring them back to Australia. (Australian biologist)

The opportunity to select positions was very important for postdocs because they could not control the range of topics of their protected space. Once a researcher had chosen a position, research had to be undertaken within the research area of the group leader. In the following case, the researcher had selected a position which turned out not to fit his interests. Since the topic was determined by the group leader, the only option he had was to leave this position before the end of its term.

I eventually took up a [postdoc in town X] and it was a whole different project. [...] they had a very practical question [...] I tried to work a bit on that, but after a year and a half I decided that this was not what really interested me. [...] I learned some useful stuff for sure. But the work per se and the research question behind it were not that appealing to me. (Dutch biologist)

Postdoctoral employment supported learning in different research laboratories and international mobility, which was expected by the scientific community. Most researchers chose a postdoc abroad. Even a sequence of postdoctoral positions may still primarily support learning. Although the range of topics available to an early career researcher was limited, it could become the starting point of new research lines, as in the following example:

[The group leader's project] was based on the molecular structures and biochemical characterisation of these different types of protein trafficking machineries. That is how I ended up in the field of protein trafficking and that is where I'm still working now. I have been continuing in that field since I started my postdoctoral work. [Australian biologist]

However, systematically pursuing a new line of research was impossible in this phase due to the small protected space offered by postdoctoral positions.

In the career phase following postdoctoral employment, two other mechanisms operated in the construction of protected space. Protected space could be built by *creating a position* and applying for it to be funded. An operating condition for this mechanism is the availability of fellowship programs, which do indeed exist in all three systems. Researchers could develop their own research ideas and submit them as grant proposals to funding agencies or universities that offered fellowship programs.

In Australia and the Netherlands, fellowships included only very little additional funding for research. Dutch researchers could not change this situation and therefore had to start their new line of research with insufficient resources. The only exception occurred when Veni fellows were appointed as UDs because the funds for the Veni position could then be used for consumables and equipment. Australian researchers attempt to supplement their fellowships with project grants from the ARC or their



universities, i.e., trigger the additional mechanism of *extending research capacities*. Due to the small size of university grants and the low success rates of ARC grants, research capacities were only slightly extended in most cases. None of the Australian and Dutch biologists who created their own positions received funding for additional research personnel.

The *search mechanism* also operated after the postdoctoral phase. However, the only positions available were university entrance positions for early career researchers, which are much scarcer than postdoctoral positions. Researchers sought for Research and Teaching Associate positions and Junior Professorships (Germany), lecturer positions (Australia) and UD positions (Netherlands). Selecting a position that fitted thematically was difficult because only few such positions were available. The search was further constrained because nearly all of the investigated researchers wanted to return to their home countries. In this phase, the search mechanism operated under the conditions of scarcity of positions and a far lower epistemic diversity. When German and Dutch researchers found a university entrance position, the strong hierarchies still operating in universities often limited their protected space. The incomplete thematic fits and university hierarchies triggered another mechanism, namely, *negotiating protected space*. Negotiations usually addressed the range of topics researchers would receive resources for. They were, however, only possible where research interests of early career researchers were close enough to those of the local organizational environment.

And then you try to find a happy medium. The happy medium means to apply my approach to questions that interest both myself and him [the group leader]. [...] And there are indeed substantial overlaps of interests. But there are also things for both of us that don't interest the other. [...] And those I would probably push a bit more if I was more independent. (German Research and Teaching Associate)

This negotiation of the thematic breadth of protected space illustrates the close coupling between dependencies in research groups and opportunities to change lines of research. But even researchers who were formally independent and thus did not need to negotiate thematic breadth still had to negotiate the resource capacity of their protected space. They negotiated start-up funding, annual allowances for consumables and equipment, laboratory space, or technical support.

Well, we negotiated that we will get funding as any research group. [...] ... as a junior research group we get an annual lump sum for the repair of equipment and so on. This is not the same everywhere. Elsewhere you are much more dependent on the chair holder. (German Junior Professor)

In addition, discretion over research personnel could be negotiated if departments or professors had control over such resources. This control is diminishing due to the shift from recurrent funding to competitive external funding. Therefore, biologists on university entrance positions were forced to extend their research capacities by applying for external grants as soon as they took the positions.

**Table 5** Successful, precarious and not yet occurring work on new lines in molecular biology

Work on new lines of research	Germany	Australia	Netherlands
Not yet started	4 (early postdoc phase)	7 (extended postdoc phase and lecturers)	2 (early postdoc phase)
Started but precarious	none	1 searching	1 creating 1 searching
Successful	1 creating, negotiating and extending 3 searching and extending	4 creating and extending 1 creating and negotiating	2 searching and negotiating 1 creating and extending 3 creating and negotiating

Then I basically got the message ‘you get operating money for a year, you can have some students and just start working.’ What I did was I started working with students, Master’s students, so not very skilled, not PhD students. I started writing project proposals. In the first year I think I wrote four project proposals. Every single one of them was reviewed by the referees very well, very good to excellent and one got awarded; one out of four. So that gave me a PhD student and a technician [...] Now I’m slowly building up my group; I at least have a solid basis here, it’s myself, it’s my technician, and it’s a PhD student. Now the most important thing for me is to get new publications out in order to be successful and getting new grants. So this year will be critical. (Dutch UD)

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I applied for university grants and was unsuccessful in that bioscience area, so I feel like there is nothing. I don’t think I could apply for an ARC [grant] or anything like that. I just don’t have the background, I need to be tagged onto someone else who has a higher profile in the field. That’s how postdocs work but you tag yourself to someone who’s a much more senior researcher in that field and then you build up your own profile behind someone else which means eventually you become the senior researcher. And I don’t have that support mechanism.

Q: How do you now fund your fungi work?

Well I do it because I have a little bit of money that I’ve saved over time but I don’t have any students to carry on the work. I’ve had third year students, I had one Honours student a few years back [...] (Australian lecturer)

As illustrated by the two quotes, the fierce competition for external funding and low success rates let new lines of research lines emerge very slowly, and their survival is difficult to predict.

Table 5 summarizes the mechanisms and their effects as they occurred in the three national career systems. It is important to keep in mind that the numbers in the table do not enable any conclusion about the frequency of successful starts of new

research lines or of occurrences of mechanisms. However, they do describe characteristic situations of early career molecular biologists in the three countries produced by the mechanisms.

In all three countries, some of the interviewed early career researchers had not begun work on new lines of research at the time of their interviews. Among these, the German and Dutch researchers were in early stages of their postdoctoral career phase (up to three years), which makes it likely that some of them were successful after the interviews were conducted. The Australian early career researchers either had been postdocs for a long time (up to eight years) or were on lecturer positions. The two cases of lecturers without a research program of their own indicate a problem of the Australian system, namely, the impossibility to continue research in the first years on a university entrance position due to high teaching loads (Laudel and Gläser 2008). This problem is aggravated by the small chances of extending protected space with grants.

Scarcity of project funding is also the reason why work on new lines of research was precarious for one Australian and two Dutch early career researchers. In a resource-intensive field like molecular biology, any position that does not include access to resources for research forces the incumbent to acquire additional grants. This applies to university positions in all three countries and to fellowships in Australia and the Netherlands. German researchers could create fellowship positions for themselves that included discretion over resources, and had better chances of extending their protected space with grants if they had university positions. Their Australian and Dutch colleagues always needed to extend their protected space with grants or by negotiating access to resources with professors or group leaders. In cases where this was impossible, the work on new lines of research turned precarious.

The necessity to acquire additional resources made the success of several early career researchers dependent on negotiations. This foremost applies to Australian and Dutch biologists. One German early career biologist negotiated an extension of his protected space beyond the immediate necessities of his line of research. One of his seven PhD students was funded by his professor.

Finally, a comparison of successful starts of new lines of research shows that although these occurred in all three countries, Australian and Dutch early career researchers had to utilize more mechanisms than their German colleagues. While German researchers could apply for fellowships that were sufficiently endowed with resources, Australian and Dutch fellows always had to apply a second time in the grant funding system. The latter's low success rates created situations in which early career researchers who successfully applied for fellowships with their idea for a new line of research could not implement this idea because the same system did not provide them with the necessary resources. Extending protected space with grants was easier for German researchers due to higher success rates.

The formal dependence of German and Dutch early career researchers on professors who controlled the university infrastructure and the supervision of PhD students did not make a difference in the investigated cases but may matter for other researchers. In a field like molecular biology, where research is collaborative both within and between groups, independently following a new line of research depends

on having one's own group. As the examples illustrate, new lines of research may emerge through collaboration with group leaders and under conditions that are negotiated with group leaders, but remain both cognitively and organizationally precarious until researchers become group leaders themselves.

## Starting New Lines of Research in History

The necessary protected space for starting new lines of research in history differs considerably from that in molecular biology because resource requirements are usually low. Research in history is highly individualized, i.e., historians conduct their projects alone without relying on additional research personnel. Empirical research requires travel to archives, whose costs are rather low compared to the resource requirements of experimental research. The only exception were trips by Australian historians to overseas archives. The most important requirements concern time. Historians need long time horizons and sufficient time for research because there is no division of labour. They also need long uninterrupted periods of time for research in which they can work on their topic and concentrate all the empirical evidence in their mind without being forced to focus on something else (Gläser et al. 2010: 314–315). Since personal perspectives on the state of the art and empirical material are crucial for successful projects, the range of topics available to researchers is also a very important dimension of the necessary protected space.

The three national systems differ significantly in the ways in which protected space is provided. In the German chair system, the range of topics for early career historians is constrained by the scientific community's expectation that they radically move away from their PhD topic and conduct historical research on a different geographical area and time period. This requirement for obtaining a tenured position (professorship) in the German system is linked to the expectation that a professor in history can teach a broad range of subjects. The qualification for professorship – the book representing the *Habilitation* – must be thematically different from the book about the PhD work. Many German researchers struggled with this limitation of their protected space's range of topics:

And I can think of many topics, e.g., about England which I would like to research but this does not work because the PhD was already about England.  
(German Historian)

In the two tenure systems, the national communities did not expect such radical thematic change.

In the first early career phase after the PhD *search and application* was the prevalent mechanism in all three countries. However, the mechanism operated under conditions that were completely different from molecular biology because positions were scarce even though postdoctoral positions have become more common in the Dutch and German systems. Postdoctoral positions further limited the range of topics of protected space because the topic defined by the group leader set thematic boundaries. Although thematic changes were possible and project funding could be flexibly used, the protected space provided by the project leader

was never big enough that an entirely new topic could be started on a postdoctoral position.

And also I knew that I could draw the research myself, fill it in the way I wanted. Of course, it had to be structured within the context of the problem of cultural [...], but within that context I felt fairly free to do whatever I want to do. (Dutch postdoc)

This was a rather unusual situation because historians commonly conduct a PhD on a self-defined topic to meet an expectation of their scientific community.

The topic did appeal to me. As I worked on [...] for my PhD project and the current project was on [...], I could see a connection, I could understand why they here might see why I would be good to pursue this project. But it is completely different because here was a project that was already there. [...] This was for me very different, I couldn't come up with it myself and think about it. This was a sort of existing project I had to step in. (Dutch postdoc)

The topics often differed from the PhD in terms of the subject matter, the investigated location and time period, and the approach. But there was also inertia if postdocs were hired because of their knowledge obtained through the PhD.

Okay, the topic of the project is relatively easy ... I got recruited because of my dissertation, "there is somebody who just worked on this." (German postdoc)

This researcher could not fulfil the expectation of the scientific community to start an entirely different line of research on the position. He solved this problem by working only part-time and using the remaining time to start a completely different topic for his *Habilitation*. Although postdoctoral positions were research-only positions and thus provided plenty of uninterrupted time, the time "belonged" to someone else's research topic. This is why research capacities and range of topics for the start of new lines must be considered as low.

The general scarcity of positions in history also led to the inclusion of non-research positions in the search. Historians took casual teaching positions and contract work (e.g., preparing exhibitions). While casual teachers could gain teaching experience, they paid for this by reducing research capacities, sometimes until no time for research was left.

I went to the University of [...] and I had a very, very heavy teaching load there, I didn't have time to think about research at all. I gave a paper on [my PhD topic] and I'd spent about three days researching and that was the only research I got the whole year. (Australian historian on casual teaching position)

None of the researchers on such a position started a new line of research. Instead, they all continued the topic of their PhD, e.g., by preparing the book publication of their PhD.

The third type of positions sought was the university entrance position. German historians could take on positions of Research and Teaching Associates or Junior

Professors. In four of the seven cases in which this happened, the search process was limited because the positions became available at the same university where they completed their PhD. Research capacities were strongly limited due to teaching and administrative duties but allowed the slow start of new lines of research with the time horizon of six years.

In this first career phase after the PhD, another mechanism, the *creation of positions* was observed in the Australian and the Dutch systems. Research fellowships provided protected space with a self-determined range of topics and uninterrupted time for research for up to three years (in the case of Dutch Veni fellows). Fellowships taken up immediately after the PhD led to topics that were still closely connected to the PhD:

And this is in fact what happened because my Veni work is going on on the subject, not exactly, but it is still using the basis of my thesis. (Dutch historian on fellowship)

This temporary continuation of the PhD topic is not unusual in history. After the book on their PhD topic is published, historians write articles and are often invited to write book chapters about this topic.

In the second early career phase, both the *search for positions* continued and led some historians secure tenured positions in the Dutch system (UD) and in the Australian system (lecturer), while their German colleagues secured temporary university entrance positions as Research and Teaching Associates. In all three career systems, the research capacities were low, i.e., there was little uninterrupted time for research. This problem was exacerbated by the expectation to work on externally funded collaborative projects:

Well, this [...] project was driven by external funding which wasn't really close to my heart. Ideally you should do research in the areas that you are really interested in. (German historian on postdoc position).

Similarly, Dutch historians were confronted by university expectations to collaborate with other historians in the department.

At this moment and especially in the last couple of years this is much more restricted and directed by the university I am working in. I am now applying for research projects that are part of the larger research groups here. And they tie together research from the people from this department. In the next years my research will change probably again or will focus on those kinds of fields that are comparable to and can work within the research groups of this university. [...] If it is going to be successful, all these projects are going to start, then I am going to have time problems and also ... for instance, I was thinking about a project on my own, apply for a Vidi project, set up your own research project. I set the project up already. I have an idea what I want to do, but I don't have the time to develop it further. (Dutch historian on UD position)

**Table 6** Successful, precarious and not yet occurring work on new lines in history

Work on new lines of research	Germany	Australia	Netherlands
Not yet started	1 (postdoc)	3 (lecturers and fellow)	2 (postdoc and Universitair Docent)
Started but precarious	None	1 (searching)	None
Successful	2 searching and creating, 5 searching 2 creating	3 creating 3 searching	2 creating 4 searching

These historians had to split their already limited research time between their own topics and topics of others, which slowed down the development of their new topics considerably.

In this phase, extending protected space became crucial. German historians on university entrance positions *extended* their *protected space* by *creating a position*. These mechanisms coincided for several historians who suspended their employment as Research and Teaching Associates and worked on Feodor Lynen fellowships. They stayed abroad for one or two years, extended their protected space and gained precious uninterrupted time to work on their *Habilitation* topic.

Dutch and Australian historians on tenured UD or lecturer positions also tried to *extend their research capacities* by applying for grants. However, due to low success rates, nearly all of these attempts failed. Interestingly, the mechanism of *negotiating protected space* was not observed. Historians seemed to have little negotiating power for reducing their teaching and admin load to increase their time for research.

Although the pattern described by Table 6 shows some similarities to the one observed for molecular biology, the differences between the two fields in terms of epistemic practices and resulting requirements of protected space are visible in the mechanisms operating during the early career. The two main reasons for differences between the patterns are, first, that history is far less resource intensive, and second, that the time available for research is critical for any research in history, including, of course, the start of new lines of research.

The six cases in which no new line of research was identified in interviews include two early career researchers who were on research-only positions but failed for epistemic reasons. An Australian fellow and a Dutch UD had managed to begin a new line of research on fellowships but their new topics were exhausted with the fellowship projects rather than leading to new lines of research. The other four early career researchers did not have enough time for developing new lines of research. The two Australian lecturers faced time constraints due to high teaching loads. The German and Dutch postdocs were on positions in other researchers' projects, which meant that they did not have time for independent research.

The findings on time constraints are confirmed by the case of an Australian researcher whose research progressed only slowly and was precarious when he was a lecturer. All successful Australian historians had either created research-only

positions for themselves or pursued lines of research that were thematically close to their PhD project, thereby compensating for the time pressure. Successful German and Dutch early career historians worked on university positions and tried to extend their protected space by applying for research-only fellowships.

## Conclusions

The empirical investigation reported in this article could establish causal links between national career systems and opportunities for early career researchers to begin new lines of research. It demonstrated that epistemic practices of experimental, codified fields with a high dynamics of methodological development and the accompanying specialization, collaborative research and group structures create specific conditions, which generally let new lines of research emerge later, in interactions with others, and dependent on authority relations as well as access to resources. By contrast, the emergence of new lines of research in weakly codified, observational and individualized fields with a low dynamics of methodologies, independence based on new lines of research is expected much earlier, and is primarily influenced by the access to positions and time for research.

The trade-off between breadth and depth prevented this study from including micro-processes of emergence, i.e., the epistemic interactions in which new ideas emerge, are negotiated in research groups or in discussions with colleagues, and are solidified as plans for new projects. Thus, this study is complementary to ethnographic studies of laboratory practice. Integrating the two levels of study of epistemic practices remains a challenge but would undoubtedly further our understanding of the link between governance and research content.

The empirical investigation leads to methodological, theoretical and political conclusions. Methodological conclusions concern the conceptual framework that evolved in the three projects and informed the ultimate analysis of their data. The two central concepts employed were the concept of academic careers as consisting of three intertwined but analytically distinguishable careers (cognitive, community and organizational), and the concept of protected space, which was extended here by a third dimension, namely, range of topics in addition to time horizon and research capacity. The two concepts supported the comparison of national career systems and research fields. They also enabled the identification of mechanisms through which protected space is built and the conditions under which they operate.

The second methodological point is that formal authority relations and formally granted conditions of research tied to positions for early career researchers are a poor predictor of the actual conditions and thus cannot explain the conduct or content of research. While this seems to be trivial, formal conditions are nevertheless sometimes used as proxies for actual conditions (e.g., by Waaijer 2015). My analysis showed that the selection of research problems is instead influenced by the relationship between perceptions of necessary and actual protected space, and that researchers actively construct the latter. Formal conditions and authority relations are constraints of and resources in these construction processes.



Theoretical conclusions concern the relationship between systems of institutions, careers, and research content. A first conclusion is that the synchronization of organizational, cognitive and community careers is field-specific. In molecular biology, the apprentice phase extends beyond the PhD because the postdocs still need to learn methods in order to develop independent research projects. In history, the independent design of research projects is expected after the PhD is granted, if not earlier. This is why in molecular biology new lines of research are developed later in the postdoc phase or even after this phase, while they are expected immediately after the PhD in history. The fact that historians tend to stick to their PhD projects at least some time after the PhD when no other career expectations exist proves rather than undermines this point because it highlights the autonomy granted to them.

A second theoretical conclusion addresses the relationship between cognitive careers and protected space. Due to the differences in research content, the importance of the three dimensions of protected space for starting new lines of research varies and triggers different mechanisms depending on institutional conditions with which it overlays. Material research capacity is important to biologists but not to historians due to the different resource intensity of the two fields. Time for research is important in both fields but time pressure can be compensated for by employing research personnel only in molecular biology because research problems are indivisible in history.

Owing to these interactions, the split funding mode (limited recurrent funding plus competitive project funding) has field-specific consequences for early career researchers in the two fields. Opportunities to extend protected space through external funding are clearly more important in resource-intensive fields.

At the same time, it becomes clear that the split funding mode creates a rather complex situation for building protected space. German early career researchers face fixed-term contracts and formal dependence on professors on most positions but enjoy rather better access to project funding and de-facto autonomy on many positions in history. Dutch and Australian early career researchers can move to permanent positions and thus unlimited time horizons of their protected space much earlier. However, Dutch researchers face de facto dependence by collaborative pressure in history, and researchers in both countries have more difficulties in extending their protected space.

This leads to the political conclusion. Which career system is the best for early career researchers? It turns out that each of the systems produces nationally specific obstacles for early career researchers who want to start new lines of research. The major political conclusion is that instead of attempting local repairs that are inevitably offset by deficiencies in other aspects of the system, science policy needs to assess and modify the situation of early career researchers in its entirety.

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