TRANSNATIONAL CAREERS IN THE SERVICE OF EMPIRE: GERMAN NATURAL HISTORIANS IN EIGHTEENTH-CENTURY LONDON

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In the night of 6 March 1754, the Saxonian literary critic and natural historian, Christlob Mylius, died of pneumonia in London, aged 36 years. He bequeathed only 36 shillings in cash, but outstanding debts of £120. For Mylius, London was supposed to have been only an intermediate stop on his way to America, where he first wanted to explore the British-dominated North, and then go on to Dutch Surinam to send back botanical specimens, astronomical data, and descriptions of the fauna and native peoples to Germany. With Mylius's death, a unique expedition project of German natural history came to a premature end. Under the leadership of some of the most renowned German-speaking scholars of the day, such as the Göttingen professor of medicine, Albrecht von Haller, and the Berlin philosopher Johann Georg Sulzer, a group of donors had formed an association with the aim of sending an explorer—quasi in the name of German scholarship as a whole—beyond the borders of Europe and across the oceans. This project, however, was ill-fated from the start: initially, it had been unclear where the explorer was to be sent in the first place, and immediately before his departure, Mylius was diverted from East India to the Americas. Playing the role of future globetrotter in the drawing rooms of North Germany and the Netherlands, Mylius took six months just to travel from Göttingen to London, where he then spent another seven months visiting theatres and translating various pieces. The explorer and his heterogenous community of donors were not bound by a contract, nor did Mylius have a contact person in London that could assist and supervise his preparations for departure and his acquisition of the required equipment. As a consequence, the funds were already spent before Mylius had even left Europe, and his patron Haller was, to a degree, relieved that the failed explorer's death put an end to this embarrassing affair.[1]

[1] Dieter Hildebrandt, *Christlob Mylius. Ein Genie des Ärgernisses* (Berlin 1981).

Imperial Dependencies: German Natural History and Knowledge Production in the Age of European Expansion

The Mylius expedition was to remain the last attempt of German natural historians in the eighteenth century to organise an independent expedition as a group. It highlights the difficulties of scholars employed at the universities, academies, and courts of the Holy Roman Empire in gaining first-hand experience observing the extra-European world, the exploration of which became a central theme of scholarly as well as popular literature in the course of the eighteenth century. Until the mid-nineteenth century, German states, after all, were land-locked or had no naval resources to speak of. Much of Germany's coast was under the control of Denmark and Sweden, and Hanover was essentially a British subsidiary power from 1714 on. The attempts of Germany's leading powers, the Habsburg Monarchy and Brandenburg-Prussia, to establish themselves as naval powers and gain a share of the Asian and African trade, had been abandoned early in the eighteenth century, and for the remainder of the century, Prussia and Austria concentrated on expanding their military presence on land. This conditioned the way Germans experienced the extra-European world. Far into the nineteenth century, a pattern of "mediated experience" was continued—a pattern that had been a feature of the way German travellers, explorers, and soldiers experienced the wider world for a long time. German gunners had staffed Portuguese ships in the early sixteenth century; German secretaries had served the Dutch East India Company in the seventeenth century, and in Venetian, Dutch and British pay, German soldiers fought all over the globe, from the Eastern Mediterranean to Cape Town, America and India. In particular in the eighteenth century, this also resulted in a rich literature of memoirs that came to occupy an important place in Germany's burgeoning public sphere.[2]

For natural historians based in Germany, however, this increasingly posed a problem. While throughout the eighteenth century the exploration of extra-European territories became increasingly important for the natural sciences, German scholars remained reliant on their correspondence

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[2] Roelof van Gelder, *Das ostindische Abenteuer—Deutsche in Diensten der Vereinigten Ostindischen Kompanie der Niederlande 1600–1800* (Hamburg 2004); Peter Wilson, 'The German "Soldier Trade" of the Seventeenth and Eighteenth Centuries: A Reassessment', *International History Review* 13 (1996), 757–792. For a survey, see Joan-Pau Rubiés, *Travellers and Cosmographers: Studies in the History of Early Modern Travel and Ethnology* (Aldershot 2007) and, very briefly, Gisela Graichen and Horst Gründer, *Deutsche Kolonien—Traum und Trauma* (Berlin 2007), 13–24.

networks and travel reports published elsewhere. The reliability of travel reports, however, was notoriously difficult to assess, and remained a matter of debate throughout the period, although natural historians, including Buffon, continued to use them. The more important first-hand observation became in the hierarchy of epistemological paths, the more precarious the role of travel reports became.[3] Hand in hand with the new role given to first-hand observation, the rank and prestige of the travelling explorer increased: following their return from their first South Sea voyage in 1771, James Cook and Joseph Banks became not only celebrities in Britain, but throughout Europe.[4] Banks, indeed, built his entire career that led to the presidency of the Royal Society, on this voyage.[5] After the Seven Years War, and with the relative decline of the Netherlands and Spain, the great powers Britain and France led the exploration of the Indian and Pacific Oceans, and Russia began to explore the Eurasian land mass.[6] The South Sea came to occupy a particular place in the decades following the Seven Years War—both as an erotically charged utopia where European (male) fantasies of a class-less society and free love were located, and as a scientific challenge, as the descriptions and objects explorers such as Cook and Bougainville brought back from the South Sea raised doubts about many assumptions and theories that had been put forward by natural historians.[7] The geology, flora, fauna and human population of the Pacific, after all, were not easily integrated into the existing systems of classification as, for instance, South Sea plants could not be classified among any of the species known at that time, nor could the Pacific islanders be classified as one of the four "varieties" of the human race, which formed the basis of the natural history of man.[8]

British and French-led exploration was closely linked to imperial projects, which also determined the way expeditions were conducted: they were not primarily, or exclusively, of a scholarly nature; rather, economic

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[3] Lorraine Daston, 'On Observation', *Isis* 99 (2008), 97–110: 102.

[4] Gananath Obeyesekere, *The Apotheosis of Captain Cook: European Mythmaking in the Pacific* (Princeton 1992).

[5] John Gascoigne, *Joseph Banks and the English Enlightenment: Useful Knowledge and Polite Culture* (Cambridge 1994).

[6] Dittmar Dahlmann, Anna Friesen and Diana Ordubaldi (eds.), *Carl Heinrich Merck: Das sibirisch-amerikanische Tagebuch aus den Jahren 1788–1791* (Göttingen 2009).

[7] Christiane Küchler Williams, *Erotische Paradiese: Zur europäischen Südseerezeption im 18. Jahrhundert* (Göttingen 2004).

[8] Hans-Jürgen Lüsebrink, 'Wissen und außereuropäische Erfahrung im 18. Jahrhundert', in Richard van Dülmen and Sina Rauschenbach (eds.), *Macht des Wissens: Die Entstehung der modernen Wissensgesellschaft* (Köln 2004), 629–653.

and political gain stood at the forefront.[9] This economic and political dimension also determined the practice of exploration; despite exchanges in the republic of letters, national and imperial demarcations were becoming increasingly important. The French conceived their expeditions as national projects, and the British, in turn, never employed any Frenchmen. Rather, they turned to Protestant scholars in the smaller German and Scandinavian states. If German-based scholars, in contrast, wished to play a role in botany or anthropology, they needed to establish access to the political as well as scholarly establishment of the naval powers first of all. This also highlights that the image of the republic of letters as a peaceful alternative to the aggressive world of politics, shaped by respect for the force of the better argument, has rightly been long refuted by Robert Proctor and others.[10] In recent studies, questions of rank and prestige, utility and demarcation have been placed at the centre of a history of scholarliness that emphasizes the mutual dependencies of the production of knowledge and socio-economic change.[11]

This chapter will examine how German and English scholars combined their particular resources and qualifications to meet these challenges of natural history. The particular focus will be on German natural historians in the service of the British Empire. This approach, focusing on scholarly practices rather than the contents of publications, takes its cue from recent research into the genesis of early modern and modern cultures of knowledge, which focuses less on theories and ideas—and certainly not on the insights of "great men", the sequence of whom is then supposed to constitute scholarly "progress".[12] Rather, the categories of patronage and hierarchy, the practices of taxonomy and scholarly sociability and the configurations of the European republic of letters and imperial expansion will be used to ask how the world of natural history functioned, and how the production of knowledge and the working of scholarly, social and political institutions were linked. The present chapter thus aims to contribute to reconstructing the culture of knowledge as a cultural practice; an approach that is interested less in the result, the "discovery", of scholarly activity, than in the processes generating knowledge, essential parts of which are

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[9] John Gascoigne, *Science in the Service of Empire: Joseph Banks, the British State and the Uses of Science in the Age of Revolution* (Cambridge 1998), 166–198.

[10] Robert Proctor, *Value-free Science? Purity and Power in Modern Knowledge* (Cambridge 1991).

[11] Marian Füssel, *Gelehrtenkultur als symbolische Praxis: Rang, Ritual und Konflikt an der Universität der Frühen Neuzeit* (Darmstadt 2006).

[12] Ibid., 24.

scholarly exchange and the formation of networks.[13] This blends with a current fresh perspective on later eighteenth-century natural history, the practice of which was dominated by collections. This practice had contributed to the marginalization of this period in the history of science which, until the 1990s, remained primarily interested in laboratories and experiments.[14] No wonder then that aristocratic collectors, such as Joseph Banks, were sidelined as corrupt obstacles to "real" innovation. In the past two decades, however, collections—"factories of the wise", as they were called by Friedrich Heinrich Wilhelm Martini, the founder of Berlin's *Gesellschaft Naturforschender Freunde*[15]—have come to occupy a central place in research, and are now considered important spaces of an observing, ordering and experimenting natural history. Rather than assigning objects a permanent place, eighteenth-century collections were spaces as well as instruments of a scholarly exchange that always had aims other than taxonomical ones.[16] All collections, after all, were places of exchange as well as of communication, for instance as meeting places of scholarly associations. Collections and libraries were at the centre of scholarly networks; they were places where objects were exchanged, and where people met not only on a local, regional or national but also a transnational level.

Anglo-German Scholarship Networks between Holy Roman Empire and British Empire

However, we know surprisingly little about the structures that conditioned exchange between English and German natural historians in the second half of the eighteenth century.[17] This can be blamed partly on the negative

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[13] Helmut Zedelmaier and Martin Mulsow, 'Einführung', in Helmut Zedelmaier and Martin Mulsow (eds.), *Die Praktiken der Gelehrsamkeit in der frühen Neuzeit* (Tübingen 2001), 1–8.

[14] Nicholas Jardine, 'Sammlung, Wissenschaft, Kulturgeschichte', in Anke te Heesen and Emma Spary (eds.), *Sammeln als Wissen: Das Sammeln und seine wissenschaftsgeschichtliche Bedeutung* (Göttingen 2001), 199–220: 214.

[15] Anke te Heesen, 'Vom naturgeschichtlichen Investor zum Staatsdiener. Sammler und Sammlungen der Gesellschaft Naturforscher Freunde zu Berlin um 1800', in te Heesen and Spary 2001 (note 14), 62–84: 62.

[16] Staffan Müller-Wille, 'Botanischer Tausch und Ökonomie der Natur', in Regina Dauser et al. (eds.), *Wissen im Netz. Botanik und Pflanzentransfer in europäischen Korrespondenznetzen des 18. Jahrhunderts* (Berlin 2008), 79–89.

[17] Michael Hoare's remarks on the lack of works in this field are still valid: Michael Hoare, 'Introduction', in Michael Hoare (ed.), *The Resolution Journal of Johann Reinhold Forster, 1772–1775* (London 1982), vol. 1, 1–122: 21.

view of the later eighteenth century that had long dominated British narratives of the history of science, and partly on the way the history of the British Empire as a whole has been written, and is still being written. First, the perceived decline of the Royal Society, and of English scholarship as a whole, after the "heroic" age of Newton and his colleagues, has, in the last decade or two, been challenged, and historians now emphasise that the epistemological changes that marked the transition to the modern world cannot be understood without considering the practice of natural history in the eighteenth century. Secondly, "Atlantic history" has highlighted the interdependencies of imperial "centre" and "periphery".[18] This approach has shown the interconnectedness of the first British Empire in particular in fields such as trading networks or, as Mary Sarah Bilder has recently demonstrated, law, where she identified a "transatlantic constitution".[19]

The field of knowledge formation, however, has always transcended political-legal borders, although of course political and social structures as well as military and economic rivalry also shaped what intellectual historians now call "cultures of knowledge". Historians of science have demonstrated how imperial exploits fostered British pride, and formal and informal connections between scholars and the state have been explored by a historiography analysing the dense webs of politics, patronage, and scholarship that organised the ways information and objects were gathered all over the world and brought to London or Paris. Through the series of studies by John Gascoigne on Sir Joseph Banks, by Richard Drayton on empire, botany and gardening, Lisbet Koerner on Linnaeus, and Emma Spary on French natural history between Old Regime and Revolution, it has become apparent how in Britain, Sweden, and France powerful patrons based in metropolitan institutions and personal networks wielded power at the intersection of national politics and scholarship, thereby contributing to the expansion of Empire as well as the creation, or strengthening, of national identities.[20] All these studies examine the ways in which information—reports, images, and specimens—flowing back from various parts of the Empire was transformed into knowledge back in the capital, thereby demonstrating how crucial the "periphery" was for the formation

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[18] Bernard Bailyn, *Atlantic History: Concept and Contours* (Cambridge 2005).

[19] Mary Sarah Bilder, *The Transatlantic Constitution: Colonial Legal Culture and the Empire* (Cambridge 2004).

[20] Richard Drayton, *Nature's Government: Science, Imperial Britain and the Improvement of the World* (New Haven 2000); Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge 2000); Emma Spary, *Le jardin d'utopie: l'histoire naturelle en France de l'Ancien Régime à la Révolution* (Paris 2005); for the work of John Gascoigne, see notes 5 and 9.

of attitudes, values, and identities at the "centre". However, by putting the emphasis on the interrelationship between imperial "periphery" and "centre", these studies tend to exclude other variables, in particular other European centres of scholarship. Despite imperial rivalry and national pride, after all, communication between European scholars remained the bedrock of scholarship, but there is still a need to explore how the imperial and Atlantic connection on the one hand, and European scholarship on the other, were entwined. In his study of "imperial botany", Richard Drayton points out how much of Banks's work at Kew was fired by imperial rivalry with France, and informed by German cameralism, but the search for foreign intellectual "influences" should not cause us to overlook the much more direct ways in which British and continental scholars cooperated. Thus, more can be done to go beyond the relationship of Britain and its colonial "outposts", and to further integrate the British Empire into a wider European framework as well. In this respect, Atlantic history needs to be careful not turn into a new, and methodologically up-to-date, edition of the old British history, which emphasised the particularities of the British Isles and in particular the English *Sonderweg* [peculiar path]. Mainly the connections between British and French scholars have found scholarly attention.[21] In contrast, the connections between England and Germany have remained largely unexplored. We know a lot about the important role Britain played for eighteenth- and nineteenth-century Germany; in particular the phenomenon of Anglophilie, the German image of England as a model of political "freedom", economic prosperity, and sociable culture. Little is known, however, about the role Germany played for England.

Early modern scholarship was a European phenomenon, and in the network of academies and universities, scholarly associations and individual scholars, international epistolary exchange formed the basis of scholarship in all fields despite persisting confessional divides and emerging national rivalries. Exchange between German lands and England had always been determined by confessional proximity, and it had thus been the Holy Roman Empire's Protestant territories and Switzerland that built up particularly close links with England during the early Enlightenment.[22] Throughout the eighteenth century, this confessional

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[21] Ann Thomson, Simon Burrows and Edmond Dziembowski (eds.), *Cultural Transfers: France and Britain in the Long Eighteenth Century* (Oxford 2010).

[22] Stefan Siemer, *Geselligkeit und Methode. Naturgeschichtliches Sammeln im 18. Jahrhundert* (Mainz 2004), 65–73.

dimension remained as important as political links. After the Cromwell years, scholarly exchange between Switzerland, Germany, in particular the Protestant North, and England re-emerged: Johann Jakob Scheuchzer developed his diluvial theory in close co-operation with English scholars,[23] and in the later seventeenth and early eighteenth centuries, a number of Lutheran theologians complemented their studies with a stint at Oxford. Among them were the Prussian court preacher and president of the Berlin Academy, Daniel Ernst Jablonski, who studied at Oxford between 1680 and 1683; and the Brunswick court preacher Johann Friedrich Wilhelm Jerusalem, who was at Oxford in the 1740s.[24] Both were closely associated with the "enlightened" branch of Lutheran theology, which became so important for the spread of *Aufklärung* in eighteenth-century Germany, but never gained much influence within the Church of England. Also, the leading representative of "enlightened" Protestant theology, Johann David Michaelis, made his first English contacts in this tradition when spending a year at Oxford as a student. He later used this as a stepping stone towards a close and long-term involvement with the English world of scholarship, which would mark a new phase in Anglo-German scholarship. This had less to do with the personal union between Hanover and Britain after 1714 as such. Rather, it was a matter of the particular institutional and communicative framework provided for the integration of German and English scholars.

Here, the role assumed by the brand-new University of Göttingen in the European world of scholarship within the first three decades after its founding in 1737, is central.[25] Originally established to provide a training ground for the civil servants and clergy of the electorate of Hanover, it very soon gained a reputation as the leading research university among the 33 universities of the Holy Roman Empire; in the second half of the century it became—as one historian of science has called it—*the* university of the age of Enlightenment, an institution the entire European republic of letters looked to. It was tightly controlled by the state; indeed,

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[23] Michael Kempe, *Wissenschaft, Theologie, Aufklärung: Johann Jakob Scheuchzer (1672–1733) und die Sintfluttheorie* (Epfendorf 2003).

[24] See now Joachim Bahlcke and Werner Korthaase (eds.), *Daniel Ernst Jablonski: Religion, Wissenschaft und Politik um 1700* (Wiesbaden 2008); Klaus Erich Pollmann (ed.), *Abt Johann Friedrich Wilhelm Jerusalem (1709–1789): Beiträge zu einem Colloquium anläßlich seines 200. Todestages* (Braunschweig 1989).

[25] This section is based on Thomas Biskup, 'A University for Empire? The University of Göttingen and the Personal Union, 1737–1837', in Brendan Simms and Torsten Riotte (eds.), *The Hanoverian Dimension in British History* (Cambridge 2007), 128–160.

it was a department *of* the state, but unlike many earlier institutions, including the English universities, it was open to students from *all* confessions in typical Enlightenment spirit. The Hanoverian government, in the person of leading minister Gerlach Adolph von Münchhausen, made a point of appointing a number of highly renowned professors in Law, theology, and medicine. Göttingen was strong not only in law, in particular Imperial Law, the knowledge of which was of course a prerequisite for any diplomatic career in central Europe. It was, above all, strong in those subjects that had traditionally been excluded from the university curriculum: reform theology and natural history, much of which was elsewhere taught only at specialist training colleges, such as the Freiberg mining institute. While a number of continental universities, such as Uppsala, Halle or the Dutch universities, had opened up to these fields in the late seventeenth century, and the Scottish universities were to follow, the two English universities in particular remained essentially theological colleges. Thus, natural history was increasingly conducted outside the universities in eighteenth-century England, in voluntary associations dominated by gentleman scholars, such as the Royal Society.

Building Up a Special Relationship: Göttingen and London, 1760s to 1780s

How, in this intellectual and institutional context, transnational scholarship networks operated, will be demonstrated in what follows by the examples of Sir Joseph Banks and Johann Friedrich Blumenbach. They built on the connections established in the 1760s and 1770s by Michaelis, who had been keen to put Bible Studies on a scientifically sound footing. He stood at the forefront of the re-appraisal of biblical and mythological texts, which was one of the most-discussed problems of the eighteenth century, and signalled a major shift in the representation of the past. Of central importance was the question to which degree Scripture could be taken as a source book on "real" events of the past, or if not, then rather as a source book from which the mind-set of ancient peoples could be reconstructed. Considering that the interpretation of Scripture was central to politics and society in the eighteenth century, when in all European states the Church was still a state church and controlled most levels of the educational systems, this was an eminently political project that stood at the crossroads of several disciplines. Michaelis thus worked closely with scholars in philology and philosophy, geography and ethnography, and

here in particular, with English scholars who belonged to the king's and queen's scholarly circle. This group included, among others, the Bishop of Oxford, Robert Lowth, Robert Wood, politician and famous traveller to the Near East, and Sir John Pringle, President of the Royal Society, court physician, government adviser in scientific matters, correspondence partner of Haller's, and an avid reader in theology. He was the unofficial head of this circle and Michaelis's most important correspondence partner since the mid-1760s, when Pringle had visited Göttingen with his friend Benjamin Franklin, when both were elected to its Academy of Sciences. Unlike biblical philology and chronology, which had for a long time been the domain of Bible scholars, scholarship of the Michaelis-Pringle mould also included the organisation of expeditions to the Near East to gain first-hand reports on the geography, botany, and ethnography of the Holy Land, to be able to establish the factual correctness of data provided by the Bible. Pringle and Haller also closely followed Cook's voyages to the South Sea.[26] Like Banks a decade later, Pringle corresponded with a number of Göttingen experts, and divided his correspondence according to fields of interest, writing to Albrecht von Haller on medical matters, and to Michaelis on theology. This required a certain amount of diplomatic skill, as Haller and Michaelis did not always get on well. Pringle corresponded extensively with people all over Europe, but with Albrecht von Haller and Johann David Michaelis, his two most important correspondents were Göttingen men. Pringle, in turn, was one of the most important correspondence partners of both Michaelis and Haller in Britain.

Michaelis had made his reputation by organising Niebuhr's Arabian expedition of 1761, and in the following decades, he remained closely involved in similar projects, which were organised with the help of London's scientific associations, for instance the Society of Dilettanti, which was instrumental in publishing the results of Robert Wood's travels to Greece and Turkey. Thus, Michaelis became one of the founding figures of what later emerged as "oriental studies" from under the umbrella of theology, and his *Orientalische Bibliothek*, the first scholarly journal dedicated to oriental studies, also served as a model for the *Asiatick researches* published by London's Asiatic Society. Michaelis's work was thus not only situated at the crossroads of several disciplines; indeed, it contributed to the emergence of new disciplines. It was also situated at the crossroads of pol-

[26] Otto Sonntag (ed.), *John Pringle's Correspondence with Albrecht von Haller* (Basle 1999), 11.

itics and scholarship, and high patronage was thus paramount. Thus, close connections to the court and the government of Lord North were essential, which after Pringle's death in 1782 were maintained through the Bishop of Winchelsea, Lord North's brother. No wonder then that Michaelis feared for his connections when the North government ended, as Michaelis's political patronage in London was also a party political matter.[27]

Joseph Banks was elected president of the Royal Society in 1778, mainly due to the reputation he had gained as a travelling botanist on James Cook's first South Sea voyage. He published only a small number of scientific papers but exerted enormous influence over decades through his extensive correspondence, his proximity to king and court, and an enormous number of offices: he was founding director of the Royal Botanic Garden, an influential board member of many scholarly associations, and the most important trustee of the British Museum.[28] Banks's connections were of particular interest to Johann Friedrich Blumenbach, who was professor of anatomy at Göttingen but whose research interests went far beyond what had hitherto been considered the domain of medicine: he made Göttingen a centre of ethnography, and was a key figure in the establishment of the new science of anthropology.[29]

For these comparative projects in botany and anthropology, which aimed at nothing less than the creation of new systems of classification comprehending all species on earth, the acquisition of large collections of specimens was necessary. This went far beyond the exchange of letters and the odd "curious" piece, as in the collection of Sir Hans Sloane in the seventeenth century. Rather, systematic observation and the acquisition of specimens from all corners of the globe were required. Banks built up huge collections in his large house in London's Soho Square, which he readily used as a reservoir for his contacts with other scholars. Systematically, he built up only his botanical collections, which were based on the classification system developed by Linnaeus (or, as he was rather known on the continent, Linné), whose pupil Daniel Solander he also

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[27] Biskup 2007 (note 25), 146.

[28] The Banks correspondence amounts to more than 20,000 letters, see Harold Carter, 'Introduction', in Neil Chambers (ed.), *The Letters of Sir Joseph Banks: A Selection, 1768–1820* (London 2000), xvii. See also notes 5 and 9.

[29] Thomas Nutz, *"Varietäten des Menschengeschlechts": Die Wissenschaften vom Menschen in der Zeit der Aufklärung* (Wien 2009). For the early correspondence between Banks and Blumenbach, see Frank W.P. Dougherty (ed.), *The Correspondence of Johann Friedrich Blumenbach*, vol. 2: *1783/84* (Göttingen 2007), X and 14ff.

Fig. 1. James Gillray's caricature of Joseph Banks as *South Sea caterpillar* (1795): this highlights the central role his travels had for his reputation at home, Library of Congress (Washington).

employed as a private curator.[30] On the basis of his famous Göttingen collection of human skulls, Blumenbach, in turn, developed his theory on the variety of species, which differentiated Linné's classification and remained the standard work in the field until Darwin revolutionised the world of science again in the mid-nineteenth century.[31] The main contributor to Blumenbach's collection was Banks, who instructed his agents in the South Sea and in Canada, Africa and India to send skulls and other specimens relating to the classification of human beings to London, from where he forwarded them to Göttingen. Banks also provided hundreds of plants to Göttingen's new Botanic Garden. Thus, Göttingen's botanic and ethnographic collections—divided into Natural History of Mankind, Fauna, Flora, and Minerals according to Blumenbach's handbook—were largely based on the findings of Cook's voyages, but also integrated into the network of botanic gardens Banks set up all over the Empire, from London to Trinidad and the Indian Ocean (Ceylon).[32] As a whole, however, Blumenbach focussed on anthropology rather than botany, which in turn was Banks's main field of interest. The two patrons thus divided natural history into two fields, each of them covering one area. Blumenbach provided the expert advice Banks was in need of when it came to categorising and analysing Banks's enormous collections. In Soho Square, Banks already had a host of eminent scholarly retainers employed, and through extensive correspondence, scientific papers, and personal visits, Blumenbach came in here as well.

Blumenbach acknowledged in his letters to Banks that he benefited materially much more from the relationship than his English counterpart, but reciprocity was guaranteed as, crucially, Banks gained access to Blumenbach's expertise as well as his students. This was important precisely because, at a time when British expansion into the South Sea in the decades following the Seven Years War required unprecedented botanical, zoological, astronomical and ethnographic expertise, neither qualified "travellers", as explorers were then called, nor qualified curators were readily available in England. Natural history, as botany, zoology and mineralogy were comprehensively labelled, was not part of the English university curriculum. When young Banks became interested in botany while at Oxford, he needed to pay a private tutor out of his own purse.

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[30] Edward Duyker, *Nature's Argonaut: Daniel Solander 1733–1782. Naturalist and Voyager with Cook and Banks* (Melbourne 1998).

[31] Dougherty 2007 (note 29), XIVf. and XXV.

[32] Gascoigne 1994 (note 5), 150–155.

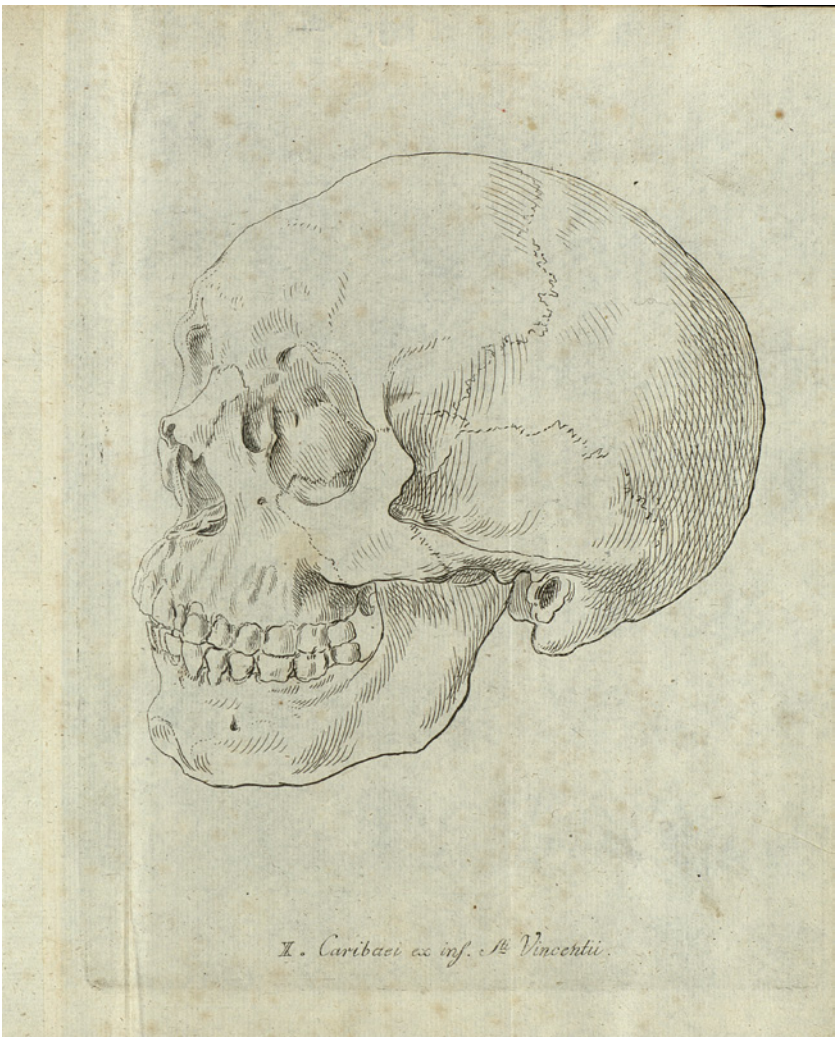

Fig. 2. "Caribaei", from: Johann Friedrich Blumenbach: *Decas Collectionis Suae Craniorum Diversarum Gentium, Gottingae* 1790/1820, 11 [pl. en reg. p. 26: crâne] X.

This turned out to be a good investment as it enabled him to participate in Cook's first South Sea voyage, on which he then built his entire scientific reputation as a leading botanist. When Banks fell out with Cook before the latter's second South Sea voyage, no English talent was at hand to fill the gap. Hence, the father-and-son team Reinhold and George Forster was

employed.[33] The former German-Polish parish priest Forster had been trying for almost a decade to establish himself as a scholar in England. Trying to survive as a tutor for Dissenting Academies, he jumped at the opportunity to join Cook as naturalist aboard the *Resolution* in 1772. After his and his son's return to London, he hoped to emulate Banks in building a career on his scholarly exploits but fell out spectacularly with Banks, Lord Sandwich, and the British establishment over the publication of the travel report (which he and his son wished to pursue on their own, and not on the Admiralty's conditions). Banks's patronage system, however, did not grant the ambitious Forster the position he yearned for. Forster's requests for an annual pension, a donation, and the publishing rights to the official travel report were rejected, and when Forster published his own travel report independently, and engaged in a public row with Lord Sandwich, the First Lord of the Admiralty (and Banks's closest ally in government), the British establishment closed ranks against the immigrant theologian of lowly Polish-Prussian background. Whereas the more elastic Solander had been promoted from Assistant Keeper to Keeper (with a salary of more than £100) at the British Museum following his participation in Cook's first South Sea voyage, Forster had breached the rules of London's scholarly society, and fled Britain, leaving behind a pile of debt. The South Sea voyage that had made his reputation in the first place now appeared as "that fatal voyage which is his ruin", as his son George later wrote.

The powerful baronet Banks was part of a small elite group that influenced almost all decisions when it came to military and trade operations, research trips and the exploitation of new territories, and he was uniquely positioned to guarantee his position as undisputed master of South Sea studies and botany in Britain. Indeed, in contrast to Cook's first South Sea voyage, which was designated the "Banks voyage", the official travel report made sure that Cook's second South Sea voyage came to be called "Cook's voyage", thus highlighting the British navigator at the expense of the German botanist.[34] It is thus particularly ironic that a decade later, Banks conveyed his strategic recommendations to Blumenbach via George Forster,

[33] For the resulting conflict between Forster and Sandwich, Michael Hoare, *The Tactless Philosopher: Johann Reinhold Forster (1729–1798)* (Melbourne 1976), 179–182 is still unsurpassed.

[34] James Cook, *A Voyage Towards the South Pole, and Round the World: Performed in His Majesty's Ships the Resolution and Adventure, in the Years 1772, 1773, 1774, and 1775* (London 1777), 2 vols.

who wrote to his wife Therese: "Banks considers Blumenbach a shining light, and thinks he should lay claim to that skull story, quite as he himself had laid claim to all things South Sea."[35] As late as 1790, Forster was unable to overcome the wall erected by Banks to protect his own field: when visiting England again to publish his research into South Sea botany, George Forster was rejected by all publishers, who were afraid "to displease a man, such as Sir Joseph Banks, who thinks he has the monopoly over South Sea plants", and who might "burden my book with his mighty condemnation."[36] This demonstrates the degree to which informal power structures determined what reached the book market in England, where no official censorship existed. On both sides of the English Channel, scholarly grandees exploited George Forster's knowledge and reputation as a traveller while withholding recognition and patronage when it came to salaried positions. Forster, who had been educated by his father and had no academic degree, was forced to accept an academic post at the remote University of Vilnius, from where he later moved to the courts of Cassel and Mainz. George Forster was used by English as well as German scholars when it came to mediating between Germany and Britain, but he fell through the loops of the very net that he helped to weave.

Explorers and Curators: German Natural Historians in 1790s and 1800s London

While the Forsters needed decades to recover from the financial consequences of this conflict, Banks learned that the lack of scientific talent needed to be addressed systematically. After the Forsters had left in 1780, Blumenbach and Banks thus intensified their co-operation by filling positions in the "imperial" sciences with Göttingen graduates. First, they jointly organised the expeditions of Friedrich Hornemann and Johann Ludwig Burckhardt to Africa and Arabia, to determine the course of the rivers Niger and Nile, and generally send back information relating to botany and zoology as well as to ethnography and geography. Banks, as the leading force of the "Association for promoting the discovery of the interior of Africa", and Blumenbach devised a concept whereby Blumenbach chose able Göttingen graduates in natural history, and provided them with a

[35] Gerhard Steiner (ed.), *Georg Forsters Werke*, vol. 16: *Briefe 1790 bis 1791* (Berlin 1980), 153.
[36] Ibid.

linguistic, geographical, and mathematical training that was designed to allow them to travel alone, which meant in disguise as travelling Muslims, through regions no European had ever set foot in, as well as to maximise their scholarly output. Hornemann and Burckhardt were then sent to London, where Banks and the African Association provided them with the latest geographical information as well as the necessary equipment, and the Royal Navy then organised the transport. Like so many explorers of that period, they all perished, but not before sending back valuable travel reports, which were then published by the Association, and which formed the basis of further explorations in the nineteenth century. Thus, in the decades following the Seven Years War, Britain, the undisputed naval power, came to occupy something of a monopoly when it came to organising overseas expeditions from Germany. While Michaelis still organised his Arabian expedition of 1761 with the help of the Danish court, all German post-war explorations of the Near East and the South Sea were arranged through the London link. Only when even Banks could not secure funds was it necessary to find other paths. Due to the financial difficulties of the African Association, Ulrich Jaspar Seetzen thus had to fall back on a grant provided by the Duke of Saxe-Gotha.[37]

Second, British expansion filled the collections of the newly-established British Museum as well as those of private gentleman-collectors, such as Banks or John Hunter, with an unprecedented number of plants and animals, mineralogical and ethnographic specimens. Due to the lack of home-grown natural historians, however, these collections were largely administered by curators trained abroad: Banks's private collection was in the hands of Linnaeus's pupil Solander, who also served as part-time curator in the chronically understaffed British Museum. Jonas Dryander, another Linnaeus pupil, also worked both for the Banks collection and for public institutions under Banks's control.[38] Through Blumenbach, Banks was now able to place a number of highly-qualified Göttingen graduates in different London collections.

The case of the Brunswick-born Carl Dietrich König is typical. On Blumenbach's recommendation, he was invited to London, where Banks

[37] Hans Plischke, *Johann Friedrich Blumenbachs Einfluß auf die Entdeckungsreisenden seiner Zeit* (Göttingen 1937), 31–38.

[38] Edward Edwards, *Lives of the Founders of the British Museum* (reprint of 1870 edn., Bristol 1997), 532 and 575; P.R. Harris, *A history of the British Museum Library 1753–1973* (London 1998), 36, 48 and 171; Marie Boas Hall, *The Library and Archives of the Royal Society 1660–1990* (London 1992), 17–21.

had him employed to re-organise Queen Charlotte's collections at Kew.[39] There, he also co-edited and contributed to the *Annals of Botany*, one of the ever-increasing number of scholarly journals. Banks later employed him in his own household, which in König's case as in so many others was a stepping stone to an official position in the English world of science. König was thus appointed to the British Museum in 1807, where he catalogued the mineral collections that had been thoroughly neglected by his predecessor George Shaw, who had even been temporarily suspended due to the neglect of his duties. Keeper of the Natural History Department at the British Museum from 1813, and Keeper of the Mineralogical and Geological Branches from 1837, König was also instrumental in bringing about major acquisitions, such as the Greville Collection, bought with the help of a Parliament Grant of more than £13,000 in 1810, and the German collection of the Baron von Moll in 1815; here, the fact that the then Crown Prince of Bavaria had also been an impressed student of Blumenbach's at Göttingen paid off. König worked closely together with another Göttingen graduate, the Museum's principal librarian Joseph Planta, whose years in office transformed the library after it had been left virtually untouched by his predecessor Charles Morton, and certainly uncatalogued, since it had moved into Montague House. The Garrick bequest of plays, the library of George III, the Cottonian library (although acquired earlier), and other major collections were integrated into what later became the British Library under Planta's reign, using cataloguing systems developed by Göttingen University Library, then Europe's leading research library.[40] This transformed a rather random collection of bequests into an "international repository that was truly global in scope".[41]

König's career followed a pattern that had been established two decades previously on Solander's arrival: qualified staff were being shuttled between the collections of London's scholarly grandees quite like the objects of natural history themselves. Thus, Banks exchanged considerable parts of his own collections with fellow collector John Hunter. After the latter's death, his collection was bought "for the nation" by Parliament, and entrusted to the Royal College of Surgeons. It was overseen by a Board

[39] For the role of the Royal court in these aristocratic urban networks, see Jane Roberts (ed.), *George III & Queen Charlotte. Patronage, Collecting and Court Taste* (London 2004).

[40] Philip Rowland Harris, *A History of the British Museum Library 1753–1973* (London 1998), 36ff.; Neil Chambers, *Joseph Banks and the British Museum: The World of Collecting, 1770–1830* (London 2007), 3f., 34–43 and 61–69.

[41] Chambers 2007 (note 40), x–xi.

of Trustees dominated by Banks, who thus found himself again in charge of parts of his own collection. The patronage resources of the Royal court were also integrated into this network: the Silesian philologist Gottfried Woide, for instance, was given the position of Reformed Chaplain at the court of St. James in 1770. Twelve years later, he was appointed Assistant Librarian in the British Museum's Department of Natural History, and the very circumstances of his death highlight the density of Banks's network: in 1790, Woide died of apoplexy in his grace and favour apartment in the British Museum, following a dinner of scholarly sociability at Banks's house.[42]

Subservience and Politeness: Immigrant Curators in London's Aristocratic Collections

A considerable part of the duties of scholars such as Woide and König was of a social nature: they had to entertain Banks's aristocratic guests at his famous Sunday dinners, as well as to function as tour guides for high-ranking visitors in the British Museum, not least Members of Parliament, who repeatedly were asked to approve additional Museum funds. Here, scholarship had to be "useful" as well as "polite", a combination for which the University of Göttingen was particularly well known. The concept of the "polite scholar" not only set the "bookish" antiquary apart from the improving *Aufklärer*; a "perfectly polished behaviour" was also the prerequisite for any success within the hierarchies of a scholarly world dominated by aristocratic grandees.[43] Simultaneously, this shared set of values facilitated trust between scholars, which became a key word for the conduct of natural history. British and German scholars were, to a degree, dependent on each other and the enormous number of forgeries in the age of Enlightenment—from archaeological artefacts to fossils—testifies to the importance of reliability and trust. "Sedentary" scholars such as Michaelis and Blumenbach thus preferred to rely on observers and channels of communication they knew well.[44]

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[42] W.P. Courtney, rev. S.J. Skedd, 'Woide, Godfrey', in *Oxford Dictionary of National Biography* (Oxford 2004), vol. 59, 948.

[43] Robert Huxley, 'Natural History Collectors and Their Collections: "Simpling Macaronis" and Instruments of Empire', in Kim Sloan (ed.), *Enlightenment: Discovering the World in the Eighteenth Century* (London 2003), 88–90.

[44] "Without the ability to place trust in reports of matters of fact that had not been personally experienced by people like oneself, the new philosophy would have remained

This taxonomic as well as sociable practice of scholarship, however, increasingly contrasted with the European republic of letters, which in the second half of the eighteenth century came to measure scholarly achievement by the number and quality of publications, and the link a scholar had with scholarly hypotheses and "discoveries". The scholarly practices of König and Planta resulted in the production of new catalogues, but only few publications in the form of articles published in the Transactions of the Royal Society, and even these were often published under the name of other, more prominent patrons. This not only reduced the visibility of curators in the Republic of Letters, but also their place in the histories of science written in the nineteenth and twentieth centuries. The same practices, however, affected their aristocratic patrons, who did not all contribute to those scholarly publications that Albrecht Haller and other luminaries considered necessary for what was now being called scientific progress. Banks was rejected by the Paris Academy at first owing to a perceived lack of publications, and tried to bolster his position in the Republic of Letters by giving away parts of his collections, but the great botanical work he had long planned never made it to the printing press.[45] In this context, his European correspondence partners took on an important function in safeguarding Banks's status: publications emphasizing Banks's contributions to scholarship, such as Blumenbach's introduction to the third edition of his *De generis humani varietate nativa* (1795), thus served to function as reminders that despite his lack of publications, Banks had contributed enormously to the progress of natural history.

The reciprocity and complementarity of German professors and English collectors did not simply rely on personal arrangements; on the basis of structurally different cultures of knowledge, they rather established a transnational co-operation that far exceeded the exchange practices cultivated by members of the Republic of Letters. While some German universities, such as Göttingen, enjoyed respect all over Europe, it was religion and politics that accounted above all for the eminent position of German natural scientists in eighteenth-century London. In Germany, natural history had a fixed place at the Empire's many universities and academies,

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fragmented and isolated in local social and geographical spaces", David Lux und Harold Cook, 'Closed Circles or Open Networks? Communicating at a Distance during the Scientific Revolution', *History of Science* 36 (1998), 179–211: 181.

[45] David Philip Miller, 'Joseph Banks, Empire, and "centers of calculation" in Late Hanoverian London', in David Philip Miller and Peter Hanns Reill (eds.), *Visions of Empire: Voyages, Botany, and Representations of Nature* (Cambridge 1996), 21–37: 21.

whereas England's most innovative scholarship was not situated at the two ancient universities, but propelled by wealthy gentleman-collectors, whose collections and associations determined the structures of the English culture of science well into the nineteenth century. Incorporating the specimens assembled in these collections into a "body of theory which would make sense of their significance",[46] however, remained a challenge for this brand of decentralised, non-academic natural history, the limits of which were highlighted by Samuel Johnson as early as 1770:

> The virtuoso therefore cannot be saied to be wholly useless; but perhaps he may be sometimes culpable for confining himself to business below his genius, and losing in petty speculations, those hourse by which if he had spent them in nobler studies, he might have given new light to the intellectual world. . . . Collections of this kind are of use to the learned, as heaps of stones and piles of timber are necessary to the architect.[47]

London's scholarly associations, such as the Royal Society or the Society of Dilettanti, were above all gentlemanly clubs serving the cultivation of elite sociability, whereas the actual work of cataloguing and classifying objects was done by scholars on lower social levels.[48] The principle of scholarly meritocracy, according to which "knowledge, achievement and contribution to the progress of science" should determine a scholar's rank, applied in this culture only to a degree.[49] Natural historians from modest backgrounds, such as König and Hornemann, had to be prepared to integrate into hierarchical structures that provided for them materially and guaranteed a certain amount of respectability. Successful curators, such as Solander and König, who had trained with luminaries such as Linnaeus or Blumenbach, were able to use their continental connections as bargaining chips; this was another field where Reinhold and George Forster could not compete. The correspondence of German and Swedish scholars, both with their old continental patrons and their acquired

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[46] Gascoigne 1994 (note 5), 158f.

[47] Quoted in: Roy Porter, *The Making of Geology: Earth Science in Britain 1660–1815* (Cambridge 1977), 169f.

[48] Harry Liebersohn, 'European Geographic Societies and Ethnography (1821–1840)', in Philippe Despoix and Justus Fetscher (eds.), *Cross-Cultural Encounters and Constructions of Knowledge in the 18th and 19th Century: Non-European and European Travel of Exploration in Comparative Perspective / Interkulturelle Begegnungen und Wissenskonstruktionen im 18. und 19. Jahrhundert* (Kassel 2004), 145–160: 150f.

[49] Hubert Steinke and Martin Stuber, 'Haller und die Gelehrtenrepublik', in Hubert Steinke, Urs Boschung and Wolfgang Proß (eds.), *Albrecht von Haller. Leben—Werk—Epoche* (Göttingen 2008), 381–414: 393.

English ones, demonstrates that proximity and distance were continually negotiated to safeguard a salaried position. The functional character of such relations—often remarked upon critically by the powerful, such as Linnaeus—is revealed by the recurring decline in communication once these aims were reached or the balance of patronage resources changed.

For immigrants, however, successful integration into the world of English natural history was only ever possible on a subservient level, with the apex being a salaried curator's, or keeper's, position. These positions were overseen by the same aristocratic trustees who also employed immigrants in their private collections, and continued to call on them once they had moved into public service. This demonstrates yet again that the borders between "public" and "private" collections remained permeable well into the nineteenth century. All this migration, however, never reached the higher social echelons of natural history, and English gentlemen-collectors as well as German professors of Blumenbach's rank would never spend more than a few weeks away from their domestic power bases.

The integration of migrant scholars was, however, not determined by national but by social descent. It affected immigrants as well as those British scholars who had no genteel background. Above all, it appears that natural history, which was structured around large private and public collections, was more hierarchical than other fields, such as astronomy. The career of William Herschel, who rose from immigrant German musician to ennobled court astronomer, would have been inconceivable in that playground of aristocratic ambition, botany. Strict as these hierarchies were, they were, in both correspondence and sociability, masked by a rhetoric of friendship, the translation of which into social equality, however, remained out of bounds. The ethos of friendship, which found expression in the presentation and exchange of objects, thus always needs to be seen in the context of patronage relations.[50]

Religion and Empire: German Scholars in the Age of Anglo-French Antagonism

In eighteenth-century London it was thus less national affiliation than social rank and scholarly ethos that determined the role of German natural historians, many of whom anglicised their Christian names once their

[50] Jardine 2001 (note 14), 216.

migration to Britain turned out to be permanent. Even beyond the Anglo-Hanoverian personal union, religion and politics shaped the career paths of German natural historians: first, the close connection of natural history and theology, which had produced scholars such as Scheuchzer and Linnaeus earlier in the century, became evident even at the turn of the nineteenth century. Upper and Lower Saxony, the Netherlands, Sweden and Switzerland—the traditional corridors of the theological *peregrinatio academica*—continued to facilitate the careers of natural historians until the early 1800s. Secondly, Banks and Blumenbach intensified their co-operation during the 1790s and early 1800s when Britain and France were almost constantly at war; 80 per cent of their letters were written in the few years between 1790 and 1803.[51] This highlights the particular role Anglo-German scholarship networks had in this period: during the 60 years between 1755 and 1815, Britain and France were at war for no less than 34 years, and imperial rivalry shaped in particular the conduct of natural history. Not least among the reasons why Buffon's system of species classification never gained a real foothold in Britain was that Buffon was French and Catholic, whereas the Swedish Protestant Linnaeus, in contrast, posed a threat in neither imperial nor confessional terms. Thus, British natural historians rejected Buffon's classification system as French scientific imperialism, and it was during the Seven Years War that Peter Collinson and John Ellis undertook an effort to achieve acceptance of Linnaeus's botanical classification system in Britain, inviting the master's star pupil Daniel Solander for this purpose at the height of the conflict with France in 1760. Apart from the structural differences between the English and German cultures of knowledge, it was confessional proximity and lack of global power that made Scandinavian and German scholars attractive for science in the service of the British Empire. Hanover was linked to Britain through the Personal Union, but also Prussia, Brunswick, Mecklenburg, and the Thuringian states were throughout the period usually either allied with Britain or at least neutral. They were certainly no threat on the global level, and quite as throughout the eighteenth and nineteenth centuries, British Royalty drew its male and female consorts from respected Protestant houses ruling over small-scale territories, these German states similarly served as a reservoir for the expanding world of English scholarship which was evidently unwilling to satisfy its demand

[51] Dougherty 2007 (note 29).

for highly-qualified botanists, mineralogists, and philologists with the help of its great rival France or her allies.

The employment of scholars standing, at least formally, outside the imperial dualism of France and Britain also contributed to the continuation of exploration throughout this period of conflict, and added weight to Banks's claims that scholarship should not be affected by war. When English explorers in the South Sea began to be arrested by the French (Matthew Flinders was arrested on Mauritius in 1803 and kept in prison by the French for seven years), non-British personnel offered the advantage of neutrality. Hornemann had no difficulty travelling through France in 1797, at the exact moment when Napoleon was preparing his Egyptian campaign, and even received the explorer in Paris. When, a few months later, the French caught up with Hornemann in Egypt, Napoleon's authorities actually assisted the German emissary of London's African Association.[52] This, however, threatened to undermine Banks's position in the British public, and his attempts to differentiate between political conflict and scholarly exchange resulted in accusations of "unpatriotic" behaviour. At this point, the inherent tension between a science that understood itself as "useful" and "imperial" on the one hand, and the norms of the European Republic of Letters on the other, could no longer be contained.

Conclusion: Scholarship and Migration

Britain was not only the period's greatest naval power and the centre of its own imperial networks. Britain was the lens through which many continental Europeans came to see the extra-European world in the eighteenth century, and as we can see in the case of the South Sea mania that gripped Germany in the 1770s and 1780s, this also determined what became visible at all, and what did not.[53] Simultaneously, however, it was also Europe which helped England make sense of her own imperial experiences. For the task of incorporating these rich collections, and of making them

[52] Gascoigne 1994 (note 5), 243.

[53] This was considered by George Forster, Helmut Peitsch, '"Noch war die halbe Oberfläche der Erdkugel von tiefer Nacht bedeckt". Georg Forster über die Bedeutung der Reisen der europäischen "Seemächte" für das deutsche "Publikum"', in Hans-Jürgen Lüsebrink (ed.), Das Europa der Aufklärung und die aussereuropäische koloniale Welt (Göttingen 2006), 157–174; John Gascoigne, 'The German Enlightenment and the Pacific', in Larry Wolff and Marco Cipollini (eds.), The Anthropology of the Enlightenment (Stanford 2007), 141–171.

relevant to the European republic of letters, she remained dependent on others. German scholars, in turn, who in this age of European expansion wished to get their hands on first-hand information from places as far as Tahiti, were dependent on the money and logistics of Britain as a world power. When the Napoleonic Wars interrupted communication between the continent and Britain, the exchange of texts, objects, and staff could no longer be maintained. The Anglo-German networks in natural history that had grown with the British Empire for half a century now fell victim to Napoleon's *Empire*, and were not resumed in the decades after 1815 when England set about restructuring the sciences. In the later nineteenth and twentieth centuries, the ensuing build-up of new domestic institutions, such as the University of London, and the reform of old ones, such as the Universities of Oxford and Cambridge and the Royal Society, would take pride of place in the narratives of a History of Science that came to be written along national lines. The dependencies and connections between the British Empire, natural history, and continental scholars were conveniently forgotten. In the genealogy of "British discoveries", Newton, Cook, and Darwin would figure as heroes, whereas gentlemen-collectors, such as Banks, as well as their continental servants, were marginalized.[54] It is perhaps no accident that these immigrant scholars are being rediscovered today, in another age of academic migration.

[54] Andrea Rusnock, 'Correspondence Networks and the Royal Society, 1700–1750', *British Journal for the History of Science* 32 (1999), 155–169: 155.