

## **BIOLOGY BETWEEN UNIVERSITY AND PROLETARIAT: THE MAKING OF A RED PROFESSOR**

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German professors in the early twentieth century were notoriously conservative, but extraordinarily among those who held forth in the lecture halls of the Weimar Republic, Julius Schaxel (1887–1943) aspired to be “a soldier of the revolution”.<sup>1</sup> Student of the Darwinist prophet Ernst Haeckel, experimental embryologist and professor at the University of Jena, at the end of the First World War Schaxel decried a deep crisis in the biological sciences and projected theoretical biology to resolve it. But by 1924 he had been branded a “red” professor for his involvement in socialist university reform. Bringing the theoretical programme together with Marxist politics, he now argued that the crisis in biology was a reflection of the crisis of capitalism. He reckoned that since the “bourgeois” universities would not reform themselves, only the organized working class could achieve a resolution. But he insisted that science would be saved only if Marxist biologists took the lead in producing a “socialist science”. One of the Weimar scientists most hated by the Nazis, in 1933 he was forced into exile in the Soviet Union, where he died during the Second World War.

Schaxel's politics made his reputation strikingly different in the two post-war Germanies. In the Federal Republic, as in the other capitalist democracies of the Cold War, Marxism officially failed — and this orthodox Marxist had little to offer the New Left. Struck off membership lists under National Socialism, he barely figured at all in the disciplinary memory of biology. In the German Democratic Republic (GDR), by contrast, the forces of his adopted country ensured that he would be honoured in Jena for several decades after his death. Scholars were required to celebrate this “first Marxist among the biologists, first biologist among the Marxists”.<sup>2</sup> Schaxel's politics had to be handled carefully even here. That he had begun his political career not as a communist but as a social democrat could be explained quite easily, but rumours that Soviet exile had been a bitter disappointment that finished with his murder were passed over in tell-tale silence; that he seemed nevertheless to have ended his life a doctrinaire Stalinist made him uncongenial to those who worked to overturn Lysenkoism. But it was above all the success in the GDR of a version of Schaxel's project that tended to discourage critical reflection on his scientific politics. Now that after-life is over, German reunification risks merely discrediting him.<sup>3</sup>

Schaxel's politics is only the first of three ways in which his legacy is fraught. A second is disciplinary: theoretical biology, the field he played a key role in organizing, did not achieve the successes its interwar practitioners expected. Embryology, their main concern, was dominated instead by Hans Spemann's school, whose participant-historian Viktor Hamburger reckoned Schaxel "a minor figure", who "had no influence on our thinking".<sup>4</sup> Though marginal to this winners' history, as a theoretical biologist in the 1920s Schaxel was actually a major figure. He was also the later Weimar Republic's most prolific and prominent writer on Marxism and natural science. But this very political engagement for which he was celebrated in the GDR appeared to coincide with his retreat from the scientific coal-face. By 1924, he had all but ceased to produce new work for specialists; he concentrated on popularizing biology in the labour movement. This provides a third, and perhaps the fundamental, reason why Schaxel has been marginalized: he mounted his political critique of biology primarily not in academic fora, but for organized workers and socialist educators. As a result he has — with, we shall see, perhaps poetic justice — fallen foul of the problematic status of popular science, 'popularization' and of studying them.

This paper contributes to the histories of science and socialism, of biology — specifically embryology, theoretical biology and Darwinism — and of scientific 'popularization'. But my main aim is to show how in Schaxel's practice as a scientist in the Weimar Republic these histories became intertwined. Dieter Fricke outlined Schaxel's "life" and political "struggle", Paul Weindling drew attention to this distinctive figure in the biological politics of the Weimar professoriate, and Herbert Mehrrens highlighted the conspicuous critic of biology under National Socialism. Georg Uschmann placed Schaxel in the institutional tradition of zoology at the University of Jena, Reinhard Mocek assessed him in relation to other experimental embryologists, and Jonathan Harwood used Schaxel's theoretical analysis as an index of the widely felt crisis in the life sciences after the First World War. Helmut Vetter focused on Schaxel's work for the socialist popular-science magazine *Urania*.<sup>5</sup> Here I bring these partial perspectives together by showing how the experimental and theoretical biologist became a Marxist who produced biology for organized workers as the principal means of his struggle over science. I stress the contingency of Schaxel's choices and emphasize the way he moved between different arenas. The Schaxel historiography of the GDR was dominated by censored extracts from his unpublished autobiography, but it continually risked being undermined both by its significant silences and by the more or less privately voiced opinion that as a scientist he had ultimately failed. I attempt to make a space for reflection by refusing the reductive choice between hero and failure, and this involves suspicion also of Schaxel's own heroic narrative and its implicit claim that he had always already known what he was going to do next.<sup>6</sup> Presenting an account of a making, I show instead how he constructed a career and its meaning from the available resources as he went along, how he recast a non-Marxist project of biological reform into a programme for "socialist science". Exploring in the process the relations and

distinctions between the arenas in which he produced biology for different audiences, I suggest how this career might challenge received accounts of Weimar science.

As the particular constellation of disciplines, institutions and practitioners with which we are still more or less familiar today, natural science had largely been made by the end of the nineteenth century. But by focusing on the changing relations between scientific institutions and other arenas in which natural knowledge was produced and challenged, we can explore ways in which the status of sciences, scientific institutions and scientists remained and remain contested. It is useful to note first that though the twentieth century began with the German universities still the most prestigious sites of research and teaching, we should be wary of following historian of biology Emmanuel Rádl's 1909 dictum that "'German science' means the universities".<sup>7</sup> By the time he was writing, the stagnating university system was increasingly being supplemented by other institutions: the technical colleges had gained the right to award doctorates; more chemists worked in industrial laboratories than in academia; the Kaiser Wilhelm Institutes would soon join other mixed public and private centres of scientific, military and commercial innovation; and scientists increasingly worked in government agencies, medicine, agriculture, forestry, zoos and marine stations.<sup>8</sup> Historians of Weimar science are showing how the science produced in these institutions was constituted by scientists' participation in wider cultures.<sup>9</sup> We also know a good deal about how the sciences were used to transform German society.<sup>10</sup> But we do not do justice to struggles over science simply by investigating how specialist science was culturally embedded, and then adding 'the popularization of science' or the multiplication of scientific cultures to a narrative in which the privileged status of the official institutions — however inclusively defined — is taken for granted. To investigate the political geography of the sciences we need to study non-specialist arenas not in isolation but in their relations to the official institutions, and reciprocally, to analyse how those institutions sought to defend or enhance their status.<sup>11</sup> People in the 'scientistic' 'twenties continued to a surprising degree to contest more than theories, technologies or even world views. At stake still, and especially in these crisis years when the threats of war and political upheaval were ever present, was who would produce knowledge of nature, for whom, where and why. Much scholarship has been concerned with the universities and National Socialism.<sup>12</sup> Here I explore the relations between academic biology and the culture of the organized working class, and so bring university science into the major political confrontation of the Weimar Republic.

Socialism is present in histories of German science in the late nineteenth and early twentieth centuries, but it is easily marginalized by the ways in which it has appeared. First, the state's monopoly of the universities ensured that very few scientists were socialists — and historians of science increasingly treat their subjects' politics as rather trivial anyway. Bruno Latour has argued persuasively that what is most importantly political about the work of scientists is not their political commitments or their ventures into politics narrowly understood, but what they do in and

using their laboratories.<sup>13</sup> Second, socialism has been kept at arm's length. Certainly, it has often been argued that scientists' work, and Imperial science policy more generally, attempted in the face of the largest socialist party in the world to incorporate the working class into the nation. But in the history of science as the history of anti-socialism, the left remains a distant threat. Socialists are confined to arenas to which Darwin can safely "descend", or to 'applied' science.<sup>14</sup> Third, and most important, socialists in the decades around 1900 are often considered to have had such faith in science that they posed no real threat. For, from the nature philosophy of the influential later writings of Engels through the expositions of the "pope of Marxism" Karl Kautsky to the socialist leader August Bebel's popular introduction, *Woman and socialism*, Marxism was modelled on, and imbricated with, the natural sciences.<sup>15</sup> The standard forms of these arguments have effectively marginalized socialism from the history of science because there is truth in all of them. Laboratories *have* made much more difference than those left scientists who have occasionally strayed across the stage of world history: the astronomer Anton Pannekoek, the major theorist of left-communism, or the theoretical physicist Friedrich Adler, who assassinated the war-mongering Austrian prime minister Count Stürgkh.<sup>16</sup> Socialists *were* kept as far from power as possible. And Marxists generally *did not* reject natural science. But if few socialists fought science, many struggled with it and over it: they claimed that where science was not biased by the class interest of the bourgeoisie, it justified and underpinned socialism; and they boasted that in the socialist future the labour movement, as the legitimate heir of German culture, would take over and improve the sciences out of all recognition.<sup>17</sup> If not as radical as many have since wished, this was a major challenge to official science. Here I show that by taking Schaxel's practice as a socialist scientist seriously, and especially by following him in his work with socialists outside the universities, we can see how he eventually confronted his academic colleagues with the threat of science as a socialist form of knowledge. I argue, then, that he was not irrelevant to academic biology by 1924, but was rather becoming involved in a much more general and far-reaching challenge.

It is important, however, to appreciate that Schaxel's work for a "socialist science", though in some respects a radicalizing initiative, aimed also to limit and harness an existing threat. Schoolteachers, writers and journalists were much more important communicators of science to socialist audiences than scientists, who were less inclined to political activity than their colleagues in the humanities, and conspicuous by their absence from the labour movement.<sup>18</sup> But Marxist scientists are especially interesting because they were also involved in esoteric science. This gave them unique resources, but meant that they had to negotiate the acute problem that to be a scientist and a socialist was to participate in "thought collectives" that were generally hostile.<sup>19</sup> Isolated among the faculty, neither could Schaxel be sure of a warm welcome in the labour club. The rights and duties of all intellectuals in the unusually proletarian German Social Democratic Party had been a matter of acrimonious debate even before Bebel's famous comment at the 1903 party conference:

"Look at every party member, but if it is an academic or an intellectual, then look at him twice and three times."<sup>20</sup> And as a scientist between the World Wars, Schaxel faced special problems. Socialist interest in science was declining from the great age of natural-scientific enlightenment before 1914, some socialists joined members of the educated middle class in blaming the natural sciences not just for the disenchantment of the world but for the horror and destruction of the War, and by the end of the 1920s many workers held science responsible for rationalizing them out of a job. Gary Werskey's fine collective biography tends to present J. B. S. Haldane, J. D. Bernal and other British left scientists of the 1930s as effortless entrepreneurs of science, whose sheer charisma was enough to get things done.<sup>21</sup> But though Haldane and Bernal were more firmly established — indeed Establishment — before they began to link science and left politics than Schaxel, Bernal had to acknowledge "the deep distrust of the working class for science as it is practised today".<sup>22</sup> Being a biologist among Marxists could be nearly as problematic as being a Marxist among biologists. Schaxel had to work as hard, if with better prospects of success, to persuade other socialists that socialism needed his science as to convince other scientists that science needed his socialism. Producing biology for these two contrasting audiences produced also the constrained radicalism of this socialist expert, who when he wrote in *Urania* was actually working to restore the authority of (a reformed) science and of (socialist) scientists.

First I place Schaxel in academic zoology during and immediately after the First World War. Having sketched his earlier embryological studies, I focus on the genesis, purpose and reception of his theoretical work. He argued that the biological sciences were in deep crisis, but that this could be resolved by an ambitious programme of "theoretical" and "general" biology, and in particular by regulating the highly contested distinctions and relations between specialist and popular science. As the country was convulsed by the Revolution that followed Germany's defeat, Schaxel also joined the German Social Democratic Party (SPD) and became much more heavily involved in university reform. But this does not mark the major discontinuity in his biological writing. Although his work as a reforming biologist, which I discuss in the first section, and his practice as a socialist reformer, which I describe in the next one, should certainly be understood as aspects of the same project, the major change did not come until 1924. That was when the left's more general educational reforms were blocked and his reactionary university ostracized him for his involvement in them. Publicly bringing Marxism and biology together, he now transformed general biology into "socialist science". He drew on his analysis of the crisis, and concern with the proper relations between biologists and their publics, to claim that the decisive cultural struggles were taking place outside the "bourgeois" institutions of higher learning: only the organized working class, he announced, could reform them and their "bourgeois science". However, as I discuss in the third section, Schaxel insisted that only the socialist scientist could provide the knowledge workers needed in order to recognize their position in nature and society, and so change it. This was the crucial political function that he gave his



FIG. 1. Julius Schaxel with Ernst Haeckel, 1910.

writing for the socialist press. He could not altogether set the terms of socialist cultivation of science, but he did succeed in establishing a position from which to put radical scientific reform more firmly on the left's agenda. By carefully managing his relationship to the warring social democrats and communists, he was able, as I show in the fourth section, to bring his brand of socialist Darwinism into the culture of the labour movement. Finally, in the last section, I reflect on the significance to his various audiences of the "dialectical biology" that Schaxel articulated in the last years of the Republic. This he invoked in his contributions to the socialist freethinkers' festivals of the summer solstice, but what did it mean when he claimed that here was the biology of the future, which he would bring home to roost when the proletariat stormed the universities?

#### 1. THE CRISIS OF THE LIFE SCIENCES AND THEORETICAL BIOLOGY

Schaxel was the last pupil of the evangelist of German Darwinism, the zoologist Ernst Haeckel, and made his career in Haeckel's University of Jena (Figure 1). Haeckel was a highly controversial figure both within academic zoology and in popular culture, but he was best known for riding roughshod over such distinctions. As he neared retirement, the evolutionary morphology that he had articulated in the 1860s had become less a programme of research than the butt of polemics, but the

aged visionary spent most of his time arguing for an enhanced role for science in public life and preaching a "monistic" nature-religion that supposedly overcame the "dualism" of Christianity. Reading these works of monism had, for Schaxel as for so many others, given direction to teenage revolt from a bourgeois milieu (his father was a businessman in Augsburg), and brought him to Jena to study with the prophet in 1906. Here he forged a career from the intense clash between the sweep of Haeckel's zoological philosophy and the values and standards of the zoological community, especially those of the new experimental biologists.<sup>23</sup>

Though he was exceptionally close to Haeckel, Schaxel's 1909 doctorate was awarded for cytological analyses of oogenesis carried out in Richard Hertwig's Munich laboratory under the supervision of the geneticist Richard Goldschmidt. He went on to undertake an increasingly experimental analysis of embryonic cleavage in marine invertebrates, and soon became involved in *Entwicklungsmechanik* ("developmental mechanics"). Its champion, anatomist Wilhelm Roux, had criticized Haeckel's evolutionary morphology for subordinating individual development, which Haeckel had called "ontogeny", to evolutionary development, which Haeckel had named "phylogeny". Instead of explaining how an embryo developed from one stage to the next solely in terms of a series of ancestors, Roux argued that scientists should use experiment to ask questions about the proximate causes of embryogenesis. He was widely, if perhaps too simply, presented as having used his own experiments principally to support the speculative "determination machine" of the zoologist August Weismann, in which cells were progressively determined by the self-disassembly of an inherited complex. Haeckel rejected Roux out of hand as a mechanist who failed to appreciate phylogenetic causation, but Haeckel's younger student Hans Driesch actually went much further than Roux in announcing that an historical science was a contradiction in terms. He attempted a mathematical-mechanical explanation of ontogeny, but by the early 1900s espoused a vitalism in which the development of the embryo was directed by a non-spatial and immaterial "entelechy".<sup>24</sup>

Much turn-of-the-century research on embryos had little to do with these heroes of experimental embryology, and many experimentalists found that they could work independently of high theory. But when Schaxel came on the embryological scene, it did appear to him that the field was divided by the two reified oppositions between mechanism and history, and between mechanism and vitalism. And a late student of Haeckel whom others had directed to 'modern' biology reckoned he could do no better than engage with the modern and experimental affront to monist free thought that was Driesch's vitalism. Schaxel's 1915 book, *Die Leistungen der Zellen bei der Entwicklung der Metazoen* (*The activities of cells in metazoan development*), summarized his results and used them to discuss the progressive determination of cells in development. Quite traditionally, he rejected both the "determination machine" and vitalism. But unusually, he did not just reject Driesch's vitalism, he even insisted that there was nothing remarkable about its main experimental support, Driesch's celebrated discovery of the early 1890s that a whole sea-urchin

embryo could develop from a part. According to Schaxel, who had repeated and reinterpreted the experiments, a whole larva formed if, and only if, the part had the same constitution as the whole embryo from which it was isolated. Denying the existence of what Driesch had christened “harmonious-equipotential systems”, he argued that it was highly misleading to suppose that “atypical” structures created by experimental intervention could “regulate” towards the formation of an harmonious whole. His own solution to the mechanism–vitalism controversy leant heavily on Roux. In Schaxel’s minimalist theory of development “in successive acts”, each stage was simply determined by the resultant of the individual cellular activities of the previous one.

Schaxel’s attack gave Driesch a welcome opportunity to defend himself, and the two men polemicized in the pages of the *Biologisches Centralblatt*.<sup>25</sup> Driesch attempted to save the “harmonious-equipotential system” by distinguishing it from his own vitalist conclusions. In his support he cited the outstanding embryological experimenter Hans Spemann, director of a division at the Kaiser Wilhelm Institute of Biology and the most successful zoologist of his generation, who had made a similar distinction when he commented on Schaxel’s lecture at the 1914 meeting of the German Zoological Society. He asserted that Schaxel had “confused” the concept of the “harmonious-equipotential system” with the conclusions Driesch drew from it. He claimed that it was possible to “reject the latter and still perceive in the former a fundamental problem of developmental physiology”.<sup>26</sup> But Schaxel repudiated this remark, arguing that “confusion” was rather fostered by retaining the theory-laden concept without accepting Driesch’s conclusions. Crucially though, the field was sufficiently loosely structured that none of the three men had to modify his views as a result of their exchanges.<sup>27</sup>

This polemic appeared in wartime, as professors leapt to the ‘defence’ of German *Wissenschaft*. Neither Driesch nor Schaxel took part in the intellectual mobilization, but Schaxel, sustaining an illusion of purity that he would later work to dispel, lamented that “external circumstances” were so “unfavourable” to their pursuit of “pure science”.<sup>28</sup> Actually, his stock rose steadily during the war, and he profited from being a representative of experimental zoology and member of Haeckel’s circle at a university that was somewhat in decline but had access to the significant private funds of the Carl Zeiss Foundation. This had been set up by the scientific entrepreneur Ernst Abbe to dispense the profits accumulated by what were becoming the town’s main industries, the Carl Zeiss optical and precision engineering firm and the Schott glassworks.<sup>29</sup> *Die Leistungen* secured Schaxel an *außerordentliche* professorship of zoology in 1916. Two years later Haeckel’s protégé and *Ordinarius* of zoology at Breslau, Willy Kükenenthal, told his mentor that he would put Schaxel, “one of our most promising younger colleagues”, on the list of candidates to succeed him should he, as he did, move to direct the Museum of Zoology in Berlin.<sup>30</sup> Schaxel can hardly have hoped for a chair so soon, but he did manage to exploit the favourable local circumstances to obtain one of the next best things: his own institute. Haeckel’s cantankerous successor as professor of zoology,



the outspoken Darwinist and racial hygienist Ludwig Plate, made it nearly impossible for Schaxel to use the Zoological Institute. So Schaxel called on Haeckel's associates, whose noses Plate had put permanently out of joint by mistreatment of his predecessor, to support an application for some of the increasingly large sums that the Zeiss Foundation was pouring into the University. The physiologist Wilhelm Biedermann and the botanist Ernst Stahl had long been favourably disposed to *Entwicklungsmechanik*, and the anatomist Friedrich Maurer used his power as dean of the medical faculty to help a brilliant Jena student and Haeckel intimate obtain a small Institute of Experimental Biology. Plate, as dean of the philosophical faculty, staged a walk-out from the Senate, but Haeckel's cronies won.

Installed in his institute, Schaxel aimed to provide further evidence against vitalist and teleological arguments with a series of experiments on limb regeneration in the axolotl: he insisted that it was not a matter of replacing what was missing after amputation, but of forming a structure according to the constitution of the stump. He argued that such experiments were theoretically, and perhaps medically, important, but he distinguished himself from the majority of his colleagues by arguing that experiments were not enough, that biology needed comprehensive theoretical reform.<sup>31</sup> His major work, *Grundzüge der Theorienbildung in der Biologie* (*Rudiments of theory formation in biology*), was finished as he moved into the new accommodation in the summer of 1918.<sup>32</sup> The book articulated concern about biological fragmentation and specialization that had been rife for many years, but brought it to a new pitch of alarm. In the post-war turmoil many academics were speaking of crises,<sup>33</sup> but Schaxel's analysis was unusually systematic and extraordinarily critical; he relentlessly dissected the contradictions and heterogeneity of biology, explained them historically, and outlined a programme of reform. He blamed what he claimed were the inadequate methodological foundations of Darwinism and the addition to this chaos of various new experimental disciplines. However, although he still reckoned the reasons for the crisis in biology "internal" to the science, his analysis ramified more widely because he presented it as a crisis in the relations between specialist and popular science. He argued that failure to reflect on methodology had produced internal weakness and heterogeneity. Their science a jumble of poorly grounded theories, biologists had been unable to resist, and indeed had collaborated in, its co-option by popular movements. Now they could offer only to guide the searcher around the "labyrinth of opinions".<sup>34</sup>

In this polemical history, the rot set in when the materialists of the mid-nineteenth century took Darwinism out of the hands of responsible scientists and made truth a matter of "public opinion". Finally safe to bite the hand that had fed him, Schaxel denounced Haeckel's conjuring with the "magic word development" for making a disastrous situation worse.<sup>35</sup> In the second, 1922, edition he stressed the baleful effect of life-philosophy, that intellectual response to the strains of capitalist industrialization which flourished in a Germany ravaged by war. This "anti-science movement" rejected strict science, which was in any case inaccessible. It was, however, the dubious privilege of biology that it looked as though it might quench the

widespread “thirst for the living”. Worse, where traditional mechanism had failed, biologists were themselves picking up this latest “offering from popular philosophy”, and mixing their own inner experience into their science.<sup>36</sup> Schaxel was contemptuous of Henri Bergson’s “intuitive vitalism”, but far more worried that those who considered themselves good mechanists were routinely and unconsciously smuggling into supposedly sober science the psychological insights he reckoned should be banished from biology. He even demanded to know,

By what right does the mechanist speak of adaptation and purposiveness, of individuality, of the whole and its parts, of the unity of organization, of harmony, regulation, activity, autonomy, finally even of organism?<sup>37</sup>

Lack of reflection and nervous empiricism meant that great swathes of biology had become a twilight zone of “careless conceptual romanticism”.<sup>38</sup> Schaxel’s main targets were, then, those who reckoned they were doing “exact” and theoretically cautious science, but were actually the unwitting prisoners of others’ unexamined assumptions, and he attacked these “empiricists” in strikingly similar terms to those Haeckel had once used against the likes of the anatomist Wilhelm His.<sup>39</sup> But now the treacherous assumptions by which Schaxel reckoned the “empiricists” imprisoned were above all Haeckel’s own. And thus we can understand the book as seeking to initiate the recovery of a unifying vision of Haeckelian grandeur from what most biologists agreed was the catastrophe of Haeckel’s practice.

Experimental endeavours like *Entwicklungsmechanik* and genetics certainly had Schaxel’s sympathy. There was no necessary contradiction between doing experiments and being concerned with theory. Theoretical biology was invented to guide and control, not to oppose experiment, and theoretical biologists generally stood shoulder-to-shoulder with those who considered themselves modern, experimental biologists against those they represented as pursuing merely descriptive or comparative studies. But crucially, Schaxel treated the most aggressively experimentalist sciences critically too. *Entwicklungsmechanik* had not replaced, but rather, he argued, presupposed and joined with, evolutionary embryology. Its practitioners were wrong to think they could just keep their own house tidy, because they had inevitably built on the Darwinian quicksands. Their fundamental concept of ‘determination’, often in the form of an inherited “determination structure” that was supposed to specify the development of an organism, relied on transformism to explain its own evolutionary formation. But determination was thus burdened with preformationist notions that had been taken over via phylogenetic Darwinism from the old static morphology. It threatened to deny organisms the history that was supposed to explain it. Attempts to escape this rigidity invoked such notions as ‘regulation’, which tended to absolutize the organism and make causal analysis impossible. Genetics, by actually investigating the historical formation of the determination structure, might have offered a way out. But in their over-reaction to Haeckelian “speculation”, its “exact” practitioners had ended up forgetting that inheritance was a process bound up with ontogeny, and had produced instead “a

machine without a mechanism [*Mechanismus ohne Mechanik*]"'.<sup>40</sup> Schaxel realized that his colleagues would be tempted to continue to sweep these problems under the carpet, but he insisted that the only real solution was theoretical reform to clarify concepts, order the results of experiment and assign each area of research to its proper place.

Schaxel was concerned not just to modernize the biological sciences but, like other professionals after the war, to restore a supposedly lost moral order.<sup>41</sup> He argued that theoretical reinforcement was necessary to protect biology from the outside world. At present, he wrote, the "heterogeneity of the science of life forbids entrance to hardly a thought, however foreign to the subject and to careful reasoning it may be". Biologists and philosophers must use theory to erect such a secure conceptual structure that only the results of properly methodical research could gain admittance. Thus would a genuine science of biology become proof against "extra-scientific influences".<sup>42</sup> Schaxel's contemporary, the immunologist and sociologist of science Ludwik Fleck, considered popular science constitutive of scientific practice: scientific concepts often originated in widely held notions, and the public culture of science depended on communication by vivid icons.<sup>43</sup> In the *Grundzüge* Schaxel discussed certain related features of the biological sciences, but insisted they must, as the cause of a specific crisis, be eradicated. Rigorous planning would make biology strong enough to withstand the onslaught of those who refused to recognize proper distinctions between science for professionals and the guidance only they could provide others. The general public desperately needed enlightenment, but this communication must be carefully controlled and proceed in one direction only. Attacking the nineteenth-century materialists, he explained that the power of materialism hardly resided in deep thoughts, but rather,

in the instinctive, in the emotions, which can be carried into the crowd on some slogans, once the basic mood is there. Democratic conviction and political radicalism always go together with the call for general enlightenment, which has a preference for crude 'truths'. There is an aversion to all subtleties, especially of principles, and hence all methodology....

For the purpose of general levelling, which only acknowledges graded differences, the doctrine is perfect that reckons man to the animals, puts him among his equals in nature and thus into the hands of the materialist-naturalist propagandist.<sup>44</sup>

Extraordinarily, Schaxel repeated these spectacularly élitist lines in the second edition of the *Grundzüge*, and was then himself denounced as just such a character only three years later.

In the disorientation of defeat many biologists and philosophers were receptive to Schaxel's message — the 500 copies of the first edition soon sold out — but he sought to use the book to organize specific and controversial reforms.<sup>45</sup> First, he promoted conceptual criticism and theoretical reconstruction by setting up the *Abhandlungen zur theoretischen Biologie* (*Treatises on theoretical biology*), the

first forum for the subject, which more than any other venture defined the new field.<sup>46</sup> Second, he intervened in the debates about educational reform and biological teaching that raged in the early years of the Republic. Complaining that “biology” still existed only in name, he was one of those reformers who, a century after the word was coined, were now promoting “the science of life” as a synthesis.<sup>47</sup> These projects were linked by his ambitious plans for a theoretical and general biology, a conceptual framework that would govern the organization of the scientific enterprise, the activity of research, and the communication of its results.

Schaxel still targeted vitalism, but he nevertheless presented Driesch as the founder of theoretical biology. He had credited Driesch even in *Die Leistungen* with the first great attempt to refound an independent biology, and compared to his treatment of “intuitive vitalism”, Schaxel praised Driesch’s “categorical vitalism” with faint damnation. Driesch, though, had described himself as contributing not so much to “theoretical biology” as to the “philosophy of nature”. He held out the prospect of “a natural science that is in permanent relation to philosophy, a natural science which does not use a single concept without justifying it epistemologically”, but his intellectual aim and personal institutional goal was in fact to “enter the sacred halls of pure philosophy”.<sup>48</sup> Schaxel insisted, against Driesch and the other vitalist system-builders, the Kiel botanist Johannes Reinke and the environmental researcher Jacob von Uexküll, that theoretical work must be firmly tied to experimental practice.<sup>49</sup> Likening biology to an old building which had suffered too many renovations of long forgotten origin, Schaxel called for a modern edifice, planned and built in a unified style. But he did not recommend wholesale demolition, nor did he reckon the new structure could be created by fiat. Theoretical biology must be a continuous and cooperative project, pursued in close contact with experiment.<sup>50</sup> No thread runs through Schaxel’s work more consistently than anti-vitalism, but because he was as critical of mechanical materialism and of hasty applications of physics and chemistry as he was of vitalism, the *Grundzüge* was not read as pushing a particular line; it rather established him as a critic.<sup>51</sup> He was not in a position to make taking his side on burning issues, or even on the nature and purpose of theoretical biology, a condition of participation in the *Abhandlungen*.<sup>52</sup> Schaxel was certainly struggling with the likes of Reinke and the extremely right-wing Baron von Uexküll over the content of theoretical biology, but his priority had to be winning biologists and philosophers for the work of conceptual clarification and theoretical ordering. This critical work would eliminate speculation and undecidable questions, and so, he reckoned, allow the struggle of competing theories to produce definitive answers in the end.

The *Abhandlungen* were ultimately most successful among younger scientists interested in embryology. Schaxel commissioned Ludwig von Bertalanffy’s first book for the series,<sup>53</sup> and theoretical biology began in Britain as an import from the German-speaking world, introduced by J. H. Woodger after he visited Hans Przibram, one of Schaxel’s authors, in Vienna. Woodger translated Bertalanffy’s monograph, got the Cambridge biochemical embryologist Joseph Needham interested in organicism, and was the main mover behind the Theoretical Biology Club.<sup>54</sup> At the

end of the 1920s it was to Schaxel's *Grundzüge* that Woodger and Bertalanffy looked back, not for specific tools but for the most usable description of the situation they claimed theoretical biology would remedy, and it was among contributors to the *Abhandlungen* that they found those whose work they could present as paving the way for their own.<sup>55</sup>

The Bertalanffy-Woodger brand of theoretical biology has been explained as the product of "physics envy" and biologists' interest in establishing the independence of their science. On this reading, modern-minded biologists used the revolution in physics to break mechanistic materialism, which was making them vulnerable to the disciplinary imperialism of physicists and chemists, and developed an often organicist theoretical biology to secure a place for biology in the world of unified science.<sup>56</sup> Schaxel articulated these concerns very early, but theoretical physics was in 1918 not actually as obvious a model as it might seem with hindsight. Though Felix Auerbach had been an *außerordentlicher* professor of theoretical physics in Jena since 1889, it was not until the eve of the First World War that theoretical physics in Germany could be considered "a flourishing discipline", and even then it did not have the high status that it would acquire in the next three decades.<sup>57</sup> Clearly though, Schaxel relied on its exemplary appeal when he asserted that "we possess no theoretical biology corresponding to theoretical physics", and even that "theoretical physics based on mathematics is the purest model of general science".<sup>58</sup> This last remark encourages us to look for Schaxel's resources as much to axiomatic mathematics, or even philosophical logicism, as to physics. Suggestively, he spent a good deal of time with the Göttingen school of the modernist mathematician David Hilbert.<sup>59</sup> But whatever the model, Schaxel produced theoretical biology in an urgent attempt to resolve what he insisted was an acute crisis in the biological sciences.

Few embryologists were prepared to join Schaxel. Whilst the terrain still needs mapping, it is clear that though the *Abhandlung* authors Driesch, Przibram, Bertalanffy, Emil Ungerer, Alexander Gurwitsch, Paul Weiss and Eugenio Rignano agreed that burying one's head in experiment was no substitute for theoretical reflection, others considered large-scale "theorizing" a waste of time compared to cautiously interpreted experiments. Contrasting Schaxel's activities with those of Spemann, some eighteen years older and the field's increasingly acknowledged leader, puts the positions of both men into perspective. Spemann, in spite of their earlier disagreement, had apparently been impressed by Schaxel's theoretical work and indicated his willingness to take part in the project.<sup>60</sup> But he did not in fact contribute a monograph and would pointedly call the summary of his life's work, "*Experimental contributions to a theory of development*". Schaxel had praised Spemann's uncharacteristically theoretical analysis of the concept of homology, but in the second edition of the *Grundzüge* commented adversely on his description of developmental determination. Terms like "organization centre" and "morphogenetic tendency [*Streben*, also 'striving']" might seem harmless, but could have far-reaching theoretical consequences; Schaxel was reminded of the "realization of the

formative drive of the idealist embryologists". Spemann had other fish to fry, but after this it is not surprising that his monograph never materialized.<sup>61</sup> The two embryologists also disagreed on general biology. For Schaxel, general theory would produce such an ordered enterprise that every particular could be assigned a unique place in the conceptual framework, where it would serve merely as an example. He sought a science "freed from the burden of details", in which "isolating abstraction" would bring out general principles. Spemann, on the other hand, insisted that "even mentally one cannot live from extracts", and defended the cultural value for medical students of a zoology that would be organized by "leading ideas", but would aim to broaden and deepen awareness of the human organism.<sup>62</sup>

In 1922 Schaxel was a successful young biologist. Some of his colleagues felt he inclined too much to empty theorizing, others that he was for his 35 years extraordinarily able to take the broad view of the biological sciences that was so desperately needed. He was also a socialist, and worked alongside biological reform for more general reform of the universities. His decisive step was to become a full-time educational official in a left-wing regional government: the disastrous *dénouement* of this gamble made him a nationally notorious "red" professor, and this forced biology and socialist politics publicly together.

## 2. A MARXIST AMONG BIOLOGISTS

The most prestigious German scientists were university professors, and most professors were "mandarins", the teachers and leading spokesmen (*sic*) of the educated middle class. Alarmed by the consequences of industrialization, they aspired to heal the wounds from a vantage point above the politics of interest. But the First World War, which began with the professors at one in calling Germans to arms, ended not just with crushing defeat and the ruin of the monarchy, but with those who had claimed a mission to unite the nation themselves deeply divided into two warring camps. By 1918, German nationalist advocates of large-scale territorial annexation faced "moderates" who pinned their hopes on a negotiated peace. All were appalled at the revolutionary upheavals that followed Germany's defeat, and though few went as far as the zoologist Richard Semon, who shot himself in despair as he lay on the now discarded Imperial flag, none was initially able to muster much affection for the new democratic regime. But though the wartime "annexationists" became irreconcilables who would consider only the restoration of authoritarian government, the moderates became "republicans of reason", coming to terms with the new order by forcing their heads to rule their hearts. The outspoken nationalists were a minority of the professoriate, but they outnumbered the few who declared themselves for the Weimar constitution, and dominated the majority who stood between the two camps. They made the universities bastions of reaction, "an intact foreign body in the lifeblood of the Weimar Republic".<sup>63</sup>

The mandarins, though, were now having to share faculty meetings with various "outsiders". By 1914 the professoriate was recruiting significantly from the industrial

and petit bourgeoisie, whose offspring were foreigners to mandarin tradition. Those Harwood has called "outsiders", they understood themselves as experts not as sages; they were more likely than the mandarins to be politically active, and included minorities on the left and the radical right. Mandarins certainly regarded the Nazis as uncouth, but the German nationalists among them felt considerable sympathy for their aims, and treated them with uncharacteristic tolerance. More conventionally considered outsiders, the pacifists and socialists, though like Schaxel often also outsiders in Harwood's wider sense, were much more fundamentally isolated from academic political culture than was the radical right.<sup>64</sup>

Until 1918, declared socialists had been forbidden to lecture in the German universities. Academics tempted into socialist activity were warned off by the law enacted in 1898 to remove the right to teach from the Berlin physicist Leo Arons. His faculty and some of the bureaucracy were unhappy about this restriction of academic freedom, and Arons, as the financial backer of the revisionists, was just the kind of right-wing socialist the more liberal Establishment reckoned should be encouraged. But they were powerless in the face of Wilhelm II's telegraphed instruction that he would not tolerate a socialist university teacher, that "this impudent scorner of state institutions" must be removed.<sup>65</sup> Small wonder that the Marxist chemist Carl Schorlemmer had worked in Manchester, or that the two scientists among the widely read socialist popularizers of Darwinism in Germany, the botanist Arnold Dodel and the methodologist of biology Sinai Tschulok, had chairs in the liberal haven of Zurich.<sup>66</sup>

In the Republic, left-wing activity was no longer a sacking offence, and in late 1918 Schaxel joined the SPD and became a member of the workers' and soldiers' council in Jena.<sup>67</sup> He also increased his involvement in academic politics. An elected member of the Senate since 1917, he became active in the movement of junior faculty (*Nichtordinarien*, or "non-full-professors"), in which he was from 1919 Chairman of the Association of Non-Prussian *Nichtordinarien* Organizations, and hence of the Cartel of German *Nichtordinarien* Organizations; he had served for its first two years as the only leftist on the committee of the Association of German Universities.<sup>68</sup> He may well have reckoned that he was going with the flow. By 1922 the journalist Erich Everth was able to count as many as fifty socialist university teachers.<sup>69</sup> But that was only around 1%, and sticking your neck out could still endanger your job.<sup>70</sup> As politics polarized in the post-war revolutionary crisis, Schaxel's open socialism was reciprocated by the anti-Republican demonstrations of the right-wing professors, prominent among them Ludwig Plate. Jena and Thuringia, the new central German state of which it was now the university town, was becoming a political battlefield.<sup>71</sup>

Socialists in the universities in fact had less in common with their faculty colleagues than with kindred spirits in non-university research institutes or the free professions, or indeed the broadly left-leaning literati and artists, Peter Gay's "outsiders as insiders".<sup>72</sup> Beyond the universities, after all, the left was the biggest political bloc, and the SPD, excluded from political power under the Kaiser, had become

the strongest pillar of the Republic. But in the aftermath of Germany's defeat the party also completed a deep split. Now the reformist SPD confronted the revolutionary and increasingly Moscow-controlled German Communist Party (KPD).<sup>73</sup> In a complex re-organization, the SPD also ended up divided against itself. The right of the party tried to jettison Marxism, but Schaxel became associated with the left wing, which insisted from its strongholds of Saxony and Thuringia that a "living" Marxism was still valid. The right supported the Republic unconditionally; the left, though rejecting Bolshevism, put up with the Weimar settlement only as a station on the road to socialism.<sup>74</sup>

Education was under the jurisdiction of the governments of the German *Länder*, and a left-socialist administration came into office in Thuringia in October 1921 with ambitious plans for radical and anti-clerical educational reform. The education minister Max Greil was determined to include the University of Jena, and took advantage of the retirement of the *Kurator*, the government's representative at the University, not to refill that post but instead appointed Schaxel as a ministerial official in October 1922 (Figure 2). The socialist government was, however, implacably opposed by the rector and most of the faculty, who fomented a full-scale confrontation over the appointment of new professors to teach the elementary-school teachers whom the government wanted to be trained at the University. Schaxel, as the official responsible, was the pivotal figure in a conflict that escalated into a national scandal. After the rector passed a letter of complaint to the press in October 1923, Greil ordered the University to clear all of its official correspondence with Schaxel; the majority of his colleagues in the Senate retaliated by voting to have no further dealings with him.<sup>75</sup> Partly as a result of this conflict, but also because of the entry of communists into the government and the supposed threat of a communist uprising — the stillborn "German October" — the army invaded the state, quashed the government and arranged new elections. Under the state of emergency and a ban on the KPD, the left lost the elections, the new government kicked Schaxel out of the ministry, and he went back to his old job. But there was no going back, either for the riven state of Thuringia, where the left would not be in power again and the Nazis would join their first government, or for Schaxel. He was a marked man, reduced by May 1924 to ringing the new conservative ministry to complain about a defamatory article. Two thousand university teachers were reading in their trade journal that he had "denied his academic past" to put himself in the service of a "ministerial absolutism", but that "especially incriminating, indeed outrageous", had been his standing silent while the rector was "mendaciously insulted" at a "party-political meeting".<sup>76</sup>

Schaxel's political notoriety ruined his relations not only with most of his fellow professors in Jena but also with the leading figures of his most important professional body, the German Zoological Society, in which he had just established a significant role. In early 1922, at his initiative, and as a result of his negotiations with the Jena publisher Gustav Fischer, the Society had launched a review journal, the *Zoologischer Bericht* (*Zoological report*), on which Schaxel was one of four





FIG. 2. Julius Schaxel, undated but probably in the early 1920s.

members of the editorial board. For the first two years he did most of the reviewing in his chosen field of "General biology" and his own work was noticed. In May 1923 his position in the Society as he reported on the *Zoologischer Bericht* at the

annual meeting might have seemed secure. He had, after all, attended every full meeting since 1910, regularly contributed papers at these events, and been largely responsible for the Society's major new publishing venture. But this was to be the last meeting he ever attended.<sup>77</sup> The following summer the Society met in Königsberg, "the furthest eastern outpost of German culture", as an expression of sympathy for its having been cut off from the rest of the *Reich* by the "shameful peace of Versailles". Schaxel was replaced on the board of the *Zoologischer Bericht* by Ludwig Plate, who used his old enemy's political exposure to take his job on the journal he had effectively founded.<sup>78</sup> Carl Apstein, the editor, and Hans Lohmann, the chairman of the Society, "agreed that this man, 'who is said to be involved in the Thuringian business' and who 'always' works 'against Plate in the red ministry' 'in order to oust him'", could not continue on the board.<sup>79</sup> Schaxel's next 'involvement' in the Society's business was in 1936, when at the annual meeting that Spemann hosted in Freiburg im Breisgau his life-membership was annulled.<sup>80</sup>

In 1923, Schaxel was a biologist and he was a socialist, but he produced a book at the end of 1924 in which he insisted that only socialist biologists could solve the crisis. In *Entwicklung der Wissenschaft vom Leben* (*Development of the science of life*), he brought a rapidly radicalizing socialist politics and his critique of biology together. Of course, Schaxel's biology had always been in some sense political; anyone who cared to look could have discovered homologies between his projects of biological and general university reform. But whereas before he had sought agreement or — a keyword in his theoretical biology as in Weimar industrial relations — arbitration (*Schlichtung*),<sup>81</sup> now he ran up the red flag and insisted that political commitment had to come first. How should we explain this major watershed of his career? It is probable that the man who as a student had corrected the proofs of the people's edition of Haeckel's *Die Welträtsel* (*The riddles of the universe*) had for some time participated in freethinking circles, if apparently without breaking into print in his own right. Though I know of no contemporary evidence, it is possible that Schaxel was, as he later claimed, already planning a Marxist critique of biology at the time he wrote the *Grundzüge*. That that work is silent on Marxism might be attributed to its having been tailored to its intended academic audience, but it is significant that it fails to engage even codedly with Marxist debates and that Schaxel's first Marxist work hardly demonstrates long familiarity with them either. What mattered, however, was his public position, and in changing this the university conflict was decisive. The experience of being thrown out of office after a vitriolic press campaign and the intervention of the army surely radicalized him. Reform had failed, and he had every reason to conclude that only fundamental political change could resolve the crisis in biology. His political reputation among academics could hardly be damaged further, and he now had no chance of a full professorship, either the personal one he had been promised by the socialist government or any other for which he might once have hoped.<sup>82</sup> But crucially, there had been two audiences for the events of autumn 1923. In the labour movement the same activities that had cancelled his credit with the conservative hierarchy of the German Zoological Society

were, far from a liability, an excellent testimonial.

From now on, Schaxel concentrated on writing for organized workers and socialist educators, but he also addressed *Entwicklung der Wissenschaft vom Leben* to his fellow biologists. In fact, he never entirely gave up trying to persuade them to join him — in the end, he reckoned too optimistically, increasing proletarianization would drive them to the left. The book brought Marxism to bear on his analysis of the biological crisis, promising to demonstrate “the material, intellectual and social determination” of biology.

That there still exists in the science of life extremely great ambiguity ... forces us to recognize its dependence, which exists for science [*Wissenschaft*] as for every product of human activity, on the conditions of production of the respective period of history. The development of biology is extremely instructive, because it gives the opportunity to get to know science as a social product. It contains no eternal truths about life in nature, but *reflects human truths from the history of society*.<sup>83</sup>

Schaxel's history in fact added little to this rhetoric; he even managed to describe the rise of modern science without mentioning the bourgeoisie! Within a year he would no longer be capable of such a glaring omission, but what he wrote already made the basic point about historical change in the science of life which backed his claim that,

As organism and mechanism are just forms of expression of their respective social orders for their view of life and the world, so the unclear, blurred conception of life of the present is a product of modern high and late capitalism ....<sup>84</sup>

Schaxel's crisis remained, then, the same heterogeneity and inconsistency that he had identified in the *Grundzüge*, but he now added an explanation of this appalling state of affairs.

The science of life shows its inherited heterogeneity because when organized rigorously, conclusions immediately become apparent which tend to shake the ruling position of the possessing bourgeoisie and its functionaries with respect to the proletariat. So understandably in the science that belongs to the assets of the ruling class, rigorous organization and the conclusions that follow from it remain absent.<sup>85</sup>

For example, vitalism persisted because it did not disturb the inorganic sciences so essential to the pursuit of profit, but still gave human beings the special place in nature that Schaxel reckoned ideologically crucial for the maintenance of privilege.<sup>86</sup> Only socialism could provide the clear planning and interest in the truth that would overcome the crisis.

*Entwicklung der Wissenschaft vom Leben* was reviewed in several academic journals.<sup>87</sup> A left-wing minority, like the biologist Paul Kammerer, the botanist Hugo Iltis, Haeckel's vicar on earth Heinrich Schmidt, and the statistician E. J. Gumbel,

answered the call and contributed to the popular-science magazine *Urania*. The majority of scientists, surely, either reckoned they were 'above' politics, or did not share Schaxel's and so failed to recognize themselves as functionaries of the bourgeois class. Tibor Péterfi replaced Schaxel as general-biology reviewer on the *Zoologischer Bericht*, and wrote the following notice of *Entwicklung der Wissenschaft vom Leben*.

This popularly written book is intended to serve primarily workers as an introduction to the biological sciences. In the process party-political views are so strongly and deliberately pushed to the fore that we must on this occasion abstain from a detailed evaluation of the contents.

Schaxel was branded "political", or worse, "party political". But he, symmetrically, rejected this label, insisting that his colleagues, or rather the more rabid reactionaries like Plate, were the "political zoologists". The difference was that Schaxel could be accused of politicking in a scientific publication, but had to make his accusations of bias in the socialist press.<sup>88</sup>

Though some zoologists were keen to exclude Schaxel from positions of power, most were prepared for him to remain a scientist, and content to leave polemics to the radical right. He continued to edit the *Abhandlungen* until 1931 and published in the Zoological Society's *Zoologischer Anzeiger* in 1928.<sup>89</sup> Friedrich Stier, his one-time senior colleague in the ministry, who now liaised with the Zeiss Foundation as Schaxel himself had done during his brief stint there, told them in the same year that his scientific work was "well regarded", and so the modest funds of the Institute of Experimental Biology were secure.<sup>90</sup> To the extent that his and his political opponents' most obviously "political" activities were performed for minimally overlapping audiences, they could accept each other's participation in science. Sending *Entwicklung der Wissenschaft vom Leben* for review in the *Zoologischer Bericht* crossed the line — but from 1924 other academics were no longer Schaxel's main audience anyway. The more centrist socialist professors were oriented towards other republicans in the universities, and also formed an organization of socialist academics, but Schaxel joined left socialists and communists, the educationalist Anna Siemsen, the philosopher Siegfried Marck and the sinologist Karl August Wittfogel, in rejecting such conclaves of intellectuals. They insisted that the truly momentous struggles were those in which they were engaged outside the "bourgeois" institutions of higher learning.<sup>91</sup>

In the remaining nine years of his life in Germany, Schaxel produced hardly any more academic work but wrote a total of five books and twenty-nine articles for the popular-science magazine *Urania*. Historians of science usually accord such publications, and writing about them, low status. But it is crucial not to prejudge the issue in this way, because the status of writing for different audiences was itself a stake in these struggles.<sup>92</sup> For Wittfogel, to disdain popularization was "the typical sign of a bourgeois 'cultivated' attitude, which can itself participate in the products of research, but which wants that under no circumstances are too many of the

monopolized secrets of science let out to the plebs".<sup>93</sup> For Schaxel, producing a certain kind of biology for the working class was now the only way to save the science — including everything for which he had worked earlier in his career — from practical impotence and imminent theoretical collapse.

### 3. A BIOLOGIST AMONG MARXISTS: "COMRADE PROFESSOR SCHAXEL"

Schaxel was not an 'independent' intellectual like the left-wing literati around the *Weltbühne*, but aligned himself with the labour movement.<sup>94</sup> He sought to use *Entwicklung der Wissenschaft vom Leben* to carve out a niche for scientists among organized workers and socialist educators, making an audacious bid to become the workers' "teacher and the teacher of their leaders".<sup>95</sup> The very fact that a university professor was prepared to come over to the socialist camp was a rare coup, but he was entering an arena where a professor was not guaranteed deference, and deep party-political divisions compounded intellectual differences. Though it was never likely that his involvement in socialist education would be rejected outright, Marxists did give his first popular book a very mixed reception. He skilfully used the poor relations between academy and organized labour to counter socialist resistance and achieve a prominent position, but failed to dictate the terms of participation in "socialist science".

The cultural experts among the defeated Thuringian social democrats planned to regain their position by first building the authentically socialist culture within the social-democratic milieu. They started a new popular-science monthly to reassert the centrality of contests over natural science to the socialist project. *Urania* challenged the successful bourgeois *Kosmos*, copying its format, but tackling social as well as natural science from a Marxist standpoint. The magazine was the regular publication of the Urania Free Educational Institute; Schaxel capitalized on the impressive pedigree of his personal connection to Haeckel and his courageous demonstration of partisanship during the university conflict to become its Chairman.<sup>96</sup> *Entwicklung der Wissenschaft vom Leben* was *Urania's* first book supplement, sent out just before Christmas 1924 to 25,000 subscribers in the network of ancillary organizations that had long supplemented the trades unions and Social Democracy. These clubs had been built to compensate for workers' exclusion from bourgeois society. Here they could find practical support and pursue an extraordinary range of hobbies and campaigns, from athletics to alternative medicine, or from football to first aid, and here left intellectuals found working-class audiences.<sup>97</sup> Natural science was most important to the "proletarian" freethinkers and the *Naturfreunde* ("Friends of Nature"). The former were a socialist counterpart to organized "bourgeois" freethinkers such as the Monist League, the latter a socialist hiking and leisure organization. Though widely regarded as cranks, and unpopular with the national leadership of the SPD, the freethinkers and *Naturfreunde* had a respected place in the left-socialist milieu. For the labour aristocrats who were active in these organizations more than any other socialists, natural science was not only the sharpest

political weapon, but also the most important prize.<sup>98</sup>

It is well known that Weimar socialism could be extraordinarily scientific; it has not been sufficiently emphasized that the socialists' scientific culture was conflicted.<sup>99</sup> In making a platform Schaxel had to take account of attitudes to science that ranged from eager embrace to outright rejection. Most organized workers who got their views into print were confident that they could use science for their own purposes in spite of its "bourgeois" origin. He sought to convince them that they needed his help. But others absolutely refused to recognize the authority of official science, moving one educator to complain:

Many of us know the anger that grips the teacher when some purely scientific remarks that he makes in "socialist" ... circles are rejected and attacked ... by the first loud voice to be raised in the discussion, because — all this was "bourgeois science", and is "therefore" unuseable by the "worker".... [O]nce one of these discussion speakers believed it necessary to reject even the "atomic theory" of physics as a "bourgeois invention" to "make" the workers "stupid" ....<sup>100</sup>

As the teacher's anger indicates, the right to decide what was "pure" science and what was bourgeois ballast was in dispute. The professor claimed it for Marxist scientists.

Schaxel distinguished between "bourgeois science" and science as part of "proletarian culture"; by the following year he would call it "socialist science". "Bourgeois science" was a standard and often rather loosely applied socialist term of abuse for official learning. Engels's literary executor and leading revisionist Eduard Bernstein had argued against Kautsky that *Wissenschaft* was classless; "scientific socialism", a socialist social science, was, he reckoned, no more a coherent notion than the, to him, obviously absurd "liberal physics", "socialist mathematics" or "conservative chemistry".<sup>101</sup> Kautsky, however, defended the distinctness of socialist *Wissenschaft*, and Schaxel followed him in arguing that natural science too was determined by class. But, countering radical rejection, the biologist insisted that although the "proletarian culture" would "commit much of bourgeois science to oblivion", it would "at the same time fit the building-stones from it that it needs into its edifice, according of course to its plan".<sup>102</sup> Appealing to the authority of radical icon Lenin, he argued that it would be "senseless ... to throw the whole tradition overboard": proletarian culture could be achieved only through "exact knowledge" and assimilation of the "culture that was made through the whole development of humanity".<sup>103</sup> Or in terms of the analogy, the only sensible way to make the worker housing of the socialist future was by re-using a good many of the bricks from the villas of the bourgeoisie. And who else could be the architects but the Marxist scientists, such as himself and the colleagues he hoped to convert, for who else combined "exact knowledge" of science with a committed and critical approach? Schaxel reckoned that only socialism could save science. And, like other academic socialists on the left of the SPD, he rejected those who looked to the intellectuals as its agents; they could not usurp the historic task of the proletariat. But he claimed that

the workers could fulfil their mission only if those “experienced personnel” he later called “special functionaries” told them the truth about nature and society.<sup>104</sup>

Schaxel’s position neatly retained flexibility with respect to the academy. Whilst he argued that true scientificity meant acting as a socialist, by representing the process of constructing socialist science as “sifting and filtering” he ensured that the critical programme of the *Grundzüge* and the *Abhandlungen* could consistently continue. Certainly, only Marxists could solve the crisis in biology, let alone provide a unified world view, but some “bourgeois science” was comparatively uncontaminated with bourgeois ideology and more of it could be washed clean.<sup>105</sup> Reciprocally, some scientists who were politically opposed to Schaxel were probably pragmatic enough quietly to welcome his attempts to make science palatable to militant workers.

Socialism had often been defined, most famously by Bebel, as *Wissenschaft* applied, and Schaxel made this license his claim that only Marxist scientists could safely underwrite the socialist project. The education provided by the state and many of the independent initiatives that socialists had been prepared to patronize would not help realize “proletarian culture”, but was, in fact, worse than useless. He attacked specific “bourgeois” theories — vitalism, any hints of religion and right-wing racial anthropology most prominently — but also put a new spin on his critique of biology as a contradictory jumble: this “diversionary science” served to distract workers from the essential knowledge they needed.

Dull so-called enlightenment, recovered from the educational leavings of bourgeois society, is being picked up by proletarians thirsting for education. It is not merely that this sort of thing is of no use to them in the fulfilment of their historic task; rather, they are being distracted from the battlefield of the class struggle to miserable playgrounds, where the swirling of the cultural fog of the bourgeoisie blocks the view of the high ground of freedom that remains to be climbed.<sup>106</sup>

Schaxel was like the socialist cultural experts who tried to wean workers off literary “trash”, and the epitome of “trash” science must have been *Kosmos*-author Wilhelm Bölsche’s extraordinarily popular reveries. Schaxel prudently did not take on Germany’s best-selling non-fiction writer and eloquent defender of the rights of the freelance popularizer, but the professorial purveyor of “rigorous” science was fundamentally at odds with Bölsche and his whimsical representations of nature as “a giant gallery of beautifully coloured erotic paintings”.<sup>107</sup>

Schaxel remained true to what he had written in the *Grundzüge* on the relations between specialist and popular science, including his diatribe against the “materialist-naturalist propagandist”. It re-appeared, re-worked of course, in *Entwicklung der Wissenschaft vom Leben*. He still accused the ‘vulgar’ materialists, and by extension many freethinking and socialist writers on science, of peddling the false comfort of “shallow enlightenment and superficial general comprehensibility”. But now he criticized them for bad strategy: picking out politically congenial theories would not do because it never failed to bring a backlash.

Just when democracy seemed “based on nature”, the same “proofs” of the struggle for existence and survival of the fittest are used for a naturally necessary and God-ordained aristocracy.... [B]ourgeois scholars are still fighting reality with props from the Darwinist lumber-room.<sup>108</sup>

A great deal had changed since a previous generation of scientific radicals, but not enough for Schaxel. He insisted that socialists needed to learn that science had both progressed and — his major innovation with respect to previous socialist theoreticians of biology — become much more problematic since their parents’ day. Marxism was securely founded in biology, but the exact nature of those foundations was now unclear, and would remain so unless committed specialists got to work.

Compared to the fluency of Schaxel’s later socialist writings, *Entwicklung der Wissenschaft vom Leben* was awkwardly constructed and stylistically problematic. But the tensions and ragged edges in his first major effort, and the problems readers had with it, are especially instructive, because they show us how difficult it was for a socialist biologist to find his way between critique of the present state of science and his interest in arguing that a reformed biology must be at the heart of the socialist project. I shall examine how Schaxel’s book was received by socialist and other reviewers. It is certainly an important, though perhaps an unanswerable, question, what the mythically ‘ordinary’ worker might have made of it. But the rather select band who set the tone of social-democratic activities were often out of touch with the majority of party members, let alone voters.<sup>109</sup> What in fact mattered to Schaxel’s securing a position was, most directly, the opinion of leading functionaries and educators.

*Entwicklung der Wissenschaft vom Leben* won lavish praise in several socialist publications. The magazine of the Workers’ Radio League, for example, puffed Schaxel’s “extraordinarily important” book:

We call special attention to this investigation not least because the author as a well-known socialist is not content with the usual bourgeois-scientific dogmatism, but with reference to Karl Marx takes new and for the workers’ cultural movement very significant steps.<sup>110</sup>

*Urania* was quick to deploy the accolades.

This is what an *Urania* reader in a prominent position in political life wrote to us after reading Schaxel’s book: “... The scales fell from my eyes. Frankly I had till then not yet seen the justification for *Urania*.... Now ... the point of your programme has become quite clear to me; in this manner and *only* in this manner can humanity be given education capable of effecting and promoting cultural striving founded on a free world view....”<sup>111</sup>

Positive reviews built up the professor’s reputation,<sup>112</sup> but the reception of his first major effort was by no means as simple as the eulogies imply.

By Schaxel’s own lights, after all, it was not an easy task to write accessibly about a subject that was still a chaos of competing theories, of which the most vivid



concepts were hopelessly contaminated and confused. But could he not simply have taken as a model his one-time supervisor Goldschmidt's highly successful *Ascaris: Eine Einführung in die Wissenschaft vom Leben für Jedermann* (*Ascaris: An introduction to the science of life for everyman*), which had come out two years earlier?<sup>113</sup> Like Schaxel, Goldschmidt, now head of a department at the Kaiser Wilhelm Institute of Biology, represented modern experimental science. But he adopted an avuncular persona to make "everyman" the object of familiar, chatty and anecdotal instruction. The book was named for the roundworm, and Goldschmidt masterfully spun his digressive narrative around observations on this intestinal parasite, using the reassuring style of the *Plauderei* (chat) to make this impolite topic respectable. But though Schaxel had welcomed his supervisor's book,<sup>114</sup> his purposes were different, and he rejected Goldschmidt's style for a reason. Schaxel wrote a combination of textbook and political pamphlet, enlivened only by occasional flashes of humour. He did not chat and he told no stories; no one could accuse him of meandering digressions or casual analogies. For these would have subverted his message. He was writing not for "everyman", but for biologists and socialists; he too aimed to enlighten his readers, but he did not want to divert them.

"Bourgeois" reviewers praised this "extraordinary clarity and discipline [*Schulung*]" in the sections of Schaxel's book that dealt with biology, but disapproved of how it gave way to "inadequate and unclear conceptions" as soon as he turned to society and politics.<sup>115</sup> That was predictable, but more importantly, the contents of the middle section in which he presented "The conceptual framework" actually attracted little socialist comment. Here he distinguished knowledge of life derived from introspection as the business of psychology from knowledge of living things, which was the proper domain of biology. He delineated two groups of phenomena, the succession of individual beings due to reproduction and their sexual association, and accordingly divided the science between the "order of being" and the "determination of development", presented under the headings "formation", "behaviour" and "relations". This may have been a step towards a rigorous, materialist biology, but socialist reviewers could not see how it would ground their political project; it was, I have argued, an important part of Schaxel's message that much of the work remained to be done before that would be possible. On the other hand, socialists could see that Schaxel had rejected the tried and tested techniques of science popularization. He had put in examples and illustrations, but even some sympathetic reviewers reckoned the book too dense for workers.<sup>116</sup> His enemies were less polite. He had criticized Plate for smuggling affective expressions into supposedly mechanistic biology, and for preaching politics in his lectures. Now, in a sensationally hostile review in the journal of the German Society for Racial Hygiene, Plate lampooned Schaxel's incomprehensibility. He supported his assertion that "the author ... possesses a strange ability to cloak quite simple concepts in a jumble of words" by quoting a sentence that he pointed out made up an entire one-seventh of Schaxel's section on "Sex":

The determination of formation leads in pursuing its direct course to connections, which individual beings in certain states of development make with others of the same kind, and which thereby lead to association [*Nebeneinander*], the other basic phenomenon of life besides succession [*Nacheinander*].<sup>117</sup>

In context, this might have come across more easily, but it was not difficult for Plate to make political capital out of his opponent's style.

The best Schaxel could do with critical responses from socialists was probably to try to learn from them, but Plate's animosity could be turned to advantage. *Urania* skilfully exploited the difficult relations between academy and labour movement, beginning a review of reviews by bolstering Schaxel's academic authority.

Bourgeois science today is characterized by its fear of conclusions. No longer strong enough to suppress emerging truths, it leaves burning questions open and timidly does not decide what is actually true. The present-day science of life with its bewildering confusion of contradictory theories is a good example of the scientific enterprise of a dying class. In the first *Urania* book supplement, *Entwicklung der Wissenschaft vom Leben*, Professor Julius Schaxel, with Marxist rigour, outlined ... the preconditions, content and consequences of this situation. He was competent to do this as no one else; for he has produced a great work, about which the Karlsruhe scholar E. Ungerer writes: "The best introduction to the jumble of theories and problems, which present research into life represents, is J. Schaxel's *Grundzüge der Theorienbildung in der Biologie*."<sup>118</sup>

Then, in its second move, this meta-review used the socialist commitment that Schaxel had shown in *Entwicklung der Wissenschaft vom Leben* to expose the prejudices of the same learned world. In an unusually explicit example of Pierre Bourdieu's "cases of perfect inversion", it presented a couple of negative reviews as ludicrously prejudiced: one person's "insult" had actually become another's "coat of arms".<sup>119</sup> In this game, the worse the review, the better it was. So Plate's venomous response was *Urania*'s trump card. He

makes the discovery that Schaxel addresses himself to "social democrats and communists". He reckons that "the presentation is made appetizing to the comrades by references to the importance of proletarian culture, by lots of quotes from Kautsky, Trotsky and other red saints, mostly of the Jewish race".

Juxtaposition with the egregious Plate put their man in the best possible light.

In fact Schaxel attempted to construct a frankly heroic role for socialist scientists by dramatizing their persecution in the universities. He wrote an obituary for Kammerer, the progressive neo-Lamarckian and *Urania* author, who committed suicide in 1926 after his experiments on the inheritance of acquired characters were claimed to be fraudulent. Schaxel reckoned that "cowardly slander" and "malicious incitement" had put the weapon in his friend's hand, because

Kammerer's gift for presenting what he had researched and seen with inspiration and inspiringly made him, who was more like a brilliant artist than a busy scholar, widely famous. For many "colleagues", especially some personalities comfortably dosing on their chairs, he always remained just a "Jew" and "socialist", whom they did not need to take seriously and who especially must not be allowed to come up in the world.

Kammerer's true crime was having drawn freethinking, materialist conclusions from his work. Actually, he remained so much the West European scholar that he wanted to steer clear of political consequences, but his revolutionary spirit kept breaking through. "And", Schaxel thundered, "it was the revolutionary pushing to the surface that the official science of the bourgeoisie had to bring down".<sup>120</sup> But Kammerer had not died in vain: "One falls, the mass rises up!"<sup>121</sup> Schaxel himself emerges as the leading drawer of uncomfortable conclusions, hampered by neither the martyr's hesitations nor his "artistic" side.

Among socialist cultural producers there were very few university professors, but a much larger group of schoolteachers and worker-functionaries. People of such different status could collaborate in socialist science education by affirming their common political commitment. But Schaxel made socialist scientists into heroes, and deployed a scientist's resources, to distinguish himself from the others. His institute had become more useful to him as a symbol than as a site of experiment, and he generally had himself photographed in his laboratory. The Urania Press presented readers who bought its 1927 diary with an image of Schaxel similar to that shown in Figure 3. He appeared on the same spread as a photo of Freud, and belonged in such exalted company because he was one of "the pioneers of a modern biological research, who also draw the necessary ... conclusions from their results".<sup>122</sup> Schaxel himself insisted that science could be popularized accurately only by "working directly from the sources", and as if to demonstrate his unmediated contact, had plates of his experimental results bound at the front of *Entwicklung der Wissenschaft vom Leben*. They announced that the author was someone who could do experiments of his own, but lest the point be missed, he wrote that

the educational worker ... may not be a mere go-between at second or third hand, who lightly passes on what he has superficially acquired. Otherwise he runs the risk ... of anaesthetizing the proletarian need for education instead of satisfying it.<sup>123</sup>

With his "Professor Dr" taking up as much space on the cover of the book as his name, Schaxel shared with scientist-popularizers on the right the dream of getting rid of the intermediaries, of taking control of communicating science to their wider publics.<sup>124</sup>

This blatant pitch raised hackles. Adolf Lau, a leading functionary in the *Naturfreunde*, paid Schaxel the back-handed compliment of devoting two thousand words to trying to rescue his "extraordinarily valuable" conception from its having been produced without regard to the knowledge it could be assumed workers would



FIG. 3. Julius Schaxel photographed in his laboratory, undated but probably about 1926.

bring to it. He explained that many a *Naturfreund* who had excitedly awaited the first *Urania* book would put it down disappointed, “for he had expected to receive here good and yet quickly comprehensible science”, but would find instead that understanding was made “extraordinarily hard”. Lau was diplomatic, but he

interposed himself as an intermediary, demonstrating the importance of pedagogic skill, and bursting the bubble of Schaxel's fantasy of unmediated communication. He presented a selective interpretation of the professor's argument along with suggestions for further reading on various points. In some respects he may have acted as a 'multiplier', but by the time he had finished with it, the message was no longer the same. He did rather insightfully translate Schaxel's strictures on not seeking easy "proofs" of socialism into the injunction that fact must come before value, first the "purely scientific moment", then "the psychological", the "evaluation".<sup>125</sup> But nothing remained of the supposedly unique ability of the scientist to provide knowledge of things that was rooted in things.

Others went much further than the conciliatory Lau. August Thalheimer, the leading theoretician of the communist right, reviewed the Kautsky *Festschrift*, to which Schaxel had contributed a chapter on "Marxism and Darwinism" just before writing *Entwicklung der Wissenschaft vom Leben*, in the international communist journal *Unter dem Banner des Marxismus*. As far as Thalheimer was concerned, Schaxel was wallowing in the same swamp as the other exponents of "petty-bourgeois socialism" on the left of the SPD. Sure, Haeckel had been a "bourgeois democrat" and turned the struggle for existence against the working class.

But in his science he was a firm, even a valiant materialist, and we won't let Haeckel's natural-scientific materialism be blackened because of Mr Schaxel's declaration of belief in the Kautskian brand of socialism.

Thalheimer found nothing in what Schaxel was offering to persuade him to give up Haeckel and the old materialists, and he ridiculed Schaxel's history and philosophy of science. A more differentiated approach was needed than the biologist's complaints about Darwin's bourgeois economics, or his desire to eliminate "struggle for existence" from the scientific vocabulary because Malthusians had misused a term which simply described "a fact of observation". He would be rejecting that other bourgeois product, the infinitesimal calculus, next. Schaxel was struggling to find a solution to what he regarded as an unarbitratable debate between mechanism and vitalism, and cautiously to bring this problem to the attention of fellow socialists, but to Thalheimer he was just a closet "anti-materialist". And, worse, was asking him to exchange nineteenth-century achievements that were perfectly good if you knew how to use them for "the scum of bourgeois, reactionary drivel of the twentieth century", which he could not distinguish from "sanctimonious sophistry" and "spiritualist clichés".<sup>126</sup>

These responses to Schaxel's most problematic publications bring out the difficulty of what he was trying to do. The range is instructive. Dr Thalheimer was quite happy with the biology he already knew, and knew how to deploy, and saw no need to take on Schaxel's agonizing complications, which just seemed to muddy the waters. He was utterly unimpressed by Schaxel's claims to special authority, and as a communist he anyway did his best to find fault with a social democrat. The fans, on the other hand, give the impression less of having been won over by the argument

than of valuing the professor as a trophy. The more differentiated socialist responses were critical, but these reviewers, like Lau, welcomed Schaxel's efforts whilst refusing to cede their own competence to interpret science.<sup>127</sup>

Within these important limits, however, the professor's exploitation of his unusual position had established him among precisely the left-wing social democrats Thalheimer despised, and he could now make his way to the next book. *Urania's* review of reviews ended by referring to Plate's complaint that Schaxel's section on "Sex" spanned only 35 lines.

Well, he can find the sexual enlightenment that by his own admission he lacks in the first book supplement of the third volume of *Urania*, in which Professor Schaxel deals with *Phenomena and determination of sex*, of course again not a gift for bigots, but rigorous natural- and social-scientific enlightenment.<sup>128</sup>

Schaxel had used a conference of socialist educationalists and cultural politicians that he organized in 1925 to take over writing position statements for *Urania*, and when the founding editor, the teacher Ernst Mühlbach, left in 1927, he occupied the tailor-made post of "scientific director" (*wissenschaftlicher Leiter*). This must have given him considerable editorial power, but the magazine was still a forum, and his own articles the most radical. Nevertheless, Schaxel was far from a one-man-band. In addition to the handful of progressive scientists, *Urania* attracted a host of science writers, reforming physicians, socialist cultural politicians, teachers and functionaries. Their contributions made for a heady programme of science, class struggle and lifestyle reform, represented for many by the name "Schaxel".<sup>129</sup> Now he was secure enough not to push so hard for a privileged position. A broad coalition of socialists was organized around natural science as a political issue, and he had become a figure of acknowledged authority among them.

#### 4. PRODUCING "FIGHTING KNOWLEDGE" FOR THE "PEOPLE OF THE FUTURE"

Over the next few years Schaxel immersed himself in socialist cultural politics. Having originally come into science via Haeckel's free thought, he became especially involved in the activities of the proletarian freethinkers, and held office in the Thuringian district of the German Freethinkers' Association (*Deutscher Freidenkerverband*). Prolific in print, he was also active in broadcasting as *Gauleiter* of the Workers' Radio League in central Germany. Immediately after the launch of the *Urania* project, he visited the Soviet Union for several months and brought important resources home. He used the trip to establish a more flexible position with respect to the parties of the left, and also made the "New Russia" a working model of the dominant role he sought for science and for scientists. And this he attempted to prefigure as he propagandized for biology as the foundation of socialist practice and ideology in the distinctive scientific culture of the socialist freethinkers of Germany.

Schaxel was distant from the pressing concerns of most party members. Gerda

Groll, from 1929 an apprentice clerk in the SPD press where *Urania* was produced, recalled that the social gulf was inevitably considerable.

Schaxel was a progressive scientist, ... he had his materialist world view, but he was always the man of the upper class.... Not, "I want to be detached" [*Distanz*], ... but he couldn't be anything else.

In spite of his being so "well-groomed, you might almost say conservatively dressed", Groll and others described him as "open", and he was a hit explaining the facts of life to the Socialist Workers Youth (*Sozialistische Arbeiterjugend*, SAJ).<sup>130</sup> He contributed to the economy of the socialist cultural organizations by becoming a sought-after speaker, a 'draw' who gave dozens of educational talks to freethinkers, *Naturfreunde* and young socialists, and was also a source of useful contacts. But the functionaries, like Karl Brundig of the Jena *Naturfreunde*, worked out a programme and then asked the professor to speak. He would talk over with them what he might say, but came along at the appointed time, said his piece, took part in the discussion and then left.<sup>131</sup> His distance from the day-to-day life of the movement was, however, not just inevitable: it was strategic.

Most important, it meant that Schaxel was aloof from the faction fights that he, like other left intellectuals, never tired of lamenting diverted political energy into fruitless internecine strife. But much as many of the battles that so absorbed functionaries' attention were not Schaxel's, if he wanted to be listened to, he had to negotiate them carefully. On his return from Russia he gave a series of extravagantly pro-Soviet lectures, which attracted enormous publicity and got him into trouble with the local social democrats, but were lapped up by the communists. Joining the KPD was never a real option for Schaxel: he would almost certainly have forfeited his university position and, especially after the ultra-left turn of the Comintern in 1928 split the socialist cultural organizations, access to the much larger social-democratic rump. But he had previously been too firmly identified with the SPD-left of Greil and the cultural politicians he worked with on *Urania*. The way he used the Soviet trip weakened his disabling association with a particular faction.

Schaxel's line would remain basically as he had set it out in *Entwicklung der Wissenschaft vom Leben*, but he came back from Russia with sharpened Marxist vocabulary and analysis. Now the "pathetic wriggling" of the "undecided-vacillating, pussyfooting, hinting, euphemistic" language that Thalheimer had found so disgusting was gone.<sup>132</sup> In future Schaxel received far more praise for his accessible and gripping language than he had got brickbats for *Entwicklung der Wissenschaft vom Leben*, though some social democrats did find him doctrinaire. His name was invoked in the local KPD paper as an authority even on matters very far from the development of the science of life. At a meeting of the Jena *Naturfreunde*, a social democrat had objected to Moscow's extremely controversial decision to invite professional "bourgeois" chess-players to the Soviet Union. But

It was explained to him that the government of the Workers' and Peasants' State had, in its correct understanding of the great importance of the game of chess to the working class and cultural progress, arranged this match for reasons of propaganda, with the successful result that today in Moscow alone the workers' chess clubs number 65 000 members.... Soviet Russia just is, as Prof. Schaxel confirmed, in cultural politics the leading country in the world....<sup>133</sup>

Schaxel, who rarely pronounced on current political issues, had reinforced his claim as a biologist and freethinker to provide a "socialist science" above the struggles of the day. As Brundig put it,

[S]ince he was politically not very tightly tied to the one or other party, he had enough freedom of movement.... Basically he was a left-wing social democrat; others said he was a communist. You could get that impression from many of his speeches.<sup>134</sup>

A regional conference of the Thuringian *Naturfreunde* gives a good example of what this freedom meant. In a nationally scandalous move the leadership's slate was voted down, but reports ended with praise for the lovely talk by the Comrade Professor.<sup>135</sup> His aloofness gave him access, but he did run the risk that he might be invited to entertain and just the tone once the serious cut-and-thrust was over.

The first socialist state became an extremely important model for Schaxel. He confidently pointed to the "first great, durable attempt to realize the unlimited possibilities of socialism under the dictatorship of the proletariat" as evidence that History was on his side. He also now projected the proper relations between scientists and the wider society, and between specialist and popular science, in terms of "Science in Soviet Russia". Science was rigorously planned. Equally important, it was becoming "the common property of all members of society" and tolerated "*no separation of strict scholarly and popular cultivation*". In the *Grundzüge* Schaxel had been concerned to erect barriers to protect biology, to enforce clear distinctions between popular and specialist science, so that biologists could offer public instruction from a position of internal strength. He now argued that the Bolsheviks had not only banished the threat that the decadent bourgeoisie had posed to strict science, but put scientists in charge of the channels of scientific communication. There was a graded series of scientific literatures for people of different educational levels written by scientists or at least "from the sources", and so informed by the same principles throughout. Alongside research units in every enterprise and the full integration of biology into the process of production, the means to form a scientific socialist world view were now available to all.<sup>136</sup>

In Germany, Schaxel reckoned they could build this future in earnest only once the proletariat had taken power, but the preparations had to begin before the revolution. He claimed the task of "sifting and filtering" the bourgeois heritage, arguing that what he rescued would form both the knowledge that the proletariat would use in its struggle for liberation, and the germ of the socialist science of the future. He spent a good deal of energy attacking "bourgeois science", but he concentrated on



showing that satisfactory materialist explanations were possible, and that these would take socialists beyond the limits to knowledge of the terrified bourgeoisie to true mastery of nature. He wrote and spoke about many different subjects. The disciplines that were so important in the universities did not matter here, but the topics included his own field. The human embryological descriptions that the sex reformer and *Urania* author Max Hodann was putting out were possibly of more immediate concern to *Urania*'s readers than limb regeneration in the axolotl, but research in embryology was widely understood as addressing burning issues of world view. And writing about his own work reinforced the professor's status.

Schaxel took specific, and in some cases quite specialized, conflicts in which he had been involved in embryology and theoretical biology, and sought to enlist organized workers on his side. He contributed a piece on "Life and form" to *Urania*'s very first issue, concluding that materialist science, provided it avoided the rigidity of mechanicism, would solve the problems of development. And when he presented his own experiments in "Regeneration or substitute formation?", he claimed to eliminate vitalism, and held out the prospect of further advance, by concluding that, "[w]hat is missing is not formed again in some mysterious way, but in the course of development, in accord always with what is present, *new structures* are made" (Figure 4).<sup>137</sup> Schaxel was read as having shown that the formation of an individual was not absolutely determined in advance, but that changes were possible, and that this opened the way for humanity to control life just as it already controlled matter.<sup>138</sup> These articles, though certainly controversial, would have been strikingly less out of place in the German Zoological Society than Schaxel's polemics. He had more or less culled the last part of "Life and form" from an article in the *Archiv für Entwicklungsmechanik*, but between the covers of *Urania* the same sentences and images acquired a greater political charge. The *Archiv* remained within institute libraries and studies; some of the one-hundred-fold more copies of the socialist magazine ended up in the rucksacks of revolutionary hikers.<sup>139</sup>

Much the most important knowledge as far as Schaxel and *Urania* were concerned was the evolutionary alternative to the Biblical narrative. It explained to organized workers how humans had evolved through the struggle for existence, and how socialism would develop through the class struggles of history. In an article that appeared in spring 1928, he encouraged his readers to collect frog spawn from ponds and watch it develop in a glass container by a sunny window.

In the course of three months [he concluded] from ... simple cells, via water-inhabiting tadpoles have developed four-legged air-breathing frogs. In part of a year we have followed a series of events that, when it occurred evolutionarily in the development of life, took millions of years.

This was a standard, even hackneyed, series of observations, but in the pages of *Urania* the old ontogenic proof of phylogeny demonstrated the natural necessity of socialism.<sup>140</sup> Schaxel's problems with the biogenetic law were beside the point here; fighting with the right wing of the Monist League for his teacher's mantle, he claimed

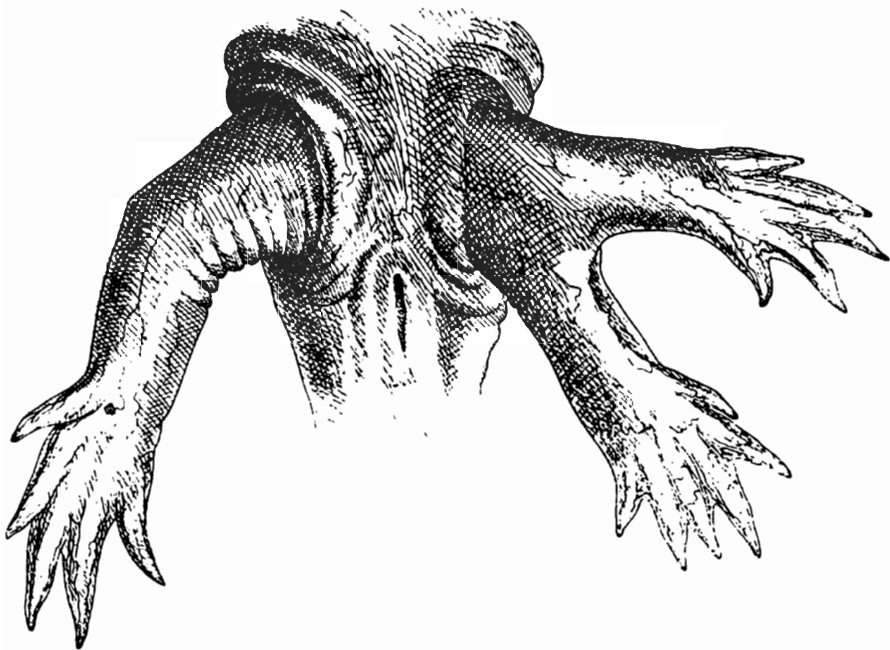


FIG. 4. "Double formation after complete removal of the left hindlimb" of an axolotl (belly view). This image was intended to show that depending on the particular conditions of the operation scientists could produce "nothing, too little or [as in this case] too much". What was missing was, Schaxel insisted, not replaced by some mysterious and vitalistic regulation, but new structures formed according to what was present. Not an idealized representation but drawn from a specimen, the verisimilitude of this picture made the point that the detail of what developed mattered. From Schaxel, "Wiedererzeugung" (ref. 137), 139.

that Haeckel was to be placed "in the series of intellectual ancestors of socialism".<sup>141</sup>

This knowledge that Schaxel reckoned most essential, the "fighting knowledge" (*Kampfeswissen*) with the aid of which the proletariat would recognize the reality of its position in nature and society and so change it, he put in his *Menschen der Zukunft* (*People of the future*). It was a very special kind of book, endowed with potentially enormous significance by presenting it to young people on one of the most important days of their lives. The socialist freethinkers, making their own ceremonial culture as an alternative to that of the churches, promoted a secular confirmation, the *Jugendweihe*. Rather than admitting the young adult to the community of Christ, they welcomed him or her in a mass school-leaving ceremony into the ranks of the organized working class. The high point of the proceedings was a speech, at the end of which each child was presented with a small but improving book.<sup>142</sup> By this time, 1929, the *Jugendweihe* book was already a standard genre, but until now the freethinkers had lacked one of their own. *Menschen der Zukunft* was produced in agreement with them to provide "the materialist catechism",

Schaxel's Marxist version of Haeckel's natural history of creation. The linen-bound volume contained 62 pages of large type, including nine full-page pictures, in which Schaxel promised his "young comrades ... the guidance which leads from the natural history of humanity to the history of human society, to the readiness to act, to the act itself".<sup>143</sup> The book was divided into three parts, Past, Present and Future, themselves split up into short sections headed by quotes from Haeckel, Marx, Engels, Rosa Luxemburg and Bebel. Here was a complete developmental story in easy language that the freethinkers could give their young people. It was widely advertised and generously praised in the freethinking press and in the magazines of the *Naturfreunde*, and regularly given at *Jugendweihe*.<sup>144</sup>

In Jena, 220 youths received *Menschen der Zukunft* at the annual *Jugendweihe* on Sunday morning, 24 March 1929. The children who took part would generally have come from social-democrat and communist families who had previously taken them out of religious education and registered them instead for lessons given by freethinking teachers. The *Jugendweihe* itself was the culmination of months of weekly classes in several schools and also a few special lectures for all participants: in 1929 Schaxel spoke on "The development of human beings in society" and was followed by others discussing "The Peasants' War" and "The meaning of proletarian celebrations".<sup>145</sup> The *Jugendweihe* took place before parents, relatives and the others who had been encouraged to attend: "Older workers must show ... that they accept the young comrades-in-arms enthusiastically into their fighting ranks."<sup>146</sup> The choirmaster opened the proceedings with an organ prelude and then directed the Jena People's Choir in an uplifting song. The communist teacher who had been supposed to give the speech had so savaged the social democrats at the annual conference of the proletarian freethinkers in Jena — at which Schaxel was re-elected as second chairman — that they had declared him unfit.<sup>147</sup> So the teacher Zimmermann from Ruhla near Jena spoke instead.

He compared adult life with a sea, on which, when the rising sun melts the snow on mountains and in the country, a great number of Columbusses set sail to discover new land.... Working-class youth does not sail on the ship of wealth equipped with every luxury and comfort, but on that of poverty, on which there is not enough. Workers' children learn at an early stage to see that there are two classes....

The point of this rite was for them to affirm their allegiance to one of them:

Today you are being introduced into the adult world, the world of the proletariat, to which you will henceforth belong. Here are your class comrades, a firm, iron mass, into which on this day you are received. May you now confirm with a handshake that you will serve this might army of all workers with the strong power of your youth.

As they shook Zimmermann's hand, in the moment when they were individually the centre of attention, the young people were presented with copies of *Menschen*

*der Zukunft* inscribed, albeit with less than literal truth, from “the whole working class of Jena”. The ceremony finished with everyone joining in the popular socialist song, “Brothers, on to the sun, on to freedom”. This *Jugendweihe*, like most, might not have represented the new cultural form to which the party’s theoreticians aspired — Gerda Groll especially remembered her new hat and the long dress she had to wear for the first time. But after all the work of the weeks before, she had learned where human beings had come from, and what they were supposed to do.<sup>148</sup>

## 5. THE DIALECTICS OF BIOLOGICAL CRISIS

As Germany plunged deeper into economic and political crisis, Schaxel rejected the liberal republicanism of the *Grundzüge*, and denounced in ever more apocalyptic terms the inability of “bourgeois science” to provide a world view. Haeckel had been its “last hero”.<sup>149</sup> Now there was not just chaotic eclecticism, but the danger of something much worse. Historians of Weimar science have understandably focused on this threat from the right. But up until the end of the Republic millions of Germans fully expected that the radical left was about to complete the unfinished business of 1918. Schaxel worked to provide them with a biology for this socialist future.

Following Luxemburg in lamenting that the very conditions so brilliantly explained by Marx had meant that his theory could for a long time not be properly developed and applied, Schaxel reckoned it important to go beyond “fighting knowledge”. So he set about applying dialectical materialism to natural science. He claimed that he had intended to put “mechanical materialism in dialectical motion” since 1906, but more plausibly that he had begun in earnest only when he helped prepare Engels’s *Dialectics of nature* for publication on his first Soviet trip.<sup>150</sup> He started publishing his attempts to construct a “dialectical biology” in 1929. Cautious about legislating for a science that could be built only under socialism, the dialectical biologist retained the critical perspective of the *Grundzüge*. But in adopting the “dialectical method” he now committed himself to a philosophical position from which he claimed it was possible to grasp the general relations of biological phenomena and so to resolve the crisis of biology. And he used the dialectic to draw together the various strands of his dynamic biology into a self-consciously collectivist philosophy of nature.

The most fully worked out example of the red professor’s dialectics is an article on “The biological individual” that he published in the logical positivist journal *Erkenntnis* after giving a talk on 25 February 1930 to the Empirical Philosophy Society in Berlin. Just as his *Urania* comrade Anna Siemsen’s pedagogy sought to overcome individualism, so he criticized the biological concept of individuality. The problem, he reckoned, was a problem of bourgeois society. That was why it was always posed but never solved. In fact, the biological individual was being historically, genetically, formally and socially dissolved. In his theory of development in successive acts, for example, form was neither predetermined nor did it

develop towards the fictive individuality and totality peddled by those who mistakenly spoke of regulation. And socially, in the most advanced species, individuality was being overcome in the collective.<sup>151</sup>

In a sardonic and probably solitary moment, Schaxel speculated on human relations in a world without individuality. In "Social eugenics and erotic collective" he imagined that "[a] society that will have arranged its relationships other than to serve the property relations of individuals" would forget "personal love with other accompanying phenomena of ... exploitation". But "[o]nly when the last bourgeois has been exterminated will the human individual die out and personality no longer have any meaning". He was not particularly interested in reproduction; eugenics would deal with the business of "planned genetic industry" somehow. "The people of the future" would have "food, shelter and work" instead of "private property", "religion" and "bedroom secrets".

Love ends. It occurs to no one to want to possess another. There are no motives for jealousy. Should eroticism remain, it will be a component of the physical culture of leisure. It has its appointed time like every other mass sport to compensate hygienically and prophylactically for the partial activity of the body consequent on the division of labour. The capitalist breeding ground of flirts [*Kokken*], prostitutes and priests [*Pfaffen*] is removed.

In his own numerous sexual liaisons with women, Schaxel claimed to have prefigured the disappearance of love. But he wrote, "I was alone as a boy and have remained so as a man".<sup>152</sup>

Schaxel sought especially to convince young scientists that whereas "empiricists" and "metaphysicians" would not find their way through the chaos, "dialecticians" would reap "a rich harvest".<sup>153</sup> The University of Jena had become a centre of fascist agitation, but Schaxel lectured to students on dialectics and on "Marxism and Darwinism", apparently without disruption.<sup>154</sup> His activities were followed with interest not just by the logical positivists but by some members of the Frankfurt Institute of Social Research.<sup>155</sup> It will be important to find out more about how other established German scientists treated him by this time, but it is unlikely that any were tempted by dialectical materialism. For his part, Schaxel followed Engels in claiming that there were two routes to understanding the dialectics of nature: the easy way via knowledge of the laws of the dialectic, and the hard one through scientific research itself. Schaxel knew enough of his colleagues' social being to have realistic expectations of the numbers who might take the high road, but he supported his claim that dialectical biology had a future in Germany by pointing out that scientists he admired, such as the right-wing Richard Goldschmidt, were actually turning into dialectical materialists, if "no doubt without becoming conscious of it".<sup>156</sup> This raises the long disputed but no longer urgently asked question, to what extent dialectical materialism has offered biology a real, let alone a viable alternative — and might aid the construction of a liberatory one.<sup>157</sup> That Goldschmidt could exemplify good scientific practice shows graphically how little "dialectical

biology” represented some kind of ‘rupture’ with “bourgeois science”. Schaxel did, however, stand for distinctive theoretical positions, for the sub-discipline of theoretical biology, and for the planning of every aspect of the science along lines that horrified his mandarin colleagues.

Though he appealed to them, Schaxel did not rely on German biologists, and nor can historians assess the range of alternatives for biology in the last years of the Weimar Republic by focusing narrowly on “the German scientific community”. He looked beyond Germany to the Soviet Union, and he looked beyond scientific institutions to the organized working class. More even than, for example, the Vienna Circle Schaxel produced for audiences outside the academy.<sup>158</sup> But even in *Erkenntnis* he declared that

A social stratum, forced on to the defensive, erects the ideological dictatorship, which aims to prohibit the empirical access of offensive empirical experience. The validity of every ban is a question of power.<sup>159</sup>

Crucially, it was because Schaxel recognized that the success or failure of his project of scientific reform was a question of political power, and not just a theoretical debate, that he took his work in the labour movement so seriously. By the last years of the Republic he had ensured that biological reform was on socialists’ agenda, and pinned everything on winning.

When, however, we do venture beyond scientific institutions it becomes impossible to take at face value Schaxel’s own account of his actions, in which, quite simply, he led the enlightened vanguard to certain victory against the forces of darkness. First, the labour movement culture in which he worked was not only under siege, it was also deeply divided against itself. He was not, in spite of his claim that workers were naturally materialists, simply articulating some proletarian common sense. The effort that, we have already seen, he put into steering a middle course of critical appropriation between rejection and acceptance of “bourgeois science”, and his repeated insistence that neither religion nor going “back to nature” would solve the ideological crisis, is a measure of the opposition. For all the strength of the freethinking milieu in Saxony and Thuringia, by no means all of his “spiritualist”, “quack” and “metaphysical” enemies were outside the Marxist camp.<sup>160</sup> Second, this rigorous scourge of mysticism himself participated in practices in which science-nature was not so much analysed as worshipped. I shall explore these contradictions, and draw together the main points I have made about his work in the labour movement, by finishing with an exploration of the high-point of his career as a ceremonial speaker.

In 1931 Schaxel gave the “fire speech” at the annual *Sonnwendfeier* (midsummer festival) organized by the freethinkers of Jena. The winter solstice had not caught on as a secular alternative to Christmas, but the summer festival was very popular.<sup>161</sup> He had given the speech two years before, when the local social democrats still had an uncomfortable relationship to a ceremony then too much in communist hands for their taste.<sup>162</sup> Illness had kept him away in 1930, but now he was set to

rally the troops against church and capital in a ceremony which *Das Volk*, the local SPD newspaper, presented as a joyous, ecumenical affirmation of the secular faith by the entire working class of the town, but was actually controlled by the social-democratic freethinkers and the SAJ.<sup>163</sup> The KPD's policy of "revolutionary unity" — splitting — had, after all, left the town's group of proletarian freethinkers more firmly in social-democratic hands than it had been for a long time.

On this Friday afternoon and evening, men and women, boys and girls made their way to the Otto-Schott-Platz, a large clearing in the woods above the city that was used as a sports ground. Children "romped in the fresh forest air", people ate and drank, and the SAJ showed pictures of their camp; posters describing the development of the freethinking movement provided historical instruction. On the lower part of the square stood the great pile of wood awaiting its festive ignition, and a huge red flag fluttered in the wind. Then, as dusk finally fell, came the announcement over the loudspeaker of the Workers' Radio League that the ceremony was to begin. The crowd of thousands fell silent.

The songs of the Jena Peoples' Choir rang out into the mild summer night and cast their spell over the great proletarian congregation. The chorus [*Sprechchor*] of the workers' youth showed how humanity still lies in the chains of reaction, how the torch-bearers of the new age light up the darkness, how they burst the chains....

This to the accompaniment of drums, violins and fanfares. Now the diminutive figure on the podium stepped into the limelight:

Solemn silence. No sound disturbed the hour of proletarian celebration. Comrade Schaxel gave the fire speech, which, amplified by loudspeaker, rang far over the great square into the forest.

The talk had gone down pretty well in 1929, so he gave the same one again. This scientist who urged his colleagues to be vigilant against the merest suspicion of vitalism or faith in a higher power, worked to keep his audience spellbound with a speech that declared the scientific certainty of secular salvation. As befitted the occasion, he developed a simple symbolism by blending the dialectics of nature that he had helped to dig out of Engels's notes in the archive in Moscow with a reminder why he and his audience had come together:

Today height of summer, seasonal development of life in nature reached fullness. In its prime first signs of age: yellow leaves: change to descent in the arc of becoming. Beginning of negation in the dialectical process, which carries its resolution within itself.<sup>164</sup>

Then he raced through the materialist catechism:

Activity of the living nature that surrounds us bound to seasons. Socialized man ... makes himself independent of seasonal change. He masters nature....

Very many work, only very few harvest.... [C]apitalism and proletariat....

Struggle for existence in nature continues in the class struggles of history — also a dialectical process, of which we are at the same time subject and object. We make our history with sweat and blood.

Now came the punch-line:

As the activity of life in the course of the year so the dialectical process of the history of society carries negation and resolution within itself. Here as there change. Our time, time of transition....

The forces of nature, cosmic and terrestrial, power the natural process. The class that can develop, the offensive proletariat, drives the social process forwards.

Much as this would have made most of his university colleagues choke on their beer, in this forum it was by now hardly controversial — but then controversy was the last thing the organizers wanted this midsummer night. The American journalist Hubert Renfro Knickerbocker reckoned Jena “literally another world” from “the desolate territory of empty mills and wretchedness just a few hours away”. He presented Jena and Zeiss as “the real Germany — the Germany of order and industry, cleanliness and comfort, productiveness and skill”, but he had to admit “it was not easy to understand” why nearly 30% of Zeiss workers were communists. Even in Jena, an oasis of comparative well-being where the absolute number of SPD votes would unusually increase the following June, the deep divisions of the years after the war were biting. The point of the *Sonnwendfeier* was to show unity.<sup>165</sup>

First, unity against the threat from the right, which was now ever-present, especially in Thuringia, where the National Socialist Wilhelm Frick held the powerful post of Minister of the Interior, and Nazi students were organizing in Jena. Frick had forced the appointment to a professorship of racist ideologue H. F. K. Günther, foreshadowing the building of Jena under National Socialism into one of the two main university centres of racial hygiene, where the right would also claim Haeckel’s mantle as their prize.<sup>166</sup> On the following nights, encouraged by President Hoover’s granting to Germany of a year without repayments, solid bourgeois clubs gathered around midsummer fires, flying the old monarchist flag and vowing to defend the fatherland to the “last drop of blood”.<sup>167</sup> Second, the socialists’ *Sonnwendfeier* was trying for a few hours to forget the divisions *within* the Marxist camp. But these were so deep that they could not just be ignored, and Schaxel, who had managed carefully his relationship to the parties of the left, was well placed to reassure his audience that all would be well in spite of the splits. Finally forced to choose, he had remained in leading positions in the freethinkers and the Workers’ Radio League, and defended the reformist tactics of their social-democratic leaders rather than joining the small communist breakaway organizations. So these days he did not always get an easy ride from the communist press; half a year later even the “right-wing deviationists” of Thalheimer’s KPD (Opposition) would lambast a speech defending the social-democratic freethinkers’ leadership. It had been “a top performance of undemanding platitudes in the area of Marxist thought”. Schaxel



reckoned the political strike an impossible weapon in such a crisis, so

we should wait for better times (the consolation of happiness in heaven) till an attack is possible. The Nazis were only 35% of the voters, apart from which they were internally hollow, not active and not ready for the struggle. (Ergo: it's not so bad about the fascist danger after all.) At the end some superficial remarks about the cultural reaction.... One true word Schaxel did say, which we would not wish to conceal: Philosophy is opium for the people. Very true!<sup>168</sup>

Nevertheless, he certainly had much more credibility in communist circles than the hated SPD hacks. He wound up:

The necessity of the dialectical process drives us on to make our own history! When the leadership doubts, we remember: individuals don't lead, the masses move the world! Renewal happens from below. From below! The naturalness of the social process moves it from one transition to the next.

Socialism would succeed capitalism as surely as leaves turn from green to yellow.

At the end he intoned the chant that was the signal to light the fire:  
Let the flame rise!  
What is rotten sinks into grave and gloom;  
We push it as it falls!  
We want to build the world anew;  
We now are nothing, let us be all!

For the proletariat would dig the capitalists' grave, and the last would be the first and only ones to be saved. But were organized workers to save themselves, or were they to be saved by the historical laws of nature and society? Or did his listeners buy the stuff about "dialectical necessity" and "subject and object"? Did they allow the red priest of nature to stipulate the meaning of their ceremony? Fine words on a special occasion to be forgotten before work the next morning, a moving night out that helped to make up for the dullness of work — or the despair of having none — or, as *Das Volk* wanted it, a message of hope that transcended differences of party, "purifying and making strong for the struggle for socialism, for freedom and progress"? Perhaps the wood *did* seem to be capitalism, collapsing under the weight of its contradictions and consumed by the flame of the proletarian fire.<sup>169</sup> Schaxel himself, probably when he gave the same speech the following evening in nearby Eisenberg, reckoned the "shining and consuming fire" a metaphor of the freethinkers' own fate: "We shine into the dark of the past with a view of the bright future. We shall not win it without the stigmata of struggle."<sup>170</sup> But it was the searchlight on the roof of the Zeiss works that lit the celebrants home.

\* \* \*

Two years later the German labour movement was destroyed and Schaxel beginning a difficult decade of exile in the Soviet Union. He was stripped of German citizenship,

his doctorate and membership of the German Zoological and Genetical Societies. Now he claimed to have warned even in the *Grundzüge* of the disastrous direction in which German biology was heading. We have seen that, in fact, he had come a long way since then. In his autobiography he took issue with those who had denounced his professorship as a “political” appointment of the Weimar Republic, insisting that since it dated from 1916 it had been an act of the Archduke of Saxe-Weimar.

I am not, as some provocateurs have claimed, a “red” Professor, someone who profited from the revolution, but (sorry!) an archducal one. For a revolutionary there was nothing to gain from the lost German revolution.<sup>171</sup>

Schaxel was not appointed a “red” professor, but through his actions and those of others was made one.

The most basic criterion of the seriousness of the alternative Schaxel offered is its historic success or failure. At first sight, it seems clear that he failed — obviously he did not win the battle for Weimar science, and “dialectical biology” is on few lips today — but this kind of judgement in fact depends acutely on where and when the clock is stopped: in Jena it seemed for decades after 1945 that, in the end, he had won.<sup>172</sup> For the history of Weimar science, the most relevant question is how other Germans rated Schaxel’s chances in the last years of the Republic. And here it is clear that, whilst the constituency of those who might be considered active supporters was quite small, the number of people who either confidently expected or fearfully anticipated the communist victory, in which if he had played his cards right he could have participated, was large.

Another way of reflecting on Schaxel’s making is to ask, in what sense did he come to be engaged in a *radical* project? He certainly ended up on the far left of the Weimar professoriate, and his dialectical biology appears radically collectivist. I have focused, however, on the social relations of Schaxel’s practice, especially as a theorist, reformer and popularizer of biology. And in terms of Weimar struggles over the production, not just of particular forms of natural knowledge, but of who would produce them, where and for whom, we have seen that his actions were rather more contradictory. From 1924 he argued that not only rigorous science, but also the proletariat, must be protected from “the swirling of the cultural fog of the bourgeoisie”. This involved a contested attempt to establish the authority of Marxist scientists, including against much more radical challenges to official science than he was interested in mounting himself. His position between university and proletariat in fact made Schaxel quite restorationist with respect to the ‘who’ of scientific production. And this involved him, for whom ‘popularization’ was the means of his political struggle, in working within a scientist’s conventional understanding of that problematic term. But though he claimed the leading role for red professors, workers were to usher in a new scientific era, and labour institutions were the key arena of struggle: with respect to the ‘where’ and the ‘for whom’, his actions were radical indeed. They challenge historians to take seriously the relations and distinctions between the various arenas of early twentieth-century science.

## ACKNOWLEDGEMENTS

I am very grateful to Jon Harwood, Paul Weindling, Rüdiger Stutz, Jürgen John, Kurt Meinl, Leni Arnold (Universitätsarchiv Jena), Jörg Valtin and Frau Mann (Stadtarchiv Jena), Juanita Roche, Klaus Sander, Dieter Fricke, Annette Vogt and Sybilla Nikolow for generous help. I am especially indebted to Erika Krauß for granting me access to the Schaxel papers and for numerous kindnesses during visits to the Ernst-Haeckel-Haus, which I thank for permission to reproduce Figures 1–3. I also acknowledge the assistance of the staff of the following institutions: University, Whipple, Balfour, Anatomy, Medical and Trinity College Libraries in Cambridge, British Library, German Historical Institute London, Staatsbibliothek zu Berlin, Universitätsbibliothek der Freien Universität Berlin, Stiftung Archiv der Parteien und Massenorganisationen der DDR im Bundesarchiv, Bundesarchiv Abteilungen Potsdam, Stadtarchiv Jena, Thüringer Universitäts- und Landesbibliothek Jena, Betriebsarchiv Carl Zeiss Jena G.m.b.H., Gustav Fischer Verlag, Thüringisches Hauptstaatsarchiv Weimar, Universitätsbibliothek Leipzig, Deutsche Bücherei, Urania Verlag, Senckenbergische Bibliothek, Niedersächsische Staats- und Universitätsbibliothek Göttingen, Studienarchiv Arbeiterkultur und Ökologie (Baunatal), Archiv der sozialen Demokratie der Friedrich-Ebert-Stiftung, Fritz-Hüser-Institut and Archiv der Arbeiterjugendbewegung. I thank Viktor Hamburger for responding to my questions, and Gerda Groll and the late Karl Brundig for letting me talk with them. The paper incorporates work begun as part of a dissertation for the M.Sc. in History of Science and Medicine, Imperial and University Colleges, University of London. I have benefited from the responses to earlier versions of participants in the Second Cambridge–Maastricht Workshop on the Problematics of Modern Biomedicine, and in Garland Allen and Jane Maienschein's session on *Entwicklungsmechanik* at the 1995 ISHPSSB meeting in Leuven; of seminar audiences at the Oxford Wellcome Unit for the History of Medicine and the Cambridge Department of History and Philosophy of Science; and of the Life Sciences Group at the Max-Planck-Institut für Wissenschaftsgeschichte in Berlin. For comments on drafts of the paper I thank Jon Harwood, Nick Jardine, Simon Schaffer, Reinhard Mocek, Soraya de Chadarevian, Skúli Sigurdsson, Jean-Paul Gaudillière, Jim Secord and the referees for this journal.

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21. Gary Werskey, *The Visible College: A collective biography of British scientists and socialists of the 1930s* (London, 1988 [1978]).
22. J. D. Bernal, *The social function of science* (London, 1939), 307. On the mountain of public distrust that American scientists had made for themselves to climb by the early 1930s, see Peter J. Kuznick, *Beyond the laboratory: Scientists as political activists in 1930s America* (Chicago, 1987). Most perceptive on the relations between autodidact workers, the parties of the left and "universitarian" learning is Jonathan Rée, *Proletarian philosophers: Problems in socialist culture in Britain, 1900–1940* (Oxford, 1984).
23. Biographical information on Schaxel can be found in the works cited in ref. 2. On Haeckel, see especially Gunter Mann, "Ernst Haeckel und der Darwinismus: Popularisierung, Propaganda und Ideologisierung", *Medizinhistorisches Journal*, xv (1980), 269–83; Dietrich von Engelhardt, "Polemik und Kontroversen um Haeckel", *Medizinhistorisches Journal*, xv (1980), 284–304; Reinhard Gursch, *Die Illustrationen Ernst Haeckels zur Abstammungs- und Entwicklungsgeschichte: Diskussion im wissenschaftlichen und nichtwissenschaftlichen Schrifttum* (Frankfurt am Main, 1981); Erika Krauß, *Ernst Haeckel*, 2nd edn (Leipzig, 1987); Paul Weindling, "Ernst Haeckel and the secularization of nature", in James R. Moore (ed.), *History, humanity and evolution: Essays for John C. Greene* (Cambridge, 1989), 311–27. On monism and the Monist League which was founded to promote it, see further Elfriede Teumer, "Aus dem Kampf des 'Deutschen Monistenbundes' um eine wissenschaftliche Weltanschauung", in Herbert Hörz, Rolf Löther and Siegfried Wollgast (eds), *Naturphilosophie: Von der Spekulation zur Wissenschaft* (Berlin [O], 1969), 357–76; Daniel Gasman, *The scientific origins of National Socialism: Social Darwinism in Ernst Haeckel and the German Monist League* (London and New York, 1971).
24. Driesch and Spemann spoke of *Entwicklungsphysiologie* ("developmental physiology") rather than *Entwicklungsmechanik*, but Schaxel used Roux's term. For a recent overview, see Nyhart, *op. cit.* (ref. 7). On Roux, Driesch and *Entwicklungsmechanik*, see further Jane M. Oppenheimer, *Essays in the history of embryology and biology* (Cambridge, Mass., 1967); Frederick B. Churchill, "Wilhelm Roux and a Program for Embryology", Ph.D. thesis, Harvard University,

- 1966; *idem*, "From machine-theory to entelechy: Two studies in developmental teleology", *Journal of the history of biology* (hereafter *JHB*), ii (1969), 165–85; Mocek, *Roux* (ref. 2); Garland E. Allen, *Life science in the twentieth century* (Cambridge, 1978 [1975]), 21–39, 114–26; Stephen Jay Gould, *Ontogeny and phylogeny* (Cambridge, Mass., 1977), 186–202; Jane Maienschein, "The origins of *Entwicklungsmechanik*", in Scott F. Gilbert (ed.), *A conceptual history of modern embryology* (Baltimore, 1994 [1991]), 43–61.
25. Hans Driesch, "Gibt es harmonisch-äquipotentielle Systeme? Eine Erwiderung", *Biologisches Centralblatt*, xxxv (1915), 545–55; Julius Schaxel, "Namen und Wesen des harmonisch-äquipotentiellen Systems", *ibid.*, xxxvi (1916), 374–83; Hans Driesch, "Noch einmal das 'Harmonisch-äquipotentielle System'", *ibid.*, xxxvi (1916), 472–5; Julius Schaxel, "Mechanismus, Vitalismus und kritische Biologie", *ibid.*, xxxvii (1917), 188–96. On the polemic, see Georg Uschmann, "Julius Schaxel und seine Auseinandersetzung mit dem Neovitalismus", *NTM* Beiheft, 1963, 228–33.
  26. "Diskussion" following J. Schaxel, "Rückbildung und Wiederauffrischung tierischer Gewebe", *Verhandlungen der Deutschen Zoologischen Gesellschaft*, xxiv (1914), 122–45, p. 145; quoted in Driesch, "Systeme" (ref. 25), 553. On Spemann, see T. J. Horder and P. J. Weindling, "Hans Spemann and the organiser", in T. J. Horder, J. A. Witkowski and C. C. Wylie (eds), *A history of embryology* (Cambridge, 1985), 183–242; Hamburger, *op. cit.* (ref. 4); Peter E. Fäßler, "Hans Spemann (1869–1941): Experimentelle Forschung im Spannungsfeld von Empirie und Theorie", Dissertation, University of Freiburg i. Br., 1995.
  27. Julius Schaxel, *Die Leistungen der Zellen bei der Entwicklung der Metazoen* (Jena, 1915), 130; *idem*, "Mechanismus" (ref. 25), 189. Penzlin, *op. cit.* (ref. 2), 1027, agreed with Spemann that Schaxel was wrong; Mocek, *Roux* (ref. 2), 173, considered Spemann's presentation of the dialectical relationship of determination and regulation superior to Schaxel's denial of regulation. My point is that Spemann was able to force Schaxel himself to no such conclusion.
  28. Schaxel, "Mechanismus" (ref. 25), 195.
  29. On Schaxel's university career, see Uschmann, *op. cit.* (ref. 2); on Zeiss, see most recently Rüdiger Stolz and Joachim Wittig (eds), *Carl Zeiss und Ernst Abbe: Leben, Wirken und Bedeutung* (Jena, 1993); on Jena more generally, see Herbert Koch, *Geschichte der Stadt Jena* (Stuttgart, 1966); Jürgen John (ed.), *Jenaer stadtgeschichtliche Beiträge* (Jena, 1993).
  30. Kükenthal to Haeckel, 17 June 1918, EHH: Haeckel papers; quoted in Uschmann, *op. cit.* (ref. 2), 219.
  31. Schaxel made a few statements in which he insisted that in addition to theoretical reform, biology urgently needed more facts; see, for example, his "Über die Natur der Formvorgänge in der tierischen Entwicklung", *Archiv für Entwicklungsmechanik der Organismen*, 1 (1922), 498–525, p. 525. His position was flexible enough that he could emphasize either conceptual clarification or empirical accumulation depending on his immediate purpose and audience.
  32. Schaxel to Driesch, 29 July 1918, Universitätsbibliothek, Leipzig: Driesch papers.
  33. On the "crisis of learning", see Fritz K. Ringer, *The decline of the German mandarins* (Cambridge, Mass., 1969); Forman, *op. cit.* (ref. 9).
  34. Julius Schaxel, *Grundzüge der Theorienbildung in der Biologie* (Jena, 1919), 1, hereafter *GTB*; 2nd edn (Jena, 1922), hereafter *GTB2*.
  35. *GTB*, 13, 18. For Haeckel and his circle, Schaxel's attack on him was the most important fact about the *Grundzüge*; see his note of 1 February 1919 in Krauß (ed.), *op. cit.* (ref. 2), 84–85; Wilhelm Breitenbach to Haeckel, 31 March 1919, EHH: Haeckel papers; W. B[reitenbach], *Neue Weltanschauung*, viiii (1919), 22–24.
  36. *GTB2*, 5–7.
  37. *GTB*, 85. Pace Mocek, "Entwicklungsmechanik" (ref. 2), 170, Schaxel did not confine himself

- to critiques of positions that were unrepresented in the specialist literature or textbooks. He certainly spent a good deal of time on these, but his main concern was that the boundaries between “intuitive vitalism” and everyday science were being breached routinely.
38. *GTB2*, p. iv.
  39. Schaxel used Haeckel’s metaphor of not being able to see the wood for the trees; see *GTB*, 76; Ernst Haeckel, *Die Welträthsel: Gemeinverständliche Studien über monistische Philosophie* (Bonn, 1899), p. iv.
  40. *GTB*, 65.
  41. Richard Bessel, *Germany after the First World War* (Oxford, 1993), 220–53.
  42. *GTB2*, 214 and e.g. 224.
  43. Fleck, *op. cit.* (ref. 19).
  44. *GTB*, 12–13; *GTB2*, 19. Other retrospectively ironic élitisms, such as disparagement of “intellectual proletarians” and opposition to the threat of science as planned industry destroying every individuality (*Eigenart*), may be found in his “Ernst Haeckel und seine Studenten”, in Heinrich Schmidt (ed.), *Was wir Ernst Haeckel verdanken: Ein Buch der Verehrung und Dankbarkeit* (2 vols, Leipzig, 1914), ii, 269–71.
  45. For the print-run, see Gustav Fischer Verlagsarchiv, Jena: Kalkulationsbuch, 11 December 1918, for a copy of which I thank Bernd Rolle. On the reception, see Harwood, *op. cit.* (ref. 5), 27–29. Reviews of the first edition: Adolf Koelsch, *Neue Zürcher Zeitung*, 7 February 1919; W. Lubosch, *Anatomischer Anzeiger*, lii (1919), 268–71; [Hans] Nachtsheim, *Naturwissenschaftliche Wochenschrift*, xix (1920), 127–8; Julius Schultz, *Annalen der Philosophie*, ii (1920–21), 293–9; Albrecht Hase, *Naturwissenschaftliche Monatshefte*, ii (1920), 117; F[riedrich] Alverdes, *Deutsche Literaturzeitung*, xlii (1921), 757–60; of the second edition: Fritz Karsch, *Kant-Studien*, xxviii (1923), 467–8; W. Lubosch, *Anatomischer Anzeiger*, lvi (1923), 254–6; Kurt Lewin, *Die Naturwissenschaften*, xxii (1924), 461–2; Blum, *Internationale Zeitschrift für Psychoanalyse*, xi (1925), 97–99; E. Kallius, *Zeitschrift für Anatomie und Entwicklungsgeschichte*, lxxviii (1926), 774–7; W. F. Reinig, *Journal für Psychologie und Neurologie*, xxxiv (1927), 259. The reviews of Schultz and Karsch locate Schaxel’s Neo-Kantianism.
  46. *Abhandlungen zur theoretischen Biologie* (30 vols, Berlin, 1919–31).
  47. Julius Schaxel, “Über die Darstellung allgemeiner Biologie”, *Abhandlungen zur theoretischen Biologie*, i (1919). See also his intervention in the debate over reform of the medical curriculum, *Die allgemeine und experimentelle Biologie bei der Neuordnung des medizinischen Studiums* (Jena, 1921).
  48. Hans Driesch, *The science and philosophy of the organism: The Gifford Lectures delivered before the University of Aberdeen in the year 1907* (2 vols, London, 1908), i, 4 and ii, 3. He became full professor of philosophy in Cologne in 1919. Driesch shared Schaxel’s interest in university reform, and the two men became relatively close politically and socially in the first years of the Republic, in spite of their earlier polemic (see Schaxel’s letters to Driesch: Driesch papers).
  49. Reinke, in his *Einleitung in die theoretische Biologie* (Berlin, 1901; 2nd edn, 1911), is the only author I know to have put the term ‘theoretical biology’ in a book title before Schaxel’s *Abhandlungen*, but Schaxel did not cite him in the first edition of the *Grundzüge*. For a sketch of Haeckel-opponent Reinke’s position that the evolving world was the “deed” of a divine intelligence, see Rudolf Eisler, *Philosophen-Lexikon: Leben, Werke und Lehren der Denker* (Berlin, 1912), 371. On the comparative outsider Uexküll, see Harrington, *op. cit.* (ref. 9).
  50. E.g. *GTB*, 37 and 163–4.
  51. Karl Sapper, *Biologia generalis*, ii (1926), 338–41, even reckoned Schaxel secretly sympathetic to the “organismic tendency”, which Schaxel himself considered vitalistic. Haeckel had been



- told by Maurer and Heinrich Schmidt that the “‘brilliantly’ written” work was “decked out with dualist *metaphysics*”; see Krauß (ed.), *op. cit.* (ref. 2), 85.
52. Driesch was carefully solicited for an early contribution; see Schaxel to Driesch, 13 December 1918: Driesch papers. Reinke also wrote an *Abhandlung*, but Uexküll did not.
  53. Ludwig v. Bertalanffy, *Kritische Theorie der Formbildung, Abhandlungen zur theoretischen Biologie*, xxvii (1928). For the commissioning, see Maria von Bertalanffy, “Reminiscences”, in William Gray and Nicholas D. Rizzo (eds), *Unity through diversity: A Festschrift for Ludwig von Bertalanffy* (2 vols, New York, 1973), i, 31–52, pp. 35–36. On Bertalanffy, see also Rudolf Rochhausen, “Die organische Lehre Ludwig v. Bertalanffys: Ein Ausdruck spontan dialektisch-materialistischen Denkens”, *NTM Beiheft*, 1963, 234–41; Gerhard Nierhaus, “Ludwig von Bertalanffy 1901–1972”, *Sudhoffs Archiv*, lxxv (1981), 144–72.
  54. The translation was Ludwig von Bertalanffy, *Modern theories of development: An introduction to theoretical biology*, translated and adapted by J. H. Woodger (London, 1933). On Woodger, see W. F. Floyd and F. T. C. Harris, “Joseph Henry Woodger, curriculum vitae”, in John R. Gregg and F. T. C. Harris (eds), *Form and strategy in science: Studies dedicated to Joseph Henry Woodger on the occasion of his seventieth birthday* (Dordrecht, 1964), 1–6; Nils Roll-Hansen, “E. S. Russell and J. H. Woodger: The failure of two twentieth-century opponents of mechanistic biology”, *JHB*, xvii (1984), 399–428. On Woodger, Needham and the Theoretical Biology Club, see P. G. Abir-Am, “The philosophical background of Joseph Needham’s work in chemical embryology”, in Gilbert (ed.), *op. cit.* (ref. 24), 159–80; *idem*, “The Biotheoretical Gathering, trans-disciplinary authority and the incipient legitimization of molecular biology in the 1930s: New perspective on the historical sociology of science”, *History of science*, xxv (1987), 1–69.
  55. J. H. Woodger, “The ‘concept of organism’ and the relation between embryology and genetics: Part I”, *The quarterly review of biology*, v (1930), 1–22, p. 5. Only Woodger himself is cited more often than Schaxel in Bertalanffy–Woodger’s *Modern theories of development*, and Bertalanffy still referred extensively to Schaxel’s “standard work” in his second monograph, because so much “cannot be justified better than with Schaxel’s words”. But he dismissed Reinke and Uexküll. See his *Theoretische Biologie, Erster Band: Allgemeine Theorie, Physikochemie, Aufbau und Entwicklung des Organismus* (Berlin, 1932), 3, 35.
  56. Donna Jeanne Haraway, *Crystals, fabrics, and fields: Metaphors of organicism in twentieth-century developmental biology* (New Haven, 1976); Abir-Am, *op. cit.* (ref. 54); and also V. B. Smocovitis, “Unifying biology: The evolutionary synthesis and evolutionary biology”, *JHB*, xxv (1992), 1–65.
  57. Christa Jungnickel and Russell MacCormmach, *Intellectual mastery of nature: Theoretical physics from Ohm to Einstein* (2 vols, Chicago, 1986), ii, 254.
  58. *GTB*, 4; Schaxel, “Darstellung” (ref. 47), 1.
  59. This was, however, probably in late 1918, after Schaxel had finished the *Grundzüge*. He sent Hilbert, with whom he had “several times” discussed the “uncertainty of biological conceptions”, a circular about the *Abhandlungen*, to which he claimed Hilbert’s (increasingly wayward) student, Hermann Weyl, now in Zurich, had said he would contribute (he did not); see Schaxel to Hilbert, 27 December 1918, Niedersächsische Staats- und Universitätsbibliothek, Göttingen: Hilbert papers; and further Schaxel to Driesch, 27 December 1918: Driesch papers. On Hilbert and modern mathematics, see Herbert Mehrrens, *Moderne Sprache Mathematik: Eine Geschichte des Streits um die Grundlagen der Disziplin und des Subjekts formaler Systeme* (Frankfurt am Main, 1990).
  60. Harwood, *op. cit.* (ref. 5), 28–29.
  61. Schaxel, “Darstellung” (ref. 47), 36; *GTB2*, 69. Biologists and historians of science have spent

- more time discussing their views of Spemann's psycho-Lamarckian and allegedly cryptovitalist tendencies than investigating the more historically relevant question, how contemporaries interpreted his work. Schaxel's quite differentiated criticism is particularly useful because it was published relatively early; he continued to comment on the work of Spemann's school until the end of his life.
62. Schaxel, "Darstellung" (ref. 47), 1; H. Spemann, "Die Zoologie im medizinischen Studium", *Deutsche medizinische Wochenschrift*, xlvii (1920), 834–5, p. 834. Schaxel noted these "warm words", doubtless spoken "from the soul"; see *Biologie* (ref. 47), 11. Spemann expressed hostility to "general biology" again in his autobiography, *Forschung und Leben*, ed. by Friedrich Wilhelm Spemann (Stuttgart, 1943), 206–9.
  63. Charles E. McClelland, *State, society, and university in Germany 1700–1914* (Cambridge, 1980), 328. On mandarins, see Ringer, *op. cit.* (ref. 33); on professorial politics in War and Republic, see Klaus Schwabe, *Wissenschaft und Kriegsmoral: Die deutschen Hochschullehrer und die politischen Grundfragen des Ersten Weltkrieges* (Göttingen, 1969); Kurt Töpner, *Gelehrte Politiker und politisierende Gelehrte: Die Revolution von 1918 im Urteil deutscher Hochschullehrer* (Göttingen, 1970) (p. 54 for Semon's suicide); Paul Weindling, "Theories of the Cell State in Imperial Germany", in Charles Webster (ed.), *Biology, medicine and society 1840–1940* (Cambridge, 1981), 99–155; and especially Herbert Döring, *Der Weimarer Kreis: Studien zum politischen Bewußtsein verfassungstreuer Hochschullehrer in der Weimarer Republik* (Meisenheim, 1975).
  64. Harwood, *op. cit.* (ref. 5); for socialists and pacifists as "outsiders", see e.g. Döring, *op. cit.* (ref. 63), 8, 58.
  65. Dieter Fricke, "Zur Militarisierung des deutschen Geisteslebens im wilhelminischen Kaiserreich: Der Fall Leo Arons", *Zeitschrift für Geschichtswissenschaft*, viii (1960), 1069–107, p. 1099; it made no difference that the Kaiser had confused Arons with somebody else. See further Bernhard vom Brocke, "Hochschul- und Wissenschaftspolitik in Preußen und im Deutschen Kaiserreich 1882–1907: Das 'System Althoff'", in Peter Baumgart (ed.), *Bildungspolitik in Preußen zur Zeit des Kaiserreichs* (Stuttgart, 1980), 9–118, pp. 95–99.
  66. Karl Heinig, *Carl Schorlemmer: Chemiker und Kommunist ersten Ranges*, 4th edn (Leipzig, 1986); Werner Beyl, *Arnold Dodel (1843–1908) und die Popularisierung des Darwinismus* (Frankfurt am Main, 1984); "Tschulok, Sinai", in A. Bruckner (ed.), *Neue Schweizer Biographie* (Basel, 1938), 315.
  67. Schaxel claimed he had first joined the SPD before 1914, but had appropriately left in disgust at the party's approval of war credits, so that in 1918 he was *re-joining* (why not the anti-war USPD?). But he reckoned he did nothing before the Revolution; membership began to matter only when it was open. See EHHS: "Autobiographie", 10–11 and 26–27.
  68. Thüringisches Hauptstaatsarchiv Weimar (THStAW): Thür. Volksbildungsministerium (Abt. C), Personalakte Schaxel 376, Bl. 139RS. On the *Nichtordinarien* movement, see Alexander Busch, *Die Geschichte des Privatdozenten: Eine soziologische Studie zur großbetrieblichen Entwicklung der deutschen Universitäten* (Stuttgart, 1959), 109–13; Rüdiger vom Bruch, "Universitätsreform als soziale Bewegung: Zur Nicht-Ordinarienfrage im späten deutschen Kaiserreich", *Geschichte und Gesellschaft*, x (1984), 72–91.
  69. "Politische Professoren", *Vossische Zeitung*, 25 April 1922, cited by Döring, *op. cit.* (ref. 63), 73–75. In Jena, Schaxel counted, out of 180 teaching officers, four full- and two part-timers who were social democrats, of whom four were appointed by the Greil ministry, which also quite exceptionally promoted Karl Korsch to professor; see Schaxel's "Die thüringische Landesuniversität unter dem Ministerium Greil", *Leipziger Lehrerzeitung*, xxxi, Sondernummer "Schulreform in Thüringen", February 1924, 20–21. Korsch was sacked after he had briefly become justice minister as one of three communists to join the government in September

- 1923; he eventually won back his professorship on condition he held no lectures; see Jürgen John's contribution to Siegfried Schmidt (ed.), *Alma Mater Jenensis: Geschichte der Universität Jena* (Weimar, 1983), 250–97, pp. 275–6.
70. On the persecution at Heidelberg of E. J. Gumbel, the radical mathematical statistician who documented the political murders of the post-war years, see Wolfgang Benz, "Emil J. Gumbel: Die Karriere eines deutschen Pazifisten", in Ulrich Walberer (ed.), *10. Mai 1933: Bücherverbrennung in Deutschland und die Folgen* (Frankfurt am Main, 1983), 160–98; Emil Julius Gumbel, *Auf der Suche nach Wahrheit: Ausgewählte Schriften, versehen mit einem Essay von Annette Vogt* (Berlin, 1991); Christian Jansen, *Emil Julius Gumbel: Portrait eines Zivilisten* (Heidelberg, 1991). On the right-wing campaign against the much more secure Einstein, see Hubert Goenner, "The reaction to relativity theory, I: The anti-Einstein campaign in Germany in 1920", *Science in context*, vi (1993), 107–33.
  71. Max Steinmetz (ed.), *Geschichte der Universität Jena 1548/58–1958* (2 vols, Jena, 1958 and 1962), i, 542–6; Schmidt (ed.), *op. cit.* (ref. 69), 258–87; Weindling, *op. cit.* (ref. 5), 327–8.
  72. Peter Gay, *Weimar culture: The outsider as insider* (Harmondsworth, 1974 [1969]). On industrial scientists, see Jeffrey A. Johnson, "Academic, proletarian, ... professional? Shaping professionalization for German industrial chemists, 1887–1920", in Geoffrey Cocks and Konrad H. Jarausch (eds), *German professions, 1800–1950* (New York and Oxford, 1990), 123–42.
  73. On the political history of the labour movement in the Weimar Republic, Heinrich August Winkler's *Monumentalwerk* is indispensable: *Von der Revolution zur Stabilisierung: Arbeiter und Arbeiterbewegung in der Weimarer Republik 1918–1924*, 2nd edn (Bonn, 1985); *Der Schein der Normalität: Arbeiter und Arbeiterbewegung in der Weimarer Republik 1924–1930*, 2nd edn (Bonn, 1988); *Der Weg in die Katastrophe: Arbeiter und Arbeiterbewegung in der Weimarer Republik 1930–1933*, 2nd edn (Bonn, 1990).
  74. On the SPD-left, see Dietmar Klenke, *Die SPD-Links in der Weimarer Republik: Eine Untersuchung zu den regionalen organisatorischen Grundlagen und zur politischen Praxis und Theoriebildung des linken Flügels der SPD in den Jahren 1922–1932* (2 vols, Münster, 1983); Franz Walter, Tobias Dürr and Klaus Schmidtke, *Die SPD in Sachsen und Thüringen zwischen Hochburg und Diaspora: Untersuchungen auf lokaler Ebene vom Kaiserreich zur Gegenwart* (Bonn, 1993).
  75. On the reforms of the Greil ministry and the "Thuringian University Conflict", see Steinmetz (ed.), *op. cit.* (ref. 71), i, 571–5; Paul Mitzenheim, *Die Greilsche Schulreform in Thüringen: Die Aktionseinheit der Arbeiterparteien im Kampf um eine demokratische Einheitsschule in den Jahren der revolutionären Nachkriegskrise 1921–1923* (Jena, 1965); Schmidt (ed.), *op. cit.* (ref. 69). Schaxel is mentioned by Reinhard Buchwald, *Miterlebte Geschichte: Lebenserinnerungen 1884–1930*, ed. by Ulrich Herrmann (Cologne, 1992), 330–1. On social-democratic school policy more generally, see Wolfgang W. Wittwer, *Die sozialdemokratische Schulpolitik in der Weimarer Republik* (Berlin [W], 1980).
  76. For the phone-call, see Friedrich Stier to Ministerialdirektor, 16 May 1924, THStAW: Personalakte Schaxel 376, Bl. 144. For the offending article, the relatively liberal Jena law professor Rudolf Hübner's triumphalist retrospect at the Association of German Universities conference in Jena, see "Der Kampf der Universität Jena mit dem Ministerium Greil", *Mitteilungen des Verbandes der Deutschen Hochschulen*, iv (1924), 26–33, p. 32; see also "Dokumente zum Konflikt der Universität Jena", *ibid.*, 2–7. For Schaxel's side of the story, see his "Landesuniversität" (ref. 69).
  77. For negotiations over the *Zoologischer Bericht*, see the correspondence between Schaxel and Fischer; THStAW: Bestand Gustav Fischer, 1921 and 1922, for permission to consult which I thank Johanna Schlüter. See also *Verhandlungen der Deutschen Zoologischen Gesellschaft*, 1921, 41–42; 1922, 34–35; 1923, 29.

78. *Ibid.*, 1924, 7, 63–64.
79. Quoted from Armin Geus and Hans Querner, *Deutsche Zoologische Gesellschaft 1890–1990: Dokumentation und Geschichte* (Stuttgart, 1990), 107 (I did not have access to the Society's archive).
80. *Verhandlungen der Deutschen Zoologischen Gesellschaft*, 1936, 15.
81. E.g. *GTB*, 51, 68, 124; on arbitration, see e.g. Winkler, *op. cit.* (ref. 73), *passim*.
82. For the promise and his faculty's rejection of it, see THStAW: Personalakte Schaxel 376, Bl. 42, 121.
83. *Entwicklung der Wissenschaft vom Leben* (Jena, 1924), 9–10. Throughout, emphasis is in the originals. The German term 'Wissenschaft' referred more widely to 'scholarship' than the English 'science', but the authors I cite were principally concerned with natural science, or at least took it to be the model of *Wissenschaftlichkeit*.
84. *Ibid.*, 81.
85. *Ibid.*, 83.
86. Julius Schaxel, "Die vitalistischen Irrungen der gegenwärtigen Biologie", *Unter dem Banner des Marxismus*, i (1925–26), 291–301, pp. 293–4.
87. Academic reviews not referred to elsewhere: *Annalen der Philosophie*, v (1925–26), 129\*–130\*; [Rudolph] Zaunick, *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, xxiv (1925), 174; [Otto] Fenichel, *Internationale Zeitschrift für Psychoanalyse*, xi (1925), 490–1.
88. [Tibor] Péterfi, *Zoologischer Bericht*, vi (1925), 427; also in *Anatomischer Bericht*, iv (1925), 561; Julius Schaxel, "Darwinismus und Marxismus: Ein Beitrag zur wissenschaftlichen Voraussetzung des Sozialismus", in Otto Jenssen (ed.), *Der lebendige Marxismus: Festgabe zum 70. Geburtstag von Karl Kautsky* (Jena, 1924; reprinted Glashütten im Taunus, 1973), 485–500; and *idem*, "Politische Zoologie: Eine Richtigtstellung", *Der Freidenker*, vi (1930), Nr. 8.
89. Compared to the first five years, the rate of publication of the *Abhandlungen* and the seniority of the contributors were lower after 1924, but I have no evidence that political discrimination was the reason. Schaxel was still able to publish monographs by Bertalanffy and Weiss.
90. Stier to Stiftungskommissar Erbsen, 31 July 1928, Firmenarchiv Carl Zeiss Jena G.m.b.H: BA CZ 1491, Bl. 258.
91. Döring, *op. cit.* (ref. 63), 146–7; Julius Schaxel, "Universität und Proletariat", *Vorwärts*, 10 October 1929. Together with Siemsen, Schaxel opposed Hendrik de Man and the unsuccessful *Bund sozialistischer Akademiker*; see his "Die Intellektuellen und der Sozialismus", *Das Volk* (Jena–Weimar; hereafter *DV*), 29 May 1926. On the *Bund*, see Walter, *op. cit.* (ref. 20), 89–130.
92. Pierre Bourdieu, *Homo academicus*, transl. by Peter Collier (Cambridge, 1988).
93. Karl August Wittfogel, *Die Wissenschaft der bürgerlichen Gesellschaft: Eine marxistische Untersuchung* (Berlin, 1922), 78. Schaxel used the book in preparing *Entwicklung der Wissenschaft vom Leben*, an extract containing this passage was published in *Urania*, i (1924–25), 153–6, and Wittfogel was personally involved in the *Urania* project. On Wittfogel, see G. L. Ulmen, *The science of society: Toward an understanding of the life and work of Karl August Wittfogel* (The Hague, 1978).
94. On the literati, see Istvan Deak, *Weimar Germany's left-wing intellectuals: A political history of the Weltbühne and its circle* (Berkeley, 1968).
95. Schaxel, *Entwicklung* (ref. 83), 9.
96. On *Urania*, see Hopwood, *op. cit.* (ref. 17).
97. On labour-movement culture, see especially Hartmann Wunderer, *Arbeitervereine und*

- Arbeiterparteien: Kultur- und Massenorganisationen in der Arbeiterbewegung (1890–1933)* (Frankfurt am Main, 1980); Dieter Langewiesche, "Politik — Gesellschaft — Kultur: Zur Problematik von Arbeiterkultur und kulturellen Arbeiterorganisationen in Deutschland nach dem 1. Weltkrieg", *Archiv für Sozialgeschichte*, xxii (1982), 359–402; Wilfried van der Will and Rob Burns, *Arbeiterkulturbewegung in der Weimarer Republik: Eine historisch-theoretische Analyse der kulturellen Bestrebungen der sozialdemokratisch organisierten Arbeiterschaft* (Frankfurt am Main, 1982); W. L. Guttsman, *Workers' culture in Weimar Germany: Between tradition and commitment* (Oxford, 1990).
98. On the *Naturfreunde*, see Jochen Zimmer (ed.), *Mit uns zieht die neue Zeit: Die Naturfreunde. Zur Geschichte eines alternativen Verbandes in der Arbeiterkulturbewegung* (Cologne, 1984); Hartmann Wunderer, "Der Touristenverein 'Die Naturfreunde': Eine sozialdemokratische Arbeiterkulturorganisation (1895–1933)", *IWK*, xiii (1977), 506–20; Wulf Erdmann and Jochen Zimmer (eds), *Hundert Jahre Kampf um die freie Natur: Illustrierte Geschichte der Naturfreunde* (Essen, 1991); Viola Denecke, "Der Touristenverein 'Die Naturfreunde'", in Franz Walter, Viola Denecke and Cornelia Regin, *Sozialistische Gesundheits- und Lebensreformverbände* (Bonn, 1991), 241–91; and on the proletarian freethinkers, see Wunderer, *op. cit.* (ref. 97), 55–67 and 142–60; Jochen-Christoph Kaiser, *Arbeiterbewegung und organisierte Religionskritik: Proletarische Freidenkerverbände in Kaiserreich und Weimarer Republik* (Stuttgart, 1981). "Proletarian" and "bourgeois" were the left's terms for labour-movement and non-labour-movement institutions; they do not, of course, refer strictly to members' class origin.
  99. Hopwood, *op. cit.* (ref. 17). Schwartz, *Eugenik* (ref. 14), shows that medical and social policy experts were able to anchor eugenic policies in the social-democratic parliamentary parties of the *Reich* and key *Länder*, but only because they bypassed party conferences and other fora in which heated opposition was expressed.
  100. Der Eckensteher ("The Loafer"), "Politik und Vererbung", *Monistische Monatshefte*, xiii (1928), 24–30, p. 24.
  101. Eduard Bernstein, *Wie ist wissenschaftlicher Socialismus möglich?* (Berlin, 1901), 32; see also Robert N. Proctor, *Value-free science? Purity and power in modern knowledge* (Cambridge, Mass., 1991), 128–9.
  102. Schaxel, *Entwicklung* (ref. 83), 80. Schaxel's architectural metaphor was borrowed from the one Kautsky used against Bernstein, for which see Bayertz, *op. cit.* (ref. 17), 377.
  103. Schaxel, *Entwicklung* (ref. 83), 79–80.
  104. Julius Schaxel, "Rückblick und Ausblick", *Urania*, iii (1926–27), 1–3.
  105. For "sifters and filters", see *ibid.*, 2. Writing in a scientific news magazine, Schaxel denied with reference to the Soviet Union that there was "a communist astronomy or biochemistry"; see "Wissenschaft im Dienste der Gesellschaft: Eindrücke aus Sowjet-Russland", *Die Umschau*, xxx (1926), 145–7. He could consistently deny that the content of *particular sciences* was *already* different in the first socialist state. Schwartz, *Eugenik* (ref. 14), 37, has argued that socialist experts restricted themselves to critical reception or application of eugenic science because they were generally not engaged in scientific research. Schaxel's case shows that a biology professor could consider critical work the top scientific priority. More generally, even the most productive researcher could make synthetic claims only by reviewing fields in which s/he was not a specialist.
  106. Schaxel, *Entwicklung* (ref. 83), 7–8.
  107. Kelly, *op. cit.* (ref. 14), 54. There are some parallels with the British biologist Lancelot Hogben's work in the Plebs League, but Schaxel insisted that experts were needed not so much because their science had the answers as because of the severe, unresolved problems in biology; see

- Rée, *op. cit.* (ref. 22), 37–45.
108. Schaxel, *Entwicklung* (ref. 83), 26–27; the reference is to Haeckel's defence of Darwinism as "aristocratic" against Rudolf Virchow's charge that it was socialist. On the 'vulgar' materialists, see Frederick Gregory, *Scientific materialism in nineteenth century Germany* (Dordrecht, 1977).
  109. See, for example, Klenke, *op. cit.* (ref. 74); and, relentlessly, Helmut Gruber, *Red Vienna: Experiment in working-class culture 1919–1934* (New York and Oxford, 1991).
  110. *Der neue Rundfunk*, i (1926), 868.
  111. *Urania*, i/4 (1925), p. I.
  112. Reviews: *Der Naturfreund*, xxix/7–8 (1925), cover; *Die Naturfreunde*, iv (1925), 77; *Solinger Volksblatt*, quoted in *Urania*, ii/3 (1925), p. IV; an extract, "Wissen und Handeln", was reprinted in *Der Aufstieg*, v/4 (1925), 4–7; the book was commended by K. Schäfer, "Darwinismus, Lamarckismus und Sozialismus", *Urania*, i (1924–25), 257–9, p. 259, and Ernst Mühlbach, "Was jeder von der Abstammungslehre wissen sollte", *Urania*, ii (1925–26), 13–15, p. 13; it was also translated into Russian.
  113. Richard Goldschmidt, *Ascaris: Eine Einführung in die Wissenschaft vom Leben für Jedermann* (Leipzig, 1922). Goldschmidt's book was more than three times as long as Schaxel's, highly illustrated, and this Thomas edition was probably priced outside most workers' reach.
  114. *Anatomischer Bericht*, i (1923–24), 176.
  115. [Rudolf] Wilke, writing in a "bourgeois" library journal. He reckoned that, "How little the tight association of socialism and biological science, in which Schaxel believes, actually exists, appears even in the way his biological exposition basically stands unconnected next to the socialist one". He was perplexed by Schaxel's combination of "unclear and internally long overcome scientism [*Szientifismus*]" with a "no less unclear relativism and — *sit venia verbo* — antiscientism". See *Hefte für Büchereiwesen*, x (1926), 352–3.
  116. The left-radical SPD literary intellectual Dr Karl Schröder considered the book important in spite of its difficulty and less than unified construction; see *Bücherwarte*, i (1926), 17.
  117. Ludwig Plate, *Archiv für Rassen- und Gesellschafts-Biologie*, xviii (1926), 223. Schaxel had himself written book reviews for the *Archiv* in its more pluralist days under the Empire.
  118. Anon., "Allerlei Wissenswertes", *Urania*, ii (1925–26), 379.
  119. Bourdieu, *op. cit.* (ref. 92), 11.
  120. Julius Schaxel, "Paul Kammerer", *Urania*, iii (1926–27), 74–75. Herbert Richter, commenting in the magazine of the Saxon *Naturfreunde* after reading what Schaxel had written, reckoned that "[a]nyone who had believed till now that science and its teaching was free, will be taught otherwise by the obituary for the revolutionary among scholars, Paul Kammerer"; see *Der Wanderer*, ix/6 (1927). On Kammerer, see Arthur Koestler, *The case of the midwife toad* (London, 1971); Albrecht Hirschmüller, "Paul Kammerer und die Vererbung erworbener Eigenschaften", *Medizinhistorisches Journal*, xxvi (1991), 26–77.
  121. "Paul Kammerers Bedeutung für die Biologie", 7 December 1926, EHHS: "MS von Vorträgen, die von J. Schaxel gehalten wurden".
  122. Rudolf Lämmel (ed.), *Urania-Kalender für das Jahr 1927* (Jena), 77.
  123. Schaxel, *Entwicklung* (ref. 83), 8.
  124. Compare Richard Goldschmidt's view: "Of course there are professional popularizers.... Not having first-hand information, they usually cannot discern what is important or unimportant, essential or nonessential, certain or controversial. In addition they tend to exaggerate, to be sensational, to promise future developments, to cater to the taste of the lower class of readers. It is therefore the duty of the man with the first-hand information to disseminate it...." See *In and out of the ivory tower: The autobiography of Richard B. Goldschmidt* (Seattle, 1960), 69. For monists in general demanding that scientists should address the public directly, see Niles

- R. Holt, "Monists and Nazis: A question of scientific responsibility", *Hastings Center Report*, v (issue of April 1975), 37–43, p. 42.
125. Adolf Lau, *Fahrtgenöß* (Zentrale Wien), vi (1925), 6–8. The social democrat Lau had been the Reich leadership's main local supporter in their expulsion of communists from the Brandenburg district at the end of the previous year; see Wolfgang Bagger, "Die fraktionelle Spaltung des Touristen-Vereins 'Die Naturfreunde' im Gau Brandenburg und in Berlin 1924/1925", *Grüner Weg* 31a, x (issue of January 1996), 3–15. I am very indebted to Dr Bagger for the following biographical information: Born in Rostock, Lau (1897–1974) left elementary school to train as a carpenter; he launched himself on an active career in the socialist cultural organizations by attending the Workers' Educational School of the USPD in Berlin in 1917.
  126. August Thalheimer, "Die Auflösung des Austromarxismus", *Unter dem Banner des Marxismus*, i (1925–26), 474–557, a review of Jenssen (ed.), *op. cit.* (ref. 88).
  127. On *Urania* readers' interpretive competence, see further Hopwood, *op. cit.* (ref. 17).
  128. Anon., *op. cit.* (ref. 118). The book was actually published as *Das Geschlecht: Seine Erscheinungen, seine Bestimmung, sein Wesen bei Tier und Mensch* (Jena, 1926).
  129. Herbert Richter, *Der Wanderer* (Sachsen), xiv/7 (1932). The programme is described in Hopwood, *op. cit.* (ref. 17).
  130. Interview (Jena, 22 March 1994) with Gerda Groll (née Löttsch, b. 1915).
  131. Interview (Weimar, 29 March 1994) with Karl Brundig (1909–96), a Zeiss worker from 1929, later unemployed and re-employed, who was active in the KPD (Opposition); for his illegal political activity and imprisonment after 1933, see "Niederschrift über die Einheitsbestrebungen und die illegale Tätigkeit der KPDO in Thüringen", unpublished 1956 typescript copy of 1948 statement (kindly supplied by Rüdiger Stutz). For testimony from an older generation of functionaries on their relationship with Schaxel, see Fricke, *op. cit.* (ref. 2), 35–36.
  132. Thalheimer, *op. cit.* (ref. 126), 509. In Fricke's biography, *op. cit.* (ref. 2), contact with the Soviet Union is made theoretically decisive for Schaxel, rather than, as I describe it, secondary to the crucial shift of *Entwicklung der Wissenschaft vom Leben*.
  133. "Generalversammlung der 'Naturfreunde'", *Neue Zeitung*, 16 January 1926; on workers' chess, see Joachim Petzold, "Klassenbewußtsein und Parteipolitik in den Arbeiterschachvereinen", *Mitteilungen aus der kulturwissenschaftlichen Forschung*, xv (1992) 30, issue "Arbeiterkultur und Massenkultur", 165–71.
  134. Brundig interview, *op. cit.* (ref. 131).
  135. Report on the *Gaukonferenz* of 3–4 April 1927 in Erfurt, *Fahrtgenöß*, viii (1927), 23. At the 1931 conference too, Schaxel's "clear comments spiced with humour and intelligible to all went down very well with everyone"; see E. Lamoué, "Unsere Gauversammlung", *Am Wege*, xii (1931), 63.
  136. "Kulturpolitik im NR", Bl. 1a, EHHS: "MS von Vorträgen"; Julius Schaxel, "Wissenschaft" (ref. 105), 146; *idem*, "Von der Wissenschaft in Sowjet-Rußland", *Urania*, ii (1925–26), 161–4. On Schaxel's relations with the Soviet Union, see further Heike Schimke and Dagmar Roth, "Julius Schaxels Eintreten für die Sowjetunion in den Jahren der Weimarer Republik und sein Kampf gegen die faschistische Ideologie", Diplomarbeit, Sektion Biologie, University of Jena, 1988; Ines Andruschek and Frank Wiegand, "Mekka der Proletarier aller Länder oder bolschewistisch-stalinistische Terrorherrschaft? Zu den Aufenthalten Jenaer Arbeiter und Intellektueller in der Sowjetunion zwischen 1921 und 1933", Staatsexamensarbeit, Historisches Institut, University of Jena, 1991.
  137. Julius Schaxel, "Leben und Form", *Urania*, i (1924–25), 9–14; *idem*, "Wiedererzeugung oder Ersatzbildung?", *Urania*, iv (1927–28), 134–9, p. 139.
  138. "Wie die moderne Biologie arbeitet", in Lämmel (ed.), *op. cit.* (ref. 122), 77–78.

139. Compare Schaxel, "Natur" (ref. 31). In 1933 the international circulation of the *Archiv* was 249, of which 71 copies went to subscribers in Germany; see B. Romeis to H. Spemann, 15 January 1934, Senckenbergische Bibliothek, Frankfurt am Main: Spemann papers. I discuss further what made *Urania's* science socialist in Hopwood, *op. cit.* (ref. 17).
140. Julius Schaxel, "Anschauliche Entwicklungsgeschichte", *Urania*, iv (1927–28), 193–7; reprinted in the magazine of the *Naturfreunde* in Brandenburg, *Fahrtgenöß*, ix (1928), 28–29.
141. J. Schaxel, "Ernst Haeckel", *Kulturwille*, vi (1929), 160.
142. On *Jugendweißen*, see Klenke, *op. cit.* (ref. 74), 880–918; Manfred Isemeyer and Klaus Sühl (eds), *Feste der Arbeiterbewegung: 100 Jahre Jugendweihe* (Berlin [W], 1989); Guttman, *op. cit.* (ref. 97), 294–7. In Jena, the "proletarian" freethinkers co-operated in organizing the *Jugendweißen* with the Monist League.
143. Julius Schaxel, *Menschen der Zukunft* (Jena, 1929), 5.
144. For positive reviews, see *Bildungsarbeit* (Wien), xvi (1929), p. xxiv; *Der Atheist*, iii/6 (1929), 15; *Der Freidenker*, v/2 (1929); *Der Naturfreund* (Niedersachsen), viii/5 (1929), 75–76; *Am Wege*, x/3 (1929); *Berg Frei*, viii/2 (1929), 8; *Der sozialistische Freidenker*, iv (1929), 47; *Der Wanderer*, ii/9 (1930), 155; *Volksgesundheit*, xxxix/4 (1929), 84. Praise was not unanimous: precisely the vanguardism and invocation of the freethinkers that Theodor Hartwig, *Urania* author and chairman of the Proletarian Freethinkers International, welcomed in *Der Atheist* earned Schaxel a ticking off in the main daily of the SPD-left; see *Leipziger Volkszeitung*, 18 March 1929. This is explicable in terms of the freethinkers' greater integration into the SPD in Leipzig than in Thuringia; see Klenke, *op. cit.* (ref. 74), 893–905. The national daily *Vorwärts* and the left's cultural monthly *Kulturwille* — which had a commercial interest in other *Jugendweihe* books — disliked his style; see "Drei Jugendweihe-Bücher", *Kulturwille*, vi (1929), 122–3. Probably precisely because of this the book was more-or-less acceptable to both socialists and communists, by whom it was given to two girls at a *Jugendweihe* in Steinheid in the district of Sonneberg in Thuringia; see "Unsere Freidenker-Jugendweihe ein glänzender Erfolg", *Neue Zeitung*, 30 March 1929.
145. "Jugendweihe 1929", *DV*, 17 January 1929; "Konfirmation oder Jugendweihe", *DV*, 18 January 1929; "Jugendweihe 1929", *DV*, 13 February 1929; "Jugendweihe 1929", *DV*, 6 March 1929; "Jugendweihe 1929", *DV*, 16 March 1929.
146. "Jugendweihe 1929 in Jena", *DV*, 23 March 1929.
147. "Die Jahreshauptversammlung der Freidenker: Kommunistische Demagogie — Eine notwendige Erklärung", *DV*, 14 March 1929. The organization split later in the year; see Kaiser, *op. cit.* (ref. 98), 269.
148. Report, including of the speech, from "Jugendweihe", *DV*, 25 March 1929 (note how the sentimental language contrasts with Schaxel's); inscription from a similarly presented copy of Ed. Erkes, *Wie Gott erschaffen wurde* (Jena, 1925), in the archive of the former Thüringer Verlagsanstalt und Druckerei (currently the Druck- und Verlagshaus Jena G.m.b.H.), which Günter Hörnig kindly showed me; interview with Groll, *op. cit.* (ref. 130), who worked later in life to promote *Jugendweißen* in the GDR.
149. Julius Schaxel, "Haeckels Naturgeschichte des Lebens", *Urania*, vii (1930–31), 258–62, p. 262.
150. *Idem*, "Naturdialektik", in *Gegen die Spalter der I. P. F. Vorwärts trotz alledem!* (Protokoll d. IV. Kongresses d. IPF in Bodenbach a. d. Elbe, 15–17 November 1930, Vienna, 1931), 93–116, p. 95. Schaxel helped revise the German text and compiled extracts from the works of the authors Engels cited; see D. Rjazanov, "Einleitung des Herausgebers", in *idem* (ed.), *Marx-Engels-Archiv*, ii (Frankfurt am Main, 1927), 117–50, p. 150.
151. Julius Schaxel, "Das biologische Individuum", *Erkenntnis*, i (1931), 467–92; August Siemsen, *Anna Siemsen: Leben und Werk* (Hamburg and Frankfurt am Main, 1951), *passim*. The



relationship between Haeckel, for whom individuality was a keen interest, Schaxel and Engels needs further investigation. Scientists who became Marxists in the 1930s not uncommonly discovered a sort of “pre-established harmony” between their previous practice and the new philosophy. J. B. S. Haldane, for example, notoriously produced “testimonials” to the “patent medicine” of a dialectical materialism that bore a striking resemblance to his father’s “scientific deism”; see Rée, *op. cit.* (ref. 22), 101–5. Since Schaxel claimed deliberately to have been working towards his “dialectical biology” for his entire career, and especially because Haeckel was a major resource not just for him but for Marxists generally, it is likely that in his case the debts were deeper.

152. EHHS: “Soziale Eugenik und erotisches Kollektiv”, 12 February 1931; for the liaisons, see EHHS: “Autobiographie”, quote from p. 31.
153. Schaxel, “Individuum” (ref. 151), 492.
154. For a list of the university lectures that Schaxel announced, see Penzlin, *op. cit.* (ref. 2), 1029–32, and on their non-disruption, see EHHS: “Autobiographie”, 29.
155. Julia Feinberg, review of “Das biologische Individuum”, *Zeitschrift für Sozialforschung*, i (1932), 234–5. Schaxel had had contact with the Institute as long ago as 1924: he acknowledged their help in the preface to *Entwicklung der Wissenschaft vom Leben*, and brought their work to the attention of *Urania* readers in “Gesellschaftswissenschaftliche Forschungsstätten, 1: Das Institut für Sozialforschung an der Universität Frankfurt a. M.”, *Urania*, i (1924–25), 97–99. Theoretically and in his activism Schaxel was distant from the critical theory of Max Horkheimer and Theodor W. Adorno, and closer to those like Wittfogel who had more influence in the Institute’s early years; see Martin Jay, *The dialectical imagination: A history of the Frankfurt School and the Institute of Social Research 1923–1950* (London, 1973).
156. Schaxel, “Individuum” (ref. 151), 475–6.
157. It remains even today to some small degree open: red biology professors at Harvard have comparatively recently considered dialectics worth reanimating after the dogmatic ossification of its Stalinist phase. See Richard Levins and Richard Lewontin, *The dialectical biologist* (Cambridge, Mass., 1985); and also Peter Taylor’s review of this book, “Dialectical biology as political practice: Looking for more than contradictions”, in Les Levidow (ed.), *Science as politics* (Radical Science series, no. 20; London, 1986), 81–111.
158. On the important role of the socially reforming, left-liberal and Marxist network of “Red Vienna” in the philosophy of the Vienna Circle before 1934, see Alessandra D’Acconti, “The genealogies of logical positivism”, Ph.D. thesis, University of Cambridge, 1995; and also Friedrich Stadler, *Vom Positivismus zur “Wissenschaftlichen Weltauffassung”: Am Beispiel der Wirkungsgeschichte von E. Mach in Österreich 1895–1934* (Vienna and Munich, 1982).
159. Schaxel, “Individuum” (ref. 151), 469.
160. For an example of his writing against religion and going back to nature, see Schaxel, *Menschen* (ref. 143), 42, 46; for the conflictedness of the socialist culture of science in which Schaxel participated, see further Hopwood, *op. cit.* (ref. 17); and on the general viability of social-democratic culture at the end of the Republic, compare Peter Lösche and Franz Walter, “Zur Organisationskultur der sozialdemokratischen Arbeiterbewegung in der Weimarer Republik: Niedergang der Klassenkultur oder solidargemeinschaftlicher Höhepunkt?”, *Geschichte und Gesellschaft*, xv (1989), 511–36, and Hartmann Wunderer, “Noch einmal: Niedergang der Klassenkultur oder solidargemeinschaftlicher Höhepunkt?”, *Geschichte und Gesellschaft*, xviii (1992), 88–93.
161. These ceremonies are usually associated with the right, and Gasman, *op. cit.* (ref. 23), 67–70, described them as a specifically *völkisch* feature of the monist movement. In fact, as the following description will show, left-wing monists worshipped the sun too. On monist science

- as religion, see further C. Hakfoort, "Science deified: Wilhelm Ostwald's energeticist world view and the history of scientism", *Annals of science*, xlix (1992), 525–44; and for a stimulating resource for deeper investigation of the cultural meaning of such festivals than I have attempted here, see Mona Ozouf, *Festivals and the French Revolution*, transl. by Alan Sheridan (Cambridge, Mass., 1988).
162. DV, 22 June 1929; *Neue Zeitung*, 22 June 1929.
  163. "Sonnenwendfeier", DV, 20 June 1931, from which all quotations describing the events are taken; see also DV, 19 June 1931; "Johannistag", DV, 24 June 1931; and *Jenaer Volksblatt*, 20 June 1931.
  164. This and the following extracts are from Schaxel's notes, "Sommersonnenwende 1929/31 Jena", EHHS: "MS von Vorträgen".
  165. H. R. Knickerbocker, *The German crisis* (New York, 1932), 59, 68 (thanks to Jürgen John for drawing this book to my attention); for the election result, see Klenke, *op. cit.* (ref. 74), 729.
  166. Weingart *et al.*, *op. cit.* (ref. 10), 445–55; Paul Weindling, "'Mustergau' Thüringen: Rassenhygiene zwischen Ideologie und Machtpolitik", in Norbert Frei (ed.), *Medizin und Gesundheitspolitik in der NS-Zeit* (Munich, 1991), 81–97; Brigitte Jensen, "Karl Astel — 'Ein Kämpfer für die Volksgesundheit'", in Barbara Danckwortt, Thorsten Querg and Claudia Schöningh (eds), *Historische Rassismusforschung: Ideologen — Täter — Opfer* (Hamburg, 1995), 152–78 (thanks to Paul Weindling for a copy of this article).
  167. "Lodernde Flammen", *Jenaische Zeitung*, 25 June 1931.
  168. "Jenaer Freidenker-Generalversammlung", *Arbeiterpolitik*, 30 January 1932.
  169. W. Meister, "Sonnenwende", *Am Wege*, ix (1928), 81.
  170. EHHS: note added to "Sommersonnenwende", *op. cit.* (ref. 164), dated "19/6/31 Jena; 20/6/31 Eisenberg".
  171. EHHS: "Autobiographie", 27.
  172. Just before his mysterious death Schaxel was closely associated with the German communist leadership in exile; see Krauß (ed.), *op. cit.* (ref. 2), 123. Had he lived he would probably have occupied a very senior position in the GDR; his unexceptional student Georg Schneider was professor of theoretical biology and director of the Ernst-Haeckel-Haus in Jena from 1947 to 1959; see Steinmetz (ed.), *op. cit.* (ref. 71), ii, 808; Gabriele Aust, "Georg Schneider (1909–1970)", in Jena-information (ed.), *Jenaer Straßennahmen erzählen ...* (Jena, 1983), 73–74; Penzlin (ed.), *op. cit.* (ref. 3), 112.