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‘To hold the subject’s territory’: The Swedish Association of Biology Teachers and two curricular reforms, 1960-1965

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The aim of this article is to investigate and analyse the cultural boundaries of school biology, and to a certain extent the natural science subjects in general, in two Swedish curriculum reforms, from the viewpoint of the Swedish Association of Biology Teachers (ABT). Thomas Gieryn’s concept of boundary-work is thus used in analyzing how the ABT acted to ‘hold the subject’s territory.’ The ABT had substantial influence on the content of the new biology curricula, although this was sometimes achieved after internal conflict and required support from other actors, especially university biologists. Upper secondary biology had the highest status and was seen as a science, related to modern biological research and curriculum development in particularly the USA. Despite the efforts of the ABT boundary-work was unsuccessful regarding timetable; the natural science subjects were reduced both on lower and upper secondary level, in contrast to many other Western countries.

Keywords: educational reform, history, science, secondary education

In Europe and America the 1950s and early 1960s was a period of firm belief in science and technology as a foundation for modern, industrialized society, although there was also a growing uneasiness about negative effects of this ‘Atomic Age’ such as the atomic bomb and environmental pollution.¹ During this period significant reforms of science education also took place in many Western countries, and two events have

¹ Mikael Hård and Andrew Jamison, *Hubris and Hybrids: A Cultural History of Technology and Science* (New York & London: Routledge, 2005), 56, 245-48; Michael Godhe, *Morgondagens experter. Tekniken, ungdomen och framsteget i populärvetenskap och science fiction i Sverige under det långa 1950-talet* (Stockholm: Carlssons, 2003), 15-19.

often been seen as the igniting sparks. The Soviet launching of Sputnik in 1957 was a shock especially to the USA, which all of a sudden lagged behind in the Cold War competition. This shock fuelled American and even, for example, British reforms of science education already under way since the mid-1950s.² The other event was the publication in 1959 of C. P. Snow's Rede lecture about the gap between scientists and literary intellectuals. It became widely distributed and highly influential on the debate about the place of science in general education.³

Furthermore, gaining momentum after World War II was a movement away from elitist, multi-tracked secondary schools toward less differentiated, more comprehensive forms of secondary education, which also resulted in revisions of science curricula.⁴ Following 20 years of preparation, the Swedish elitist parallel school system in 1960-65 gave way to a democratic 'school for all', which comprised both primary and secondary education. Science education in the new secondary school has hardly been researched at all within Swedish history of education and science.⁵ It is a particularly interesting case since it displayed similarities but also many notable differences compared to Nordic neighbours such as Denmark as well as the USA and Great Britain.

In this article I will study science education in the transition to the new Swedish secondary school in 1960-65, from the point of view of the Swedish Association of Biology Teachers (ABT).⁶ The ABT, formed in 1933 after a reduction of biology

² John L. Rudolph, *Scientists in the Classroom: the Cold War Reconstruction of American Science Education* (New York: Palgrave, 2002), 1-8; David Layton, *Interpreters of Science: A History of the Association for Science Education* (London: John Murray & the Association for Science Education, 1984), 234.

³ C.P. Snow, *The Two Cultures and the Scientific Revolution: the Rede Lecture* (New York: Cambridge University Press, 1959); Mary Waring, 'Background to Nuffield Science', *History of Education* 8 (1979): 223-37; Emma Eldelin, "De två kulturerna" flyttar hemifrån. C.P. Snöws begrepp i svensk idédebatt 1959-2005 (Stockholm: Carlssons, 2006), 9, 43-61; Kristine Hays Lynning, 'Portraying Science as Humanism – A Historical Case Study of Cultural Boundary Work from the Dawn of the "Atomic Age"', *Science & Education* 16 (2007): 491-96.

⁴ David H. Kamens and Aaron Benavot, 'World Models of Secondary Education, 1960-2000', in *School Knowledge in Comparative and Historical Perspective: Changing Curricula in Primary and Secondary Education*, ed. Aaron Benavot and Cecilia Braslavsky (Hong Kong: Comparative Education Research Centre & Springer, 2006), 135-142.

⁵ Exceptions include, for example, Harry Lindholm, *Föreningarna för matematisk-naturvetenskaplig undervisning. Fortbildning och skolpolitik 1933-1971* (Uppsala: Föreningen för svensk undervisningshistoria, 1991); Staffan Wennerholm, *Framtidsskaparna. Vetenskapens ungdomskultur vid svenska läroverk 1930-1970* (Lund: Arkiv, 2005); and Daniel Lövheim, *Att inteckna framtiden. Läroplansdebatter gällande naturvetenskap, matematik och teknik i svenska allmänna läroverk 1900-1965* (Uppsala: Uppsala University, 2006).

⁶ Subject or teacher associations have received relatively little attention in the history of education and science. However, Layton, *Interpreters of Science* traces the origins of the British Association for Science Education and its precursors from the early twentieth century. Edgar Jenkins, 'The Association for Science Education and the Struggle to Establish a Policy for School Science in England and Wales, 1976-81', *History of Education* 27 (1998): 441-459 focuses on the ASE's internal policy-making. Ivor F.

education in a new secondary school curriculum,⁷ were, paraphrasing David Layton, ‘interpreters of science’ who often had quite a decisive influence on biology in school, both curricula, text books and actual teaching practice. In 1965 the ABT comprised 85% of Sweden’s biology teachers in secondary education.⁸ Maybe the most pronounced aim of the association was expressed by long-time board member Tore Donner:

The most important task for every subject association is, of course, to hold the subject’s territory. It was for this reason that the ABT came into existence and it is this task that the national association as well as its local sections and individual members still are committed to.⁹

Goodson, *Learning, Curriculum and Life Politics: The Selected Works of Ivor F. Goodson* (London & New York: Routledge, 2005), 56-67 analyzes the origins and development of the English school subject geography from the point of view of the Geographical Association and its lobby activities, from the end of the nineteenth century onward. John L. Rudolph, ‘Turning Science to Account: Chicago and the General Science Movement in Secondary Education, 1905-1920’, *Isis* 96 (2005): 353-389 deals in part with the American Central Association of Science and Mathematics Teachers. In the Scandinavian context there is also Lindholm, *Föreningarna för matematisk-naturvetenskaplig undervisning* that follows the history of the Swedish Association for Mathematics and Natural Science Teaching. There are a few studies that partly or as a whole deal with secondary school biology, for example, William V. Mayer, ‘Biology Education in the United States During the Twentieth Century’, *The Quarterly Review of Biology* 61 (1986): 481-507; Dorothy B. Rosenthal and Rodger W. Bybee, ‘Emergence of the Biology Curriculum: A Science of Life or a Science of Living?’, in *The Formation of School Subjects: The Struggle for Creating an American Institution*, ed. Thomas S. Popkewitz (New York: Falmer Press, 1987), 123-144; Philip J. Pauly, ‘The Development of High School Biology: New York City, 1900-1925’, *Isis* 82 (1991): 662-688; Philip J. Pauly, *Biologists and the Promise of American Life: From Meriwether Lewis to Alfred Kinsey* (Princeton: Princeton University Press, 2000), 171-193; Rudolph, *Scientists in the Classroom*; Edgar Jenkins, *From Armstrong to Nuffield: Studies in Twentieth-Century Science Education in England and Wales* (London: John Murray, 1979), ch. 4; Ivor F. Goodson, *Studying Curriculum: Cases and Methods* (Buckingham: Open University Press, 1994), 40-50; Ole Andreas Isager, *Den norske grunnskolens biologi i et historisk og komparativt perspektiv* (Oslo: Universitetet i Oslo, 1996); Wennerholm, *Framtidsskaparna*; and Lövheim, *Att inteckna framtiden*.

⁷ The Swedish *undervisningsplan* and later *läroplan* constituted official, national documents that prescribed the content and goals for the Swedish school, much as the German *Lehrplan*. The term *curriculum* will be used as a rough English translation. The Swedish *kursplan* was also an official document included in the *läroplan* that prescribed the content and goals for specific subjects. It will accordingly be referred to as subject-specific part of the curriculum.

⁸ Layton, *Interpreters of Science*; RA (Riksarkivet), BF E1:7, letter from the ABT to the National Agency for Education, 1965-11-16. In the early 1960s the ABT was organized as a national association with an executive committee, a board and annual meetings, but it was also made up of local sections with their own boards. In 1965 there were four local sections, the Southern, Western, Dala and Stockholm sections. Decision-making was mainly carried out by the executive and the board, although all important questions were submitted to the annual meeting: RA, BF B1:1, annual reports of the ABT for 1962 and 1963; E1:5, letter from the executive committee to the members, November 1962; Tore Donner, ‘Biologilärarnas förening - 50 år. Några tankar inför ett jubileum’, *Biologen* 49, no. 2-3 (1983): 8.

⁹ Donner, ‘Biologilärarnas förening - 50 år’, 6. All translation from Swedish into English was carried out by the author.

The aim of this article is, more specifically, to investigate and analyse the cultural boundaries of school biology, and to a certain extent the natural science subjects in general, in two Swedish curriculum reforms – the compulsory school reform of 1962 and upper secondary school reform of 1964 – from the viewpoint of the ABT.¹⁰

Ivor F. Goodson argues that ‘subjects are not monolithic entities but shifting amalgamations of subgroups and traditions which through contestation and compromise influence the direction of change. . . . the debate over curriculum can be interpreted in terms of conflict between subjects over status, resources and territory.’¹¹ I believe that the concept of *boundary-work* from the sociology of science is a useful tool for analyzing such curriculum conflicts.

According to Thomas F. Gieryn the boundaries of science are constantly being contested in a variety of societal settings. Boundary-work is a sociological explanation for the cultural or epistemic authority of one image of science over another, and as such it is a kind of cultural cartography that results in *cultural maps* of school biology, in this case related to new biology curricula. Furthermore, Gieryn writes that ‘boundary-work is a likely stylistic resource for ideologists of a profession or occupation’, that is, for *cultural cartographers*, when the goal is monopolization or expansion of its authority and expertise or protection of its autonomy.¹² The dynamic between these two aspects of boundary-work – the cultural maps and their cartographers, or the construction of school biology and those who do the constructing – is an interesting one that will follow through this article when analyzing the boundaries and inner landscape of the cultural maps of school biology. The ultimate power to decide what cultural maps of school biology would find their way into the curriculum – and thus to achieve what

¹⁰ The source material utilized in this study is minutes of the ABT executive committee, board and annual meeting, ABT annual reports and official statements as well as the ABT journal – *Medlemsblad för Biologiläraarnas förening (MB)* for 1960-1964 and *Biologen* for 1965. Private letters have supplemented this material when relevant. Furthermore, various curricula as well as parliamentary documents such as official reports (SOU) and bills have also been used. The method employed is a hermeneutic method, that is, a method of interpretation. The stance put forward here is historicist, that is, that meaning is determined by the context in which the source material was written as well as the historian’s own context: Peter Burke, *History and Social Theory* (Cambridge: Polity Press, 1992), 17-21; Ian MacLean, ‘Reading and Interpretation’, in *Modern Literary Theory: A Comparative Introduction*, ed. A. Jefferson and D. Robey (London: B.T. Batsford, 1986), 122-24, 136-38.

¹¹ Goodson, *Studying Curriculum*, 42.

¹² Thomas F. Gieryn, *Cultural Boundaries of Science: Credibility on the Line* (Chicago: University of Chicago Press, 1999), 1-25; Thomas F. Gieryn, ‘Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists’, *American Sociological Review* 48, no. 6 (1983): 781-795 (quote on p. 791). In recent years Gieryn’s boundary-work concept has been employed in studies within curriculum history and history of science education. See, for instance, John L. Rudolph, ‘Portraying Epistemology: School Science in Historical Context’, *Science Education* 87 (2003): 64-79 and Hays Lynning, ‘Portraying Science as Humanism’.

sociologists of science and technology call *closure*¹³ – lay with Parliament, which was potentially influenced by various cartographers and interests, not just the ABT.¹⁴

Organization and governance of the Swedish school

The governance of the Swedish public school system was quite unique from an international point of view, since the Government's political and non-political administration were organized separately. The Ministry of Education and Ecclesiastical Affairs (*Ecklesiastikdepartementet*) was the central political body with the Social Democrat Minister Ragnar Edenman as its head between 1957 and 1967. The Minister appointed commissions, received statements in response to the commissions' proposals as well as presented bills. The two chambers of the *Riksdag* (Parliament) constituted the highest decision-making body, but every resolution was prepared and in practice decided in advance by the special school committee (*särskilda skolutskottet*). The National Agency for Education (*Skolöverstyrelsen*), formed in 1920, constituted the non-political central administration, which executed and followed up reforms, supervised teacher pre-service and in-service education, funded pedagogical research etc.¹⁵

Prior to the 1962 compulsory school reform the Swedish school was divided between several different, partly parallel educational forms. The basic distinction was between elementary/primary education – *folkskola*, a locally organized seven-year school for the children of workers, farmers and the lower middle class – and secondary education – *läroverk*, which was a school for middle and upper class boys organized by

¹³ In this context closure means finished, conclusive boundary-work for the cultural map of biology that went into the curriculum: Wiebe E. Bijker, *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change* (Cambridge, MA & London: MIT Press, 1995), 84-88.

¹⁴ Gieryn, *Cultural Boundaries of Science*, 6-12. There is a wide range of literature relating to the role of place and space in the construction of science. Along with Simon Naylor one can roughly divide such studies into those that deal with actual geographies of science, that is, the spaces where scientists have worked such as laboratories, schools, museums, cities, regions, and those which address the 'cultural spaces' or cartographies of science, such as the cited works of Gieryn: Simon Naylor, 'Introduction: Historical Geographies of Science – Places, Contexts, Cartographies', *British Journal for the History of Science* 38 (2005): 1-12. See, for example, Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, NJ: Princeton University Press, 1985), 333-42; Steven Shapin, 'The House of Experiment in Seventeenth-Century England', *Isis* 79 (1988): 373-404; Pauly, 'The Development of High School Biology'; and David N. Livingstone, *Putting Science in Its Place: Geographies of Scientific Knowledge* (Chicago & London: University of Chicago Press, 2003).

¹⁵ Sixten Marklund, *Skolsverige 1950-1975. Del 3, Från Visbykompromissen till SIA* (Stockholm: Liber, 1983), 91-111; Sixten Marklund, *Skolsverige 1950-1975. Del 6, Rullande reform* (Stockholm: Liber, 1989), 168-89; Gunnar Richardson, *Svensk utbildningshistoria. Skola och samhälle förr och nu* (Lund: Studentlitteratur, 1999), 192-98.

the Government. Secondary education was divided into two different school forms, *realskola* and *gymnasium*, chronologically following one another. Since girls were not allowed in secondary schools until 1927 private girls' schools constituted yet another form of secondary education. There was also a number of other, often locally organized, secondary schools – *högre folkskola*, *kommunal mellanskola*, *fortsättningsskola* – some of which could also be vocational.¹⁶ The 1962 reform meant the introduction of a unitary, obligatory school form for both sexes and the children of all classes – *grundskola*, a nine-year compulsory school. In 1964 came a reform of upper secondary level – the voluntary *gymnasium*. Lower secondary level – *realskola* – had then already merged with the new compulsory school.¹⁷

Reduction of science education: Biology in the new compulsory school curriculum

The question of creating a compulsory school for the children of all classes – variously known as a *bottenskola* or *enhetsskola* – had been debated ever since the teacher Fridtjuv Berg first argued for it in 1883.¹⁸ The 1946 School Commission (*1946 års skolkommision*) proposed in its historical report of 1948 a fusion of the *folkskola* and *realskola* into a unified nine-year compulsory school for all children, which was deemed essential for the continued democratization of society. A new compulsory school would make education democratic by including previously disadvantaged pupils as well as promoting experiential pedagogy, according to a bill two years later. The parliamentary resolution of 1950 became a compromise: school attendance was to be extended to nine years and the already initiated local compulsory school experiments expanded. Exactly what this new school form would look like remained unclear,

¹⁶ The *folkskola* was often unisex in the countryside but divided in the cities. Other vocational schools at both lower and upper secondary level were, for example, *verkstadsskola*, *lärlings- och yrkesskola*, technical upper secondary school (*tekniskt läroverk*) and higher commercial school (*handelsgymnasium*): Sixten Marklund, *Skolsverige 1950-1975. Del 1, 1950 års reformbeslut* (Stockholm: Liber, 1980), 14-41; Jonas Hallström, 'Elementary School Technology Education in Sweden, ca. 1900-1920', in *PATT 18, Pupils' Attitudes Towards Technology, International Conference on Design and Technology Educational Research 2007, Teaching and Learning Technological Literacy in the Classroom*, ed. John R. Dakers, Wendy J. Dow and Marc J. de Vries (Glasgow: Faculty of Education, University of Glasgow, 2007).

¹⁷ Richardson, *Svensk utbildningshistoria*, 59-91; Sven Hartman, *Det pedagogiska kulturarvet. Traditioner och idéer i svensk undervisningshistoria* (Stockholm: Natur och kultur, 2005), 34-38, 47-54. The ABT and the other subject associations were mainly interested in secondary education, that is, *läroverket* before the reform and the last three years of compulsory school (*högstadiet*) and the *gymnasium* after the reform.

¹⁸ Hartman, *Det pedagogiska kulturarvet*, 245-248.

however, and the definitive introduction of a compulsory school was made dependent on the outcome of the experiments.¹⁹

The obscurities of the school resolution of 1950 resulted in a statement by the Swedish *Riksdag* in 1956. It was then stated that a nine-year common compulsory school definitely would be created. The 1957 School Commission (*1957 års skolberedning*) presented the details of the compulsory school reform in its proposal in 1961.²⁰ When the proposal arrived to the ABT its board distributed the proposal to some selected individual members in Stockholm and to representatives of the Southern and Western local sections. The final version of the ABT official statement became a compromise between these actors' opinions.²¹

Swedish subject associations in general had varying comments on the proposal of the Commission, both subject-specific and more general ones, but the ABT focused on the biology subject itself in its official statement. The reform of compulsory education was a major change in Swedish educational history, since the democratic implications were that children of both sexes and all classes would attend the same school, not various parallel school forms. Secondary school teachers had generally been against the reform – especially the undifferentiated school classes – but the ABT only commented these big changes incidentally. The reason for this was probably that political peace had been reached as early as 1960 – the so-called ‘Visby compromise’ – when Social Democrats, Liberals and the other political parties agreed on a compulsory school where only the ninth grade would be differentiated and modeled on the earlier *realskola*. Consequently, there was presumably no point in commenting other issues than the strictly subject-related.²²

In its statement, first of all, the ABT regretted that the number of hours per week for biology and chemistry had been reduced compared to the prevalent *realskola* – one and

¹⁹ SOU 1948:27; Government Bill No. 54, in *Bihang till riksdagens protokoll 1962*, 1 saml., C9, 23 February 1962, 5; Richardson, *Svensk utbildningshistoria*, 72-75; Marklund, *Skolsverige 1950-1975. Del 1*, 76-81.

²⁰ SOU 1961:30; Government Bill No. 54, in *Bihang till riksdagens protokoll 1962*, 1 saml., C9, 23 February 1962, 1-10; Richardson, *Svensk utbildningshistoria*, 75, 189-92. The proposal was presented as a couple of separate official reports as well as a school law, but for the sake of simplicity they are seen as a unified proposal. This proposal and the proposal of a reform of upper secondary education were both sent to different bodies and associations for comment. The official response of a particular association in the form of a written statement is called *remissvar* in Swedish.

²¹ RA, BF A1:2, minutes of the executive committee, 1961-02-21; E1:5, letter from the Ministry of Education and Ecclesiastical Affairs, 1961-07-17, letter from the chairman of the ABT to the board, 1961-08-03, and minutes of the board, 1961-10-21.

²² Marklund, *Skolsverige 1950-1975. Del 3*, 32-111. The Conservative Party was initially against the reform but yielded rather late in the process.

half an hour respectively. This would mean a serious impairment of science education, while the humanities instead gained ground:²³

Society of tomorrow will be dominated by natural science and technology to a much greater extent than today. . . . Therefore it seems inexcusable to weaken essential parts of the basic biological education on which all specialist education is based. Furthermore, biology in itself contains great educative [*allmänbildande*] values. . . . The threatening destruction of invaluable Swedish natural resources requires as prime counter-measure teaching about the laws that regulate the balance of nature. Nature conservation (including water protection) must become a reality for our people in an entirely new way compared to before.²⁴

The proposed reduction of biology education is very surprising. The natural science subjects would lose one and a half hours per week compared to the *realskola* (see Table 1). The total amount would decrease from 37 to 35 and the timetable was extremely crowded in Swedish schools; 15 subjects competed about the proposed 35 hours per week.²⁵ Still it is something of a mystery that Parliament passed a reform that reduced science education when science and technology were commended by the School Commission itself and were generally held in such high esteem at the time.²⁶

Apart from the overall reduction of school time, one explanation may be that the School Commission considered mathematics to play a leading part in the technological advancement of society and therefore increased its share in the timetable, which affected science education negatively. Representatives of industry and universities did not object to this. Furthermore, few other actors joined forces with the ABT and the Association for Mathematics and Natural Science Teaching (*Föreningen för*

²³ Government Bill No. 54, in *Bihang till riksdagens protokoll 1962*, 1 saml., C9, 23 February 1962; RA, BF E1:5, Official statement (*remissvar*) of the ABT regarding the 1957 School Commission's proposal, October 1961, 1.

²⁴ RA, BF E1:5, Official statement of the ABT regarding the 1957 School Commission's proposal, October 1961, 1-2.

²⁵ The School Commission and the 1960 Upper Secondary School Commission both wanted to reduce the total number of weekly hours in secondary education, and referred mainly to the pupils' health but also to the general reduction of hours in working life as reasons for this cut: SOU 1961:30, 197-98; SOU 1963:42, 331-36.

²⁶ SOU 1961:31, 16; *Läroplan för grundskolan* (Stockholm: National Agency for Education, 1962), 117-21. Cf. Sixten Marklund, *Skolsverige 1950-1975. Del 5, Läroplaner* (Stockholm: Liber, 1987), 169-81; Rudolph, *Scientists in the Classroom*, 137-64; Lövheim, *Att inteckna framtiden*, 137-44, 170-71. Lövheim claims that both science and humanities were reduced compared to the previous compulsory school experiments.

matematisk-naturvetenskaplig undervisning) – the latter of which had mixed interests in this issue anyway – in defending the timetable.²⁷

The ABT argued for more biology in the timetable of compulsory school to counteract environmental destruction caused by technology, which was influenced by the incipient environmental awakening and interest in ecology that took place in the Western world in the early 1960s. This has often been seen as triggered by the publication in 1962 of Rachel Carson's book *Silent Spring*.²⁸ It is obvious that something extraordinary happened to the general concern for the environment, but it was a complex process that cannot only be attributed to Carson. Many intellectuals and scientists such as biologists had long been aware of environmental degradation and the need for nature conservation, water protection etc. – the ABT is a prime example of this.²⁹

Secondly, history and social science (*samhällskunskap*) were new as separate subjects on lower secondary level. The 1946 Commission, which was the main designer of the “new” social science subject, placed it on a scientific foundation and expected it to help shape democratic, critical citizens.³⁰ History and social science had gained ground by half an hour in the proposed timetable, whereas the ABT implied that societal aspects of biology were underrepresented. In a statement from Östra real, a secondary school in Stockholm that had helped draft the ABT official statement, this argument can be seen more clearly:³¹

[It is] important to call attention to the fact that certain parts of biology more and more tend to draw near . . . social science. . . . [An] aspect of biology as social science is medicine,

²⁷ SOU 1961:30, 199; Government Bill No. 54, in *Bihang till riksdagens protokoll 1962*, 1 saml., C9, 23 February 1962, 163-64. The School Commission argued against the view that the status of a subject was dependent on its allotted number of hours only; a thorough revision of the curriculum, new teaching methods and cooperation between subjects could give a subject a qualitative boost that counterbalanced the loss of hours: SOU 1961:30, 314-15.

²⁸ Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin, 1962).

²⁹ Håkan Thörn, *Rörelser i det moderna. Politik, modernitet och kollektiv identitet i Europa 1789-1989* (Stockholm: Tiden/Athena, 1997), ch. 7; Donald Worster, *Nature's Economy: A History of Ecological Ideas* (Cambridge & New York: Cambridge University Press, 1994), ch. 16; Björn-Ola Linnér, *The World Household: Georg Borgström and the Postwar Population-Resource Crisis* (Linköping: Linköping University, 1998), 227-34; Sverker Sörlin, *Naturkontraktet. Om naturumgängets idéhistoria* (Stockholm: Carlssons, 1991), 256-58.

³⁰ Tomas Englund, *Läroplanens och skolkunskapens politiska dimension* (Göteborg: Daidalos, 2005), 199-207; Birger Bromsö, *Samhällskunskap som skolämne* (Stockholm: Stockholm University, 1965), 51-67.

³¹ RA, BF B1:1, annual report of the ABT for 1961, 1962-01-03; E1:5, Official statement of the ABT regarding the 1957 School Commission's proposal, October 1961, 2. Tore Linnell, secretary and editor of the journal *MB*, worked at Östra real.

which is occupied with our body's structure and function as well as the dangers that threaten it in modern society. Just because 'social biology' is primarily directed at and interested in the individual human being and her problems it should not be seen as less significant as a societal factor than the parts of social science that deal with the more collective activities of the citizens.³²

Thirdly, the association objected to the heavy emphasis on systematics and classification in the seventh grade. It would seem that the Commission proposed a return to an older form of biology curriculum. Certainly, the ABT realized that it would be convenient in the proposed undifferentiated school classes to keep the pupils busy with determining different species of animals and plants, but it would still be better to focus on ecological interactions and the human role in nature. Finally, the ABT welcomed the focus on experiential education, which meant that excursions and laboratory work became central, but they wanted better school equipment in order to fulfill this.³³

In the spring of 1962 the Swedish Minister of Education and Ecclesiastical Affairs presented the new bill with the compulsory school reform and a parliamentary resolution basically in line with the bill came shortly thereafter. It meant that a new nine-year compulsory school for all citizens gradually became introduced in all of Sweden. The compulsory school was divided into three sections (*stadier*), each comprising three years. The ninth grade was divided into nine parallel programs (*linjer*), theoretical as well as vocational.³⁴

The ABT's distinct emphasis on the number and distribution of hours for biology was a kind of boundary-work in itself; the image and boundaries of school biology depended on the amount of time available to communicate the cultural map to the pupils. The new curriculum was probably a disappointment in this respect, for nothing was changed compared to the proposal. However, regarding content the ABT's boundary-work had been more successful: ecology, nature conservation and evolution

³² RA, BF E1:5, statement from Östra real, not dated.

³³ RA, BF E1:5, Official statement of the ABT regarding the 1957 School Commission's proposal, October 1961, 3-4.

³⁴ Government Bill No. 54, in *Bihang till riksdagens protokoll 1962*, 1 saml., C9, 23 February 1962, 1-10; Richardson, *Svensk utbildningshistoria*, 75, 189-92.

became more central in the new curriculum, besides the earlier items of zoology, botany, genetics, human physiology and health instruction.³⁵

Later in the spring of 1962 there was a discussion of whether or not the association could have done more to promote biology in the compulsory school reform. The National Agency for Education commissioned ABT members Anders Boierth and Stig Fred to write the new biology curriculum, but they had only been able to influence the content and not the allotted weekly hours.³⁶ Perhaps as a result of the lack of support in the question of timetable reduction for biology and the other natural sciences, a broader discussion ensued about the importance of strong allies. One member argued that the ABT needed support from ‘all the professions within the biological sciences.’³⁷

Specialist or generalist? The ABT struggles with new upper secondary biology

The biology curriculum for upper secondary level had not been significantly revised since the 1930s. It basically deepened the aspects of biology found in the curriculum of the *realskola*, but evolutionary theory and genetics also had a more central position.³⁸ In 1959 the ABT board commissioned its executive committee to keep in contact with those who would issue the new biology curriculum for upper secondary level, in order to ‘look after the interests of biology.’³⁹ The next year work of reforming Swedish upper secondary education (*gymnasium*) began when Minister Edenman appointed the 1960 Upper Secondary School Commission (*1960 års Gymnasieutredning*, hereafter abbreviated GU). The reform of upper secondary schools was naturally propelled by the new compulsory school – in a way it was part of the same democratic reform – but it was also a result of an increasing number of pupils and new demands from universities, trade and industry.⁴⁰

³⁵ SOU 1961:31, 16; *Läroplan för grundskolan*, 117-21; *Kursplaner och metodiska anvisningar för realskolan* (Stockholm: National Agency for Education, 1955), 20-21, 128-37. Evolution was hardly noticeable at all in the *realskola* curriculum.

³⁶ RA, BF B1:1, annual report of the ABT for 1961, 1962-01-03; Astrid Wallerius and Tore Linnell, ‘Göteborg, årsmötesplats i år’, *MB* 28 (1962): 3-9.

³⁷ RA, BF A1:2, minutes of the board, 1962-05-31 (official and handwritten).

³⁸ Hugo Grimlund and Harald Wallin, *1933 års läroverksstadga med förklaringar och hänvisningar jämte timplaner och undervisningsplan* (Stockholm: Norstedts, 1939), 326-30.

³⁹ RA, BF A1:1, minutes of the board, 1959-10-31.

⁴⁰ RA, BF B1:1, annual report of the ABT for 1960, 1961-01-03; SOU 1963:42, 76-77; Richardson, *Svensk utbildningshistoria*, 62, 79-83; Henrik Román, ‘Pedagogiken, gymnasieutbildningen och 1960-talets skolreformer - om reformhistoriebruk och en historia i andra hand’, *Studies in Educational Policy and Educational Philosophy*, no. 3 (2003): 1-12.

As a first step, the ABT board summoned its members as well as specially invited non-members interested in the future of biology to a meeting in Stockholm in February 1960. The object was to discuss the coming reform of upper secondary education, particularly the relationship between specialist and comprehensive, generalist knowledge (*allmänbildning*) in biology.⁴¹ The term *allmänbildning* was derived from the German word *Bildung*, meaning comprehensive, all-round knowledge that fundamentally transforms human beings into becoming mature, independent citizens. The closest English translation of *allmänbildning* would be *general, comprehensive* or *liberal education* (or *knowledge*), depending on the context.⁴²

By tradition, Swedish upper secondary schools were regarded as the forecourts of the universities, but in the current educational debate this was being questioned more than before.⁴³ According to Anders Boierth, upper secondary schools should not comply with university demands, since they were so varied. He therefore wanted biology to provide comprehensive knowledge (*allmänbildning*). Most speakers at the meeting agreed with Boierth on this point, but there was less agreement on the specific content of a comprehensive biology subject: ‘Certain fixed knowledge should exist, but exactly what? What is essential?’, said deputy chairman Harry Bergquist.⁴⁴ Some participants argued for species knowledge (*artkunskap*) as essential to biology, whereas others spoke in favor of botany-zoology, genetics or human biology (hygiene, human physiology, sex instruction etc.). Several people talked about ecology as a basic outlook and theme in biology education.⁴⁵ At the annual meeting of 1961, this discussion continued. Bror Forsman and the chairman Karl-Erik Näsmark argued that both

⁴¹ RA, BF B1:1, annual report of the ABT for 1960, 1961-01-03; ‘Gymnasiebiologin åter i stöpsleven. Hur vill vi själva ha den?’, *MB* 26 (1960): 5-10.

⁴² *Bildung* was an ambiguous concept since its inception, and the elitist, neo-humanist meaning that it most often acquired in Scandinavia was derived from the German philosopher and pedagogue Wilhelm von Humboldt, who was Minister of Education in Prussia in the early 1800s. The concept also had an undercurrent related to the ‘practical’ natural sciences and technology that grew in strength in the twentieth century: Sven-Eric Liedman, *Ett oändligt äventyr. Om människans kunskaper* (Stockholm: Bonniers, 2001), 350-55; Sten Högnäs, ‘The Concept of *Bildung* and the Education of the Citizen: Traits and Developments in the Nordic Countries 1870-2000’, in *Nordic Lights: Education for Nation and Civic Society in the Nordic Countries, 1850-2000*, ed. Sirkka Ahonen and Jukka Rantala (Helsinki: Finnish Literature Society, 2001), 29-31; Hård and Jamison, *Hubris and Hybrids*, 111; Hallström, ‘Elementary School Technology Education in Sweden’.

⁴³ Cf. Lövhelm, *Att inteckna framtiden*, 37-38.

⁴⁴ ‘Gymnasiebiologin åter i stöpsleven’, 7.

⁴⁵ RA, BF B1:1, annual report of the ABT for 1960, 1961-01-03; ‘Gymnasiebiologin åter i stöpsleven’, 5-10.

comprehensive and specialist knowledge in biology were needed, but that particularly the former was something that all upper secondary pupils should obtain.⁴⁶

The above discussions on the core of biology went in several different directions, which was typical when identity, boundaries and cultural maps of subjects were challenged in connection with curriculum reforms.⁴⁷ These arguments linked up with a Swedish debate about generalist and specialist knowledge in secondary schools already in swing since several decades, and particularly after the appointment of the GU in 1960 this debate became wide-spread. The discussion in early 1961 was held after the publication of C.P. Snow's *The Two Cultures and the Scientific Revolution* in Great Britain, but before the Swedish translation. Yet the influence of a Swedish reception of Snow could be discerned. For example, one discussant wanted to introduce the history of biology as a way of 'lessening the gap to the humanities.'⁴⁸

To establish where the boundaries of school biology were to be drawn on the ABT's cultural map the executive in 1962 sent out a survey to some 80 experienced upper secondary teachers to ask what they thought were the most essential areas. They prioritized the following aspects of school biology:

1. Human physiology
2. Genetics and evolution
3. Humans and nature
 - Nature conservation
 - Ecology
4. Systematics
5. Species knowledge⁴⁹

The results of the survey were handed over directly to Lars Öhman and Torsten Wickbom, ABT representatives in the GU.⁵⁰

⁴⁶ Astrid Wallerius and Tore Linnell, 'Årsmötet', *MB* 27 (1961): 4-10; Bror Forsman, 'Biologi, special- eller allmänbildningsämne', *MB* 27 (1961): 14-18; Karl-Erik Näsmark, 'Allmänbildning eller specialkunskaper i skolbiologin - lyder frågan', *MB* 27 (1961): 18-21.

⁴⁷ Cf., for instance, Layton, *Interpreters of Science*, 238; Bromsjö, *Samhällskunskap som skolämne*, 65.

⁴⁸ RA, BF E1:5, minutes of the annual meeting, 1961-01-03; Wallerius and Linnell, 'Årsmötet', 8-9 (including quote); SOU 1963:42, 79-81; Wennerholm, *Framtidsskaparna*, 151-61; Lövheim, *Att inteckna framtiden*, 145; Eldelin, *"De två kulturerna" flyttar hemifrån*, 93-121, 138-45.

⁴⁹ RA, BF A1:2, minutes of the board, 1962-10-28.

⁵⁰ RA, BF A1:2, minutes of the executive committee, 1962-09-26, minutes of the board, 1962-10-28; B1:1, annual report of the ABT for 1962, 1963-01-02.

At the annual meeting in January 1963 the reform of upper secondary education spontaneously entered the debate. The igniting spark was a report from the OECD biology education seminar in Switzerland in September 1962, by associate professor in genetics Ruth Sävhaugen. The purpose of the seminar was for biology teachers in secondary education to get into contact with their counterparts in other countries. A concluding comment was that the biology subject was of minor importance in many countries; too few studied biology or they studied too little or obsolete courses. West Germany was pointed out as the prime example of this, whereas the USA was a notable exception. One of the most significant steps to reform biology education was to give teachers the opportunity to keep up with the rapidly developing biological research.⁵¹

Curriculum development in the USA came to affect the current cartography of school biology within the ABT. Tore Donnér compared the American and Swedish ways of reforming the biology curriculum, and wondered gloomily what was going on concerning the current Swedish reform.⁵² Harry Bergquist considered the proposed American curriculum to be radical and essential.⁵³ The curriculum referred to was a reform of secondary biology education under way in the United States, initiated by the Biological Sciences Curriculum Study (BSCS, founded in 1958). Although an incipient reform of science education existed before 1957, it is clear that the launching of Sputnik by the Soviet Union boosted and accelerated this process. The BSCS started a major work of transforming American biology education by enlisting some of the biggest names among university-level biologists, as well as biology teachers in schools. ‘Science as a way of knowing is more important than science as a collection of facts,’ sums up the motto of the reform.⁵⁴ The most enduring contribution of the BSCS was three textbooks in biology, carefully tested in collaboration with teachers and pupils in 1960 to 1962: the Yellow Version (cells, development and evolution), the Green Version (ecology) and the Blue Version (molecular biology).⁵⁵

⁵¹ RA, BF B1:1, minutes of the annual meeting, 1963-01-02; ‘Årsmötet’, *MB* 29 (1963): 8-15.

⁵² ‘Årsmötet’, 13. GU representative Wickbom, for instance, would not disclose anything about the reform or the proposed curriculum: RA, BF B1:1, minutes of the board, 1963-01-02 (handwritten).

⁵³ RA, BF B1:1, minutes of the annual meeting, 1963-01-02.

⁵⁴ Mayer, ‘Biology Education in the United States’, 486. By this time, the physics counterpart to BSCS – PSSC, the Physical Science Study Committee – had already made a deep impression on the Association for Mathematics and Natural Science Teaching. The PSSC came to influence the physics curriculum for upper secondary school: Lindholm, *Föreningarna för matematisk-naturvetenskaplig undervisning*, 127-39.

⁵⁵ Mayer, ‘Biology Education in the United States’, 484-92; Rudolph, *Scientists in the Classroom*, 137-64.

In the fall of 1963 the proposal of a reform of upper secondary education was presented by the Ministry of Education and Ecclesiastical Affairs.⁵⁶ Immediately work began on an official statement from the ABT. The four local sections as well as some individual members were to work out their own drafts, which in turn would be brought together and rewritten as a unified document by a committee, consisting of first deputy chairman Donnér and secretary Tore Linnell. In November a fairly critical draft was presented to the board.⁵⁷

Early 1964 was an intense period in which particularly the members of the board were involved in drafting, circulating and re-writing the official statement of the ABT. Particular concern was caused by information from the ABT biology experts in the GU – Öhman and Wickbom. The biology subject had won respect and a fairly favourable place in the curriculum and timetable thanks to the work of these representatives. It was therefore feared by Donnér and Linnell that a critical statement would upset the GU and endanger the position of biology, whose boundaries were threatened by, for example, the subjects chemistry and religion. It would also show that, in Gieryn's vocabulary, one important group of cultural cartographers, Swedish biology teachers, were not united, which could lead to the questioning of the place of biology in the new upper secondary schools altogether.⁵⁸ It was better to try and secure the number of hours per week that had been proposed: '[W]hat is at stake now is the number of hours per week, which equals survival for upper secondary biology.'⁵⁹

Donnér and Linnell thus sent out a letter to the board to plead for a new drafting round, in order for the criticism in the statement to be softened. The overall response to this plea was positive.⁶⁰ Board member Axel Björklund wrote an interesting answer to the letter, which in many ways sums up the problematic situation:

⁵⁶ The proposal was really presented in a number of separate official reports, but for the sake of simplicity they are seen as a unified proposal. See primarily SOU 1963:42 and 43.

⁵⁷ RA, BF A1:2, minutes of the executive committee, 1963-09-18; minutes of the board, 1963-11-17; E1:7, 'Hur ett remiss-svar kommer till', apology by Donnér and Linnell, February 1964.

⁵⁸ Geography had been removed from the proposed curriculum, and it was feared that the same thing would happen to biology if the ABT did not close ranks. Lennart Hultgren, external biology expert for the GU, wrote to Linnell that '[t]hose in authority has no respect for biology whatsoever, and active propaganda is being made in political circles, even by school representatives, for a removal of biology from upper secondary level': RA, BF E1:7, letter from Lennart Hultgren to Tore Linnell, 1964-01-07.

⁵⁹ RA, BF E1:7, letter from Tore Linnell to the ABT board, 1964-01-18 (including quote), 'Hur ett remiss-svar kommer till', apology by Donnér and Linnell, February 1964.

⁶⁰ RA, BF E1:7, letter from Ove Almborn to Tore Linnell, 1964-01-22.

As I see it, our dilemma is that ‘our’ experts have proposed one (new) kind of biology, while the remaining teachers want to keep another (old) kind. Thus there is disunity since the authorities must be of the opinion that the experts are the spokesmen of the biology teachers. . . . But because [the experts’] opinion probably corresponds more to that of the authorities we have to . . . at least pretend to stand behind the experts.⁶¹

The final statement sent to the Ministry began with a discussion of the Swedish concept of *allmänbildning* related to the natural sciences, which mirrored the GU proposal as well as the current Swedish public debate.⁶² The influence of C. P. Snow was great on the importance that was ascribed to science and technology, but he had really picked up a trend that was growing in significance in Sweden as well as throughout the Western world since the early 1950s. Science and technology were seen as remedies to many world problems – for example, famine in third-world countries⁶³ – and education was believed to play a central part, especially after the ‘Sputnik crisis.’⁶⁴ The debate about what constituted comprehensive knowledge also had its counterparts in other OECD countries, for instance, the USA and Denmark, where there was critique against the dominance of arts and humanities in liberal education/*almendannelse*.⁶⁵

The ABT criticized the highly specialized biology curriculum in the natural science program. The argument was that even though it may be difficult to come to an agreement on the definition of the concept of comprehensive knowledge (*allmänbildning*), the demand for such knowledge was yet imperative: ‘In biology this means reasonable familiarity . . . primarily with nature itself and its components, interaction between them and with human beings, in short ecology. A dynamic society with great technical resources, which as a result of the utilization of nature is capable of fast upheaval, has a strong need of ecological knowledge.’⁶⁶

The most space was devoted to commenting on the biology subject in the natural science program, which was seen as the main track for pupils wanting to become

⁶¹ RA, BF E1:7, letter from Axel Björklund to Tore Linnell, 1964-01-22.

⁶² RA, BF E1:7, Official statement of the ABT regarding the proposal of the GU, 15 February 1964; SOU 1963:42.

⁶³ Linnér, *The World Household*, 227-34.

⁶⁴ George S. Papadopoulos, *Education 1960-1990: the OECD Perspective* (Paris & Washington, D.C.: Organisation for Economic Co-operation and Development, 1994), 11-15, 26-32; Wennerholm, *Framtidsskaparna*, 122-50; Lövheim, *Att inteckna framtiden*, 137-60.

⁶⁵ Paul Duvigneaud and L.C. Comber, *Biology To-day, Its Role in Education: Report of an OECD Working Session on the Teaching of School Biology, Hellebaek (Denmark), June 1964* (Paris: Organisation for Economic Co-operation and Development, 1966), 7; Rudolph, *Scientists in the Classroom*, 118-25, 139-43; Hays Lynning, ‘Portraying Science as Humanism’, 483-86.

⁶⁶ RA, BF E1:7, Official statement of the ABT regarding the proposal of the GU, 15 February 1964, 2.

university-trained physicians, scientists or engineers. The ABT regarded it as ‘a great success for biology that the significance of the subject has been recognized through the creation of a modern biology course,’⁶⁷ but was still not happy with the allotted number of hours per week. The corresponding biology subject in the current upper secondary school had seven hours per week, but the GU wanted to reduce this figure to five.⁶⁸ This would make it quite impossible to make it through the entire new, ambitious curriculum, especially as the pupils from the new compulsory school would bring more superficial knowledge of biology. The ABT pointed to the situation in other Western countries, particularly Denmark where biology had several more hours per week, so at least six hours was a minimum for the Swedish course.⁶⁹

The content of the biology curriculum was deemed modern and highly relevant. Laboratory-oriented biochemistry, molecular biology and cell physiology were dealt with in detail partly because they were new, but also because, for example, university professors in medicine considered them to be the most important.⁷⁰ However, the ABT wondered whether the strong emphasis on these areas of modern biology did not at the same time marginalize traditional field biology. The study of nature, be it evolution or ecology, also required basic systematics and species knowledge.⁷¹

The cartography of the cultural map of the biology subject for upper secondary level obviously involved compromise between different interests, both within and outside the ABT. The laboratory-oriented and physiological bias was partly due to the representatives in the GU having such competence, which also gave them support from interest groups primarily in higher education. Cell physiology, molecular biology, biochemistry and genetics were also the most modern and developed disciplines within the biological sciences, epitomized by the successful DNA research, which was shown

⁶⁷ RA, BF E1:7, Official statement of the ABT regarding the proposal of the GU, 15 February 1964, 5.

⁶⁸ Yet the biology experts in the GU had managed to increase it with one hour per week compared to what was originally suggested: RA, BF E1:8, minutes of the annual meeting of 1964, undated; Elsa Wicklund and Tore Linnell, ‘Årsmötet’, *MB* 30 (1964): 9-15.

⁶⁹ RA, BF E1:7, Official statement of the ABT regarding the proposal of the GU, 15 February 1964, 5-6. The Danish *Gymnasium* was still an elitist institution, however, which meant that it was more specialized: Hays Lynning, ‘Portraying Science as Humanism’, 484.

⁷⁰ This modern focus was also quite natural considering the composition of the whole biology expert group in the GU: Professor Nils Fries (botany, physiology), Associate Professor Peter Perlmann (cell physiology), Principal Torsten Wickbom (genetics, cell physiology) and teacher Lars Öhman (zoology, cell physiology): RA, BF E1:8, minutes of the annual meeting of 1964, undated; Wicklund and Linnell, ‘Årsmötet’, 10.

⁷¹ RA, BF E1:6, letter from Lennart Hultgren to Tore Linnell, 1964-01-14; E1:7, Official statement of the ABT regarding the proposal of the GU, 15 February 1964, 7-9; E1:8, minutes of the annual meeting of 1964, undated; Wicklund and Linnell, ‘Årsmötet’, 10-11.

by the rapid development of research and several Nobel Prizes in the post-war years.⁷² Furthermore, at the international school arena these disciplines dominated the biological sciences, for instance, in the American BSCS textbooks.⁷³ On the other hand, there was also a strand within the ABT that questioned the new and wanted the cultural map of school biology to include more traditional areas (cf. the survey with the 80 teachers).

Compulsory biology was completely missing in the technical program, which was criticized by the ABT, authorities and university institutions as well as many scientists in the public debate.⁷⁴ The ABT argued that particularly future engineers needed knowledge of how nature works – ecology – and how it is to be protected – nature conservation. There was to be a certain amount of biology – nature conservation and water protection – in social science, but the ABT claimed that these areas were in essence biological and thus needed biologically trained teachers, not social science teachers. The association suggested compulsory biology for all programs – apart from the natural science program this would be within the context of the new comprehensive, interdisciplinary subject natural science, *naturkunskap*.⁷⁵

When the Ministry had received official statements from different associations and bodies in the spring of 1964, the ABT's representatives in the GU started revising the original curriculum proposal. In doing this revision Wickbom and Öhman were inspired very much by the ABT's ideas, as they were expressed by Donnér and Linnell.⁷⁶ Most notably, ecology was given an own section, expressed succinctly by Wickbom: 'Above all it was necessary to detach ecology as an item in itself. Our attempt to integrate was not viable but must succumb in the struggle for survival to more vigorous forms of life!!'⁷⁷

In late 1964 came the parliamentary resolution by which upper secondary education was reformed along the same lines as compulsory education. It was to consist of three-

⁷² Nils Uddenberg, *Idéer om livet. En biologihistoria. Band II, Arvets natur, känn dig själv* (Stockholm: Natur och kultur, 2005), 88-99; Liedman, *Ett oändligt äventyr*, 224-29. In 1962, for example, the designers of the DNA double helix model, Francis Crick, James Watson and Maurice Wilkins, received the Nobel Prize in Physiology or Medicine: Nobel Foundation, nobelprize.org, cited 2006-11-03.

⁷³ Rudolph, *Scientists in the Classroom*, 154-56. The BSCS textbooks emphasized genetics, biochemistry, cell physiology, ecology and ethology at the expense of classical morphology and systematics: Mayer, 'Biology Education in the United States', 490.

⁷⁴ Government Bill No. 171, in *Bihang till riksdagens protokoll 1964*, 1 saml., C32, 16 October 1964, 245-46; Lövheim, *Att inteckna framtiden*, 165-69.

⁷⁵ RA, BF E1:7, Official statement of the ABT regarding the proposal of the GU, 15 February 1964, 3-5.

⁷⁶ RA, BF A1:2, minutes of the executive committee, 1964-05-04; E1:7, letter from Tore Linnell to Torsten Wickbom, 1964-04-02, letter from Wickbom to Linnell, 1964-04-04.

⁷⁷ RA, BF E1:7, letter from Wickbom to Linnell, 1964-04-04.

year programs, except for the four-year technical one. The first grade was to give a core of general education, while the two following grades would be more specialized.⁷⁸ The effect of the association upon the finished biology curriculum became quite substantial in the end. Apart from ecology, other matters that were changed on the basis of ABT influence were, for example, evolution as a separate item in the curriculum and the teaching of biology in both second and third grade. However, they did not achieve any more than the five weekly hours in biology.⁷⁹

Although the ABT did not give the proposed timetable as much attention as in the compulsory school reform, it was still an important question. Certainly all programs in the new upper secondary school either got the same or more biology compared to the old *gymnasium*, but this did not apply to the natural science program compared to the previous *reallinje*, biological branch, which lost two hours. This was a big symbolic loss.⁸⁰ In spite of being modernized in content the two other natural science subjects, physics and chemistry, also experienced a reduction on this program of one and one and a half hours respectively, which upset the Association for Mathematics and Natural Science Teaching (see Table 1).⁸¹ The reduction for the natural sciences in the new upper secondary school was thus considerable, despite the GU emphasis on the importance of science and technology, but can partly be explained by the abundance of subjects and overall reduction of school time. The GU asserted that a clearer focus in the natural science curricula and better cooperation between these subjects could make up for lost time.⁸²

⁷⁸ Government Bill No. 171, in *Bihang till riksdagens protokoll 1964*, 1 saml., C32, 16 October 1964, 1-4.

⁷⁹ SOU 1963:42, 43; Official statement of the ABT regarding the proposal of the GU, 15 February 1964; *Läroplan för gymnasiet* (Stockholm: National Agency for Education, 1966), 73, 326-29; Wicklund and Linnell, 'Årsmötet', 11.

⁸⁰ Torsten Wickbom, 'Skolbiologin inför framtiden', *Biologen* 31 (1965): 1-4.

⁸¹ Lindholm, *Föreningarna för matematisk-naturvetenskaplig undervisning*, 141-47; SOU 1963:42; Government Bill No. 171, in *Bihang till riksdagens protokoll 1964*, 1 saml., C32, 16 October 1964; *Läroplan för gymnasiet*, 69-78.

⁸² SOU 1963:42, 140-204, 367-76.

Table 1. Total number of hours per week for mathematics and natural sciences in Swedish secondary education before and after the two reforms.

	Lower secondary level		Upper secondary level	
	<i>Realskola</i> , 1955 timetable, <i>allmän linje</i> , three last grades	Compulsory school, 1962 timetable, grades 7-9	<i>Gymnasium</i> , 1960 timetable, <i>reallinje</i> , biological branch, grades 1-3	<i>Gymnasium</i> , 1966 timetable, natural science program, grades 1-3
Mathematics	11	12	14*	15
Biology	6	5	7	5
Physics	6	6	11.5	10.5
Chemistry	4.5	4	8.5	7
Natural science			2**	3-9***

* In the mathematical branch there were 20 weekly hours.

** On higher commercial schools.

*** On programs other than the natural science and technical ones.

Note: *Kursplaner och metodiska anvisningar för realskolan* (Stockholm: National Agency for Education, 1955), 18-23; *Läroplan för grundskolan* (Stockholm: National Agency for Education, 1962), 117; *Läroplan för gymnasiet* (Stockholm: National Agency for Education, 1966), 69-73; SOU 1963:42, 374.

The ABT, the curricular reforms and Swedish school biology in perspective

Regarding the reform of compulsory education, the members of the association seem largely to have agreed on the *content* – and thus the boundaries – of the cultural map of biology, in which traditional field biology, ecology and human biology dominated. Internal boundary-work was therefore rather unproblematic. The petition to include ecology and nature conservation in the new curriculum was also heeded by the Ministry and the Parliament, so the external boundary-work became fairly successful.

The reform of upper secondary education, on the other hand, was prepared long beforehand with extensive debates about the content of the subject, especially in relation to the dichotomy comprehensive (*allmänbildande*) – specialist education, which was rooted in a Nordic tradition but also reflected the influence of C.P. Snow and current debates in Sweden, Denmark and other OECD countries, particularly the USA. Modern, laboratory-based areas of biology were also controversial; it seems that the board embraced them while many “grass roots” remained skeptical. The internal boundary-work to define the boundaries of the subject was thus significantly more intense, even conflict-ridden, in this case, which is not surprising considering the status of upper secondary biology and the close proximity to the university level. However, the cultural map of school biology that the ABT board promoted in relation to the reform was largely accepted and consequently this external boundary-work was successful.

There were yet several shifts in what kind of biology the ABT considered important to include in the cultural maps, if we compare the reform of compulsory and upper secondary education. First of all, in the former ecology and nature conservation were regarded as central, and the comprehensive, educative (*allmänbildande*) value of biology was also emphasized. In the latter, ecology and conservation were stressed even more, especially in relation to technology and its role in the destruction of natural resources. Future engineers could devastate the environment unless they had a thorough knowledge of ecology. Here ecology became the particularly educative part of the subject. Concern for environmental issues therefore increased as part of the ABT's activities and self-image, if we compare the two reforms. This also goes for other contemporary associations of biologists in Sweden to which the ABT had connections, for example, *Fältbiologerna* and *Svenska naturskyddsföreningen*, which saw ecology as

an antidote to technology, scientific specialization and nature degradation, the dark side of modernization.⁸³

Secondly, the ABT considered the element of systematics and species knowledge to be too extensive in the compulsory school proposal, whereas in the upper secondary proposal it was regarded as too small compared to the more modern parts. According to chairman Torsten Wickbom, influential people in society still in 1965 associated biology with boring plant collection and taxonomy, which was why especially the board wanted to distance itself from this.⁸⁴ It is clear, on the other hand, that there were greater demands for a substantial portion of systematics on the pupils who would go on to university education. Consequently, there was an ambiguous attitude to systematics within the ABT but few denied it a place on the cultural maps, especially the one that was promoted for upper secondary biology.

There was fair agreement on what generally should be included in a curriculum, but when it came to discussing what was really essential – the core of school biology – opinions were divided. As Rudolph (2003) has pointed out, ‘the curriculum is the one place that society has set aside specifically for the purpose of systematically conveying to the public just what science is.’⁸⁵ This may explain why particularly the cultural map in the upper secondary biology curriculum, the prime example of biology as a *science*, became a controversial case. Paradoxically, a rather recently established discipline such as ecology helped integrating the traditional and modern elements. Ecology became a meta-discipline, even world-view, and as close to a core as it was possible to get; it incorporated all nature, including humans.⁸⁶

The early 1960s can thus be seen as a time of transition for the cultural maps of Swedish school biology. The curriculum for upper secondary level signified a sort of closure, achieved to a great extent by leading cartographers in the ABT together with allies at universities. The boundaries were drawn around what the zoologist Julian Huxley labelled the ‘modern synthesis’ of evolutionary biology and genetics, as well as

⁸³ Wennerholm, *Framtidsskaparna*, 259-72; Sörlin, *Naturkontraktet*, 199-226; Björn-Ola Linnér, *Att lära för överlevnad. Utbildningsprogrammen och miljöfrågorna 1962-2002* (Lund: Arkiv, 2005), 34-83.

⁸⁴ Wickbom, ‘Skolbiologin inför framtiden’, 1-4.

⁸⁵ Rudolph, ‘Portraying Epistemology’, 67.

⁸⁶ Worster, *Nature's Economy*, ch. 10-13. Cf. Peter J. Bowler, *The Earth Encompassed: A History of the Environmental Sciences* (New York & London: Norton, 1992), 518-37.

biochemistry, cell physiology, human biology and a little systematics, cast in an ecological mould.⁸⁷

Regarding *timetable* the weekly hours in biology, chemistry and physics diminished in the compulsory as well as upper secondary school reform. Urban Dahllöf claims that in a longer perspective – from 1919 to 1980 – the weekly hours in the natural sciences in elementary/compulsory education actually increased. Most of this increase can be attributed to two added school years in the transition from the seven-year elementary school to the nine-year compulsory school.⁸⁸ When looking at the previous corresponding school forms *realskola* and *gymnasium*, which the ABT and other defenders of school science themselves used as comparison, there was nonetheless a substantial cut in both reforms (see Table 1).

This reduction is surprising when considering the notion of a shortage of scientists and engineers and the impetus to improve science and technology education in Great Britain, the USA, Denmark and most other Western countries at the time.⁸⁹ It is likely, however, that it was explained and justified in the following ways. First of all, in both reforms the total timetable was reduced by 5 to 10% compared to the previous school forms. Secondly, at least the 1957 School Commission expressed a polytechnic ideal and argued that increased time for mathematics was important in ‘modern society with its rapid technological development.’⁹⁰ Thirdly, on upper secondary level the former *tekniskt läroverk* received equal status to the other tracks through the inclusion of the technical program, and the comprehensive subject natural science was introduced on programs other than the natural science and technical ones. Fourthly, since the new school on primary level was to be compulsory and nine years, this meant an increased total amount of natural science for a much larger group of pupils, and on upper secondary level the batch of pupils was expected to rise as well.⁹¹

Furthermore, drawing theoretical inspiration from sociologist of science Bruno Latour it is obvious that the ABT was not successful in enrolling a strong enough

⁸⁷ Julian Huxley, *Evolution: the Modern Synthesis* (London: G. Allen & Unwin, 1942); Uddenberg, *Idéer om livet*, 100-129.

⁸⁸ Urban Dahllöf, ‘Timplaner för folkskola och grundskola’, in *Från folkskola till grundskola*, ed. Erik Wallin (Uppsala: Pedagogiska institutionen, Uppsala University, 1992), 66-74.

⁸⁹ Jenkins, *From Armstrong to Nuffield*, ch. 4; Hays Lynning, ‘Portraying Science as Humanism’, 479-81, 502-3; Gary McCulloch, Edgar Jenkins and David Layton, *Technological Revolution? The Politics of School Science and Technology in England and Wales Since 1945* (London: Falmer Press, 1985), 1-8.

⁹⁰ SOU 1961:30, 199. The Commission prioritized basic skills such as calculating, reading and writing, which is also why mathematics, Swedish and other languages gained ground.

⁹¹ SOU 1961:30, 197; SOU 1963:42, 334-5; Hård and Jamison, *Hubris and Hybrids*, 85-88; Lövheim, *Att inteckna framtiden*, 149-54; Dahllöf, ‘Timplaner för folkskola och grundskola’, 74.

network of allies to be able to influence Minister Edenman and the majority of Parliament.⁹² The only issues in which the ABT had substantial support from other actors in its requests – notably from universities and tertiary education – concerned the lack of biology in the second grade of the upper secondary natural science program and the whole technical program. Success came when some biology was moved from the third to the second grade of the natural science program, but this was also because it was a requirement for chemistry. Indeed, chemistry regained half an hour in the finished timetable, which was due to very active lobbying of the Swedish Chemical Society (*Svenska Kemistsamfundet*) and other influential actors in trade and industry. Chemistry was considered absolutely crucial for the future survival of Swedish industry. The ABT had neither the powerful allies in industry nor the compelling arguments to expand, so to speak, the size of its cultural map.⁹³

The ambiguous attitude to the new subject social science must be seen in the light of the struggle for space in the timetable. Biology obviously had the potential to contain more social science aspects, especially in relation to medicine and nature conservation. In the first reform the ABT constructed ‘biology as social science’ in order to gain hours from social science, which they thought had sprawled too much in the timetable. In the latter reform, on the other hand, the ABT claimed that social science teachers could not really teach nature conservation and water protection because these were in essence biological domains. Here biology was constructed as *not* social science. In the first case the boundary-work was expansive and the boundary was opened up to the social sciences; biology was even seen as part of these. In the latter case the boundary was drawn very clearly around more traditional biological domains since social science teachers threatened to invade. In Gieryn’s vocabulary, the ABT utilized existing ‘interpretative flexibility’ regarding what biology was considered to be, and ‘alternative repertoires’ could be used to construct boundaries around the subject’s territory, depending on the situation.⁹⁴ In any case the object was to expand the domain of the biology subject.

⁹² Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1987), 259. See also Bruno Latour, *Pandora’s Hope: Essays on the Reality of Science Studies* (Cambridge, MA: Harvard University Press, 1999).

⁹³ RA, BF A1:2, minutes of the Southern section, 1962-05-14; Government Bill No. 54, in *Bihang till riksdagens protokoll 1962*, 1 saml., C9, 23 February 1962, 163-4; Government Bill No. 171, in *Bihang till riksdagens protokoll 1964*, 1 saml., C32, 16 October 1964, 243-6; Lövheim, *Att inteckna framtiden*, 165-9.

⁹⁴ Gieryn, *Cultural Boundaries of Science*, 62-4. Cf. Wiebe E. Bijker, ‘The Social Construction of Fluorescent Lighting, Or How an Artifact Was Invented in Its Diffusion Stage’, in *Shaping*

Conclusion

In the Swedish compulsory school reform there was substantial internal support within the ABT for a rather traditional cultural map of biology that relied on field biology, human biology and the new elements evolution, ecology and nature conservation. External boundary-work was fairly successful; the new comprehensive biology curriculum resembled the old one for lower secondary level, and the new items seem not to have threatened other actors. Nature conservation and societal aspects of biology were used as arguments for more weekly hours in a substantially reduced science timetable, but neither the ABT nor other interest groups could muster enough support to alter this. Sweden thus diminished science education in favour of, for instance, mathematics; prolongation of compulsory school time with two years for a large number of young Swedes should partly make up for this.

The biology curriculum for upper secondary level had an important symbolic value due to the close proximity to the university level. Here in particular the ABT promoted a cultural map of biology as a science, but the internal boundary-work became intense and contradictory, partly because of disagreement on the relationship between comprehensive (*allmänbildande*) and specialist biology. Inspired by the American BSCS project, the ABT board allied itself primarily with university biologists to form a very modern cultural map where evolutionary genetics, laboratory-based biochemistry and cell physiology marginalized field biology and systematics, something which upset traditionalists within the association. Eventually ecology became a sort of bridge between modern and traditional items. Due to successful external boundary-work the promoted cultural map by and large came to make up the new curriculum.

However, the ABT could not enlist strong enough allies to counteract the reduction of the natural science timetable, something which defenders of chemistry managed to some extent. The Swedish Government partly compensated this through the introduction of comprehensive natural science on some programs and by including the technical program in upper secondary education. Nevertheless, it is hard to escape the conclusion that Sweden, in contrast to many other Western countries, for example, role models Denmark and the USA, prioritized technology and mathematics at the expense of the natural sciences in school.

This study also tells us something about the nature of boundary-work. In order for a subject association or any interest group to carry out successful boundary-work it must first be done on an *internal* arena, that is, in relation to the inner landscape and cartographers within the association. This is necessary for successful *external* boundary-work, which involves counteracting or cooperating with other groups of cartographers. The ultimate outcome in terms of an established cultural map of science, for example, in a curriculum, is dependent upon the association's ability to enrol powerful allies with epistemic or other authority in support of its image of science.

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