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SCIENCE IN ESTONIA THROUGH THREE OCCUPATIONS

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The paper is devoted to dramatic events, which affected science and research, particularly the people of science in Estonian Republic during a fifty-year period (1940–1991) of its history. The main attention is devoted to the period 1940's–1950's, when crucial changes in the research system, including a systematic extermination of the local intelligentsia took place.

Introduction

This paper is devoted to dramatic events that affected a fifty-year period (1940–1991) of Estonian science and research, with particular attention to how those events affected the people and structures of science. This period saw three waves of occupation, a great war rolled over the small country, and there were fundamental alterations in the political, social and economic structures, and environment. Many of the specifics of science and research development in Estonia and the other two Baltic States were determined by these historical events – by the radical changes that took place in the region. This illustrates a principal difference between science in the Baltic States and in most of the rest of Europe: since the 17th century, the evolution of science in the Baltic States has been ordained to a great extent by the political and economical interests of those foreign powers that ruled the region.

In this paper the main focus is on the 1940's and 1950's when there were major changes in the R&D system, including a systematic extermination of the local intelligentsia. We will point out only a few of the most drastic features of these years.

Estonia provides a unique example of the only country in Europe where (over the last four centuries) the science establishment has undergone five cycles of rapid collapse and subsequent new beginnings. With every collapse

and resuscitation, the structure of the research establishment, the character of research, and the main research fields have altered substantially. A look at the development of university education and scientific research across the dramatic events characterising Estonia's history allows us to compare several factors that affect the formation, structure and character of the science system. These include:

- the nation's status as a small independent state or as part of a large empire;
- relations between the centre and periphery (e.g. when Estonia was occupied by the Soviet Union or by Germany);
- the role of an open or closed research environment;
- the role of freedom of communication; and
- how cardinal changes in the political situation influence the appearance and disappearance of scientific schools or whole scientific disciplines.

By the end of the 1930's, when the first occupation of the sovereign Estonian Republic (founded in February 1918) was impending*, the network of research institutions in Estonia, formed in accordance with Western patterns, was quite diverse. It included Tartu University with more than a hundred research units and institutions, Tallinn Technical University, and a number of state research facilities. In 1936–1940, there were about 1400 persons in Estonia actively engaged in research (the total population was 1.1 Million). Thirty-seven academic societies had 2700 active members. In 1938, the Estonian Academy of Sciences was founded, and the first twelve members of the Academy were appointed by the President of the Republic. Scientific research covered all branches of the humanities and basic natural sciences, as well as engineering, medicine and agricultural sciences. The development of branches of science related to the national interest was especially emphasised [1: 39; 2].

The occupation of the three Baltic States by the Soviet Union in 1940 and the subsequent events of World War II fundamentally changed every field of life. The end of political and economic independence was accompanied by a complete restructuring of the economic and social spheres of these countries.

Politically, Estonia became a peripheral region in a large communist totalitarian empire – the USSR. In 1940, private ownership was abolished and the nationalisation of private property was begun. This drastically affected the Estonian people. Thousands, including most specialists and intelligentsia were imprisoned or deported to Siberia. It has been estimated that in 1940–1941 about 60,000 people were arrested, murdered, deported or mobilised to the Red Army from the total population of 1,128,000 in 1939. In addition, about 5000 people were executed by Germans and about 10,000 men perished in the German Army. In 1943–1944, about 75,000 people escaped to

* During the period 1940–1945 Estonia suffered three occupations. The first was a takeover and occupation by the Soviet Union (1940–1941). The second was by Germany (1941–1944). The third, beginning in 1944 and lasting until 1991, was again by the Soviet Union.

Finland, Sweden or Germany. The population of Estonia decreased as much as by one fourth in this period. Hundreds of scientists were repressed or left the country [3].

The normal development of science and research was broken off under the pressure of external forces. The structure of the research establishment was quickly changed as early as 1940, and was reconstructed almost *de Novo* after 1945 by Soviet authorities, as the science establishment and research infrastructure were to a great extent destroyed in the days of World War II.

The First Occupation

The transformation of the Estonian science establishment along Soviet patterns began in earnest in 1940, as it became a part of the research enterprise of a large empire. The functions, opportunities, and the rules of the game changed completely, as the political, ideological, economic and social environments underwent drastic and cardinal changes. All scientific activities, developments, financing, international contacts, opportunities and exchanges were ordained and directed by central authorities. At the same time, there was an ideologization and politization of education and science. All educational work and research in Estonia was ordered to be rearranged on the basis of Marxist-Leninist ideology.

In July 1940, the Administration of Tartu University (the largest university) was replaced by politically faithful leaders. A new post of leader of social-and-political training was created, and filled by a professor of Marxism-Leninism, K. Kure, who was brought to Estonia from the SU. Several professors (e.g. A. Piip, H.B. Rahamägi, K. Saral) were arrested. A number of active members of the Communist Party (CP) of the SU and the Central Committee (CC) of the Estonian Communist Party (ECP) were sent to work in the universities in these years as well as after 1945 [4: 204–311; 5: 12–13]. Scientists were required to adopt the proscribed viewpoint of Soviet science, including its world outlook and investigative methods. Scientists noted for their unsuitable political background and activities were dismissed from their posts and/or repressed.

The prelude to these events began in 1936–1937, when scientists of German origin were called to leave Estonia by Adolf Hitler. In 1939–1940, there was a large exodus, including a number of scientists of Estonian nationality – more than 120 scientists (about 9 % of the total) left for Germany. This wave was accompanied by a massive "purification" organised by communist authorities [1: 39].

The Estonian Academy of Sciences – a fraternity of eminent scientists – and all academic associations based on individual freedom were abolished for political reasons. Most scientific journals were closed. Contacts with the Western world were interrupted. These events not only put an end to co-operation between Estonian scientists and foreign research organisations and

scientists, but also closed the channels for acquiring modern research equipment, even under existing contracts.

The academic intelligentsia was devastated: from the total of thirteen members of the Estonian Academy of Sciences P. Kogerman was arrested in June 1941 and deported to Siberia, Th. Lippmaa was killed in a bombing of Tartu and H. Sepp died in 1943, H. Kaho, E. Kant, O. Loorits, J. Mark, K. Schlossmann (president), G. Suits, J. Uluots and E. Öpik emigrated as refugees. Only A. Paldrok and L. Puusepp stayed in Estonia. The former Rectors of the Tartu University H. Kaho and J. Kõpp also emigrated as refugees.

The structures and specialisations of the higher educational establishments changed as they became fully proscribed by central authorities. Special research units in the universities were closed. To make Estonian universities correspond to the higher educational institutions of the USSR, academic chairs in the universities were replaced by departments and a system of subjects was replaced by a system of courses that had to be completed within a fixed period of time. The study programs were burdened with new subjects, such as Marxism-Leninism, political economy, and Darwinism. Many subjects such as theology or history of Scandinavian countries were eliminated. All professors and other teaching staff were required to attend lectures on policy, and a special Policy Lecture institution was opened in Tallinn. Academic degrees and titles conferred during the period of independence were required to be re-certified by the Supreme Attestation Commission of the USSR, and not all of them were confirmed. Because of reorganisation, activities at Estonian universities changed: they did not have the right to accept dissertations for defence in 1940–1941, and institutions of higher education were obliged to admit children of the working class in preference to those of the middle and upper classes.

According to the new Statute of Tartu University adopted in October 1940, the role of the University and Faculty Councils became formal. The Administration of the university had to act according to the (often secret) directives of CP and KGB organs. Matriculation decisions were made by a three-member commission that included representatives of the Administration, trade union and the CC ECP. The tasks of a newly established personnel department included the "purification" of the university of the "unfitting social element". All members of the university administration and faculties were confirmed to their posts by the People's Commissar of Education [5: 12–14].

The Faculty of Economics at Tartu University was transferred to the Tallinn Technical University (TTU). The Meteorological Observatory (Metobs) of the university – the centre of Estonian meteorological research – was subordinated to the Management of Hydrometeorology established in Tallinn according to USSR patterns and research work died down. The head of the sector of aerology of the Metobs, A. Kärsna, was arrested, and died in Siberia [6: 154–156].

The Faculty of Theology was closed, and its base – the Archaeological museum of Christianity, the Cabinet of Christian ancient arts and the seminar-library were destroyed. It is estimated that during the first year of occupation about 200,000 books were destroyed in Tartu alone, including about seven thousand copies of theological literature in the university library. The University Church was closed.

Analogous changes took place in the Tallinn Technical University. The Rector of the TTU, P. Kogerman, was replaced by J. Nuut. The Vice-Rector V. Paavel was dismissed, and in 1941, TTU was reorganised into a Soviet-type Polytechnic Institute. Its obligations, fixed in a new Statute were: "to prepare the cadres, able to master foremost science and technology and, armed with the knowledge of scientific socialism, to be ready to defend the Soviet homeland and to devote themselves self-denyingly to building up the communist society".

Thus cultural life, education and research in Estonia had already suffered a severe blow by 1940–1941. A number of the most prominent scientists were lost. In many fields the continuity of science was lost for decades.

The German Occupation

The war and evacuation of the civil population, the German occupation (July 1941 – October 1944), and the exodus of the majority of intellectuals completed the process of "clearing" the rows of learned men that had begun in the first occupation. The most prominent, intellectual and active professors and researchers were seen to be the most "dangerous" for the new rulers. Those who avoided arrest and deportation in 1940–1941, or mobilisations to the Red or German Army, fled to Germany and, *via* Finland, to Sweden. It has been estimated that about 230 university professors and scientists emigrated. Several of them were lost on their way to Finland, Sweden or Germany.

During WW II, research work in Estonian universities died down. By a plan drawn up in 1941 by the Chancellery of the German State Minister of the *Ostland,* Alfred Rosenberg, the system of higher education in the occupied eastern regions had to be once again reorganised. Only three institutions of higher education – the University of Tartu, the Polytechnic Institute in Riga and an agricultural institute in Lithuania or Byelorussia were to be retained with German as the language of tuition [4: 206–211; 7; 8].

At the end of 1941, a decree was issued to the effect that the institutions of higher education in *Ostland* would be closed until the end of the war. Nevertheless, at the beginning of 1942, studies were resumed in the Faculties of Medicine, Veterinary Medicine and Agriculture at Tartu University. In the fall of 1942, the other faculties were granted permission to start their work with special, reduced wartime curricula. In the autumn of 1943 the number of students was 1798, and the teaching staff included 82 professors, 111 as-

sistants and 28 part-time teachers. At the beginning of 1944, preparations for evacuation of the university to Königsberg were started.

The Tallinn Technical University resumed its work in February 1942 and closed its doors again in February 1944. The destination of the evacuation of this university was Danzig. Fortunately, these plans were not realised.

In April 1943, the occupation authorities launched a campaign of applying *Ostland* science in warfare. All research problems were divided into four categories according to their relevance for military purposes. In the context of this campaign, the Institute of Anthropology and Racial Research was opened at the Tartu University to propagate race theory. At the same time, the Literature Museum was liquidated, and its belongings, together with the Archives of Estonian folklore, were left on the street when the building was taken over by the military. Some research was continued in the astronomical observatory, the Medical and the Agricultural Faculties. In the TTU special attention was paid to work in oil-shale chemistry and technology and phosphorites processing.

The university infrastructures suffered considerable damage from battles and bombardments. Thus, in the summer 1941, Tartu University lost 22 buildings, including three major study buildings. As the buildings of the universities, as well as university clinics were occupied by German authorities and military forces, a lot of laboratory equipment and furniture was damaged or lost. Some valuable research equipment and materials were taken to Germany (e.g. a set of vertical seismographs constructed by Prof. J. Vilip, about 1.6 kg of platinum and a collection of coins taken along with the Rector E. Kant when he fled to Sweden). From the TTU objects of platinum and precious metals were taken away by the German military in August 1941. In addition, it has been estimated that during this period more than 460,000 books, including several specialised collections belonging to university professors and *literati* were destroyed in Tartu alone. Fortunately, most property, including cultural treasures and valuable equipment of the Department of Chemistry was saved and hidden by the university staff [9: 177–178].

But the losses in human potential were the most devastating. In total, during the first Soviet occupation and WW II, 16 % of the scientists left as refugees, and a further 22 % were deported to Siberia, killed for political reasons, lost in the war, or imprisoned (L. Gulkowitsch, Vice-Rector A.T. Kliimann, J. Laube, A. Looring, P. Rubel, L. Silberstein and others were killed by the Nazis; A. Humal, H. Moora, J. Mäll, P. Tarvel, V. Vadi were interned in the Tartu concentration camp). By 1945, only 393 scientists – or 28 % of the total in 1936–1940 – were left. From the six hundred Doctor and Master degree owners, only 142 continued to work as scientists in 1945. The next systematic depletion of the intelligentsia in 1945–1950, affected this group as well.

Most of the noted scientists who emigrated during the last years of the war continued their activities in Sweden, Germany, the U.S.A., Canada, Australia and other countries. In the summer of 1945, a group of university

professors and researchers from the Baltic States established the Baltic University in Hamburg-Pinneberg. This university was in operation until the end of 1949. The Baltic Institute (Baltische Forschungstelle) later organised in Bonn was its successor.

The Third Occupation

In the fall of 1944, the Soviet occupation was restored in Estonia. In the second half of the 1940's, the ideology of economic and social development was thoroughly changed, and full control over all spheres of economic, social and cultural life was given to central authorities in Moscow and to the all-Union organisations. Estonia was quickly transformed into a "Republic" of the Soviet Union. The events of this period were crucial to all spheres of life of all three Baltic States, but the greatest damage was again caused to the local population.

Forced industrialisation, whereby oil shale, oil and gas (for Leningrad) production and electric power generation, as well as construction and machine industries were rapidly expanded in Estonia, meant the introduction of thousands of migrants from Russia. By the end of the occupation in 1991, their total number was about 550,000. Specific policies, aimed at restricting the role of Estonians in society, as well as restraining Estonian culture, were implemented. These policies led to considerable changes in the structure of the Estonian population. In 1934, ethnic Estonians made up 88.2 % of the population, and ethnic Russians 8.2 %. In 1989, the proportion of Estonians had diminished to 61.5 % and that of Russians had risen to 30.3 %. In the years of the second Soviet occupation the absolute number of Estonians dropped from 992.5 thousand to 963.3 thousand [10].

In 1947, collectivisation began, and about 50,000 people were repressed. At the end of the 1940's there was a strong attack against the national culture with the goal of severing cultural continuity. During the 8th plenum of the CC ECP in 1950, orthodox communists – with Moscow's support – won the internal party battle, which resulted in the loss of any remaining autonomy and an all-out attack on the Estonian national culture. These abrupt changes caused a crisis of values and ethics, as the previous society based on European structures and system of values (such as personal freedom, democracy, private ownership) was declared by the new authorities to be false and "bourgeois".

Science organisation was also changed. Preparations to establish a Soviet-type Academy of Sciences were begun already during the war, in 1944, as the Allied victory over Germany became realistic. A number of Estonian scientists, mobilised into the Red Army or evacuated to the USSR in 1940–1941, were transferred to Moscow, where an initial group was formed.

In 1945, Tartu University (now Tartu State University) and Tallinn Polytechnic Institute restored their activities. The Institute of Natural Resources

(founded in 1938) was re-opened as the Institute of Industrial Problems. In June 1946, authority over Tartu State University and Tallinn Polytechnic Institute was transferred to the competence of the Ministry of Higher Education of the USSR. A number of persons with academic degrees were invited or came by their own initiative from other parts of the SU to Estonia to "reinforce" the restoration of the work of the universities and to build up the system of the Academy of Sciences.

In 1946, in the complicated years of post-war devastation and "building up" of a communist society, the organisation of the complex of the Academy of Sciences with twelve research institutes was started. The rapid foundation of academies in the occupied republics along USSR academy patterns helped integrate the science of the newborn USSR republics into Soviet patterns of science administration. This also served to liquidate the autonomy of science and to channel the freedom of researchers. The activities of the academies of sciences of the union republics were directed by the USSR Academy of Sciences. The whole system was given a hierarchical structure. Among other departments every presidium had the so-called 1st department (directed by the KGB) and a number of officials, working for the KGB. For 45 years, the Academy of Sciences of Estonia remained the cornerstone of the Soviet system of communist ideology and of centralisation in science.

In the 1940's and 1950's, the Academy of Sciences was a channel for the entry into Estonia of dozens of researchers and engineers with Communist Party background from other areas of the SU. In these years a number of scientists who did not have anything to do with Estonia were elected as members of the Estonian Academy of Sciences (elected in 1951: N.S. Buzulukov, A. Chernyschoff, A.F. Dobryanski, A. Kiur-Muratov). Another group of members of the Academy – J. Eichfeld (elected in 1946), J. Heil (1951), F. Klement (1951), R. Mahl (1954), G. Naan (1951) – were of Estonian origin, but came to Estonia after World War II from the SU. Nevertheless, most of the Academy members were distinguished scientists, who had high prestige (and a number of privileges).

At the same time, many noted scientists of "bourgeois" background were active in Estonian science in the 1940's. Several of them returned from exile in Siberia, and a number returned from military mobilisation. This group included the chemist P. Kogerman (elected a member of the Academy in 1946), historian H. Kruus (1946), art historian V. Vaga (1946), mathematicians J. Nuut (1946) and A. Humal (1951), construction scientist O. Madisson (1946), physicist A. Altma (1946), and archaeologist H. Moora (1957).

The organised system of science in the new-born Soviet republic – Estonia – was built up according to the sectional scheme of the USSR with three separate kinds of institutional systems:

- higher educational institutions, directed from the Ministry of Higher Education;
- institutes of the Academies of Sciences, dependent on the USSR Academy of Sciences;

- applied research ("branch") institutes, administered by all-Union or republican ministries.

Thanks to purposeful investment into higher education and science, the university infrastructure was restored and new research institutions were established during the first post-war years. The number of researchers multiplied about five times in 1945–1950, reaching 1220 by 1950. In 1951, the Estonian Academy of Agriculture was established, followed by the Tallinn Pedagogical Institute in 1952. None can disagree that this was a positive trend.

In the 1950's, a network of branch-institutes was formed, most of them subordinated to all-Union ministries. At the same time, many divisions of all-Union research institutes were "inserted" into the Baltic region. Most of these were so-called "post-boxes", secret organisations fulfilling the tasks of the Soviet military complex. At the end of the 1980s, there were four such large research institutes in Estonia, which were not counted by the local Department of Statistics. The numbers of researchers in these institutions were anonymously added to Estonian reports in Moscow [11].

The activities of the branch-institutes, bound to various segments of industry, were directed entirely by the central ministries. This meant that their research was motivated, financed and managed from the standpoint of centralised, ministerial and departmental interests. According to the April 3, 1961 regulation of the Central Committee of the CP, applied research institutions and museums were transformed from the jurisdiction of the Estonian Academy of Sciences to the ministries.

But "ideological warfare" was being waged in parallel with these positive organisational undertakings. In 1944, a number of university professors who had continued to work during the German occupation were arrested (A. Annist, P. Ariste, B. Haller, A. Miljan, A. Palm, R. Põldmäe, H. Talvik, P. Tarvel and others). The basis for this repression was formulated in a number of decisions on ideology by the CC CP(B) of the USSR adopted in 1946–1948, particularly in the journals "Zvezda" and "Leningrad" in 1946. Under political pressure, a number of professors left their universities ostensibly by their own "free will", illustrations of a campaign that was launched against the intelligentsia in general. During 1946–1950, altogether 4176 schoolteachers were discharged [12].

In 1950, a wave of systematic political repression began. In January, the Bureau of the CC ECP decided that a number of leading scientists in the Institute of Language and Literature and in the Institute of History of the Academy of Sciences (R. Kleis, H. Moora, E. Nurm, D. Palgi, E. Päss, V. Vaga, H. Üprus etc.) were "politically insecure elements" and had to be dismissed. New leaders of the Institute of Language, H. Tobias and P. Izmestyev, who came from Russia and had experience working in CP organs, were appointed. In February 1950, the CP Bureau of the Academy of Sciences concluded an investigation with the finding that more than hundred scientists were "politically undesirable" and that the Academy must be

cleaned of this "unfamiliar" element. Measures "to clean the rows" were made following the instructions from Moscow [12: 176–187; 13; 14].

There were continued massive dismissals after the 8th Plenum of the CC CP of Estonia in March 1950. These were aimed at "bourgeois nationalists" who held a positive attitude toward the science and cultural heritage of Western Europe and who protected the traditions of Estonian national culture. In the list of more than hundred discharged scientists were the names of the most prominent representatives, including members of the Academy of Sciences: A. Humal, P. Kogerman, O. Madisson, J. Nuut, Directors of the institutes A. Habermann, F. Laja, R. Toomre, V. Vadi, professors of the Arts Institute in Tartu A. Vabbe, A. Vardi and a number of teachers of that institute. The Directors of the Art Institute, A. Kongo and A. Starkopf, had already been dismissed. In December 1950, the Art institute was liquidated by uniting it with the Institute of Applied Arts in Tallinn [15: 137–143]. In July 1950, the President of the Academy, H. Kruus, was discharged, arrested and sent to Siberia. He returned only in 1956, and his status as a member of the Academy was restored. In September 1950, J. Eichweld was elected the President of the Academy, and a number of persons of Soviet background were elected the members of the Academy and to the leading Academy posts [16: 178]. Undoubtedly, such events shortened the lives of scientists, including P. Kogerman, J. Nuut and V. Vadi who died in 1951–1952.

In the fall of the 1950, the Council of Tartu University was re-organised into an advisory body with limited functions. Seven distinguished professors and twelve docents were withdrawn. Several university chairs and research sites were closed (the chairs of Estonian history, archaeology, history of arts, Archaeological museum and others) or transferred to the Academy of Sciences (Astronomical Observatory and the Meteorological Observatory) [17]. The result was that traditional scientific bonds were interrupted as the barriers between the Academy of Sciences system and the universities elected in the USSR hindered normal co-operation even in small Estonia.

The Tartu University Administration and most of the heads of research institutions were dismissed on a charge of "bourgeois nationalism and anti-Communist policy". During the year following the Plenum of the CC ECP, 76 teachers (and more than 120 other persons) were dismissed from Tartu University, twelve from the Tallinn Polytechnic Institute, twelve from Tallinn Conservatory, twelve from Tartu Arts Institute, nine from Tallinn and five from Tartu Pedagogical Institutes. In addition, in 1950–1951, ninety-seven students were dismissed [18] and 233 persons working in the system of general education had to leave their posts for political reasons. As a result of this purification, there were only five professors and twenty-nine docents left in the university instead of nineteen and fifty-two. Scientific research in many areas died down [12; 14; 18]. The campaign of political repression ended after a new Rector of Tartu University, F. Klement, was elected in 1951.

The after-effects of the 8th Plenum were not confined to repression alone. In 1951, massive elimination of literature from scientific libraries was begun. All the literature published in the Estonian Republic and during the German occupation that had not been destroyed in the first or second occupations, as well as periodicals published in the territory of the SU between 1917–1938, "ideologically harmful" books and books containing writing by the "enemies of the nation" were removed into special departments, and retained there until the end of the 1980s. To this list were added numerous works published abroad before the October Revolution. Not all researchers were granted permission to work in these departments.

The collections of geographical maps were either destroyed or declared secret in all institutions. Twenty years later, in 1972, even more strict rules for their maintenance and use were put into operation. In Tartu University alone 1236 maps were destroyed by the decision of a special commission from 12.02.1973, and 3045 were declared secret. The maps and schemes for public use were deformed. These restrictions limited the possibilities of research in the fields of cartography, geography, geology etc. [19].

The details of how research fields were defined is one more peculiarity of this period. Until the 1960's, scientists were directed in their research work by an ideological orientation designed by the CP. Many publications on the "linguistic" works of J.V. Stalin appeared, as well as on the doctrines of Lyssenko, Mitschurin or Marr. Stalin's ideas had to be referred to not only in linguistics, but in analyses and publications on history, psychology, jurisprudence, economy, medicine and even agricultural sciences. Until 1953, citation of J.V. Stalin's "linguistic" works was obligatory in almost every field of science. Due to the "geniuses" of Lyssenko and Mitchurin the study of genetics was prohibited in the SU – in this empire there could not be any genes! This restriction applied equally to cybernetics.

The repression, ideological restrictions, CP and KGB control, and security restrictions gave rise to a specific phenomenon, characteristic of this period. Because the general atmosphere was one of fear, distrust, circumspection and introversion, university teachers and researchers were under constant stress that led to adulation and humble submissiveness. This atmosphere formed several generations of scientists who also had to put up with isolation and poverty, as well as with outdated research equipment and lack of scientific information. These conditions led both to inertia, and, paradoxically, to creativity among active scientists. Examples are that the first gas-chromatographs in the USSR were constructed in Estonia in 1952 by researchers as were NMR spectrometers. Despite the harsh external conditions, the majority of scientists managed to retain their exacting intellectuality, honesty, and respect for the facts.

To summarise, the primary drawbacks for science in Estonia and other Baltic States, resulting from the imposition of an alien ideology were:

- ideologization and politization of science;
- the formation of a hierarchical science management system;

- direction of science from the "centre" (Moscow), and removal of traditional authority from the research organisations;
- isolation from western countries and security restrictions on western contacts;
- strict planning and administrative methods of research organisation management;
- financing of research institutions rather than of projects or scientists;
- poverty: low salaries and living conditions for scientists; lack of equipment and infrastructure for research;
- a rigid system of promotion and permanent employment; immobility of scientists within and between research institutions and, of course, countries.

During this period, special attention was paid to basic research in the fields of the exact sciences (physics, astrophysics, chemical physics, mathematics). Although research in these fields was directed to a large degree by the interests of the Soviet military complex, it did receive extra financing and good equipment. Research in other fields of the natural sciences – chemistry, biology, and geology – was healthy as well. In the 1970's and 1980's, studies in molecular biology gained momentum. The situation was worse in the social sciences, as many social science fields simply did not exist in the Soviet Union for political reasons.

In 1956-65, in conjunction with a certain degree of liberalisation in the USSR, some decentralisation took place. But the reforms of Kruschev's time were rather inconsistent. In 1957, the Estonian S.S.R. National Economic Council was formed as a regional controlling body. At the same time, large industrial enterprises were established in Estonia (electric power plants, electrical engineering and machinery, electronics). Despite limited political liberalisation, a large number of people who had survived deportation returned from Siberia during this period. Continuity was restored in cultural arenas, it was possible to be more free in the interpretation of socialist-realist dogmas, and a noticeable amount of creative freedom appeared. As society became more open, it was possible to follow some international trends. But this period of slight liberalisation was very brief.

In 1965, a new economic policy was launched that meant a return to economic management by branches and centralised control. In the 1980's, Moscow controlled more than 90 % of Estonian industry. The possibilities for extensive development were exhausted, and conditions of the environment deteriorated due to large-scale industrial production. Many experiments for improving the economic situation (such as "5 years for quality and efficiency") had failed.

By the mid 1970's, there was general stagnation. It was accompanied by increased censorship and restriction of creative freedom. At the end of 1978, the ECP started a campaign to restrict the use of Estonian and to increase the importance of Russian. This move increased dissatisfaction and fuelled the dissident movement. In 1980, after student protests, forty intellectuals, one

third of whom were university professors and researchers, drew attention to the unresolved nationality problem in a public letter. The atmosphere started to heat up.

It should be noted that the distribution of researchers by nationality did not follow the population distribution formed during the Soviet period. In 1960, when the proportion of Russians had arisen to 20.1 % of the total population, 15 % of the total number of researchers were Russians, 79 % were Estonians. The proportion was the same in 1982 [20]. For comparison, in 1936–1940, 85.6 % of the researchers (including university professors) were Estonians, 8.3 % Germans (their share diminished after 21,400 Baltic Germans left Estonia) and 2.5 % Russians.

In the mid 1980's, the general atmosphere began to change. Gorbatchov's reforms and *glasnost* helped to make public several Moscow's plans, including some that would be harmful to Estonia. For instance, the plans for constructing an additional, third great power plant based on oil-shale was successfully restricted and a plan to establish new phosphorite mines in Northern Estonia gave rise to a nation-wide campaign against them initiated by the Commission of Ecological Safety of the Academy of Sciences. In the years 1989–1990, a civic society was restored, a free press developed, and political parties were formed. Society became more open, and ultimately free elections took place. The ECP collapsed and relinquished its position of power. Historical truth was the basis for the Citizens' Committees movement, which proposed the restoration of the Republic of Estonia and Estonian citizenship.

By the end of the third occupation, the network of universities and R&D institutions was quite large in Estonia, including one university and five other higher educational institutions, seventeen research institutes of the Academy of Sciences, twenty specialised research institutes and laboratories plus four research-archives. More than 16,300 people were engaged in this sphere, including 7150 researchers. The development works were done in about seven hundred special constructive bureaus, laboratories and experimental departments of large enterprises, where over 21,000 people were engaged [21]. For Estonia this represented a substantial potential. The number of students (over 26,000) and graduates of the universities (about 3000–3500 per year) was also notable.

In 1988, the ideas of reforming the scientific establishment gained momentum in the flow of other developments. At an April-meeting of the leaders of the creative unions the possibility of Estonia leaving the SU was mentioned publicly by Rein Veidemann. New organisations emerged: in December 1987, the Estonian Heritage Society, in May 1988, Estonian Green Movement. In January 1989, a language law prepared by the philologists that declared Estonian to be the state language was passed by the Supreme Soviet. Discussions were begun on elaborating a national science policy, on reviving a number of science disciplines, on guaranteeing the possibilities of free communication, and on raising the social role of researchers. Represen-

tatives of academic circles played an important role in politics and non-academic public life in these years.

The reform of the R&D system launched at the end of the 1980's, was to a great extent based on the democratic ideas that overtook the whole society in the period of the "Singing Revolution". Academic freedom and autonomy, abolishment of central management and planning, and abolishment of ideological and political pressures were a universal aim. As an ideal, researchers desired to give academic considerations the highest priority, and to build up a higher education and research system that was fully compatible with the character, needs and possibilities of a small, independent country with an open, market-oriented economy.

At the beginning of the 1990's, the seemingly unbreakable Soviet system could not resist global changes, and *perestroika* opened the world and allowed access to world information. In August 1991, Estonian independence was restored. It fundamentally altered the political, economic and social situation of the country. The status and functions of the higher education and R&D system in the national economy changed once more. It was evident that the demands and opportunities afforded by a small, independent national republic differed in principle from those of a puppet republic of a large empire. But this is a different story to tell.

As a conclusion we can confirm that the fifty-one years of Soviet and German occupation were full of hardships, contradictions, unreasonable political repression yet comparatively plentiful material resources to develop large research institutions and universities, and to employ thousands of researchers (true enough, on miserable salaries) for erecting large complexes of (poorly equipped) institutes.

The experiences of these years show that the attempt to base science on political motives rather than scientific ones, to block free communication, to oppress the freedom of science and scientists, leads to an alienation of science from the administrators, as well as from the needs of the country, and restrains the development of both education and science.

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