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On the activities of the Kazan Scientific Research Institute of Epidemiology and Microbiology during the Great Patriotic War of 1941–1945

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Abstract

The article was prepared for the 75th anniversary of Victory in the Great Patriotic War and the 120th anniversary of the Kazan Scientific Research Institute of Epidemiology and Microbiology. The paper presents the contributions of the Kazan Institute of Epidemiology and Microbiology staff in the sacred cause of victory over fascism to protect the health of soldiers and civilians of our homeland during the Great Patriotic War. The scientific research data and production activities of the institute are presented. The institute turned out to be practically the closest microbiological institution to the front, having the necessary laboratory equipment and a production base. The institute launched the production of medications, including 4 types of anti-gangrenous serums, anti-dysenteric tablets, tetanus toxoid, anti-typhoid tablets, dysenteric dry bacteriophage, dysenteric subcutaneous vaccine, pentavacine, typhoid vaccine, antibiotic gramicidin and others.

Keywords: Kazan Scientific Research Institute of Epidemiology and Microbiology, The Great Patriotic War.

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Before the war, approximately 20 branch institutes in the USSR health care system were capable in terms of their equipment and human capacity to work with pathogenic microorganisms. However, in the first several months of the war, all four Moscow and Leningrad institutes had to be evacuated urgently from the forward edge of the battle area. The possibilities for a reorientation of specialized Siberian and Far Eastern institutions were limited due to their geographical remoteness.

The regional Kazan Institute of Epidemiology and Microbiology of the People's Commissariat of Public Health of the Tatar Autonomous Soviet Socialist Republic (since 1942, the Kazan Research Institute of Epidemiology and Microbiology of the People's Commissariat of Public Health of the Russian Soviet Federative Socialist Republic) was the microbiological institution almost the closest to the fighting line. Moreover, it had the necessary laboratory equipment and production capacities (Fig. 1).

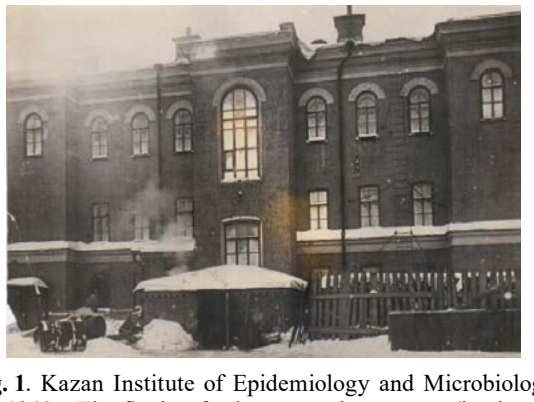

Fig. 1. Kazan Institute of Epidemiology and Microbiology, the 1940s. The flanker for long-term ice storage (ice-house) is shown in the center of the photo.

When the Great Patriotic War began, the state of the Kazan Institute of Epidemiology and Microbiology (KIEM) was far from combat readiness. Nevertheless, its personnel reorganized the work promptly in accordance with the battlefield requirements. Already in July 1941, the first batch of

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Fig. 2. Autoclave sterilization of culture media and disposal of processed material, the 1940s.

Fig. 3. Taking blood from the horse to obtain serum, the 1940s.

anti-gangrenous sera, which were the first therapeutic and prophylactic agents whose industrial production was developed by the Institute during the war years, was delivered to the acting army [1–3].

In August 1941, expert employees of the N.F. Gamaleya Moscow Research Institute, headed by Professor V.L. Troitsky, arrived in Kazan and launched work in KIEM. Soon they were joined by a group of Leningrad scientists, including the founder of medical mycology, Professor P.N. Kashkin. In total, over the years of the Great Patriotic War, more than 150 employees from other institutions, such as the Central Institute of Epidemiology, the All-Union Institute of Experimental Medicine, the Mechnikov Institute, the Leningrad Institute of Vaccines and Serums, the Rostov Institute of Epidemiology and Microbiology, visited KIEM and were employed there. Simultaneously, cooperation with universities and research organizations in Kazan also intensified. KIEM established particularly close cooperation with the Kazan State Medical Institute and the Kazan branch of the USSR Academy of Sciences.

On September 1, 1941, a Muscovite Polina Albertovna Vershilova was appointed as a director of KIEM and acted as a determined and energetic leader. After the war, P.A. Vershilova worked for a long time as Deputy Minister of Health of the Russian Soviet Federative Socialist Republic. In summer 1943, Anna Romanovna Konova from Leningrad became the head of KIEM, and she was replaced by Antonina Mikhailovna Volkova (Borzunina) in early 1945. These energetic and determined women did their best and made a tremendous personal contribution to solving the KIEM problems during the war.

Strengthening the manufacturing base and increasing productivity. Before the war, the funding of the Institute was insufficient to satisfy even the requirements of peacetime. The Institute possessed the main equipment of one steam boiler with a heating area of 16 m^2, three autoclaves with a capacity of 10 m^3, four hot-air sterilizers with a capacity of 0.8 m^3, and four thermostat rooms with a capacity of 44.2 m^3. The total area of KIEM production facilities was 601.8 m^2. With the outbreak of the war, the expansion of production capacity and the improvement of technical equipment were given special priority. In August–December 1941, KIEM received financial assistance in the amount of 1.5 million rubles. However, afterward, the Institute no longer received financial assistance until the end of the war and only once used a short-term bank loan of 400 thousand rubles.

The premises of 200 m^2, where the Department of Microbiology of the Kazan State Medical Institute was located before the war, were transferred to KIEM. Consequently, the laboratories of vaccines and bacteriophage were expanded and equipped, transformed into departments, and a new department for processing and concentration of sera was accommodated.

In late 1941, the equipment of the boiler room was replaced, and the heating area of the boilers increased to 22 m^2, while the capacity of the steam power facility increased accordingly. An additional autoclave with a capacity of 6 m^3 was commissioned. Subsequently, five more thermostat rooms were arranged at the Institute; as a result, the capacity of thermostats had doubled by 1945 in comparison with the pre-war period. The transformer substation was re-equipped in 1944 when the capacity reached 500 kW.

New dry-air sterilizers, boilers for the preparation of culture media, and other production equipment were put into operation (Fig. 2). Considerable work was performed in the mechanization of labor processes. Under difficult circumstances, KIEM employees proposed ingenious technical solutions. For example, master N.S. Krylov adapted an ordinary vacuum cleaner as a compressor, and this household appliance was efficiently used until the end of the war at two production sites, a soldering station and drying freshly washed ampoules. Overall, the processing capacity of KIEM production lines during the war years increased 2–2.5 times.

Fig. 4. Inoculation of the culture for vaccine preparation, the 1940s.

Fig. 5. Washing room, the 1940s.

Increased productivity was also enabled by advances in technology. A.M. Volkova and A.V. Beilinson proposed a fundamentally new method of plasma processing using special whisks; as a result, the serum yield increased by 62%. In 1943, the head of the variolar department, P.A. Sergeeva, introduced an intensive method of production of variolar detritus, and the yield of the drug from one producer doubled. The development of biochemical tests for certain types of microorganisms (A.D. Ado, I.E. Alatyrtseva, G.G. Akhmadullina, and N.N. Kuznetsova) enabled an increase in the yield of vaccines from 1 liter of medium by 5–6 times. A.V. Beilinson and Professor N.R. Strelkov developed a method for producing AC filter plates from cellulose, which replaced the Seitz's pads. New plates were supplied to a number of institutes in Perm, Gorky, and Kuibyshev.

"*Horse sanatorium*." The raw material for the vaccines and sera was the blood of immunized animals, mainly horses. As of January 1, 1941, the Institute had 79 horse-producers, for producing ten types of serum. With the outbreak of the war, an urgent need emerged to increase their livestock; therefore, a number of related problems (e.g., accommodation and fodder) had to be solved [1].

At the end of 1941, KIEM received the most significant replenishment (111 heads), when the horse-producers arrived from evacuated institutes, namely the V.I. Gamaleya Central Institute of Epidemiology and the Mechnikov Institute (Moscow). These animals had already been immunized for the production of anaerobic sera and were of extraordinary value; however, their physical condition was distressing since the herds were moved from Moscow to Kazan in an unusually harsh winter, and the horses were extremely exhausted. The preservation of the livestock required incredible efforts from the KIEM, but it enabled a considerable increase in the production of anti-gangrenous sera and the production of anti-tetanus sera from early 1942.

Subsequent restocking was used primarily to produce anti-diphtheria sera. They were smaller (91 horses in 1942, 58 in 1943, 30 in 1944, and 33 horses in 1945) and difficult to work with. The Institute received unusable collective farm and discarded army horses (12% of the horses transferred to KIEM died before the start of immunization). To preserve the animals in a condition suitable for production purposes, a kind of "Horse sanatorium" was created. In spring of 1942, the entire livestock of producer horses was transferred to the Laishevsky district where grazing was organized and to villages of Taneevo and Teteyevo (55 km from Kazan) where a room for immunization and a laboratory for primary blood processing equipped with centrifuges were arranged (Fig. 3). The semi-finished serum products were transported from there to Kazan. A.M. Volkova (KIEM director since 1945), the head of this sector of work, developed an original method for assessing the condition of horse-producers based on the analysis of the properties and content of blood proteins, which enabled the establishment of the optimal mode of immunization and operation of producers of therapeutic antitoxic sera.

By the start of the Great Patriotic War, the Institute produced seven items, or 15 items when the experimental series is taken into account the [1]. Those included six types of serum (normal, diphtheria, dysentery, scarlatinal, meningococcal, and streptococcal), five types of vaccines (dysentery liquid, scarlatinal combined, anti-tuberculosis BCG, anti-rabies, and triple vaccine), and scarlatinal toxin, diphtherial anatoxin, variolar detritus, and liquid bacteriophage for treatment of dysentery. The preparations' names suggest which infections posed the most significant threat to the country's population in the pre-war years, while the demand increased further in wartime. Six production departments and laboratories (serum, vaccine, hot-air, BCG, dysentery bacteriophage, and variolar department), which were partially expanded and re-equipped during the war, were engaged in the release of products.

Simultaneously with an increase in the production of agents already mastered, the production of

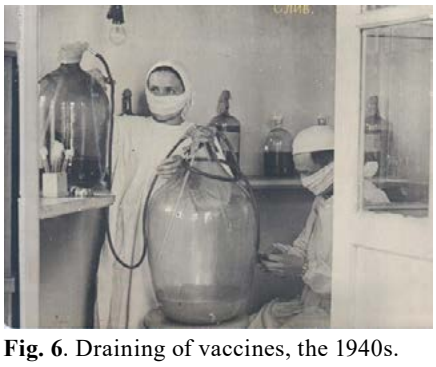

Fig. 6. Draining of vaccines, the 1940s.

Fig. 7. Pouring of medicinal sera and sealing, the 1940s.

new ones, which were urgently needed by the acting army, was necessary to be established. For this purpose, KIEM created five new production units, namely gangrenous, tetanus and typhus laboratories, an experimental laboratory for the production of antibiotics, and a department for processing and concentration of sera.

During the Great Patriotic War, the Institute mastered the production of 14 types of new preparations (Figs. 4–7):

– 1941 — 4 types of anti-gangrenous sera, triple vaccine, antidysenteric tablets;

– 1942 — anti-tetanus serum;

– 1943 — anti-typhoid tablets, dysentery dry bacteriophage, dysentery subcutaneous vaccine;

– 1944 — pentovaccine, typhus vaccine;

– 1945 — gramicidin, agglutinant sera.

A rapid increase in the number of employees was required due to the expansion of the scope of scientific research performed, the provision of two-three-shift production work, and the maintenance of various utility areas, often located at a considerable distance from the KIEM main base. According to the official report, the maximum number of employees in all categories was registered in 1943 (Table 1).

The results achieved by KIEM in wartime are reflected in the implementation of production plans. The most informative indicator is the gross output calculated in constant and selling prices of that time (Table 2).

The maximum volume of production was registered in 1943 when the output increased by more than eight times compared to the pre-war 1940 and by 4.5 times compared to 1941. Subsequently, the production volumes decreased insignificantly, but the planned targets of KIEM were still exceeded (Table 3).

Labor productivity was estimated on the basis of gross production volumes based on the average output per worker (rubles), and its increase was assessed by the relation of this indicator to the actual level of the pre-war 1940 (Table 4).

Only 55 of 800 items of materials required by the Institute for its work were centrally funded. More precisely, no more than half of the list of materials for KIEM was allocated according to orders, and even those were not received in full. For example, centralized orders for forage for horse-producers were executed locally by 20–50%, and even less for fuel and lubricants. The Institute's economic executives had to fund the rest, while showing enormous ingenuity.

Under wartime conditions, the extreme reduction of the Institute's needs was achieved, primarily by saving critical materials and finding less costly and more affordable substitutes. Given half a chance, self-sufficiency was practiced by organizing subsidiary farms, one of which was the "Horse sanatorium" in Teteyevo. However, such methods could only partially weaken the dependence on external sources of supply.

Already in early 1942, there was a dire shortage of glass, distilled water, hydrochloric acid, and

Table 1. The staff of the Kazan Institute of Epidemiology and Microbiology in 1940–1945

Years	Total number	Including		
		Researchers	Professors	Ph.D.
1940	151	6	—	—
1941	187	22	4	—
1942	270	33	3	4
1943	344	36	4	4
1944	312	23	4	—
1945	258	32	3	3

Table 2. Gross production of the Kazan Institute of Epidemiology and Microbiology in 1940–1945 (thousand roubles)

Years	Constant prices		Selling prices	
	Planned	Actual	Planned	Actual
1940	754	569	1796	1267
1941	829	1059	1302	1560
1942	3189	3985	4359	5274
1943	3954	4744	5211	5686
1944	3315	4181	3660	3734
1945 (6 months)	1519	2117	1386	1745

Table 3. Dynamics of the fulfillment of plans of the Kazan Institute of Epidemiology and Microbiology in 1940–1945 (%)

Prices	1940	1941	1942	1943	1944	1945
Constant prices	75.4	127.6	123.4	120.0	106.8	139.3
Selling prices	70.4	119.8	121.0	109.1	102.0	125.9

Table 4. Labor productivity at the Kazan Institute of Epidemiology and Microbiology in 1940–1945

Year	Average output per employee (rubles)		% (to the actual level of 1940)
	Planned	Actual	
1940	9281	7642	100
1941	10 184	16 675	218,2
1942	16 631	20 674	270,5
1943	17 652	19 526	255,5
1944	19 805	20 361	266,4
1945 (6 months)	10 721	11 895	311,3

other constantly needed materials. Even paper for crucial laboratory records was in deficiency. The procurement situation remained extremely difficult almost until the end of the war. Only in 1944, there was some alleviation with roughage for laboratory animals, but all other supply problems persisted.

There were also problems with the delivery of manufactured drugs to their destination. The Institute then had two cars, already so dilapidated that they were under repair most of the time. For this reason, the main transportation was implemented by the Institute's horse-drawn transport that included ten horses with carts. The condition of the roads was also appalling, as in autumn and spring, and sometimes even after summer rains, they became practically impassable. Now it can hardly be imagined how carefully wrapped fragile bottles with semi-finished sera were delivered from Teteyevo to Kazan in broken carts via a muddy road. However, this road functioned continuously throughout the war, and the salvation of tens of thousands of seriously wounded people depended on it.

Research activities continued actively.

During the Great Patriotic War, four employees of KIEM defended their Ph.D. theses in Medicine.

1. T.M. Kokushina ("On the use of complement and normal hemolysin for RW"). 2. K.F. Firsova ("On the role of microbial antagonists in experimental gaseous gangrene"). 3. I.E. Alatyrtseva ("On complex immunization against the microbes of gaseous gangrene"). 4 A.G. Grigorieva-Berenstein ("Epidemiological aspects of diphtheria in wartime").

In 1945, six more female employees worked on dissertation research topics at KIEM.

1. V.N. Sharovskaya ("Tryptic digestion media for toxin formation of diphtheria bacillus"). 2. V.V. Ananyeva ("Comparative evaluation of anti-perfringens serum titration methods"). 3. R.B. Donskaya ("Comparative evaluation of various diagnostic agents for the Weil-Felix test and Noble reaction"). 4. E.M. Kuryanova ("Biological characteristics of the production strain Bac. Brevis"). 5. P.A. Sergeeva ("Influence of nonspecific factors on the production of humoral antibodies"). 6. A.M. Volkova ("Study of the stability of blood serum proteins as a method for identifying exhaustion of horse-producers") [4].

During the war years, the institute staff worked dedicatedly with thorough involvement and shared harsh life conditions with all Soviet citizens; they froze and were underfed, eagerly listened to the reports of the Soviet Information Bureau, cried over condolence letters, and rejoiced with the thunders of triumphal fireworks.

The urgent task was to save the population from hunger and cold. In those years, heating in Kazan was almost exclusively wood-based; thus, the problem of heating the premises was difficult to solve. The rearward rations provided only the minimum (hunger) rate of basic foodstuffs. These tasks were solved by arranging subsidiary farms at the enterprises of the city and sending workers to participate in producing stock on terms of payment in kind. At the expense of these sources, a canteen was organized at KIEM, where workers received daily hot meals exceeding the rationing norm. According to the decision of the trade union committee, part of the food products was allocated to the families in greatest need.

KIEM subsidiary farm (40 hectares) produced annually 60–70 tons of potatoes and 5–10 tons of cabbage. Up to 150 people were involved in its service, and 1200–1300 workdays were spent per year. Every year, 20–30 people were sent from KIEM to prepare firewood for Tetyushsky timber industry enterprise from spring to autumn. Firewood was delivered by barges. The barges were unloaded in the Kazan river port by KIEM personnel, which usually completely occupied the working days of the staff. Therefore, all employees became loaders, including the top management and leading scientific experts (in all other cases, qualified specialists were not involved in general labor activities). As a result, the Institute was fully supplied with firewood. A fairly substantial balance was distributed among the employees, primarily to the families of the front-line soldiers.

The Soviet people knew not only how to work, but also to rest; otherwise, they would not be able to withstand the enormous strain of the war years.

Due to the evacuation, Kazan was temporarily transformed into a cultural capital, where famous actors performed more frequently than in other cities. During almost the entire war, KIEM organized cultural crusades to theater and cinema twice a month. These cultural crusades, which were held at the end of each working week, involved 100 to 220 people. Occasionally, a portable film projector was brought to the Institute, and cinema performances for the employees were arranged in the assembly hall of KIEM.

On special occasions, gala concerts were held with the participation of guest stars of the opera and the scenic arts, as well as local amateur performances, as the Institute had a good choir interest group of 15 people. They arranged New Year celebrations and distributed gifts, which was particularly important in providing joy for children in rough times.

Thus, together with all Soviet citizens, the KIEM employees contributed to the sacred affair of victory over fascism and to the protection of the health of soldiers and civilian population of Russia during the Great Patriotic War.

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