Soviet genetics

Totalitarianism and freedom
Biology in Soviet Union: 1920s

- Modernist project
- Development on the basis of XIX century science
- Many young people from lower social classes became able to get education
- 1924-1929 – New economic policy (NEP)
- History as a progress: ideological basis
Famous geneticists

• Nikolai Vavilov
• Nikolai Koltsov
• Sergei Chetverikov
• Alexander Serebrovsky
• Iosif Rapoport
• Georgii Karpechenko
• ...many others
Nikolai I. Vavilov
1887-1943

- Identified the centres of origin of cultivated plants
- Law of homologous series in variation (in evolution)
- One of fathers of “Green Revolution”
- He devoted his life to the study and improvement of wheat, corn, and other cereal crops that sustain the global population
- President of Soviet Agricultural Academy (VASKhNIL) in 1929-1935
N.I. Vavilov and the concept of Neolithic revolution

- Genetic diversity in narrow mountainous regions
- Primary selection in mountainous regions
- Spreading to river valleys and development of agricultural practices with further selection
- Further spreading to the periphery and out of the center of origin
- Acquiring new features (weeds become crops etc.)
Centers of origin of various crop plants (after Vavilov)

Nikolai Vavilov (1887-1943)
Spreading from the centres of origin
1 – dominant genes, 2 – heterozygous, 3 – recessive, 4 - isolates

Vavilov’s concept of species: Complex dynamic morpho-physiological system bound in its origin to a certain environment and area and following the law of homologous series in variation
Rise of civilization

- Initial agricultural practices in narrow mountainous regions
- Formation of the core of agricultural civilization
- Spreading to river valleys and formation of primary societies
- Expansion of agricultural civilizations
- Acquiring of animal farming by nomadic people
- Establishment of contacts between civilizations
- Formation of secondary societies and globalization trends
N.I. Vavilov and Margaret Newton

- Impressed with the work of Canadian phytopathologist Margaret Newton on wheat stem rust, in 1930 N.I. Vavilov attempted to hire her to work at the institute.
- She declined, but visited the institute in 1933 for three months to train 50 students in her research.
N.I. Vavilov and Hermann Muller

- Discoverer of radiation mutagenesis
- He had radical political views
- Invited by N.I. Vavilov
- Lived in Soviet Union from 1933 to 1938
- Escaped from Soviet Union with the help of N.I. Vavilov
Prison and death

- Vavilov was arrested on August 6, 1940, while on an expedition to Ukraine. He was sentenced to death in July 1941.
- In 1942 his sentence was commuted to twenty years' imprisonment; he died in prison in 1943 of starvation.
- In prison he wrote the book “The History of Development of World Agriculture” – it was destroyed.
Nikolai K. Koltsov
1872-1940

- In 1903 Koltsov proposed that the shape of cells was determined by a network of tubules which he termed the cytoskeleton (based on experiments with crustacean cells)
- In 1927 Koltsov proposed that inherited traits would be inherited via a "giant hereditary molecule" which would be made up of "two mirror strands that would replicate in a semi-conservative fashion using each strand as a template"
- Founder of the Institute of Experimental Biology and several genetics departments
Nikolai K. Koltsov

• In 1920, Koltsov was arrested as a member of the non-existent "anti-Soviet Tactical Center". Saved from execution by Maxim Gorky (writer)

• His death in 1940 was claimed to have been due to a stroke. However it was later revealed that it was a result of his poisoning by the NKVD, the secret police of the Soviet Union.
Sergei S. Chetverikov 1880-1959

- the modern synthesis of evolutionary theory
- Natural selection and mutations
- “waves” of life
- Selection of silkworm

- Arrested in 1929-1932
- Dismissed in 1948
Alexander S. Serebrovsky
1892-1948

- Concept of gene divisibility (chromosomal crossover units)
- Population gene pool
- Gene geography
- Genetic method against pest insects
Iosif Rapoport

Discoverer of chemical mutagenesis – nominated to Nobel prize in 1960s together with Charlotte Auerbach

He spoiled the triumph of Lysenko at the August 1948 Session of VASKhNIL
Georgii D. Karpechenko
1899-1941

- Allopolyploidy in evolution, also of cultivated plants
- Raphanobrassica (Brassicoraphanus, radicole) – fertile offspring of radishes and cabbages, the first instance of a new species obtained through polyploid speciation during experimental crossbreeding of different genera
- He was sentenced to death and executed on July 28, 1941.
Geneticists – victims of terror

• From 1934 to 1940, under Lysenko's admonitions and with Stalin's approval, many geneticists were executed (including Isaak Agol, Solomon Levit, Grigorii Levitskii, Georgii Karpechenko and Georgii Nadson)

Georgii Nadson – one of discoverers of radiation mutagenesis

Grigory Levitsky - author of karyotype concept
Michurinist Biology

- Soviet propaganda contrasted the "productive" "Soviet Michurinist Biology" with the "fruitless" "capitalist" Weismanist-Morganist-Mendelian genetics

- Michurin's theory of influence of the environment on the heredity was a variant of Lamarckism. He maintained the position that the task of a selectioner is to assist and enhance the natural selection.
Ivan V. Michurin (1855-1935)

- "We cannot wait for favors from Nature. To take them from it – that is our task."

- Selection of plants – like Luther Burbank
Trofim D. Lysenko
Some aspects of Lysenko research

- Vernalization
- Stage theory
- Seeding of potatoes by tuber cuts
- “Net” seeding in agriculture
- Branched wheat
- Inheritance of acquired traits

Branched-spike spring wheat (*Triticum turgidum* L.) genotypes are periodically promoted in western Canada as having very high grain yield capacity.
Stalin and Lysenko

And we shall defeat drought
Lysenko and vernalization

• Limited significance
• No mechanism revealed
Olga Lepeshinskaya

- was a Soviet biologist, a personal protegée of Vladimir Lenin, later Joseph Stalin, Trofim Lysenko and Alexander Oparin
- She rejected genetics and was an advocate of spontaneous generation of life from inanimate matter.
Session of VASKhNIL - 1948

- VASKhNIL (Russian: ВАСХНИЛ) was the All-Union Academy of Agricultural Sciences of the Soviet Union named after V.I. Lenin
Session of VASKhNIL

• “The Central Committee has read my report and approved it.” - Long applause, all stand up
• Lysenko confirmed that Stalin had personally gone over his text.
• The Michurinist biology was portrayed as a socialist, materialist, proletarian science, a kind of “creative Darwinism” deriving from Darwin, Timiryazev, and Michurin that united theory and practice, and had mastered the control of heredity.
Results of VASKhNIL session

• Genetics was officially declared "a bourgeois pseudoscience“
• All geneticists were fired from their jobs
• Lysenkoism dominated in Soviet Union until the end of Khrushchev era (mid-1960s)
• Development of biology was significantly affected for many years
Inheritance of acquired characteristics

- One of the foundations of Lamarckism (but not the main)
- Lysenko called this concept “Creative Darwinism”
- Pseudo-scientific in Lysenko theories
- Has relations to current development of molecular biology (Molecular Lamarckism of Eugene Koonin, directed mutations, epigenetic inheritance, Read-Write genome of James Shapiro).
Nikolai P. Dubinin

- One of leading geneticists
- Monopolized Soviet genetics after Lysenko
Pavlovian session

• Joint session of the USSR Academy of Sciences and the USSR Academy of Medical Sciences held on June 28 to July 4, 1950

• During the session, a number of Ivan Pavlov's former students attacked another group of his students (L.A. Orbeli, P.K. Anokhin, A.D. Speransky, I.S. Beritashvili) whom they accused of deviating from Pavlov's teaching
Bauer: Stable non-equilibrium state

• Ervin Bauer (1890-1938)
• Biological molecules are in non-equilibrium conformations
• Author of the monograph “Theoretical Biology”

• Moved to Soviet Union from Hungary
• He and his wife Stefánia Szilárd were executed in 1938
Physics and ideology

• Atomic bomb project stopped ideologization of physics
• In 1930s several physicists were repressed: Matvei Bronstein was executed, Lev Landau was arrested.
• Physicists working on the atomic project were controlled by L. Beriya (NKVD), nobody was arrested.
Current situation in Russia

- Some papers supporting Lysenko
- Not major trend but in most conservative editions
- State support of science in most recent years was devaluated by negative political development.