



Development of some methodological bases of the:

“Program of preservation of a gene pool of the basic species agricultural (farm) animals in Ukraine for the period till 2015 ”



The reporter: Igor Guziev - the deputy director of the Institute of Animal Breeding and Genetics of the UAAS,), the National Coordinator for management AnGR from Ukraine

The printed materials of scientific discussion of
"the Problem of preservation of a genofond of animals"

УКРАЇНСЬКА АКАДЕМІЯ АГРАРНИХ НАУК
Інститут розведення і генетики тварин



**ПРОБЛЕМИ ЗБЕРЕЖЕННЯ
ГЕНОФОНДУ ТВАРИН**

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Методологічні аспекти збереження генофонду сільськогосподарських тварин



Stages of statement of a question on international scene and in Ukraine

- 4
- 1946** – **Session of Advisory committee on an agriculture**
(recommended FAO to accept responsibility concerning
an estimation and conservation of fund of plants and animals)
 - 1966** – **13-n session FAO** (the working group by an estimation, use
and conservation of genetic resources has been generated)
 - 1992** – **The world summit in Rio de Janeiro** (167 countries have signed
the Convention concerning a biological variety)
 - 1994 (on November, 27)** – **The Supreme Rada of Ukraine ratified
the Convention concerning a biological variety**
 - 2007** – **The report of FAO: the Condition of the world genetic resources
of animals in sphere of the foodstuffs and agricultural**
(from 169 reports of the countries)
 - 2007 (september)** – At the first International Technical Conference on
Animal Genetic Resources for Food and Agriculture,
held in Interlaken (Switzerland), **the international community
adopted the Global Plan of Action for Animal Genetic Resources**
 - 1996-2015** – **National reports of Ukraine on preservation of a biological diversity**
(the priority task is determined – to raise a role of an agriculture
in support of a biodiversity)

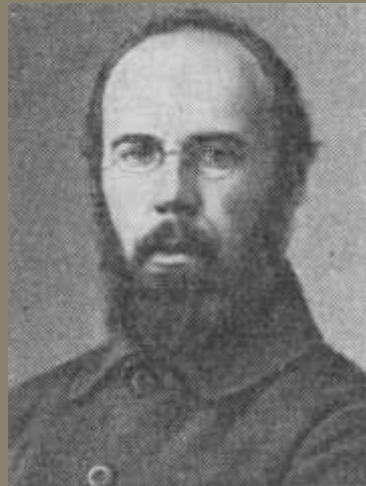
Domestic classics of a problematic of preservation of a genofond



M. I. Vavilov



V. I. Vernadsky



O. S. Serebrovsky

The Ukrainian scientists who were engaged in preservation
of a gene pool of breeds of agricultural animals



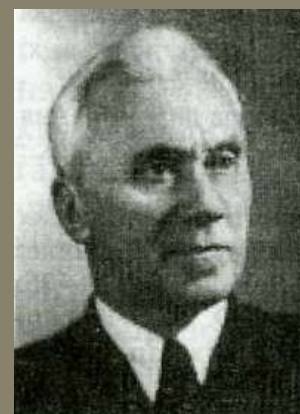
J.F. Liskun



O.O. Brauner



M.F. Ivanov



M.D. Potjomkin



M.M. Kolesnik



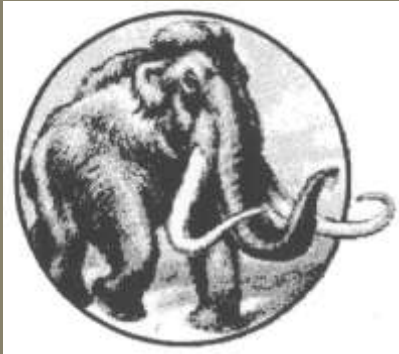
M.A. Kravchenko



F.F. Ejsner



I.V. Smirnov



B.N. Veprintsev:

«... there are all bases to consider creation of genetic cryo-banks already now a necessary part in a circuit of actions, directed on preservation of genetic resources of our Planet, real chance of rescue of disappearing kinds, and in the future – in a reconstruction of species already extinct ... »

« In theoretical circuitry of a reconstruction of animals offered by us from tinned яйцеклеток, сперматозоидов, zygotes and somatic cells are not present fundamental scientific restrictions for their realization » (1976 – 1978)

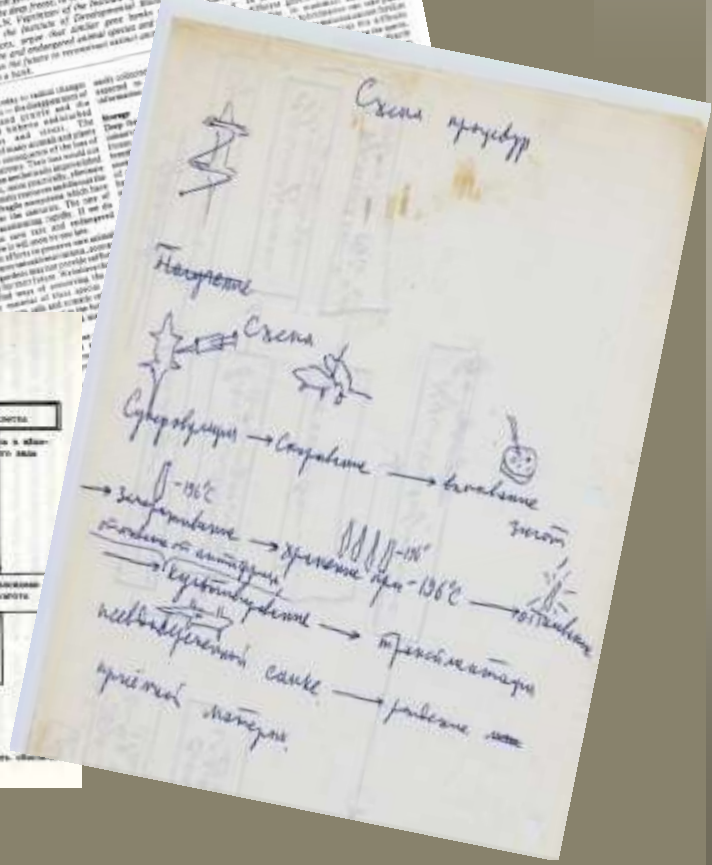
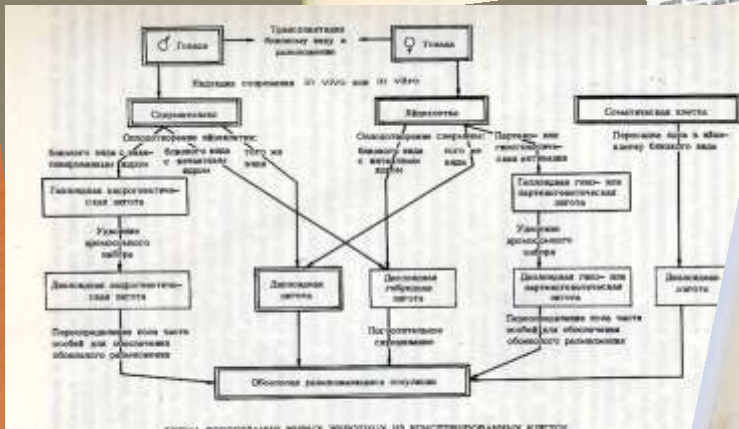
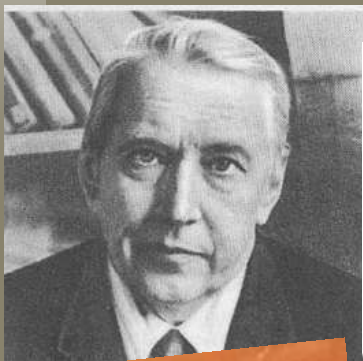
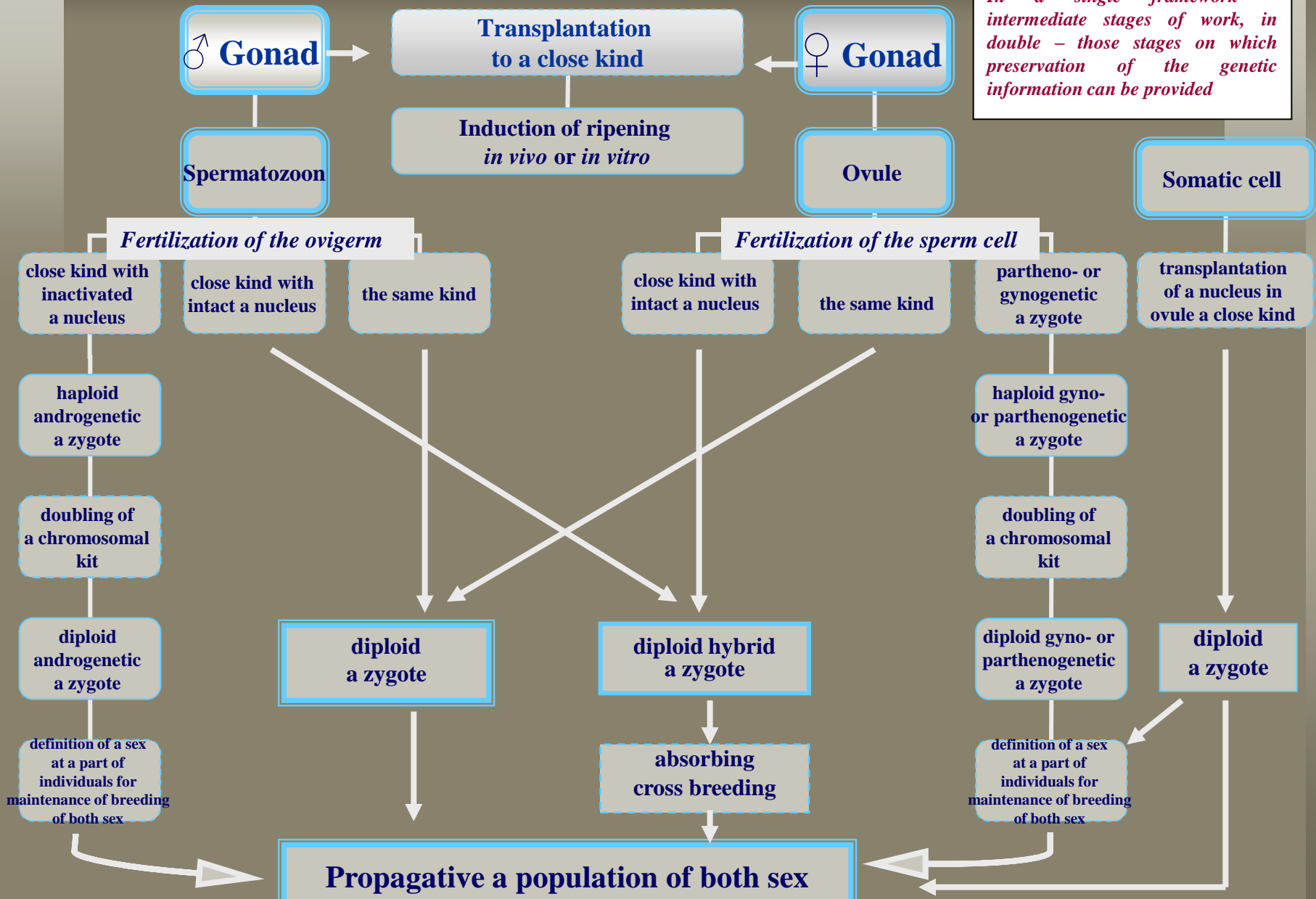


Схема восстановления живых животных из консервированных клеток. Примечание: Развод обозначил промежуточные стадии работы, выходящей за рамки статьи, в которой может быть использована сохраненная генетическая информация.

Reproduction of alive animals from tinned genomes

In a single framework – intermediate stages of work, in double – those stages on which preservation of the genetic information can be provided



The basic strategic postulate:

“We should keep everything, that has reached up to now, selection property (heritage) of the nation, and also a reserve thoroughbred genofond of domestic micro-populations of the best world (global) genetic resources “

**Preservation of a gene pool (biodiversity)
of animal industries of Ukraine**

Strategy of aggregation of problems

The organization of breeding service in the state

Gene pool object –

determined by selectors for long preservation minimally necessary volume breeding (a micro-population in conditions in situ) and genetic (conditions ex situ, in particular in cryo-bank) of resources of the certain genus, kind, subspecies, breed, offspring or type of agricultural (farm) animals.

Domestic classification:

- 1 category [1]** – domestic gene pool object which already at the moment is on the verge of disappearance;
- 2 category [2]** – domestic improving breeds (or their intrabreed: types, offspring's, populations), which for given time have rather normal total number, genealogic structure and the commercial status;
- 3 category [3]** – reserve gene pool of the best foreign improving breeds (offspring's, populations).

The international classification:

1. **Local breeds:** breeds that occur only in one country.
2. **Transboundary breeds:** breeds that occur in more than one country. These are further differentiated as:
 - 2.1. **Regional transboundary breeds:** transboundary breeds that occur only in one of the seven SoW-AnGR regions*.
 - 2.2. **International transboundary breeds:** transboundary breeds that occur in more than one region.

* **Note:** SoW-AnGR regions: seven regions were defined for the SoW-AnGR: Africa, Asia, Europe and the Caucasus, Latin America and the Caribbean, the Near and Middle East, North America, and the Southwest Pacific.

Amount gene pool objects (populations)

15

Kind of animals	Amount of objects
Cattle (Large horned livestock)	61
Horse	16
Sheep	28
Goat	7
Pig	23
Hen	86
Turkey	15
Goose	21
Duck	22
Pheasant	18
Quail	12
Guinea fowl	4

Amount gene pool objects (populations)

16

Meat pigeon	12
Ostrich	3
Fish	23 (from 12 kinds)
Rabbit	17
Nutria	10
Chinchilla	7
American mink	17
Polecat furo	4
Fox	3
Arctic fox	2
Bee	8
Bombyx	131
In total	550

The gene pool status –

it is the organizational form of preservation of the gene pool objects (a appropriate condition of the subject of a breeding affair in animal industries, which is defined by a format and specificity of its activity, directed on preservation of a genofond).

1. The gene pool population (preserve) – structure which provides thoroughbred breeding of the defined aggregate of animals of one breed in different genofond farms.

2. The gene pool herd – the group of thoroughbred animals allocated for conservation and a reconstruction of a genofond of breed.

3. Relic herd – the group of animals which concern to disappearing breed of animals.

4. Collection herd – the modular (composite) herd submitted by groups of animal different breeds and kinds.

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5. Reservation (herd of a reserve genofond) – the gene pool farm, which specializes on breeding of animal of the specified improving foreign breeds or types.

6. The gene pool nursery – the gene pool farm, where separate examples of animals contain.

7. National bank of genetic resources of animals and other cryo-banks – special depository for long-term conservation of a genetic material of animals.

The gene pool subject (farm) –
the subject of a breeding affair (business) in animal industries, to which on a direction of its activity it is appropriated of the gene pool status, therefore it acts as the carrier of the legal rights and duties concerning the contents (guarantee of functioning) specified organizational form of preservation of a genofond.

“ REGULATIONS ABOUT PRESERVATION OF A GENE POOL OF AGRICULTURAL (FARM) ANIMALS “



- 1. GENERAL DISPOSITIONS**
- 2. THE BASIC SUBJECTS OF PRESERVATION OF THE GENOFUND**
- 3. REQUIREMENTS WHICH DEFINE CONFORMITY TO STATUS OF THE GENE POOL FARM AND BANK OF GENETIC RESOURCES**
- 4. ORGANIZATIONAL - TECHNOLOGICAL BASES PRESERVATIONS AND RATIONAL USE OF THE BREEDING (GENETIC) RESOURCES**
- 5. FINANCIAL MAINTENANCE OF PURCHASE AND PRESERVATIONS OF THE BREEDING (GENETIC) RESOURCES**

**Logic of algorithm of calculations
of key parameters
of the gene pool micro-populations**

Stages of definition:

- 1. Effective population size;**
- 2. Female total number in population;**
- 3. Male's part of populations and
a corresponding ratio of sex in them.**

Necessary volume of breeding resources for preservation of the gene pool objects of some kinds of farm animals

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Kind	$N_{\text{♀}}$	$N_{\text{♂}}$	/	Lines	Note
Horse 	70	17	1:4,1	2	Minimum
	150	15	1:10	3	Optimum
	500	14-17	1:29,4 - 35,7	6	Maximum
Cattle 	100	20	1:5,0	3	Minimum
	300	18	1:16,7	4	Critical optimum
	500	17	1:29,4	6	Optimum
	1000	17	1:58,8	8	Maximum
Sheep 	200	41	1:4,9	3	Minimum
	350	38	1:9,2	4	Optimum
	500	37	1:13,5	6	Maximum




Necessary volume of breeding resources for preservation of the gene pool objects of some kinds of farm animals

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Pig 		100	25	1:4	3	Minimum	
		500	21-50	1:10- 23,8	5	Optimum	
		1000	21- 100	1:10- 47,6	8	Maximum	
Hen	Egg 		220	72	1:3	4	Minimum
			300	67	1:3	5	Optimum
			500	61	1:8,2	7	Maximum
	Meat 		250	84	1:3	4	Minimum
			300	79	1:3,8	5	Optimum
			500	72	1:6,9	7	Maximum

Necessary volume of breeding resources for preservation of the gene pool objects of some kinds of farm animals

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<p style="text-align: center; font-size: 2em;">Carp</p> 	42	84	2:1	4	Minimum
	63	126	2:1	5	Optimum
	84	168	2:1	6	Maximum
<p style="text-align: center; font-size: 2em;">Bee</p> 	200 bee-families and 2400 female bees				Minimum
	1000 bee-families and 12000 female bees				Optimum
	3000 bee-families and 36000 female bees				Maximum
<p style="text-align: center; font-size: 2em;">Bombyx</p> 	150	150	1:1	2	Minimum
	200	200	1:1	2	Optimum
	250	250	1:1	2	Maximum

Directions of favorable pressure of separate structural factors on maintenance of a genetic diversity in the closed micro-populations

Increase:

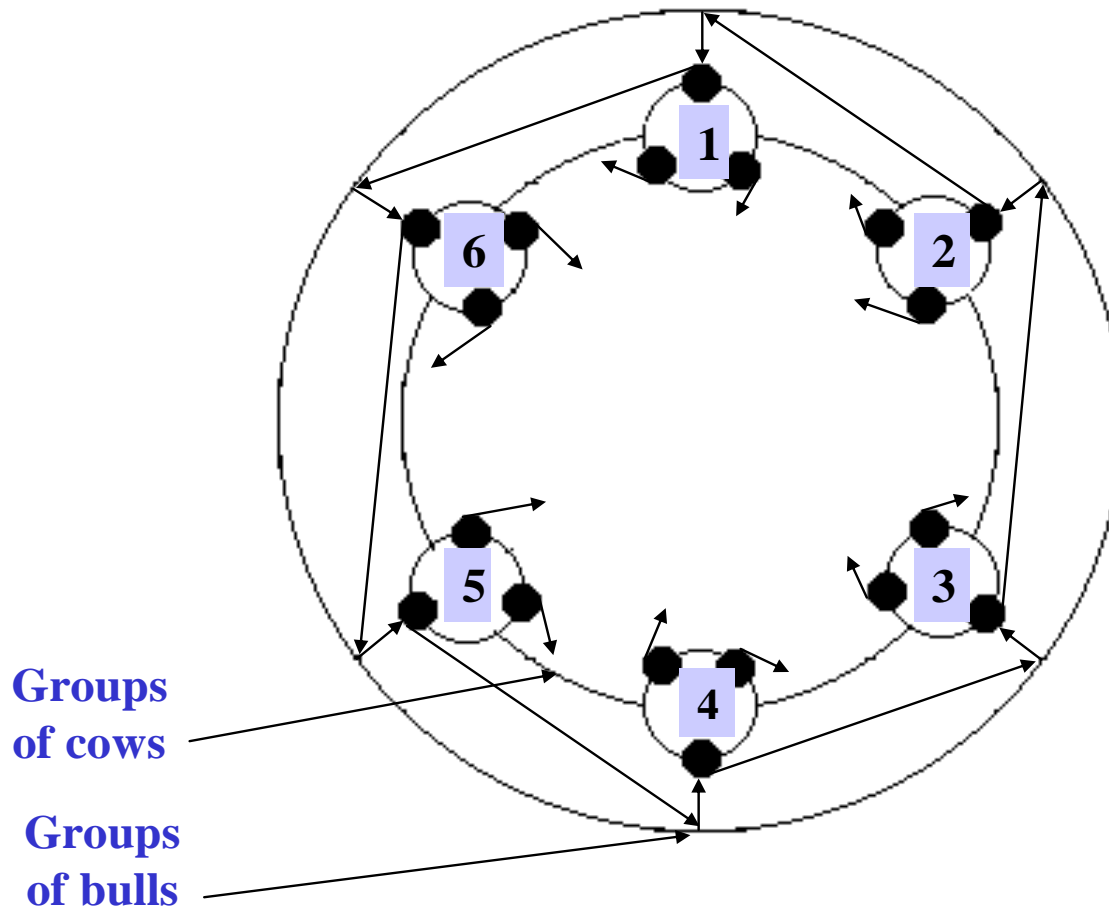
- Population size
- Shares of a male
- Uneven-age male's representation
- Genetic migration
- Interval between generations

**Assistance to expansion of a genetic diversity
in gene pool micro-populations**

Decrease:

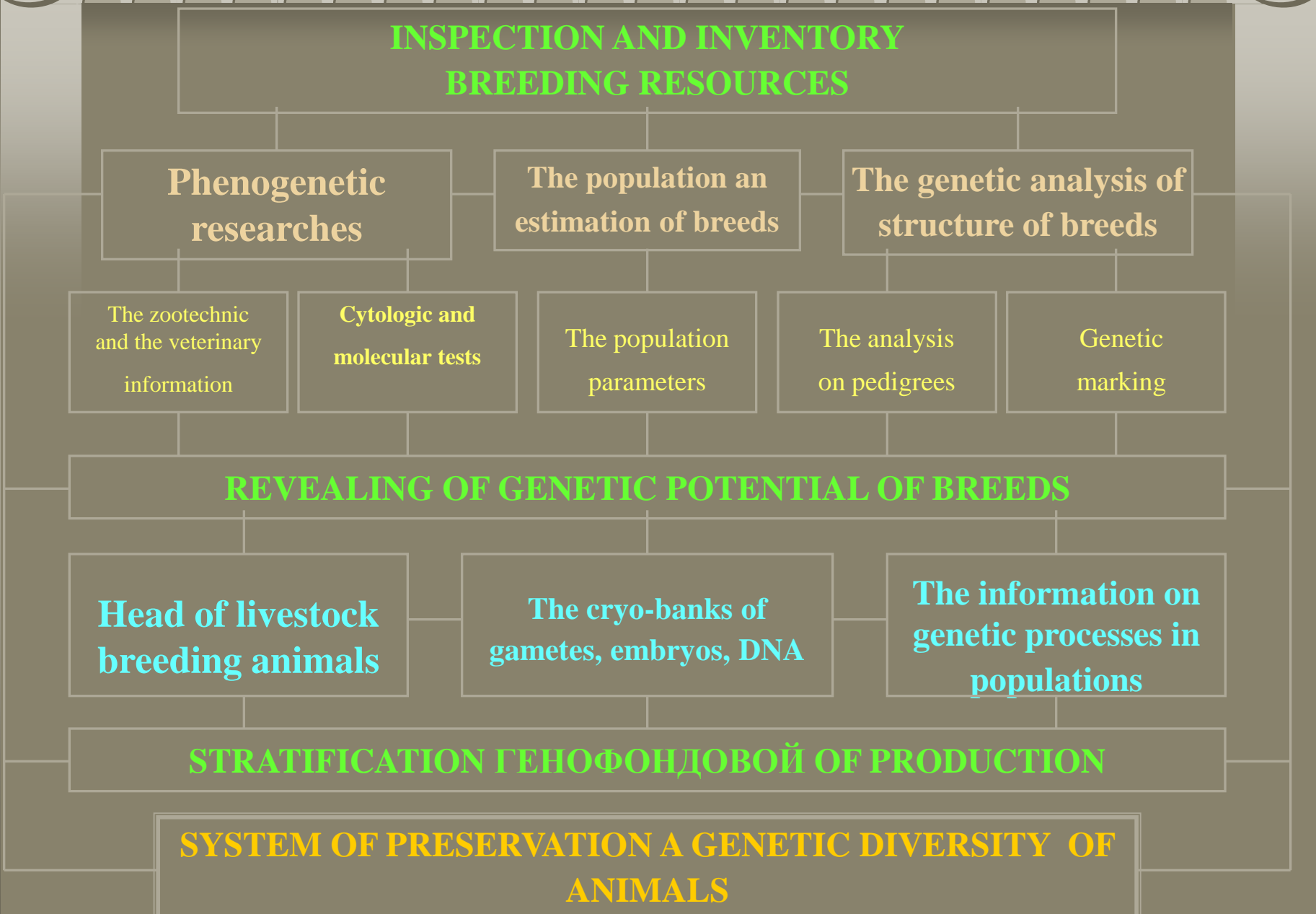
- Linear (family) differentiation
- Level of replacements of herd

The circuit of matching of pairs inside groups and between related groups in closed gene pool herd of cattle



THE BASIC STAGES OF СЕЛЕКЦИОННО-GENETIC MONITORING

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The genofond cryo-banks of branch institutes UAAN:

Institute of animal industries UAAS
Horse, Cattle, Sheep, Pig, Furry animals

Institute of animal industries of steppe areas "Askanija-Nova" UAAN
Sheep, Cattle

Institute of pigstry UAAS
Pig

Institute of poultry farming UAAS
Poultry

Institute of fish economy UAAS
Fish

Institute of bee keeping UAAS
Bees

Department of sericulture of In-te experim. and clinical vetmedicine UAAS
Bombyx

Institute of Animal Breeding and Genetics of animals UAAS
National bank of genetic resources
The central laboratory of the genetic control
All kinds of agricultural (farm) animals

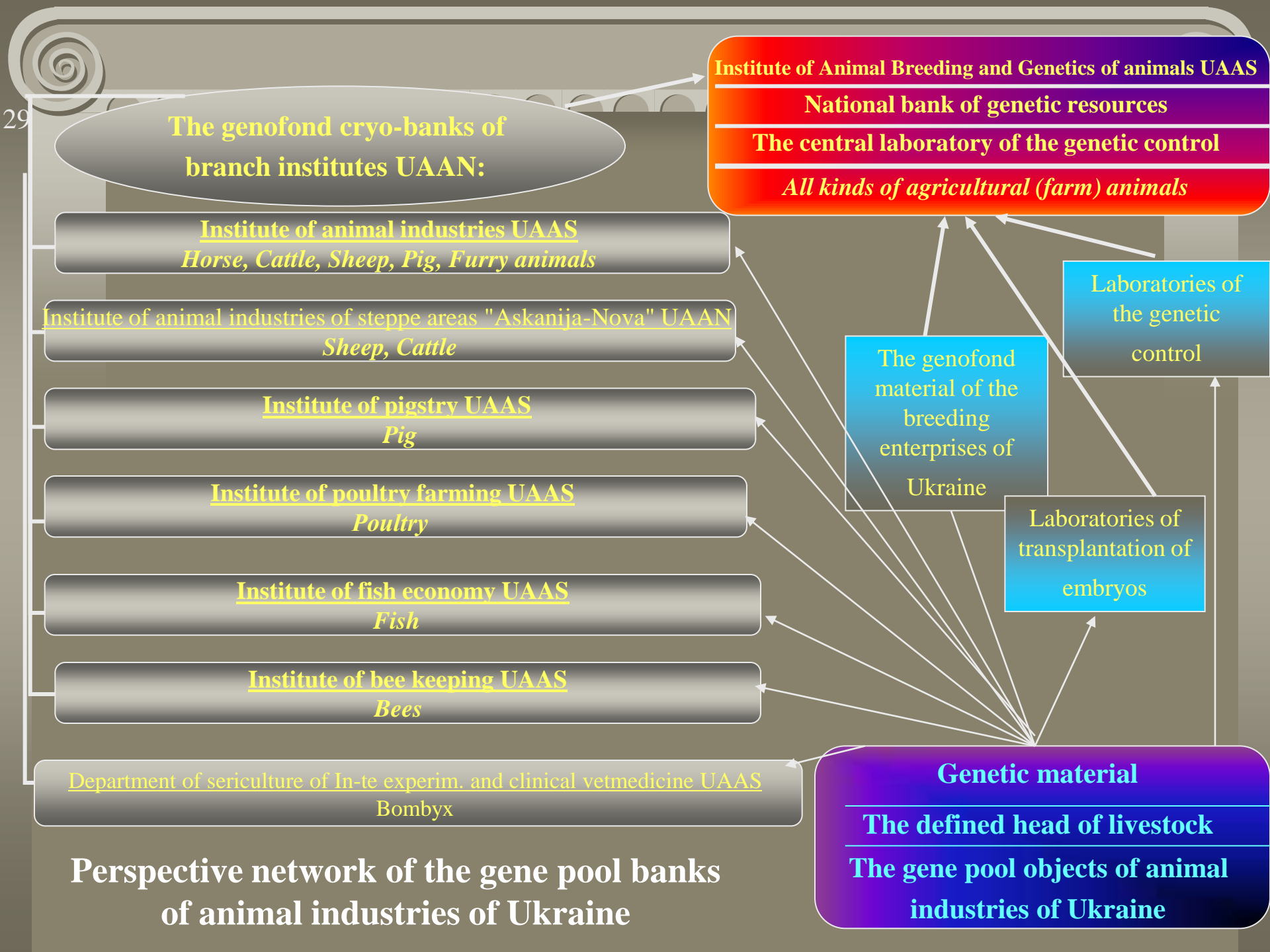
The genofond material of the breeding enterprises of Ukraine

Laboratories of the genetic control

Laboratories of transplantation of embryos

Genetic material
The defined head of livestock
The gene pool objects of animal industries of Ukraine

Perspective network of the gene pool banks of animal industries of Ukraine



National bank of genetic resources of animals of Ukraine

30

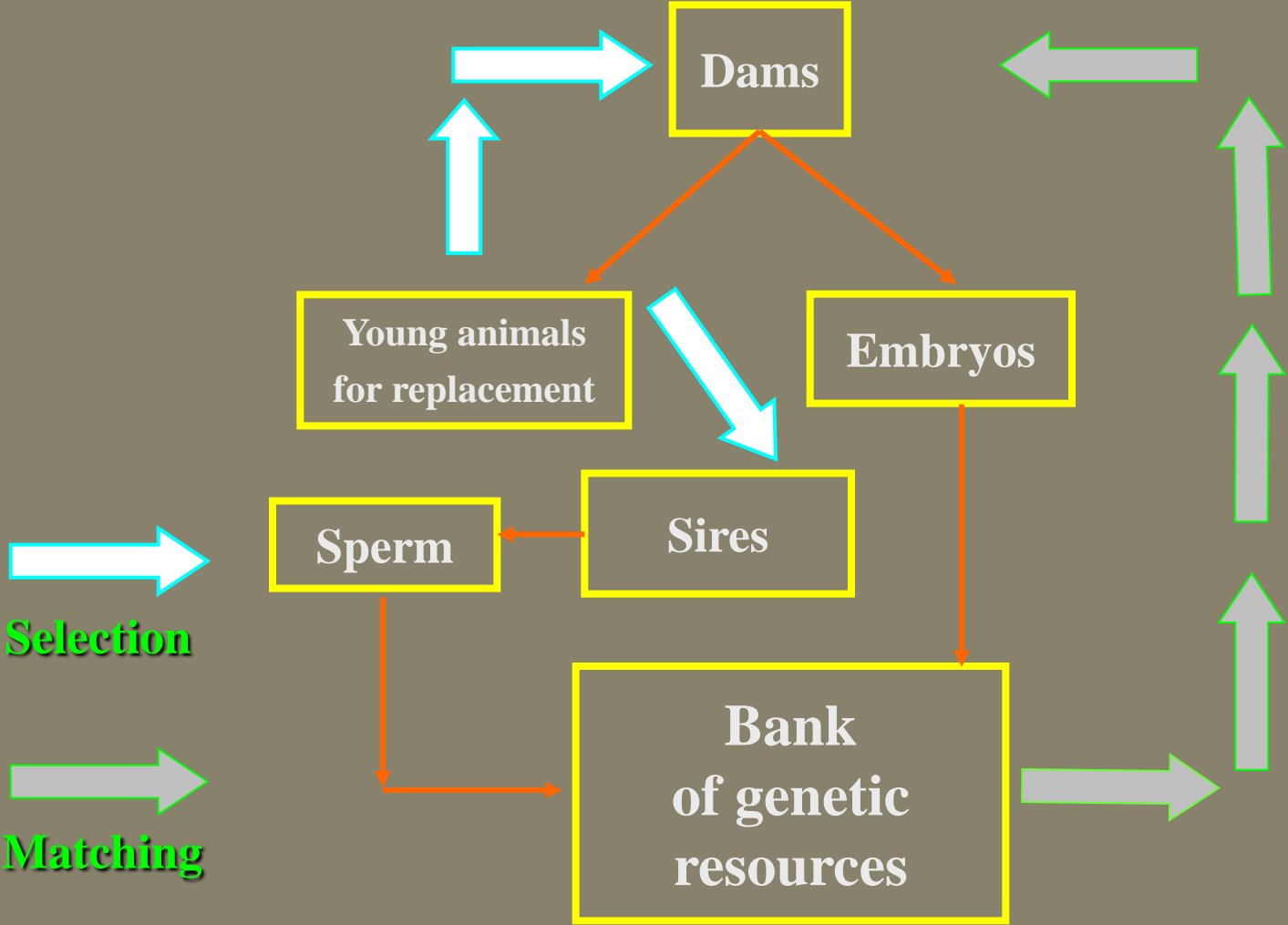
НАЦІОНАЛЬНИЙ
БАНК
ГЕНОФОНДУ
ТВАРИН



Genetic material of national gene pool cryo-bank of IABG UAAS

Genetic material	Kind of animals	Amount of breeds	Amount of sire	Amount of a material, dozes, pcs.
Sperm	Cattle	27	207	142620
	Horse	2	4	26
	Fish	1	5	130
Embryos	Cattle	6		350
DNA-samples of blood	Cattle	22		1512
	Horse	8		1173
	Pig	3		81
	Ostrich	1		5

THE CIRCUIT OF FUNCTIONING OF VIRTUAL GENE POOL CRYO-HERD (VGCH)



The reference minimal need for a genetic material for preservation of everyone genofond object and as a whole for the basic kinds of agricultural animals a method *ex situ*

Kind of animals	Amount for long-term preservation of one object		Amount of the gene pool objects	In total	
	Sperms, dozes	Embryos, pcs.		Sperms, dozes	Embryos, pcs.
Horse	3000	300	16	48000	4800
Cattle	6000	450	57	342000	25650
Sheep, Goat	10000	1000	35	350000	35000
Pig	1000	1000	23	23000	23000
Hen, Goose, Duck	1050	900*	129	135450	116100
Fish	1500		23	34500	
Bee	8000		8	64000	
In total:				996950	204550

The note: From everyone of the genofond object it is necessary to have in cryo-bank from 200 up to 1000 samples DNA.

* - The embryonic cells from 900 embryos

Preservation of a genetic material of animals

Lifetime reception and preservation of a material	Material after slaughter
Received <i>in vivo</i> embryos	Received <i>in vitro</i> embryos
	Oocytes
Ejaculated sperm	Epididymis spermatozoa





The complex program of use of biotechnological selection in a reproduction

Reception of embryos *in vitro*

Freezing of the epididymis spermatozoa

New biotechnological methods in animal industries:

- the embryonic cloning;
- reception and application of parthenogenetic embryos;
- reception of chimeric embryos;
- transgenesis, therapeutic cloning

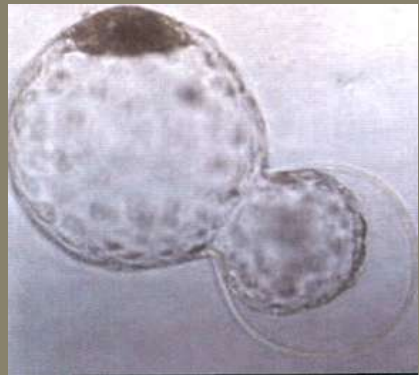
Additional preservation of a valuable genetic material

Not surgical transplantation of embryos

Lifetime definitions of sex of embryos (PCR-the analysis, differential C-colouring of chromosomes)

Reception monoovular twins. Division of embryos

Freezing of embryos by a method of vitrification



The size of the budgetary grant ('thousand hryvnas)

on preservation of a gene pool of agricultural (farm) animals

Kind of an animal	Variants		
	Minimum	Optimum	Maximum
Cattle, in total	43540	159310	306660
Including: - Dairy and dairy-beef breeds	23400	84630	162630
Beef breeds	20140	74680	144030
Horse	10282	19096	59342
Sheep	2557	4037	5543
Goat	348	664	1227
Pig	9033	35800	71599

The note: 1 € ≈ 11,5 hryvnas

The size of the budgetary grant ('thousand hryvnas)

on preservation of a gene pool of Poultry

Kind of an animal	Variants		
	Minimum	Optimum	Maximum
Hen	1229	1473	2277
Turkey	387	440	666
Goose	350	486	974
Duck	458	521	734
Pheasant	629	685	913
Quail	32	36	49
Guinea fowl	79	97	194
Meat pigeon	104	214	324
Ostrich	188	411	1026

The size of the budgetary grant ('thousand hryvnas)

on preservation of a gene pool of industrial kinds of a fish

Kind of an animal	Variants		
	Minimum	Optimum	Maximum
Fish, in total	243	367	486
Including: - Carp	166	250	333
- Spoon-billed cat	2	3	3
- The Russian sturgeon	2	3	4
- White Amur	7	11	15
- Sterlet	3	5	7
- Motley silver carp	7	11	14
- Buffalo	6	9	11
- Channel catfish	7	10	14
- White silver carp	7	11	14
- Trout river	11	16	21
- Rainbow trout	16	25	33
- The Amur sazan (carp)	9	13	17

The size of the budgetary grant ('thousand hryvnas)

on preservation of a gene pool of herbivorous and fur-bearing animals

Kind of an animal	Variants		
	Minimum	Optimum	Maximum
Rabbit	373	438	604
Nutria	465	523	895
Chinchilla	556	723	1389
American mink	664	1152	2618
Polecat furo	274	473	1076
Fox	221	300	578
Arctic fox	213	345	664

The note: 1 € \approx 11,5 hryvnas

The size of the budgetary grant ('thousand hryvnas)

on preservation of a gene pool of Bee and Bombyx

Kind, Group of breeds	Variants		
	Minimum	Optimum	Maximum
Bee	560	2800	8400
Bombyx, in total	4,303	10,590	18,586
Including, hryv.: Group of breeds of the basic maintenance	696	1670	4174
Group of alien (stranger) breeds	107	277	415
Collection group of breeds	3500	8643	13997

The size of the budgetary grant ('thousand hryvnas)

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on preservation of
a gene pool
of agricultural (farm)
animals



Variants (modelling calculation)

Kind of animals

Minimum

Optimum

**35 kinds of agricultural
(farm) animals
of Ukraine**

72 789

230 402

**The note: Calculation on
the real data - 162964**

The note: 1 € ≈ 11,5 hryvnas





**Програма збереження генофонду основних
видів сільськогосподарських тварин в Україні
на період до 2015 року**





*Many thanks
for attention!*