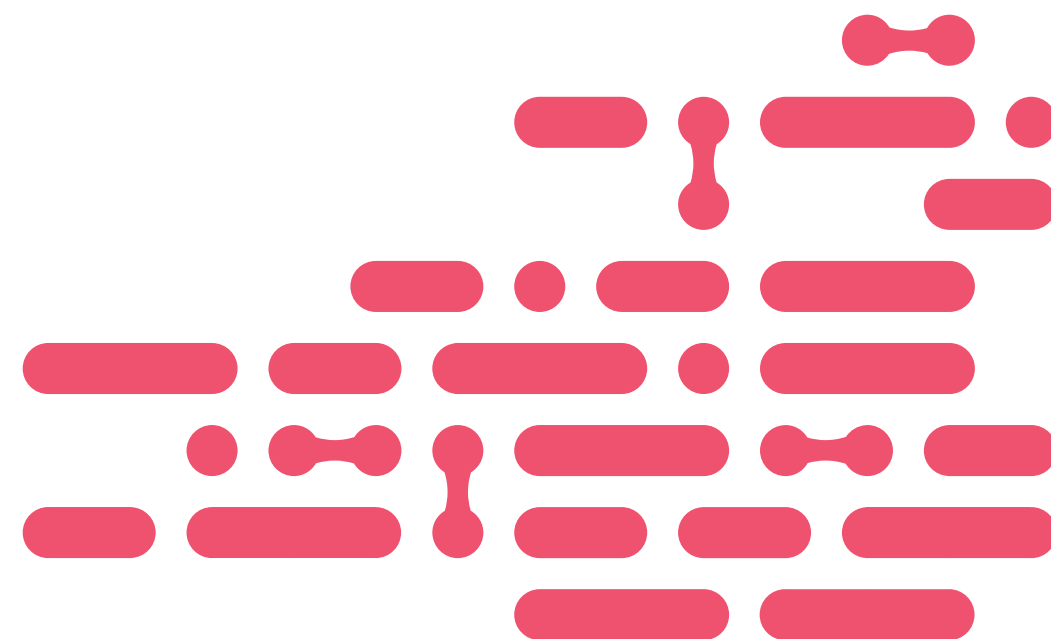


3 R

C C

Swiss 3R
Competence
Centre



Animals in Swiss Science 2017–2019

A breakdown and analysis of expired
animal experimentation licenses in Switzerland



Slides Overview

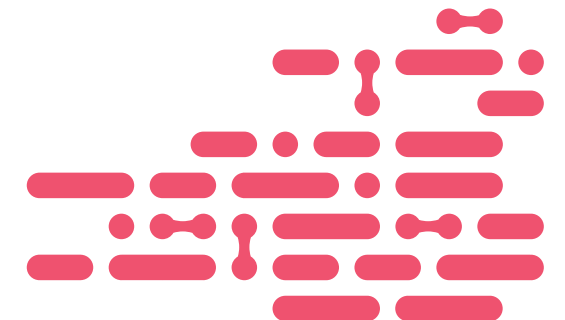
Introduction to the data

Individual licenses

Animal numbers

Research purpose

Breakdown of species information



Introduction to the data



Source of the Data

The BLV provides the public with a quarterly report with information from expired animal experimentation licenses ...

<https://www.tv-statistik.ch/de/abgeschlossene-versuche/>

The screenshot shows the website of the Bundesamt für Lebensmittelsicherheit und Veterinärwesen (BLV). The header includes navigation links for 'Der Bundesrat', 'EDI', and 'BLV', along with 'Kontakt', 'Medien', and 'Extranet'. The language selector is set to 'DE'. The search bar contains the text 'Suchen ...'. The main navigation menu includes 'Medienmitteilung', 'Statistik', 'Erweiterte Statistik', 'Bewilligungen', 'Versuchstierhaltungen', 'Erläuterungen', and 'Vierteljährliche Publikation abgeschlossene Versuche'. The breadcrumb trail shows 'Startseite > Vierteljährliche Publikation abgeschlossene Versuche'. The main heading is 'Vierteljährliche Publikation: abgeschlossene Versuche'.

Der Bundesrat > EDI > BLV

Kontakt Medien Extranet DE FR

 Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

**Bundesamt für Lebensmittelsicherheit
und Veterinärwesen BLV**

Suchen ...

Medienmitteilung Statistik Erweiterte Statistik Bewilligungen Versuchstierhaltungen Erläuterungen Vierteljährliche Publikation abgeschlossene Versuche

Startseite > Vierteljährliche Publikation abgeschlossene Versuche

Vierteljährliche Publikation: abgeschlossene Versuche

Introduction

Original Data

The BLV datasheet provides information on

- Study title
- Area of research
- Study purpose
- Animal species
- Severity degree
- Number of animals

Note that the animals described in these expired licenses could have been used up to 3 years before the year indicated

Original Table and Formatting from the BLV Website

				Werte			
Titel	Fachgebiet	Versuchszweck	Tierart	Summe von SG 0	Summe von SG 1	Summe von SG 2	Summe von SG 3
Preclinical and Personalized Breast Cancer Research	Education	Education and training	Mice / Souris	0	0	0	0
			Mice gm /Souris gm	81	0	0	0
Développement de nouvelles formulations pour des vaccins vers k	Immunology	Recherche biologique fonda	Mice / Souris	0	2321	0	0
			Rats	0	0	0	0
Do horses follow the direction of the human voice?	Ethology	Biological (including medical	Horses / Pferde / Chevaux	20	0	0	0
Linking obesity, metabolic disorders, and inflammation	Metabolism	Recherche biologique fonda	Mice / Souris	218	79	0	0
River bed restoration: how to optimise habitat management for wa	Others	Other studies	Birds / Vögel / Oiseaux	0	9	0	0
Elektrobetäubung / Sedation bei Stören	Animal breeding	Anderer Zusammenhang	Fish / Poissons	0	0	0	0
Sekretion embryonaler Faktoren in der frühen Trächtigkeit des Rin	Endocrinology	Grundlagenforschung	Cattle / Rindvieh / Bovins	0	36	0	0
Polyphenols and reproduction in heifers	Physiology	Grundlagenforschung	Cattle / Rindvieh / Bovins	40	0	0	0
Sprouting of hindlimb corticospinal fibers after thoracic spinal cor	Molecular biology	Grundlagenforschung	Rats	10	1	34	0
In vivo optoacoustic imaging of angiogenesis in a mouse model of	Medical imaging	Biological (including medical	Mice / Souris	0	0	15	0
Kinetics of house dust mite sensitization in a model of house dust	Allergy	Krankheitsdiagnostik	Dogs / Hunde / Chiens	0	12	0	0
Radiosensitization of liver colorectal cancer metastasis for stereo	Cancer Research	Biological (including medical	Mice / Souris	7	8	314	3
Untersuchungen zur Piroplasmose beim Pferd	Veterinary medicine	Krankheitsdiagnostik	Horses / Pferde / Chevaux	13	0	0	0
Prospective, randomized study of the use of either alfaxalone or pi	Oncology	Grundlagenforschung	Cats / Katze / Chats	42	0	0	0
Interaction of Isospora suis with the gut microbiome in pigs: micro	Parasitology	Grundlagenforschung	Pigs / Schweine / Porcs	47	22	0	0
Optimierte Schmerzbehandlungsprotokolle bei Mäusen	3R: Refinement	Grundlagenforschung	Mice / Souris	0	99	36	0
A small animal model to antagonize ischemia reperfusion injury in	Thoracic surgery, lung transplan	Biological (including medical	Rats	0	53	0	0
Implantation von Kathetersystemen bei kleinen Nagern - Erlernen,	Education	Anderer Zusammenhang	Mice / Souris	0	6	22	0
			Mice gm /Souris gm	0	6	20	0
Severity assessment and refinement in mice	3R: Refinement	Anderer Zusammenhang	Mice / Souris	0	6	266	0
Comparison of cardiovascular effects of intramuscular medetomik	Anaesthesiology	Entdeckung, Entwicklung und	Dogs / Hunde / Chiens	0	9	0	0
Studying the role of ALK signaling in the skin development, the hair	Oncology	Biological (including medical	Mice / Souris	0	0	0	0
			Mice gm /Souris gm	36	137	28	0
Paneuropäische FeLV-Studie	Veterinary medicine	Krankheitsdiagnostik	Cats / Katze / Chats	300	0	0	0
Pathogenesis, diagnosis and therapy in protein misfolding disease	Experimental Neurobiology	Grundlagenforschung	Mice / Souris	0	90	0	0
			Mice gm /Souris gm	0	112	0	0
Characterization and organ removal of established and novel trans	Neuroscience, Oncology, Immun	Grundlagenforschung	Mice / Souris	654	161	0	0
			Mice gm /Souris gm	2340	960	0	0
Diabetes and exocrine insufficiency	Diabetes	Grundlagenforschung	Mice / Souris	57	209	220	0
			Mice gm /Souris gm	22	180	160	0
Structural and functional imaging of the visual system in rodent m	Neurology	Biological (including medical	Mice / Souris	0	13	0	0
			Mice gm /Souris gm	0	8	9	19
F-box protein 25 and cutaneous squamous cell carcinoma	Dermatology	Biological (including medical	Mice / Souris	0	3	107	0
Food allergy in mice	Allergy	Grundlagenforschung	Mice / Souris	14	269	0	0
Regulation of mitochondrial function in the kidney tubule	Medicine	Biological (including medical	Mice / Souris	0	342	0	0
			Mice gm /Souris gm	0	264	0	0
Age-dependent Remodelling of the Female Heart - Protective or De	Cardiology	Grundlagenforschung	Mice / Souris	0	0	596	285
Ausbildungskurse in Labortierkunde: LTK Modul 1, LTK Modul 4/8 u	Ausbildung-und-Lehre	Bildung und Ausbildung	Mice / Souris	1291	746	0	0
			Rats	617	1140	0	0
			Rabbits / Kaninchen / Lapins	0	8	0	0
			Pigs / Schweine / Porcs	0	4	0	0
			Guinea pigs / Cobaye	0	3	0	0
In vitro analysis of key molecular determinants underlying reorgan	Neurobiology / Neurophysiology	Biological (including medical	Mice / Souris	0	0	9	87
Behandlung und Vorbeugung von Arzneimittel-induzierter Steatose	Klinische Pharmakologie und To	Grundlagenforschung	Mice / Souris	0	105	0	0
Untersuchungen zur Rolle des Tumorstromas bei der Entstehung i	Oncology	Grundlagenforschung	Mice / Souris	20	0	173	0
			Mice gm /Souris gm	32	0	4	0
Targeting chronic inflammation in animal models of arthritis	Rheumatology	Grundlagenforschung	Mice / Souris	0	0	0	75
Investigating local osteocyte gene and protein expression in aging	Orthopädie	Grundlagenforschung	Mice / Souris	0	74	115	1
			Mice gm /Souris gm	0	47	40	1
Wirbeltiere im SSCT für Schüler/innen im ausserschulischen Unte	Zoology	Bildung und Ausbildung	Fish / Poissons	9	0	0	0
Gesamtergebnis				244892	174576	140375	16718

Issue with Research Fields

However, the BLV indication of the subject area is self-reported in the licence, and is not standardised ...

Over 2017–2019 there are **344** unique categories in the **2900 studies** reported

Even the top 30 categories (shown right) are widely varied in level of precision ...

There are however a few super-ordinate categories that can be identified (e.g. cardiovascular, immunology, oncology etc ...)

Top 30 Research Fields in the BLV Categorisation

Top 30 BLV Fields	2017	2018	2019	Total
Allergy	10	14	8	32
Cardiology	10	5	9	24
Cardiovascular	40	31	27	98
Diabetes	17	9	21	47
Education	12	10	7	29
Ethology	10	8	6	24
Immunology	99	100	88	287
Infectiology	17	11	22	50
Inflammation	10	5	11	26
Livestock breeding	16	13	14	43
Medical imaging	8	12	5	25
Medicine	11	11	8	30
Metabolism	11	17	34	62
Metabolismus und Pharmakokinetik	20	5	5	30
Molecular biology	7	7	10	24
Musculoskeletal disorders	7	9	9	25
Neurobiologie	17	10	9	36
Neurodegeneration	12	20	19	51
Neurology	64	30	44	138
Neuropharmakologie	13	9	9	31
Neuroscience	13	22	8	43
Oncology	92	73	98	263
Ophthalmology	11	14	15	40
Others	14	11	11	36
Parasitology	9	24	12	45
Pharmacology	13	28	21	62
Physiology	36	34	28	98
Surgery	13	10	17	40
Toxicology	18	5	9	32
Veterinary medicine	25	28	31	84
Wildlife biology	7	11	10	28

3RCC Research Fields

In 2018, for the purpose of defining research areas of interest to the 3Rs for both the 3RCC Survey 2018, and the ongoing Map of Competences project ... The 3RCC Executive Board defined a **consensus set of research fields ...**

These categories were then re-applied to each of the studies by two experts* based primarily on the study title, and secondarily on the original research area given in the original dataset.

*In case of any disagreement a third expert arbitrated the final category.

3RCC Categorisation of Research Fields

Animal Farming

Blood system

Cardiovascular System

Endocrine system and Metabolism

Ethology / Animal Behaviour and Welfare

Gastrointestinal System (including liver)

Humane Education (manequins virtual models etc.)

Immune System

Infectious Disorders

Multisystemic Studies

Musculoskeletal System

Nervous System

Oncology / Cancer

Pharmacokinetics & pharmacodynamics

Reproductive / Urogenital Systems

Respiratory System

Sensory Organs (skin eyes ears)

Wildlife Ecology & Ecotoxicology

Other ...

Our Dataset

In our dataset we have added several fields which make it easier to generate meaningful information from the list of licenses...

In what follows we show a breakdown of this dataset, with particular focus on the newly added **Research Fields** examining both the **number of licenses** and directly the **animal numbers** within each license ...

Modified Dataset Used in Current Report

Study Title	Primary Research Field	Secondary Research Field	Study Purpose	Species	Modified strain	SD 0	SD 1	SD 2	SD 3	Total Numbers	Year	Licence ID
Kidney Transplantation in Non-human Primates: Donor Animals	Reproductive / Urogenital Systems		Research, development and quality control in medicine	Primates	0	0	0	0	0	0	2017	1
Ex-vivo Untersuchung immunologischer Effekte mittels extracorporaler Extremitätenperfusion transgener und wildtyp Schweine mit humanem Blut	Immune System	Blood system	Biological (including medical) studies in the field of basic research	Pigs	1	0	2	0	0	2	2017	2
				Pigs	0	0	12	0	0	12	2017	2
Incipient speciation in a recent hybrid swarm	Wildlife Ecology & Ecotoxicology		Biological (including medical) studies in the field of basic research	Fish	0	85	0	0	0	85	2017	3



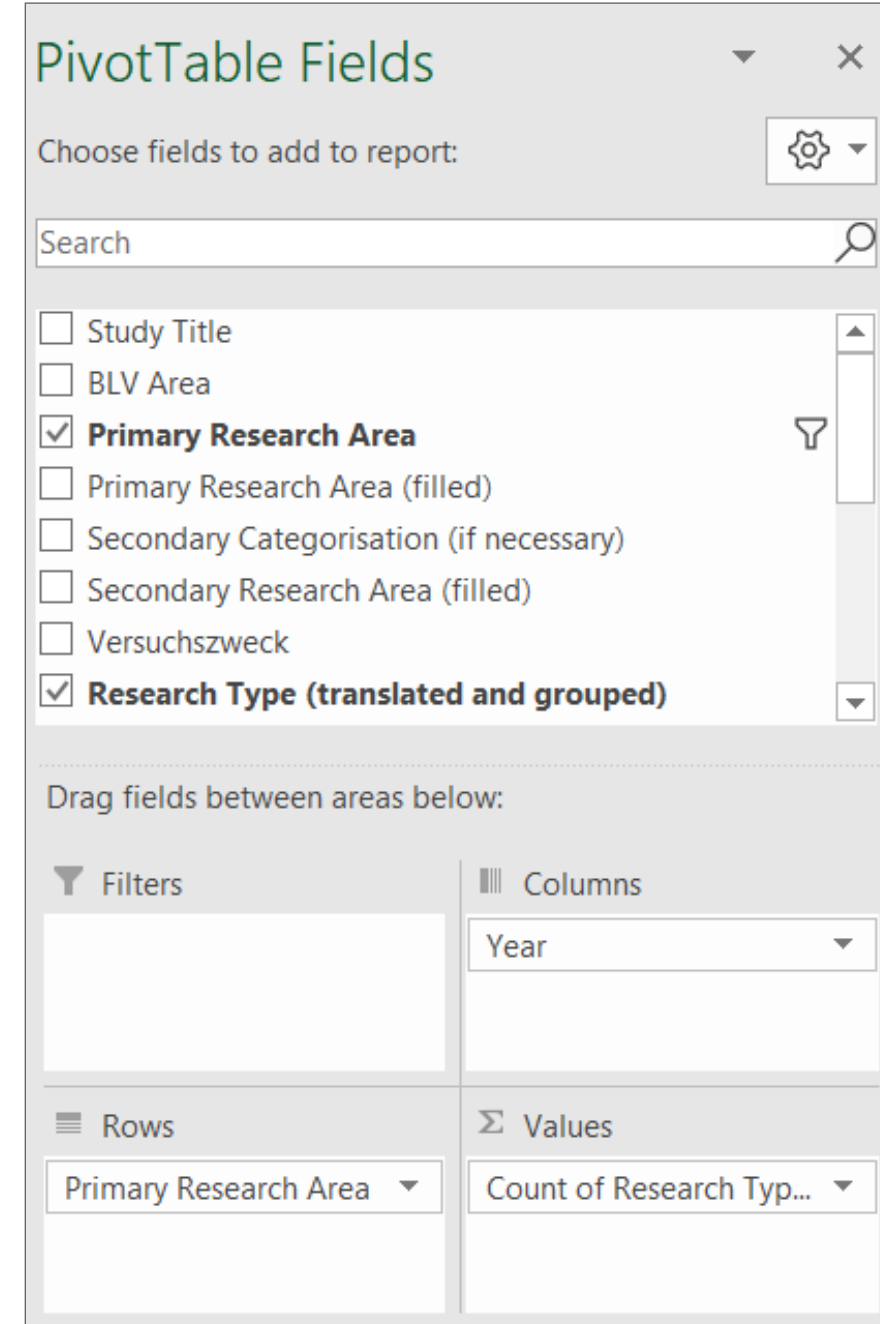
Our Report

The current report explores this dataset and creates **various graphs** for some of the most informative perspectives. We principally used pivot tables and pivot charts to build the various elements.

We also provide **additional commentary** on each graphical representation to highlight valuable insights gained with each varying perspective.

The **excel sheet linked** with this report contains all of the elements shown here. Feel free to examine the dataset yourself or ask us for even more specific information.

Example of Pivot Table and Chart Fields



Individual licenses



License numbers

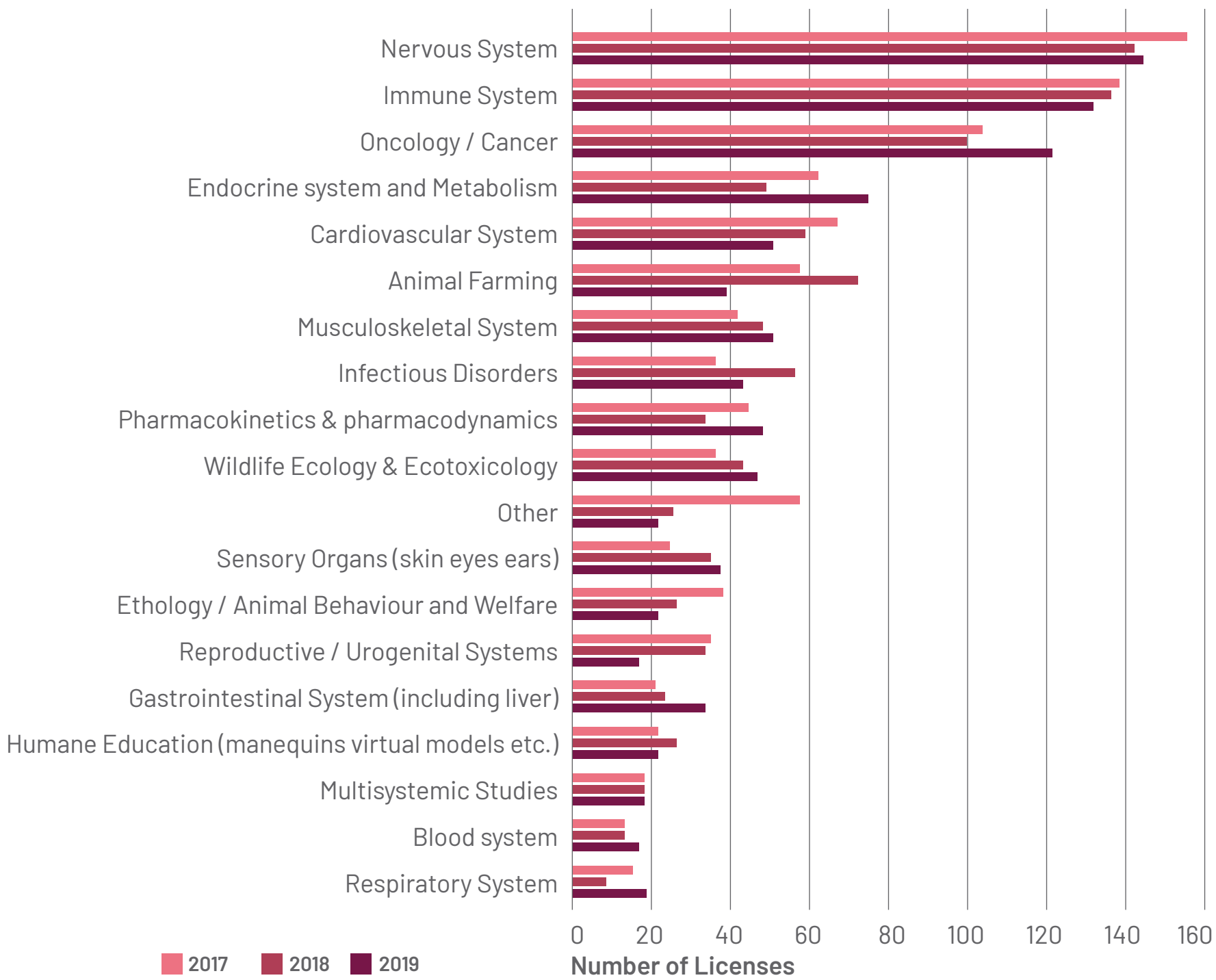
Research Fields / Year

Per year ...

2017: 989
2018: 951
2019: 960

The number of individual licenses was highest in the field of the **Nervous System** in the period of 2017–2019 (441)

Number of Licences Split by Research Field and Year



Animals per License

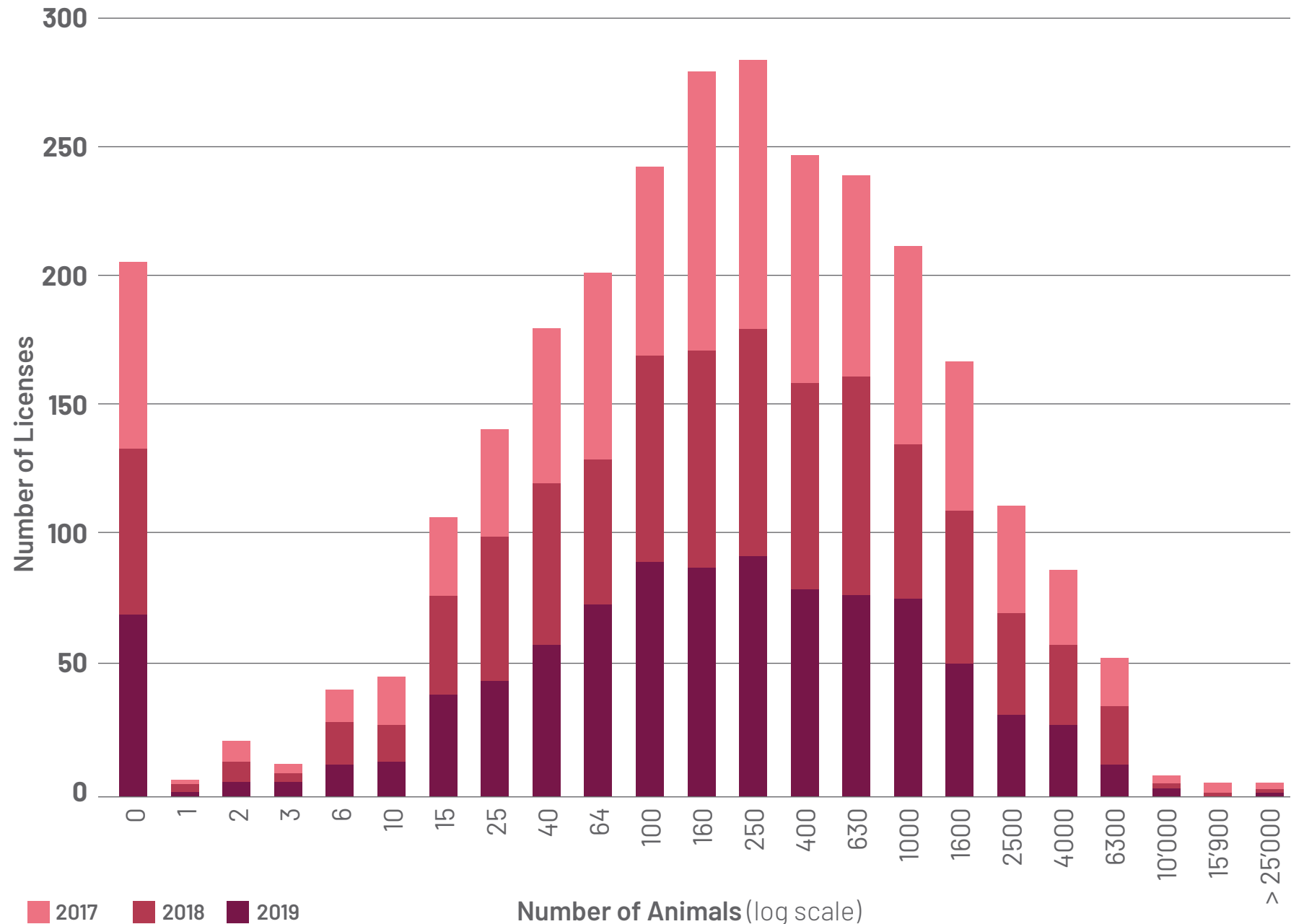
The number of **animals per license** follows a relatively normal (log-transformed) distribution

Most licenses indicated between 100-600 animals

Only 10 licences reported over 10'000 animals in the entire period 2017-2019

Several expired licences (205) did not end up using any animals at all

Number of Animals per Licence by Year



Primary and Secondary Fields

A few research fields often overlap in these licenses with **Oncology: Immune System** (28) being the most common, followed by **Immune System: Infectious Diseases** (20) and **Nervous System: Pharmacokinetics & pharmacodynamics** (19).

Note that secondary categories were only applied if thought critical to the description and so this does not represent the entire landscape.

Count of Secondary Research Fields

	Animal Farming	Blood System	Cardiovascular System	Endocrine system and ...	Ethology / Animal Behaviour ...	Gastrointestinal System ...	Humane Education ...	Immune System	Infectious Disorders	Multisystemic Studies	Musculoskeletal System	Nervous System	Oncology / Cancer	Pharmacokinetics ...	Reproductive / Urogenital ...	Respiratory System	Sensory Organs...	Wildlife Ecology & ...	Grand Total
Animal Farming		2		1	8	4		1	3		3								22
Blood System	1							1					4	2					8
Cardiovascular System				1		1						6		4	1	5			18
Endocrine system and Metabolism	1	1	1			9							2	8					22
Ethology / Animal Behaviour and Welfare	3			1		1	1				2	6			2		1		17
Gastrointestinal System (including liver)	1			2				3					3	2				1	12
Humane Education (manequins virtual models etc.)	9				2				1	1		1				1	1		16
Immune System	2	6	3	7		11			20	3	8	9	5	9	2	7	9	1	102
Infectious Disorders	3	2	1					7			9				1		1	2	26
Multisystemic Studies		1											2						3
Musculoskeletal System			2	1				2				3		3					11
Nervous System		2	1	3	4	1		10	2		2		2	19	1		1		48
Oncology / Cancer		5		1		6		28				4		3	5	2	6		60
Pharmacokinetics & pharmacodynamics		1	1	5		3		5	1	2		10	1				3		32
Reproductive / Urogenital Systems	2	1		2	1	1		2	1		1			3			1		15
Respiratory System	1	1	1					1						1	3				8
Sensory Organs (skin eyes ears)				3				2					6	1	1				13
Wildlife Ecology & Ecotoxicology					1			1	5	1					4				12
Grand Total	23	22	10	27	16	37	1	63	33	7	25	39	25	55	20	15	23	4	445

Animal numbers



License numbers

Research Field and Years

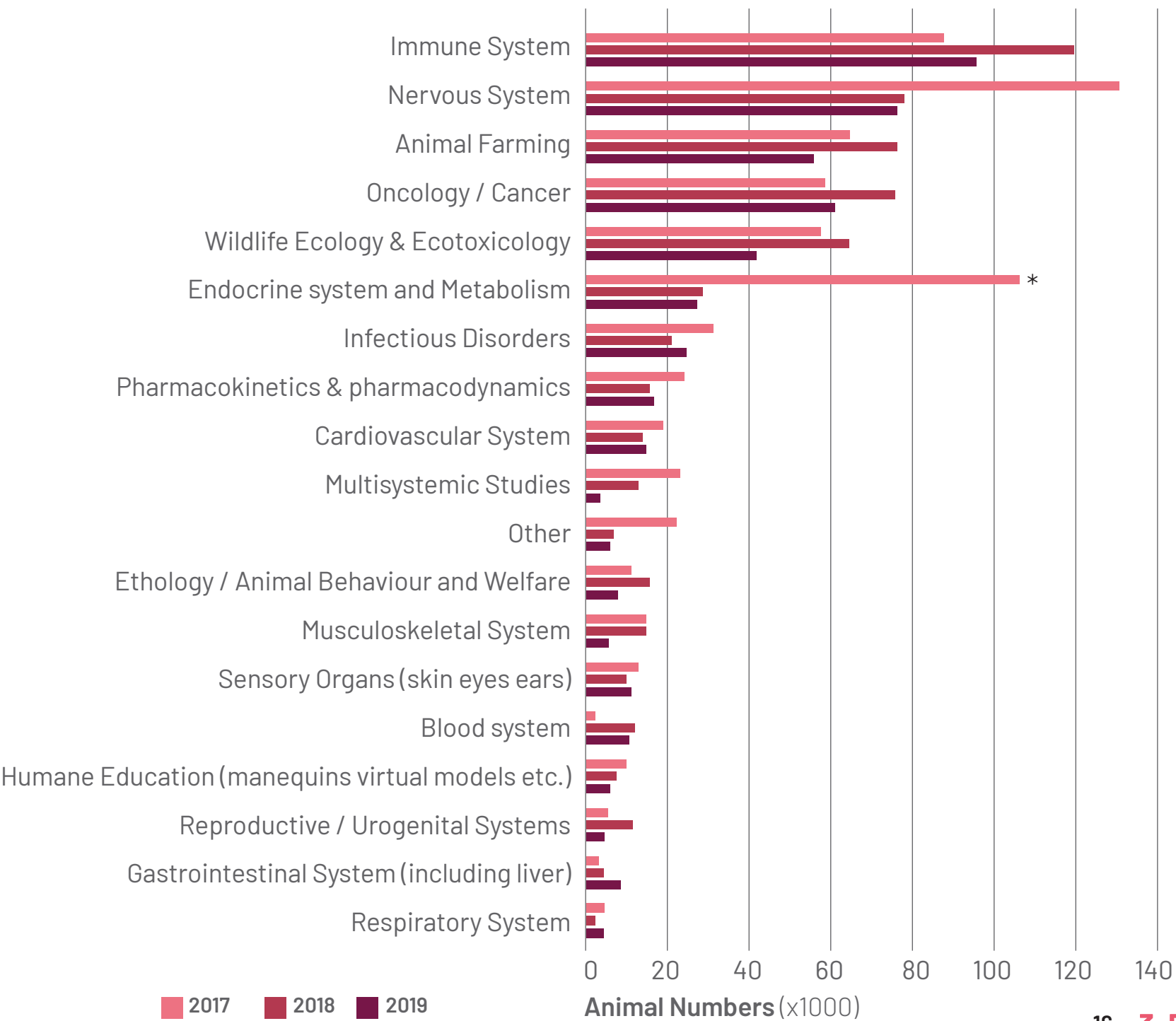
Total number of animals:

2017: 649'500
2018: 596'382
2019: 488'427

Over the course of the past 3 years there has been a **decline in the total number** of animals reported in expired licences. However, this pattern highly **depends on the research field** examined.

* A single license which expired in 2017 (n. 712) accounts for 73'784 animals ... Without this study there is no steady decline in the field of Endocrine system and Metabolism.

Number of Animals split by Research Field and Year



Animal Numbers

Research Field and Years

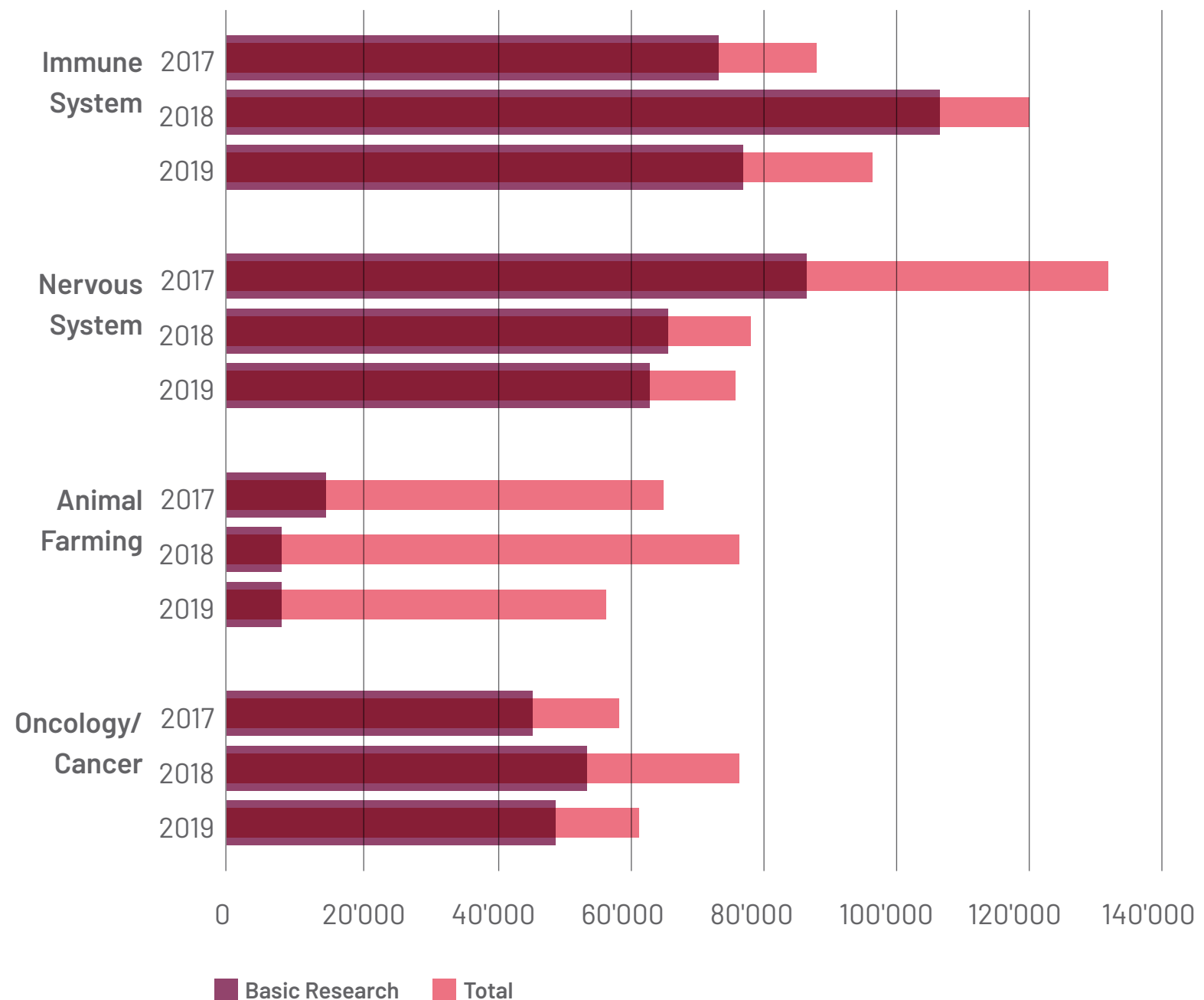
Most animals were used in studying **Immune System** (304'073), **Nervous System** (285'484), **Animal Farming** (198'067) and **Oncology** (196'613)

The fewest were used investigating the **Respiratory System** (11'971); *not shown in the graph*

Except for animal farming, most animals were used in licences for **basic research**.

Only in **nervous system** studies did the number of animals steadily decrease from 2017 to 2019.

Animal Numbers of the Top 4 Research Fields

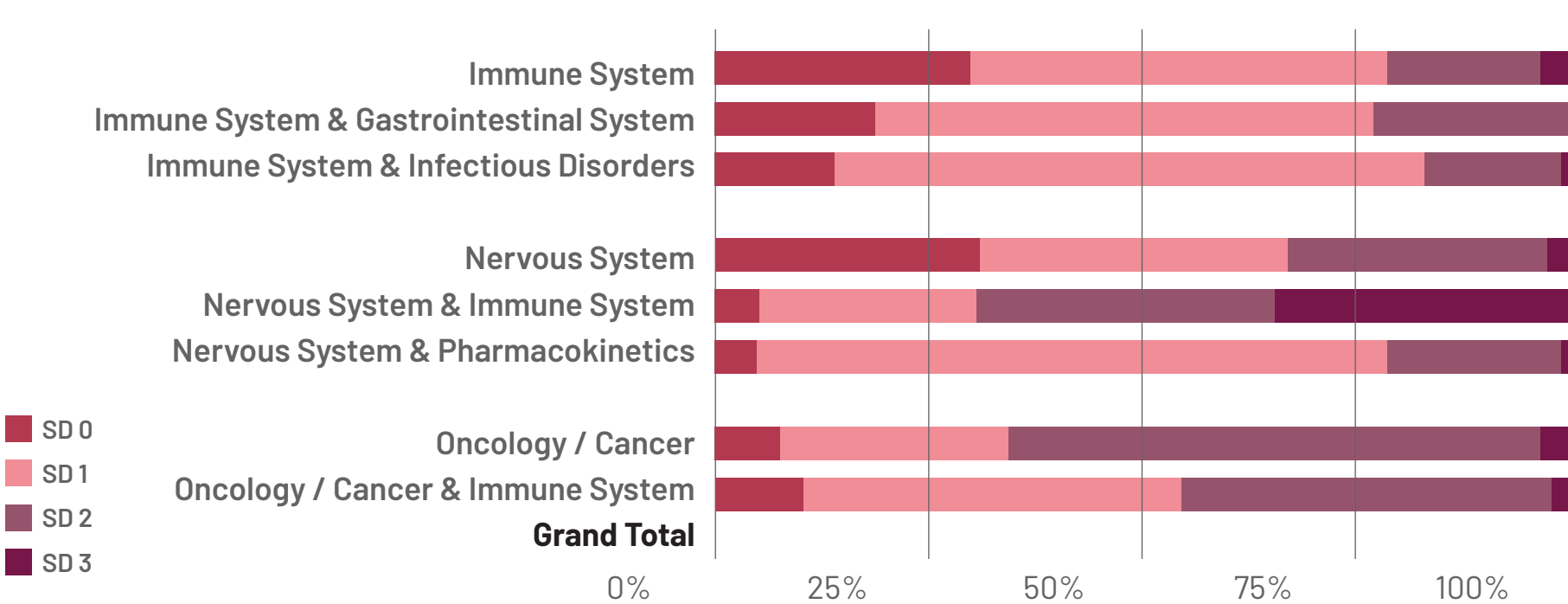


Research Field and Years

We can more closely examine our top 3 fields in terms of their **secondary field classifications**. However, these secondary classifications ultimately formed only a small subset of all licenses (67/2900).

In terms of the associated **severity degrees** (0 being the least severe and so forth), while most of the subsets have similar patterns across classifications, licenses investigating the nervous system and the immune system tended to be more severe.

Animal Numbers in the Top 3 Research Field and their Secondary Categories



Proportion of Animals in each of the Severity Degree Classifications for the Top Fields

	SD 0	SD 1	SD 2	SD 3
256'166	75'317	126'460	46'164	8225
4055	761	2385	909	0
11'521	1601	8027	1891	2
266'788	81'559	96'835	82'178	6216
4316	217	1122	1477	1500
7028	325	5235	1416	52
169'251	12'109	46'447	10'5417	5278
20'168	2095	8952	8737	384
739'293	173'984	295'463	248'189	21'657

Research purpose



Research Purpose

Licenses and Animal Numbers

Biological studies in basic research have the most licenses and report the highest use of animals across all years.

Given that Other Studies still have a considerable number of both licenses and animals, it would likely be worth finding out more about those study types.

Note that Research Purpose was pre-defined in the original BLV table

Number of Licenses split by Research Purpose and Year

Number of Licenses by Research Purpose	2017	2018	2019	Total
Biological (including medical) studies in the field of basic research	679	635	654	1968
Research, development and quality control in medicine	189	160	188	537
Other studies	59	75	53	187
Education and training	20	32	26	78
Diagnosis of disease	18	30	22	70
Toxicology	24	20	19	63
Total	989	952	962	2903

Number of Animals split by Research Purpose and Year

Total Animal Numbers by Research Purpose	2017	2018	2019	Total
Biological (including medical) studies in the field of basic research	414,519	385,920	322,318	1'122'757
Research, development and quality control in medicine	205,584	89,373	79,126	374'083
Other studies	54,513	93,629	75,275	223'417
Education and training	10,242	8,572	5,921	24'735
Toxicology	8,895	8,434	3,710	21'039
Diagnosis of disease	747	10,454	2,077	13'278
Total	694,500	596,382	488,427	1'779'309

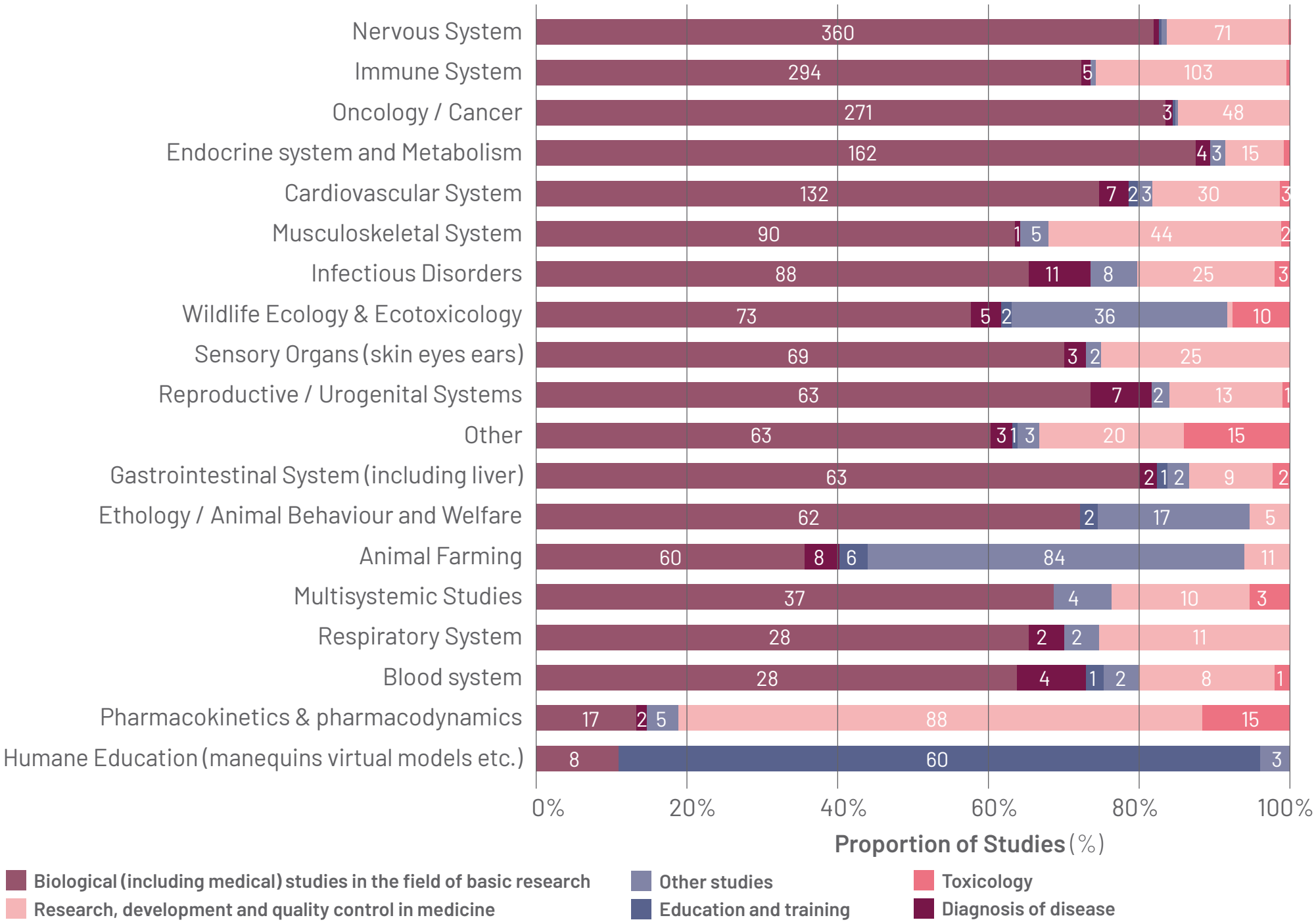
Research Purpose

Research Field and Purpose

While most studies are indeed in basic research, the relative proportions of the research purpose is **dependent on which research field** is considered.

The highest proportion of licences with a purpose in research, development and quality control in medicine is found in the field of Pharmacokinetics and Pharmacodynamics.

Proportion of Licences for each Study Purpose split by Research Field



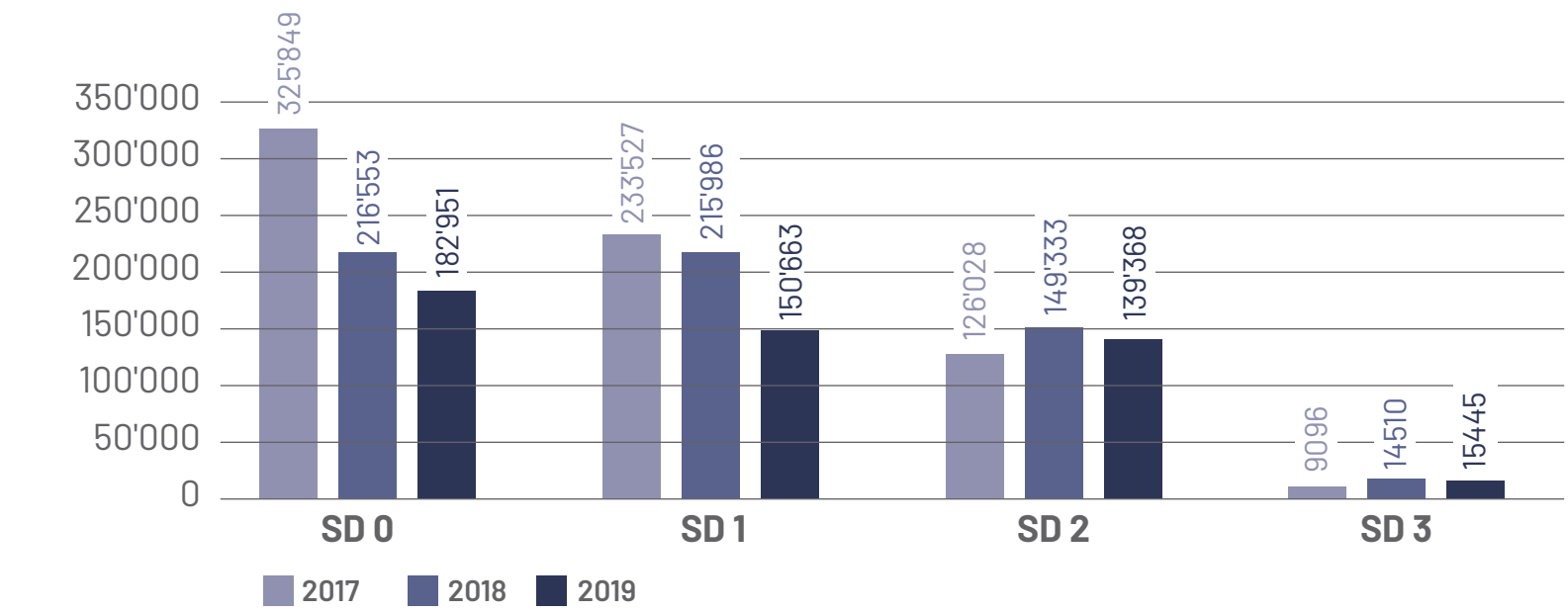
Research Purpose

Severity Degree and Year

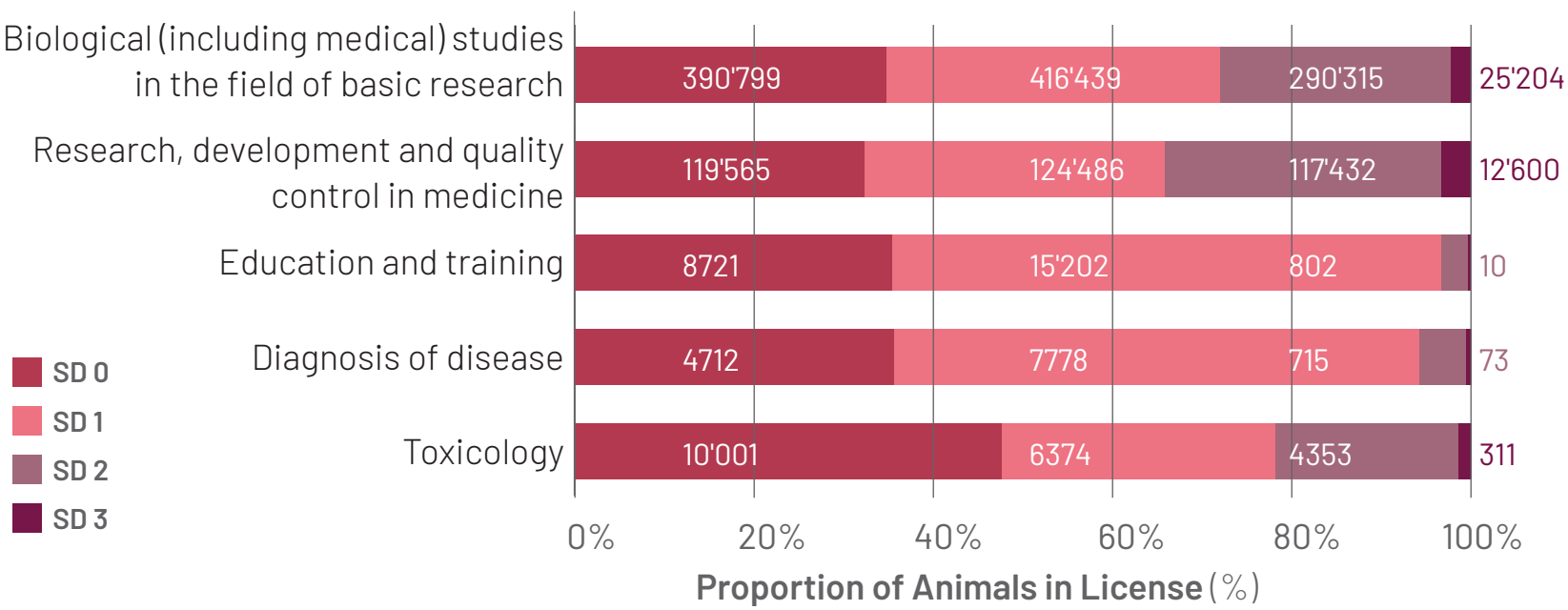
The observed yearly decrease in animal numbers seems to be mainly driven by fewer animals in severity degree 0 and 1 experiments

There are proportionally few animals used in sd 3 experiments. The distribution between sd 0, 1, and 2 depends on the research purpose considered.

Total Number of Animals in Each Severity Classification by Year



Proportion of Animals in Each Severity Classification split by Study Purpose



Breakdown of species information



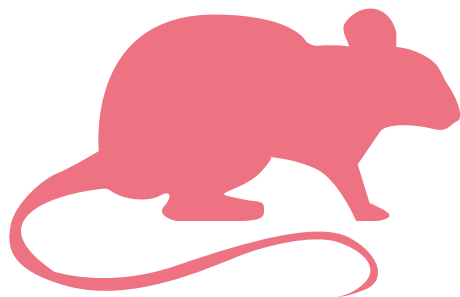
Total Numbers 2017-2019

The dataset contains information from 34 unique categories of species when aggregating across all the years available.

Mice make up 62.5% of all species used in the expired licenses.

However, **there is no well-defined heirarchical categorisation** among the species. For example, cows, cattle, and calfs are considered separately.

Proportion of All Species Reported in Expired Licences



mice
1'112'669



rats
225'881



poultry
179'195



fish
145'856



amphibians
53'076



cattle
12'904



birds
11'929



pigs
11'514

rabbits 3121	dogs 3098	other rodents 2963	horses 2957	bats 2191	sheep 1949	goats 1942	other mammals 1532	decapods 1093
guinea pigs 992	cats 868	cows 868	minipigs 851	other reptiles 559	gerbils 500	hamster 470	primates 430	frogs 78
red deer 67	calves 63	lynx 34	tupaia 21	lama 14	ibex 14	macaca 4	donkeys 4	

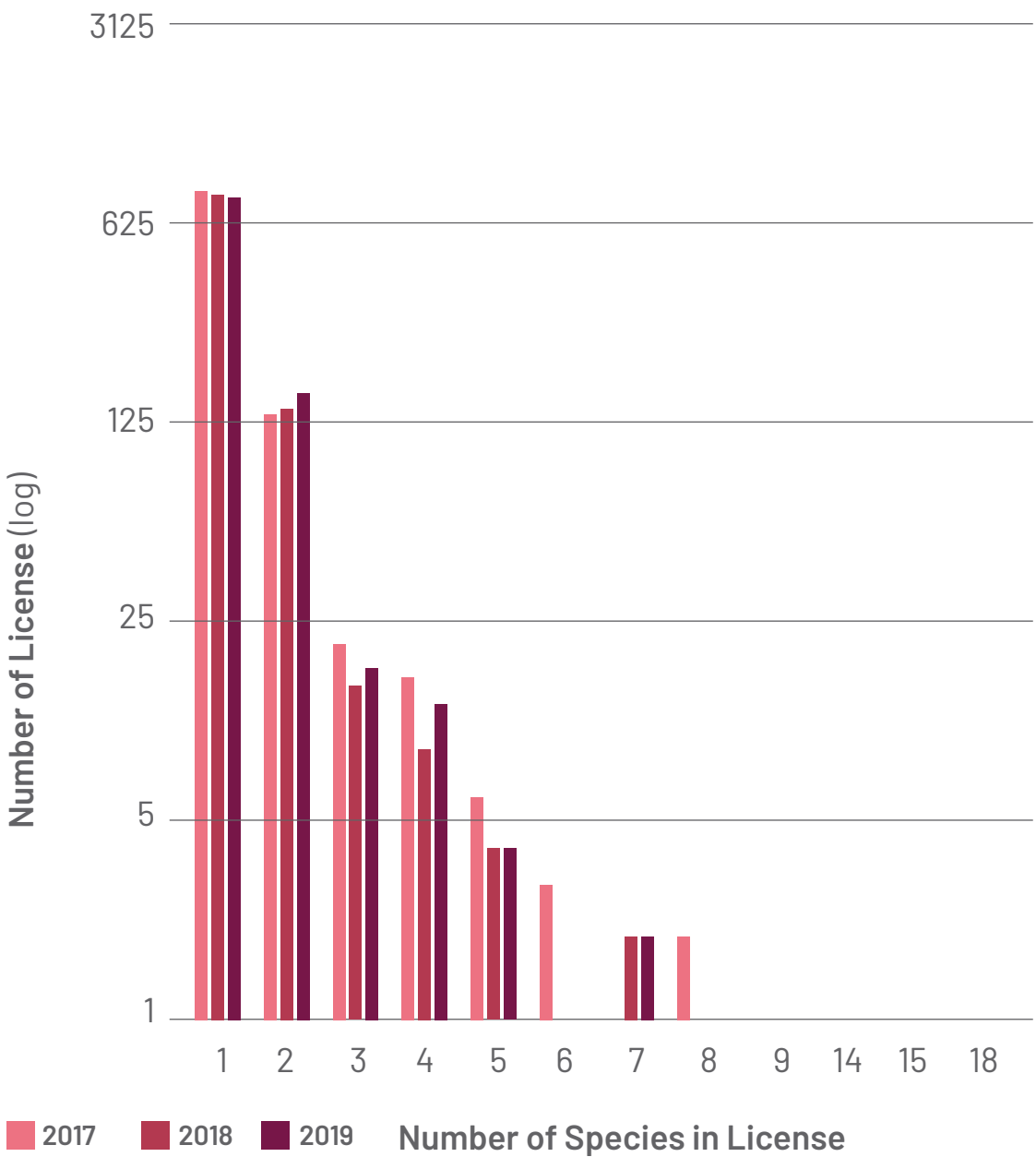
Species per Licence

The majority of studies tended to use just a **single species per license**. This may reflect the specialisation of research labs to single species or that the standard animal model for a specific disease is confined to a single species.

Nevertheless many licenses do examine multiple species.

This figure has remained relatively steady over the years 2017 to 2019.

Count of the Number of Different Species in Each Expired Licence



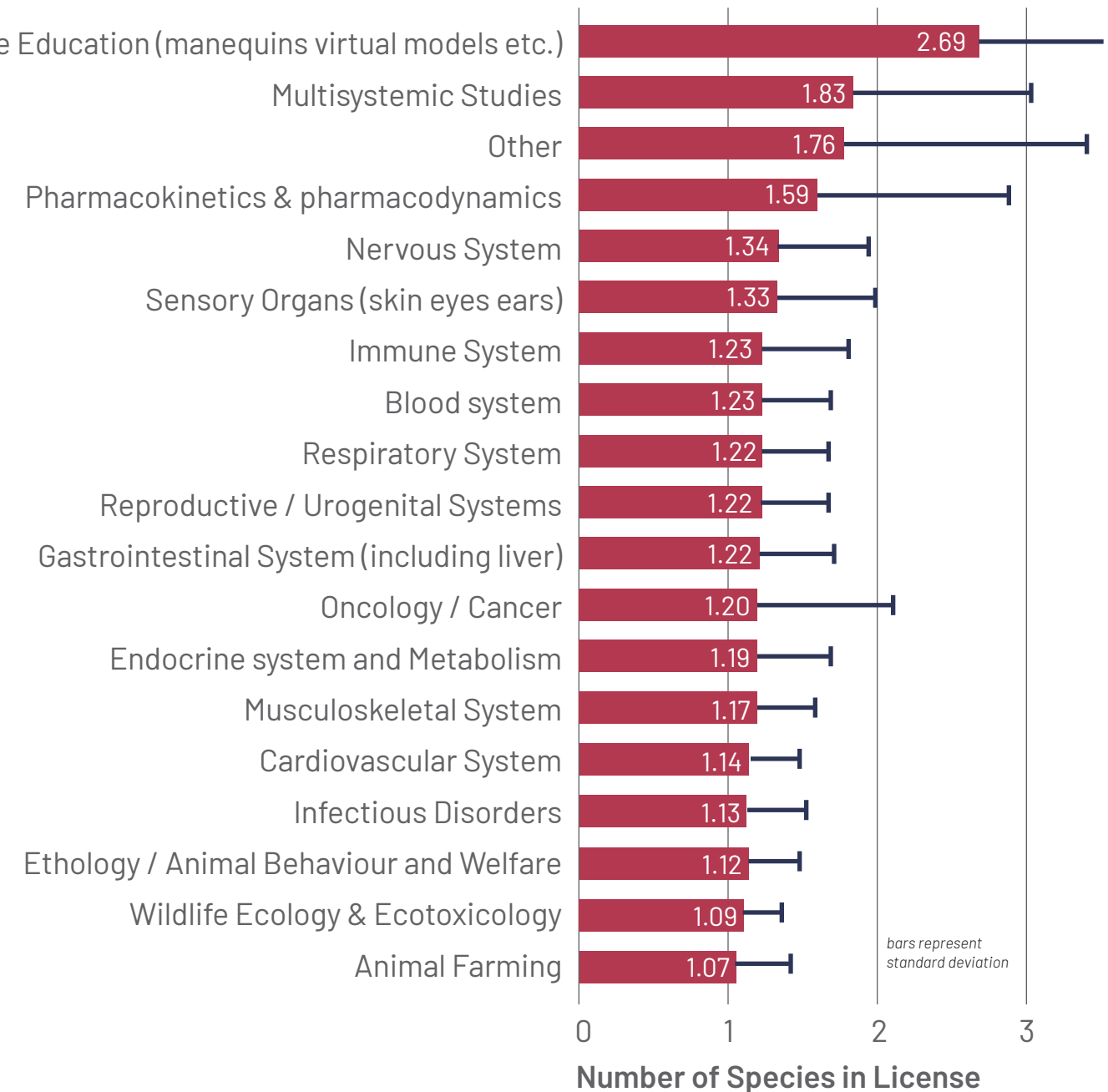
Species

Species per License by Field

Breaking down the **average number of species** within any given licence into the various research fields reveals that **human education and multisystemic studies** tended to vary the most in species...

Animal Farming, Ethology and Wildlife Ecology studies tended to focus on a **single species**. This is not surprising as those fields tend to produce results specific to the species in question and are not generally intended to translate to humans.

Number of Different Species within a Single Licence split by Research Field



Genetically Modified Species

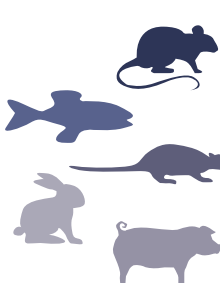
Over 97% of all genetically modified (GM) animals were **mice**, with relatively small numbers of fish, rats, rabbits and pigs.

Further more, in the mouse transgenic population, over 91% were used with the purpose of **biological basic research**.

Studies of the **immune system** used the most GM mice (117'919), accounting for~40% of the total mice used. The nervous system (96'257) and oncology (63'223) followed.

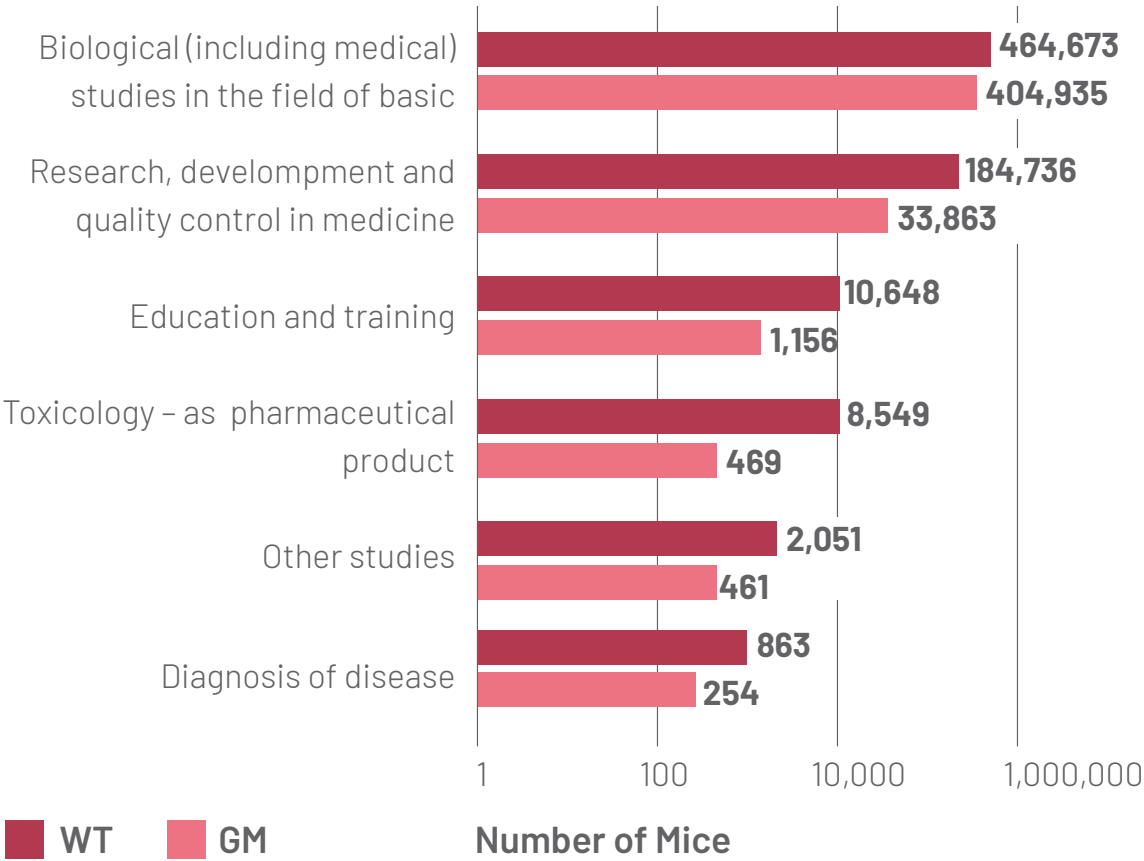
Note that "wild-type mice" (WT) simply indicates that no specific modifications were made to the genome of the animal

Animal Numbers of Genetically Modified Animals for each Species



Species	Wild-Type	Genetically Modified
Mice	671,531	441,138
Fish	138,853	7,003
Rats	222,390	3491
Rabbits	3,113	8
Pigs	11,512	2
Grand Total	1,047,399	451,642

Number of Genetically Modified Mice split by Study Purpose





Swiss 3R Competence Centre

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3RCC Directorate, Executive Board

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