(5) *Erythrocytes.*

A suspension of erythrocytes as a heterogeneous system is an obstacle for the migration of ions in the interglobular liquid.*

10/1/08. T=37° C.

Mixtures of various concentrations of defibrinated blood of normal horse 3250 and serum of the same animal:

Volume of blood corpuscles. %	Conductivity $\times 10^{-4}$ of the suspension.	Differences absolute.	Differences for 1% increase of the vol. of corp.	Difference % for 1 % volume of the corp. %
0 (Serum)	146·0			
13·3	117·9	28·1	2·1	1·5
17·8	107·1	10·8	2·4	2·0
22·2	98·5	8·6	2·0	1·9
26·7	89·0	9·5	2·1	2·1
31·1	79·4	9·6	2·2	2·5
35·6	68·9	10·5	2·3	2·9
40·0	57·6	11·3	2·6	3·8

Increase of the volume of blood corpuscles corresponds with continually increasing decrease of the conductivity.

This method could be used to find the volume of blood corpuscles in a system by means of the electrical resistance and subsequent interpolation on the curve.

E.—COMPARATIVE PHYSICAL-CHEMICAL RESEARCH ON HORSE BLOOD AND SERUM.

(With Special Reference to Horse-sickness.)

These experiments were undertaken to find differences by means of various physical methods combined between

(1) Normal horses;

(2) Horses suffering from horse-sickness;

(3) Horses immune and hyperimmune against horse-sickness;

(4) Serum horses, i.e. horses from which great quantities of blood have been taken (artificial anaemia).

(1) *Normal Horses.*

It is naturally necessary to know the normal values forming the basis with which results of pathological cases can be compared; first of all the variations undergone by the various values of the experiments on one and

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* Also in suspensions of mineral particles (sand) a decrease of conductivity takes place.—*Oker-Blom*, Pflüger's Arch., *79*, 1900—*cit.* Hamburger, Osmot, Druck, etc.

the same horse at different days had to be ascertained. For this purpose blood and serum of two horses (3682 and 3685) were examined day by day for about five weeks. One hundred and fifty cubic centimetres of blood were taken at the time, that is to say, the same quantity which was drawn from the various horses during the experiments on piroplasmosis and horse-sickness. Thus the eventual effect of continual bleeding on blood and serum could be studied and at the same time the question answered as to whether this loss of blood does or does not influence the result of the investigations on piroplasmosis and horse-sickness.

The values from the examinations contained in the tables are of the following matters :—

(1) Temperature of the body.
(2) Volume of blood corpuscles.
(3) Specific gravity of blood.
(4) Viscosity of blood.
(5) Conductivity of serum.
(6) Specific gravity of serum.
(7) Viscosity of serum.
(8) Coefficient of optical refraction of serum.
(9) Daily amount of water drunk by the animal.

HORSE 3682.

DATE.	TEMPERATURE.		BLOOD.			SERUM.					
	Morning. F.	Evening. F.	Volume of Blood Corpuscles.	Viscosity at 25° C.	Specific Gravity 37° C.	Specific Gravity 37° C.	Conductivity at 37°×10⁻⁴	Viscosity at 25° C.	Drink-water.	Index of Refraction at 37° C.	Amount of Serum (Blood=1)
June 24..	99·2	100·8	32	4·43	1·0506	1·0256	141·8	2·01	—	—	1/2
,, 25..	99·0	101·4	32	3·47	1·0499	1·0252	141·2	1·78	—	—	1/2
,, 26..	99·8	101·6	36½	3·67	1·0514	1·0266	144·5	1·82	—	—	1/2
,, 27..	100·0	101·4	31½	3·48	1·0507	1·0252	145·3	1·76	—	—	1/2
,, 28..	100·2	101·6	35½	—	1·0530	1·0263	148·4	1·82	—	—	1/2
,, 29..	99·0	102·2	39	3·87	1·0535	1·0257	145·3	1·78	—	1·34556	1/2
,, 30..	100·2	101·8	33½	3·36	1·0509	1·0253	150·1	—	—	—	1/2
July 1..	99·6	101·4	31	3·15	1·0479	1·0235	147·2	—	—	—	2/5
,, 2..	99·0	102·2	31½	3·24	1·0480	1·0243	145·3	—	—	—	1/2
,, 3..	99·0	101·4	31	3·54	1·0503	1·0249	144·4	—	—	—	1/2
,, 4..	99·6	101·4	33	—	1·0491	1·0249	145·1	—	—	—	1/2
,, 5..	99·6	101·0	33	—	1·0502	1·0254	146·6	—	—	—	1/2
,, 6..	98·4	101·4	34½	—	1·0520	1·0256	144·7	—	—	—	1/2
,, 7..	99·0	101·8	35½	—	1·0503	1·0253	144·4	—	—	1·34605	2/5
,, 8..	99·6	102·0	33	—	1·0493	1·0249	145·3	—	—	—	2/5
,, 9..	99·6	101·8	33	—	1·0492	1·0249	149·0	—	—	—	2/5
,, 10..	99·6	100·6	32½	—	1·0481	1·0239	147·0	1·68	—	1·34546	2/5
,, 11..	99·0	100·6	30	—	1·0473	1·0242	145·5	1·68	—	1·34539	2/5
,, 12..	99·0	100·6	29½	—	1·0489	1·0243	148·4	1·70	—	1·34559	1/2
,, 13..	100·0	100·8	29½	—	1·0479	1·0236	151·2	1·58	—	1·34499	1/2
,, 14..	—	—	28	3·80	1·0491	1·0256	150·0	1·79	—	1·34569	2/5
,, 15..	—	—	32½	3·87	1·0499	1·0250	151·0	1·68	—	1·34582	1/2
,, 16..	—	—	31½	3·62	1·0487	1·0244	153·8	1·57	10½+6	—	1/2
,, 17..	—	—	29	3·42	1·0466	1·0236	148·5	1·60	5½+1	—	1/2
,, 18..	—	—	31½	3·25	1·0472	1·0240	145·8	1·67	2½+1	—	1/2
,, 19..	—	—	34½	3·47	1·0475	1·0240	145·7	—	3½+3	—	1/2
,, 20..	—	—	36	—	1·0511	1·0252	143·3	—	2½+3	—	2/5

,, 21..	—	—	$33\frac{1}{2}$	—	1·0501	1·0252	142·3	—	1 +0	—	$\frac{2}{5}$
,, 22..	—	—	$31\frac{1}{2}$	—	1·0498	1·0252	145·4	—	2 +1	—	$\frac{2}{5}$
,, 23..	—	—	30	—	1·0480	1·0247	145·3	—	4 +2	—	$\frac{1}{2}$
,, 24..	—	—	33	—	1·0492	1·0254	146·5	—	$3\frac{1}{2}+6\frac{1}{2}$	—	$\frac{1}{2}$
,, 25..	—	—	30	—	1·0470	1·0249	145·4	—	$3\frac{1}{2}+2\frac{1}{2}$	—	$\frac{1}{2}$
,, 26..	—	—	$30\frac{1}{2}$	—	1·0440	1·0240	148·1	—	10 +3	—	$\frac{1}{2}$
,, 27..	—	—	27	—	1·0458	1·0240	146·5	—	No water given	—	$\frac{1}{2}$
,, 28..	—	—	29	—	1·0477	1·0252	151·0	—	11 $+6\frac{1}{2}$	—	$\frac{1}{2}$
,, 28..	—	—	$29\frac{1}{2}$	—	1·0430	1·0231	144·2	—	—	—	$\frac{1}{2}$
,, 29..	—	—	$27\frac{1}{2}$	—	1·0454	1·0243	143·7	—	$3\frac{1}{2}+4$	—	$\frac{1}{2}$

Horse 3685.

Date.	Temperature.		Blood.			Serum.					
	Morning. F.	Evening. F.	Volume of Blood Corpuscles.	Viscosity at 25° C.	Specific Gravity at 37° C.	Specific Gravity at 37° C.	Conductivity at 37° × 10^{-4}	Viscosity at 25° C.	Drink-water.	Index of Refraction at 37° C.	Amount of Serum (Blood=1)
June 24..	99·0	100·0	35½	3·06	1·0500	1·0226	152·0	1·68	—	—	½
,, 25..	98·2	100·0	35	3·46	1·0505	1·0226	147·0	1·58	—	—	½
,, 26..	99·2	99·0	35½	3·56	1·0534	1·0240	153·0	1·63	—	—	½
,, 27..	98·4	99·4	34	3·09	1·0526	1·0236	150·1	1·61	—	—	½
,, 28..	99·0	98·6	34	3·87	1·0530	1·0237	153·2	1·60	—	—	⅓
,, 29..	98·4	100·0	35	3·36	1·0517	1·0232	149·4	1·60	—	—	½
,, 30..	99·2	100·6	36½	3·20	1·0538	1·0237	153·0	—	—	—	½
July 1..	98·4	100·0	33	2·88	1·0496	1·0227	148·9	—	—	—	⅖
,, 2..	98·0	100·0	33	3·13	1·0500	1·0231	147·1	—	—	—	½
,, 3..	97·0	100·6	37	3·49	1·0524	1·0235	147·7	—	—	—	⅖
,, 4..	99·2	99·0	38½	—	1·0550	1·0239	150·8	—	—	—	½
,, 5..	98·0	98·4	37	—	1·0538	1·0235	153·1	—	—	—	½
,, 6..	99·0	99·6	36	—	1·0532	1·0244	148·8	—	—	—	⅖
,, 7..	98·4	99·0	41½	—	1·0578	1·0248	154·1	—	—	1·34553	½
,, 8..	98·0	100·0	38½	—	1·0536	1·0236	151·5	—	—	—	⅖
,, 9..	98·4	100·0	39	—	1·0543	1·0239	152·9	—	—	—	⅖
,, 10..	98·0	99·0	39	—	1·0536	1·0234	149·5	1·60	—	1·34491	⅖
,, 11..	98·4	100·6	40½	—	1·0561	1·0237	148·4	1·65	—	1·34514	½
,, 12..	99·0	100·8	36½	—	1·0545	1·0235	147·7	1·59	—	1·34476	½
,, 13..	99·0	100·2	38½	—	1·0547	1·0235	147·9	1·59	—	1·34471	½
,, 14..	99·6	99·0	40½	4·40	1·0563	1·0246	150·3	1·68	—	1·34541	½
,, 15..	99·0	100·4	37½	3·93	1·0558	1·0241	152·0	1·59	—	1·34516	½
,, 16..	98·4	100·8	36½	—	1·0515	1·0226	148·2	1·49	12 +1	—	½
,, 17..	99·4	100·0	34	3·52	1·0512	1·0230	148·2	1·54	13 +0	—	½
,, 18..	99·0	100·0	38½	3·83	1·0523	1·0235	145·7	1·57	1 +0	—	½
,, 19..	99·0	100·4	41½	4·48	1·0551	1·0238	148·0	—	4 +1	—	½
,, 20..	98·6	100·2	39	—	1·0532	1·0239	146·0	—	1½+1	—	½

„ 21..	99·2	100·8	38½	—	1·0543	1·0248	146·8	—	2½+8	—	½
„ 22..	98·4	100·0	36½	—	1·0533	1·0239	149·4	—	6½+2½	—	½
„ 23..	98·4	100·6	38½	—	1·0523	1·0237	150·3	—	6 +4	—	½
„ 24..	98·4	99·6	37½	—	1·0530	1·0239	151·5	—	10 +4	—	½
„ 25..	99·4	99·0	34	—	1·0504	1·0232	151·2	—	12 +0	—	½
„ 26..	99·0	101·0	33½	—	1·0496	1·0232	151·8	—	9 +4	—	½
„ 27..	98·4	100·4	36	—	1·0520	1·0237	152·9	—	No water given.	—	½
„ 28..	99·6	100·8	33½	—	1·0507	1·0235	152·3	—	12 +3	—	½
„ 29..	99·0	—	36½	—	1·0488	1·0230	146·8	—	—	—	½
„ 30..	—	—	36	—	1·0512	1·0235	150·2	—	10 +5	—	½

Horse 3682, grey mare, fifteen years old, bad condition.

It is normal during twenty days; afterwards a fever sets in, probably a sign of a slight horse-sickness attack, for the volume of blood corpuscles increase.

Volume of blood corpuscles and specific gravity of blood are going parallel; that is to say, they increase and decrease at the same time, but the degree of variation is different, namely, for the volume about fifty times greater than of the specific gravity. Both, volume and specific gravity, show two periods of increase and decrease, so that the final values are somewhat lower than the incipient ones. (Compare piroplasmosis and horse-sickness.)

In face of this fact it has to be taken into consideration that in cases of serial experiments on piroplasmosis or horse-sickness on horses in poor condition the decrease of red blood corpuscles might partially be due to the daily bleedings, though comparatively small quantities were taken (150 c.c.).

The viscosity of blood, as far as it is examined, goes also up and down with the volume of red blood corpuscles, but the variations are wider.

Viscosity and specific gravity of serum, compared with one another, show similar behaviour as the respective values of the blood. Like the specific gravity of the blood that of the serum has two periods and is finally lower than originally.

The conductivity increases from the beginning to the end of the research period, and must, of course, behave divergently with the specific gravity.

The quantity of water taken by the animal depends on the conductivity of serum; the animal drinks more when the conductivity is high, less when it is low. (Water given after the animal has been bled.)

Horse 3685, chestnut gelding, ten years old, good condition.

Volume of blood corpuscles and specific gravity of blood, besides their approximative parallelism, show a slight and slow increase, then a decrease to their respective original values. In this animal, the perpetual loss of blood rather acts as a stimulus for reproduction and a slight superproduction of erythrocytes.

The viscosity of blood and serum behaves similarly as in 3682. The same is to be said about specific gravity and conductivity of serum. Both the latter show divergencies as in 3682, which very likely are due to the decrease of colloids or non-electrolytes.

There is again the same dependence of the amount of water taken by the animal on the conductivity of serum as an expression of the tendency of the organism to keep the electrolyt concentration constant.

Average values and variations of the results are shown by the following tables:—

Normal Horse 3682.

Horse 3682.	Temperature.		Blood.			Serum.			
	Morning. F.	Evening. F.	Volume of Blood Corpuscles.	Viscosity at 25° C.	Specific Gravity at 37° C.	Specific Gravity at 37° C.	Conductivity at 37° × 10⁻⁴	Viscosity at 25° C.	Index of Refraction at 37° C.
Number of examinations ..	20	20	20	10	20	20	20	10	8
„ days	20	20	20	10	20	20	20	10	8
Average	*99·4*	*101·4*	*32·8*	*3·60*	*1·0499*	*1·0250*	*146·0*	*1·76*	*1·34557*
Maximum	100·2	102·2	39·0	4·43	1·0535	1·0266	151·2	2·01	1·34605
Minimum	98·4	100·6	29·5	3·15	1·0473	1·0236	141·2	1·58	1·34499
Variation above average ..	0·8 %	0·8 %	19 %	23 %	0·34 %	0·16 %	3·6 %	14 %	0·04 %
„ below „ ..	1·0 %	0·8 %	10 %	12 %	0·25 %	0·14 %	3·3 %	10 %	0·04 %
„ total	1·8 %	1·6 %	29 %	35 %	0·59 %	0·30 %	6·9 %	24 %	0·08 %
Values above average	50 %	40 %	50 %	40 %	50 %	50 %	40 %	60 %	50 %
„ below „	50 %	60 %	50 %	60 %	50 %	50 %	60 %	40 %	50 %

Normal Horse 3685.

Horse 3685.	Temperature.		Blood.			Serum.			
	Morning. F.	Evening. F.	Volume of Blood Corpuscles.	Viscosity at 25° C.	Specific Gravity at 37° C.	Specific Gravity at 37° C.	Conductivity at 37° × 10^{-4}	Viscosity at 25° C.	Index of Refraction at 37° C.
Number of examinations ..	36	35	36	15	36	36	36	15	7
„ days	36	35	36	15	36	36	36	15	7
Average	*98·7*	*99·9*	*36·9*	*3·50*	*1·0529*	*1·0236*	*149·9*	*1·60*	*1·34509*
Maximum	99·6	101·0	41·5	4·48	1·0578	1·0248	153·2	1·68	1·34553
Minimum	97·0	98·4	33	2·88	1·0488	1·0226	145·7	1·54	1·34471
Variation above average ..	0·9 %	1·1 %	12·5 %	28 %	0·46 %	0·12 %	2·2 %	5 %	0·03 %
„ below „ ..	1·7 %	1·5 %	10·5 %	18 %	0·39 %	0·10 %	2·8 %	4 %	0·03 %
„ total	2·6 %	2·6 %	23 %	46 %	0·85 %	0·22 %	5·0 %	9 %	0·06 %
Values above average	50 %	67 %	47 %	47 %	56 %	53 %	50 %	53 %	57 %
„ below „	50 %	33 %	53 %	53 %	44 %	47 %	50 %	47 %	43 %

The results of the various methods arranged in descending order of their variations give the following series for both horses :—

Viscosity blood, vol. blood corp., viscosity serum, conductivity, temperature, specific gravity blood, specific gravity serum, index of refraction.

The following values are higher :—

In 3682 : *Temperature, viscosity of blood, specific gravity serum, viscosity serum, index of refraction.*

In 3685 : *Vol. blood corp., specific gravity blood, conductivity.*

The variations are greater :—

In 3682 : *Vol. blood corp., specific gravity serum, conductivity, viscosity serum, index of refraction.*

In 3685 : *Temperature, viscosity blood, specific gravity blood.*

That is to say : In three instances (temperature, vol. blood corp., viscosity blood) the lower values show greater variations.

Conclusions.

The number of blood corpuscles and, of course, the specific gravity of blood, increase in a horse which is in good condition, and dercease in a horse of bad condition when a loss of blood amounting to 150 c.c. takes place every day. (Daily withdrawing of blood, as it is necessary in serial experiments, therefore might have a slight influence on the result when a horse is in a poor condition.)

The viscosities of blood and serum increase or decrease as a rule with the respective specific gravities.

The quantity of water taken by the animals depends (among other factors) on the conductivity of serum, and, if the latter is high, the former is great and vice versa.

* * *

In the following table the results of the application of five different physical-chemical methods on the study of blood and serum of fifty different horses are contained. The last column shows the quantities of serum (in comparison to the entire quantity drawn from an animal) obtained twenty-four hours after tapping. The blood was kept in a cool room, where it coagulated, and the fibrin clot contracted itself.

Normal Horses.

Date.	Number.	Sex.	Age.	Condition.	Blood.			Serum.				
					Volume of Blood Corpuscles.	Viscosity at 25° C.	Specific Gravity at 37° C.	Specific Gravity at 37° C.	Conductivity at 37° × 10^{-4}	Viscosity at 25° C.	Surface Tension at 37° C.	Amount of Serum (Blood=1)
11/6/08	3618	Gelding	13 years	—	28	—	1·0468	1·0235	147·4	—	—	2/5
11/6/08	3619	,,	10 ,,	—	37	4·47	1·0558	1·0270	140·5	1·90	—	1/2
15/6/08	3623	,,	16 ,,	—	36½	3·63	1·0530	1·0251	146·4	1·81	5·98	1/2
15/6/08	3625	,,	7 ,,	—	31	3·73	1·0504	1·0239	150·3	1·64	5·78	1/2
15/6/08	3629	Mare	7 ,,	—	31½	3·61	1·0498	1·0257	149·5	1·82	—	1/2
15/6/08	3630	,,	12 ,,	—	39	4·29	1·0560	1·0257	148·4	1·93	6·11	1/2
15/6/08	3631	,,	12 ,,	—	34	3·98	1·0528	1·0248	147·6	1·74	—	1/2
15/6/08	3632	Gelding	14 ,,	—	32½	3·90	1·0525	1·0274	146·7	1·87	5·70	1/2
15/6/08	3635	,,	10 ,,	—	35½	4·00	1·0512	1·0243	146·1	1·70	6·16	1/2
15/6/08	3636	,,	13 ,,	—	33	4·05	1·0545	1·0275	146·5	1·94	6·06	1/2
23/6/08	3637	,,	8 ,,	Very good	35½	4·59	1·0532	1·0274	142·3	2·04	—	2/5
23/6/08	3638	,,	Aged	Fairly good	27	3·86	1·0488	1·0265	141·6	1·95	—	1/2
19/6/08	3639	,,	,,	Poor	32½	—	1·0526	1·0253	144·3	1·84	—	1/2
19/6/08	3641	,,	8 years	Good	38	4·15	1·0545	1·0263	144·0	1·66	—	2/5
19/6/08	3642	,,	Aged	,,	42	5·27	1·0586	1·0272	142·4	1·91	—	2/5
19/6/08	3643	,,	,,	Fairly good	30	3·61	1·0501	1·0255	144·2	1·72	—	1/3
19/6/08	3644	Mare	,,	Good	29½	3·97	1·0488	1·0249	142·4	1·72	—	1/2
19/6/08	3645	Gelding	10 years	Rather poor	29	3·42	1·0472	1·0236	144·2	1·71	—	1/2
23/6/08	3646	,,	12 ,,	Very good	29	3·37	1·0498	1·0265	148·2	1·84	—	1/2
23/6/08	3647	,,	Aged	Rather poor	33	3·97	1·0503	1·0252	147·6	1·82	—	1/2
22/6/08	3662	,,	,,	,,	39	3·92	1·0547	1·0263	145·4	1·74	—	1/2
22/6/08	3663	,,	13 years	Good	35	4·15	1·0508	1·0245	150·0	1·67	5·37	1/3
22/6/08	3664	,,	Aged	Fairly good	33½	3·16	1·0497	1·0255	141·9	1·74	—	1/2
22/6/08	3665	,,	10 years	Rather poor	36½	3·49	1·0508	1·0265	142·5	1·80	—	1/3

22/6/08	3666	,,	17 years	Very good	40	4·11	1·0547	1·0265	147·2	1·75	—	½
22/6/08	3667	,,	Aged	Good	38½	4·49	1·0567	1·0260	144·6	1·76	—	½
22/6/08	3668	,,	17 years	Fairly good	33	3·45	1·0498	1·0251	147·6	1·65	5·89	½
22/6/08	3669	,,	13 ,,	Good	37	3·63	1·0510	1·0255	142·1	1·80	—	⅖
22/6/08	3670	,,	Aged	Fairly good	30	3·71	1·0495	1·0278	143·7	1·99	5·85	⅓
24/6/08	3675	,,	13 years	Rather poor	27	3·64	1·0474	1·0271	141·5	2·09	5·87	⅖
24/6/08	3679	,,	Aged	,,	32	3·09	1·0498	1·0263	144·2	1·87	—	⅖
24/6/08	3680	,,	,,	,,	28½	2·91	1·0447	1·0229	146·4	1·69	—	½
24/6/08	3681	,,	20 years	,,	29½	3·11	1·0478	1·0249	140·8	1·79	—	½
24/6/08	3682	Mare	12 ,,	,,	32	4·33	1·0506	1·0256	141·8	1·73	6·00	½
24/6/08	3683	Gelding	Aged	Fairly good	31	3·28	1·0506	1·0251	145·0	1·79	—	½
24/6/08	3684	,,	17 years	Rather poor	31	3·40	1·0487	1·0244	143·9	2·01	—	½
24/6/08	3685	,,	13 ,,	Good	35½	3·06	1·0500	1·0226	152·0	1·68	5·49	½
26/6/08	3701	,,	10 ,,	,,	32½	4·21	1·0534	1·0306	145·7	2·13	—	⅖
26/6/08	3702	,,	13 ,,	Fairly good	31½	3·28	1·0503	1·0272	148·2	1·79	—	⅓
26/6/08	3703	,,	15 ,,	Good	37½	3·67	1·0538	1·0256	148·3	1·79	—	½
26/6/08	3704	,,	16 ,,	Fairly good	32½	3·71	1·0489	1·0253	143·4	1·74	—	½
16/1/08	3253	—	—	Very good	34	—	1·0566	1·0297	155·7	—	—	—
16/1/08	3260	—	—	,,	37	—	1·0594	1·0282	157·6	—	—	—
16/1/08	3248	—	—	,,	39	—	1·0578	1·0280	156·9	—	—	—
16/1/08	3249	—	—	,,	37	—	1·0605	1·0290	156·5	—	—	—
16/1/08	3256	—	—	,,	34	—	1·0540	1·0254	160·4	—	—	—
16/1/08	3261	—	—	,,	39	—	1·0577	1·0264	157·5	—	—	—
7/10/07	2917	—	—	—	31	—	—	1·0268	146·4	—	—	—
6/10/07	2915	—	—	—	39	—	—	1·0283	143·8	—	—	—
12/2/08	2904	—	—	—	35	—	1·0528	1·0270	148·3	—	—	—

The average values are collected in the next table, which also shows the degrees of variations and the limits within which the physical-chemical values of different horses vary.

NORMAL HORSES—VARIATIONS.

	Blood.			Serum.			
	Volume of Blood Corpuscles.	Viscosity at 25° C.	Specific Gravity at 37° C.	Specific Gravity at 37° C.	Conductivity at 37° × 10–⁴.	Viscosity at 25° C.	Surface Tension at 37° C.
Number of examinations	100 *	90 *	48	50	50	81 *	42 *
,, animals	100	72	48	50	50	71	36
Average values	33 ·4	3 ·80	1 ·0521	1 ·0261	146 ·8	1 ·83	5 ·95
Maximum	43	5 ·27	1 ·0605	1 ·0306	160 ·4	2 ·13	6 ·45
Minimum	22	2 ·95	1 ·0447	1 ·0226	140 ·5	1 ·55	5 ·37
Total variation	63 %	61 ·1 %	1 ·50 %	0 ·78 %	13 ·5 %	31 ·8 %	18 ·2 %
Variation above average	29 %	38 ·7 %	0 ·80 %	0 ·44 %	9 ·2 %	16 ·7 %	8 ·4 %
,, below ,, ...	34 %	22 ·4 %	0 ·70 %	0 ·34 %	4 ·3 %	18 ·1 %	9 ·8 %
Percentage of values above average ..	48 %	41 ·1 %	46 %	48 %	40 %	37 %	57 %
,, ,, below ,,	52 %	58 ·9 %	54 %	52 %	60 %	63 %	43 %

* Besides the above written, results of other experiments are taken into calculation.

The particularities of blood and serum, arranged in descending order of the latitudes of their variations, are :

Vol. blood corp., viscosity blood, viscosity serum, surface tension serum, conductivity, specific gravity blood, specific gravity serum.

Horses 3682 and 3685 gave the same order of the serum values; the order of vol. blood corp. and viscosity of blood, however, is reversed.

The specific gravity of the blood is chiefly dependent on the volume of corpuscles, that is to say, when a blood is rich in globules, it can be expected that its specific gravity is high.

The viscosity is influenced by both, but in a series of horses the latter follows more the specific gravity than the volume of corpuscles, and only from the viscosity 4·0 upwards it is allowed to say : the higher the internal friction of the blood the greater its specific gravity (above 1·050) and the number of corpuscles.

In numerous other experiments, however, there is a much closer relation between viscosity of blood and volume percentage of globules. (See chapter on Viscosity.) As the viscosity of serum is mainly due to the colloids and the latter protract the electric conductivity, a relation between these two values had to be expected. As a matter of fact in the majority of instances a high viscosity corresponds with a low conductivity; but the product conductivity $\times$ viscosity does not show a stability within the limits of errors. Our experiments do not allow to bring forward a mathematical formula as the expression of the relation between internal friction and conductivity as it was found for pure and simple electrolytic solutions.* The same is to be said about the relation between internal friction and specific gravity. Though in most of the examined sera, the specific gravity is high when the viscosity is considerable, the quotient $\frac{\text{viscosity}}{\text{specific gravity}}$ is not constant, and only in a little more than half of the cases it is possible to calculate one from the other satisfactorily.

The few values of surface tension allow not to draw definite conclusions with regard to mathematical relations with other physical properties of the serum; apparently there are none, and the surface tension seems to stand by itself.

* *Pissarjewski and Karp*, Zeitsche. Physik. Chemie. *63*, 257, 1908.