The order of influence of the Na-anions NO_3, Cl, SO_4 on gelatine is reversed as soon as the reaction is changed. The degree of influence of these ions is much higher in the acid than in the alkaline gelatine.

The surface tension of neutral gelatine (and neutral serum) is increased by the OH and decreased by the H-ion.

D.—ELECTRIC CONDUCTIVITY.

In a homogeneous system the electric conductivity is an expression of the number of free ions and thus of the degree of dissociation, and of the velocity of the ions.

In heterogeneous systems with electrolytes the resistance for the passage of the electric current is greater than it would be *ceteris paribus* in the electrolyt solution without suspended globules, for the latter

(*a*) absorb on their surface a certain number of ions and thus simply reduce the number of carriers of electricity;

(*b*) are mechanical obstacles for the migration of the remaining free ions.

Therefore the result of examination of the serum conductivity is dependent on

(*a*) number and kind of serum ions;

(*b*) quantity and actual state of serum colloids.

That is to say on two factors which are in competition with each other.

It was found that the conductivity of milk is considerably increased by elimination of the colloidal casein * (coagulation by means of the specific enzyme).

Similarly the colloidal ferrihydroxyde decreases the conductivity of NH_4Cl.†

The following experiments were carried out to study quantitatively the influence of various organic colloids in different concentrations on the conductivity of the same electrolyte, that is to say, the influence of albumine, globuline, gelatine, and saponine on the ions Na and OH. Albumine and globuline are colloidal components of serum wherein also both ions are present.

(1) *Albumine.*

Serum diluted with dist. H_2O in the proportion of 1 : 10. The globulines precipitate; the clear remaining liquid is boiled after addition of a small quantity of $(NH_4)_2\ SO_4$. The coagulum obtained is washed several times by means of dist. H_2O and centrifugal power until the liquid has a conductivity of $0{\cdot}75 \times 10^{-4}$. From the dried deposits a 4 per cent. stock solution is made with $\frac{n}{2}$-Na OH.

9/12/07. T=37°.

Concentration of Albumine. %	Conductivity × 10^{-4}.	Differences, absolute.	Difference in percentages. %
$0 \cdot \left(\frac{n}{2}\ \text{Na OH}\right)$	1097		
0·5	1056	41	3·7
1·0	1015	41	3·9
1·5	977	38	3·7
2·0	942	35	3·7
2·5	905	37	3·9
3·0	870	35	3·9
3·5	837	33	3·8
4·0	802	35	4·2

* *Schnorf*, Thesis, Zürich, 1904.

† *Dumanski*, Zeitsche, f. Chemie und Indust., I. Kolloide, *1*, 281, 1907.

The decrease of conductivity caused by increase of the colloid concentration amounting to 1 per cent. is about 7·7 per cent.

The remaining 4 per cent. stock solution is sterilised by boiling and kept overnight in the ice-chest.

10/12/07.

Conductivity of stock solution $786 \cdot 10^{-4}$; that is to say, a decrease of conductivity amounting to 16, equal to about 2 per cent., had taken place which I am inclined to attribute to absorption of ions by the colloid particles.

The same series is made as the previous day. The conductivity of the stock solution remains constant during the experiment:

Time.	Conductivity $\times 10^{-4}$.
10.30 a.m.	785
10.45 a.m.	787
4 p.m.	785
4.15 p.m.	786

10/12/07. $T = 37°$.

Concentration of Albumine. %	Conductivity $\times 10^{-4}$.	Differences, absolute.	Difference in percentages. %
$0 \cdot \left(\frac{n}{2}\text{Na OH}\right)$	1095		
0·5	1055	40	3·7
1·0	1015	40	3·8
1·5	974	41	4·0
2·0	935	39	4·0
2·5	898	37	4·0
3·0	860	38	4·2
3·5	823	37	4·3
4·0	786	37	4·5

A difference in the colloid concentration of + 1 per cent. corresponds in this experiment with a decrease of the conductivity to the average amount of 8·1 per cent.; that is to say, the protracting effect of the colloid has slightly increased.

(2) *Globuline.*

The globulines precipitated by dilution, as above mentioned, are washed until the washing water shows a conductivity of $0 \cdot 2 \times 10^{-4}$. The deposit is dried and used for a 3 per cent. stock solution with $\frac{n}{2}$Na OH. Mixture is kept in the ice-box for forty-eight hours before used for experiments.

13/12/07. T=37°.

	9.30 a.m.	10 a.m.	12.30 p.m.	1 p.m.
Conductivity $\times 10^{-4}$ of 3 per cent. stock solution ..	863		888	
Conductivity $\times 10^{-4}$ of $\frac{n}{2}$ Na OH		1094		1093

The conductivity of globuline solution increased within three hours to the amount of 25 = about 3 per cent. The cause is very likely the high temperature of the room provoking alterations of the equilibrium between colloid particles and ions.

13/12/07. T=37°.

Concentration of Globuline. %	Conductivity × 10^{-4}.	Differences, absolute.	Difference in percentages. %
0 · ($\frac{n}{2}$ Na OH)	1094		
0·5	1057	37	3·4
1·0	1023	34	3·2
1·5	988	35	3·4
2·0	954	34	3·4
2·5	921	33	3·5
3·0	888	33	3·6

One per cent. increase in concentration of the colloid causes a decrease of the conductivity of the system amounting to 6·8 per cent.

The serum globuline decreases the conductivity somewhat less than albumine. The curve of the former is almost a straight line, whilst the curve of the latter is very slightly concave towards the abscissa.

It is not allowed to apply these results *tale quale* to serum, because

(1) the albumines and globulines are in another state than they are in $\frac{n}{2}$ Na OH solution, and therefore affect the conductivity in a different manner;

(2) the serum colloids are suspended in a mixed solution of various electrolytes and non-electrolytes, and the conductivity of such solutions of numerous components is quantitatively influenced by colloids in another manner than a simple solution. But we can safely say that the depression of conductivity of a serum which contains about 8 per cent. albuminoid substances is very great, that there is a certain normal proportion between the conductivity of the pure salt serum (deprived of colloids) and the conductivity of the native serum. This proportion will probably be another in pathological conditions according to alterations of colloids and electrolytes. At present we can only make the statement that the conductivity of serum is altered in diseases (compare tables later), especially in piroplasmosis, and that this phenomenon can be used as diagnosticum.

The following experiments with gelatine and saponine are analoga to the former with serum colloids regarding the diminution of conductivity :—

(3) *Gelatine.*

A 2 per cent. stock solution in $\frac{n}{2}$ Na OH is made on 3rd January, 1908, and kept in the ice-chest till 7th January, 1908.

7/1/08. T=37°.		Conductivity × 10^{-4}
2 per cent. Gelatine solution..	11.30 a.m.	980
	12 a.m.	980
	6 p.m.	973
	6.20 p.m.	972
$\frac{n}{2}$ Na OH	10.30 a.m.	1099
	6.40 p.m.	1100
8/1/08.		
2 per cent. Gelatine solution having been in ice-chest overnight	10.30 a.m.	954

The conductivity of the gelatine-alkali solution decreases, while the latter is kept at room temperature (30° C.) for seven hours, to the amount of 8×10^{-4} =about 0·8 per cent.; then a further decrease takes place when the solution is in the ice-box for sixteen hours, amounting to $18 \times 10^{-4} = 1 \cdot 85$ per cent. A similar decrease could be noted with the albumine.

7/1/08. T=37°.

Concentration of Gelatine. %	Conductivity $\times 10^{-4}$.	Differences, absolute.	Difference in percentages. %
$0 \cdot \left(\frac{n}{2} \text{Na OH}\right)$	1099		
0·25	1082	17	1·5
0·50	1068	14	1·3
0·75	1054	14	1·3
1·0	1039	15	1·4
1·25	1025	14	1·3
1·50	1008	17	1·7
1·75	989	19	1·9
2·00	973	16	1·6

When the concentration of gelatine increases to the amount of 1 per cent. the conductivity of the system shows a decrease of 6 per cent.

(4) *Saponine.*

The conductivity of a 4 per cent. saponine solution in $\frac{n}{2}$ Na OH remains constant, adversely to globuline, albumine, and gelatine solutions. The 4 per cent. stock solution was made on the 3rd January, 1908, and kept at the same conditions as the gelatine solution.

	37°.	Conduct. $\times 10^{-4}$
4 per cent. Saponine solution—	7/1/08.—11.15 a.m.	882
	11.45 a.m.	882
	6.10 p.m.	882
	6.30 p.m.	879
	8/1/08—10.45 a.m.	880

7/1/08. T=37°.

Concentration of Saponine. %	Conductivity $\times 10^{-4}$.	Differences, absolute.	Difference in percentages. %
$0 \cdot \left(\frac{n}{2} \text{Na OH}\right)$	1096		
0·5	1065	31	2·8
1·0	1035	30	2·8
1·5	1007	28	2·7
2·0	979	28	2·8
2·5	953	26	2·7
3·0	928	25	2·6
3·5	903	25	2·7
4·0	881	22	2·4

Increase of saponine concentration of 1 per cent. provokes decrease of the conductivity of the system amounting to 5·4 per cent. Gelatine influences the resistance of the system almost as intensively as saponine, but both somewhat less than albumine and globuline.

(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.