LXIII. Abstract of chemico-physiological researches

Joseph Scherer M.D.

To cite this article: Joseph Scherer M.D. (1842) LXIII. Abstract of chemico-physiological researches , Philosophical Magazine Series 3, 20:132, 412-417, DOI: [10.1080/14786444208650600](https://doi.org/10.1080/14786444208650600)

To link to this article: <http://dx.doi.org/10.1080/14786444208650600>

Published online: 01 Jun 2009.

Submit your article to this journal [↗](#)

Article views: 2

View related articles [↗](#)

LXIII. *Abstract of Chemico-Physiological Researches by*
JOSEPH SCHERER, M.D.

[Continued from p. 319, and concluded.]

Of Albumen.

A. **P**URE albumen from serum, dried without coagulation, was digested successively with water at 86° Fahrenheit, alcohol and æther, and then analysed.

B. Serum of the blood, merely boiled successively with water, alcohol and æther, until nothing more was dissolved.

C. Albumen from hens' eggs, dried without coagulation, was digested with water at 86°, which dissolved the pure albumen (as in A), which was then precipitated by alcohol, and boiled with alcohol and æther.

These specimens were analysed by combustion with chromate of lead, and the nitrogen determined both by Will's method and directly; the results are,

	A.	B.	C.
Carbon	55·461	55·097	55·000
Hydrogen	7·201	6·880	7·073
Nitrogen	15·673	15·681	15·920
Oxygen, sulphur and phosphorus }	21·665	22·342	22·007
	<hr/> 100·000	<hr/> 100·000	<hr/> 100·000

The albumen derived from various morbid secretions was also analysed by the same methods; from the fluid of hydrocele and of ordinary ascites; from pus (the ashes of which contained a little *iron*); from a congestive abscess. The analytical results per cent. were identical with those for normal albumen already given.

Casein.

A. Fresh milk being precipitated by alcohol, the curd was taken out and boiled repeatedly in alcohol and æther, until all traces of butter were removed. To deprive it totally of sugar it was then again boiled with water, and finally dried at 212° Fahr.

B. Milk which had become spontaneously somewhat sour, was heated; it then curdled. The curd was boiled in water, alcohol and æther, as long as anything was dissolved, and then dried at 212°.

C. Casein prepared by Liebig, by precipitating milk with acetic acid, dissolving the precipitate by carbonate of soda, and again precipitating; then extracting the butter by boiling æther.

D. The material (coagulating by heat, like albumen) which remains dissolved in milk which has become sour, was boiled with alcohol and æther, and dried.

Of these specimens of casein,

A	gives 10·0	per cent. of ashes .		
B	...	2·0	...	...
C	...	1·5	...	...
D	...	2·0	...	...

The methods of analysis being the same as in the former instances, the results were,—

	A.	B.	C.	D.
Carbon . .	54·825	54·721	54·580	54·507
Hydrogen	7·153	7·239	7·352	6·913
Nitrogen .	15·628	15·724	15·696	15·670
Oxygen	} 22·394	22·316	22·372	22·910
Sulphur				
	<u>100·000</u>	<u>100·000</u>	<u>100·000</u>	<u>100·000</u>

Protein.

Dr. Scherer prepared this body according to Mulder's method, by solution in caustic potash liquor and precipitation by acetic acid. The results with protein from three different sources agree very well with those of Mulder, and are as follows :—

	Protein from crystalline lens.	Protein from albumen.	Protein from fibrine.
Carbon	55·300	55·160	54·848
Hydrogen . .	6·940	7·055	6·959
Nitrogen . . .	16·216	15·966	15·847
Oxygen [†]	21·544	21·819	22·346
	<u>100·000</u>	<u>100·000</u>	<u>100·000</u>

As the compounds of protein do not admit of our deducing any positive rational formula for protein, Liebig proposes the empirical formula $C_{48} H_{36} N_6 O_{14}$, which gives a per cent. composition coinciding with the results of the above analyses.

Having thus determined the composition of the fundamental materials of the animal organization, Dr. Scherer proceeds to examine the secondary tissues. These are merely to be considered as products of animal life, and are not met with in vegetable structures, whereas the former class exist equally in both departments of organized nature. The substances to be analysed were obtained in the condition of greatest anatomical purity, and carefully freed from all intermixed fat, &c. by such chemical means as were least likely to alter their own texture. Although such textures are not anatomically homogeneous, but under the microscope still show

traces of the presence of nerves and blood-vessels, yet these could not be supposed to modify their composition in any important degree, as their quantity is excessively minute, and their composition not very different from that of the tissue under examination.

Tissues which yield Gelatine.

The substances selected as yielding pure gelatine, were isinglass and the tendons of the feet of young calves. They were both perfectly soluble in boiling water. The isinglass, when freed from all traces of fat by boiling in æther, and dried at 212° , gave by incineration 0.5 per cent. of ashes. The calves' tendons macerated for some time with a solution of nitre to remove any investing membrane, and then washed perfectly out with pure water, and boiled with alcohol and æther, gave on incineration 1.6 per cent. of ashes.

Each material was analysed several times, but the following results need only be given, the others were almost coincident:—

	Isinglass.	Calves' tendons.
Carbon	50.557	50.960
Hydrogen . .	6.903	7.188
Nitrogen . . .	18.790	18.320
Oxygen . . .	23.750	23.532
	100.000	100.000

The *sclerotic coat of the eye* is composed as the gelatinous tissues, although in its insolubility in boiling water it resembles those tissues which yield chondrin. It gave—

Carbon	50.995	} 100.000.
Hydrogen	7.075	
Nitrogen	18.723	
Oxygen	23.207	

If we take double the carbon which exists in the formula already given for protein as a standard, and calculate from it a formula to express the composition of gelatine as given above, we obtain $C_{96} H_{82} N_{15} O_{36}$, and subtracting from it two equivalents of protein, there remain $3.N H_3$ with $H O$ and $7 O$, for

Tissues which yield Chondrin.

Chondrin was shown by its discoverer Müller to exist in the permanent cartilages, in the bones before ossification, in the cornea of the eye, and also in some morbid enlargements of the bones.

For analysis, Dr. Scherer selected the cartilages of the ribs

of young calves, and the cornea. They were digested with water and some saltpetre to dissolve out all albuminous material, and then boiled with alcohol and æther to remove the fat.

This chondrin dried at 212° contained 6.6 per cent. of ashes.

Analysed by the usual methods the results were—

	Ribs.		Cornea.
	I.	II.	III.
Carbon	49.496	50.895	49.522
Hydrogen.....	7.133	6.962	7.097
Nitrogen	14.908	14.908	14.399
Oxygen.....	28.463	27.235	28.982
	100.000	100.000	100.000

If we take the carbon here as being of the same magnitude as that of protein, the formula resulting from these analyses is $C_{48}H_{40}N_6O_{20}$, which differs from protein by containing 4. H O and 2. O in excess.

The Elastic Coat of the Arteries.

This tissue, purified in the same manner as the other substances analysed, and dried at 212° , gave 1.7 per cent. of ashes.

The analysis of it yielded—

	I.	II.
Carbon	53.750	53.393
Hydrogen	7.079	6.973
Nitrogen	15.360	15.360
Oxygen	23.811	24.274
	100.000	100.000

The formula given by these results is $C_{48}H_{38}N_6O_{16}$, and deducting thence that of protein, $C_{48}H_{36}N_6O_{14}$, it appears that the elastic coat of arteries differs from protein in containing plus the elements of two atoms of water.

Corneous Tissues.

This substance presents itself in two forms, *membranous* and *compact*. The first constitutes the epidermis and the epithelium in its various forms; the latter constitutes hair, horns, nails, &c.

A. *Membranous Corneous Tissue.*—For analysis, Dr. Scherer selected the epidermis of the sole of the foot where it is thickest and most easily separated. It was purified by boiling in water, alcohol and æther. Dried at 212° , it gave 1.0 per cent. of ashes.

It was analysed as usual, except that the nitrogen was determined directly by volume in the old manner.

The results were,—

	I.	II.
Carbon	51·036	50·752
Hydrogen...	6·801	6·761
Nitrogen ...	17·225	17·225
Oxygen.....	24·938	25·262
	<u>100·000</u>	<u>100·000</u>

B. *Compact Corneous Tissue.*

- i. *Hair of the beard*, which gave 0·72 per cent. of ashes.
- ii. *Hair of the head* (light coloured), which gave 0·3 per cent. of ashes.
- iii. *Hair of the head of a Mexican* (very black), which gave 2 per cent. of ashes.
- iv. *Brown hair from the head.*

The analytical results were—

	I.	II.	III.	IV.
Carbon	51·529	50·652	49·935	50·622
Hydrogen ...	6·687	6·769	6·631	6·613
Nitrogen	17·936	17·936	17·936	17·936
Oxygen and Sulphur... }	23·848	24·643	25·498	24·829
	<u>100·000</u>	<u>100·000</u>	<u>100·000</u>	<u>100·000</u>

C. *Buffalo horn* purified as the other substances, gave 0·7 per cent. of ashes.

With this and the hair, the relative volumes of nitrogen and carbonic acid were found to be 1 : 7 when chromate of lead was used.

The nitrogen was also determined by the method of Will and Plantamour to be 16·380 per cent., but came out 17·284 by a direct determination.

The analytical results in four cases were—

	I.	II.	III.	IV.
Carbon.....	51·990	51·162	51·620	51·540
Hydrogen ...	6·717	6·597	6·754	6·779
Nitrogen.....	17·284	17·284	17·284	17·284
Oxygen and sulphur }	24·009	24·957	24·342	24·397
	<u>100·000</u>	<u>100·000</u>	<u>100·000</u>	<u>100·000</u>

Nails and wool purified as usual gave the following results :—

	Nails.	Wool.
Carbon	51·089	50·653
Hydrogen	6·824	7·029
Nitrogen	16·901	17·710
Oxygen and sulphur	25·186	24·608
	<u>100·000</u>	<u>100·000</u>

If we seek to establish for these horny tissues a formula comparable with that of protein, we may best adopt $C_{48} H_{39} N_7 O_{17}$, from which if we subtract protein ($C_{48} H_{36} N_6 O_{14}$) there remains $H_3 N O_3$, or the horny material consists of protein + $NH_3 + 3 O$.

When horn, wool, or hair is dissolved in solution of potash, ammonia is evolved. On decomposing the liquor by sulphuric acid, removing the precipitate by filtration and distilling, a very sensible quantity of acetic acid may be obtained. If the alkaline solution be decomposed by acetic acid, sulphuretted hydrogen is evolved, and a precipitate formed which agrees perfectly with protein in its character and composition; but if this precipitate be removed and the liquor decomposed by a new quantity of acetic acid, a grayish solid separates which is of a different nature. Its composition, and that of protein from hair or horn, is as follows:—

	1st precipitate, true protein.	2nd precipitate.
Carbon	55.408	53.536
Hydrogen . . .	7.238	6.956
Nitrogen . . .	15.593	14.801
Oxygen	21.761	24.707
	<u>100.000</u>	<u>100.000</u>

The membrane which encloses the albumen and lines the interior of the shell of the egg was found to be also a horny tissue.

Feathers.

This material, which is usually considered as horny, has been found by Dr. Scherer essentially distinct. It contains to the same carbon, hydrogen and nitrogen, an atom less of oxygen than true horn, the formulæ expressing the analytical results being $C_{48} H_{39} N_7 O_{16}$.

Black Pigment of the Eye.

This substance, the details of the preparation of which in the pure state may be passed over, consists of

	I.	II.	III.
Carbon	58.273	58.672	57.908
Hydrogen . .	5.973	5.962	5.817
Nitrogen . . .	13.768	13.768	13.768
Oxygen	21.986	21.598	22.507
	<u>100.000</u>	<u>100.000</u>	<u>100.000</u>