complex iron, molybdenum, tungsten, and chromium molecules and their union to form a new compound, *i. e.*, the passing of a heterogeneous system of molecules of like elements to a homogeneous system in the melted condition and again to a heterogeneous system in the resultant alloy; that these properties indicate a condition in these alloys analogous to an aqueous solution of a salt converted by cold to the solid state.

3. The high melting-point of the element in combination with the iron and its chemical affinity for iron is especially favorable to the separation of alloys from the cooling solution, and is the cause of the heterogeneity of these compounds. This separation of salts, *i. e.*, segregation, draws the analogy between these alloys and solutions closely.

XI. COMPOSITION OF ALLOYS.

Alloys.	A.	B.	C.	D.	E.
Molybdenum	0.2979	0.1665	.....	.....	.....
Tungsten	.....	.....	0.4646	0.1696	.....
Chromium	.....	.....	.....	.....	0.0702
Iron	0.6626	0.7942	0.5251	0.7832	0.8799
Phosphorus	0.0031	0.0030	0.0004	0.0025	0.0029
Silicon	0.0074	0.0066	0.0014	0.0207	0.0337
Combined carbon	0.0017	0.0020	0.0075	0.0184	0.0041
Graphitic carbon	0.0273	0.0277		0.0056	0.0082

THE PROTEIDS OF THE KIDNEY BEAN.

(PHASEOLUS VULGARIS.)

BY THOMAS B. OSBORNE.

(*Continued from page 712.*)

Another trial was made by treating 400 grams of bean-meal, previously exhausted by benzine, with one per cent. sodium chloride solution, dialyzing the extract for twenty-four hours, and filtering off the precipitated phaseolin. The clear filtrate after standing over night, deposited a considerable quantity of proteid, but the solution with this deposit was returned to the dialyzer and left for two days longer, when it was filtered, the precipitate washed with water, alcohol, and ether, dried over sulphuric acid, and six grams of preparation 36 obtained.

PHASELIN, PREPARATION 36.

		Ash-free.
Carbon	50.44	51.41
Hydrogen	7.14	7.28
Nitrogen	14.31	14.59
Sulphur	0.46	0.47
Oxygen	....	26.25
Ash	1.94	....
		100.00

The filtrate from preparation 36 was then dialyzed into distilled water which was renewed every twenty-four hours for several days. After a week the solution was filtered and the precipitate washed with water, alcohol, and ether, and dried over sulphuric acid. It weighed 1.60 grams, 37.

PHASELIN, PREPARATION 37.

	I.	II.	Average.	Ash-free.
Carbon	51.38	51.22	51.30	52.19
Hydrogen	7.25	6.99	7.12	7.24
Nitrogen	14.52	....	14.52	14.79
Sulphur } Oxygen }	....	....	....	25.78
Ash	1.83	1.61	1.72	....
				100.00

One more preparation, 38, was made in the same manner as 37, and had the following composition:

PHASELIN, PREPARATION 38.

		Ash-free.
Carbon	50.20	51.27
Hydrogen	7.07	7.22
Nitrogen	14.02	14.32
Sulphur	0.50	0.51
Oxygen	....	26.68
Ash	2.06	....
		100.00

Further dialysis in distilled water, of the filtrate from preparation 37, gave no more precipitate. The solution was therefore saturated with ammoniun sulphate, and the precipitate so produced filtered off and dissolved in distilled water. This solution which now had a volume of about 400 cc. was dialyzed for some

days, first in river water, and afterwards in distilled water, but only a trace of substance separated. This was filtered off, and the perfectly clear solution gave the following reactions:

Saturation with sodium chloride produced no precipitate until acetic acid was added. Acetic acid in the absence of salt gave no precipitate. Nitric acid gave a turbidity when added in considerable quantity, and the addition of some sodium chloride produced no further precipitation. Copper sulphate gave no precipitate. This solution when heated became turbid at 57° and particulate at 63°.

The entire solution was therefore heated to 70° in a water-bath which did not exceed this temperature, and after two hours, filtered from the separated coagulum. This was then washed with distilled water, alcohol, absolute alcohol, and ether, and dried over sulphuric acid. It weighed 0.48 gram. Before drying, this coagulum dissolved readily in two-tenths per cent. hydrochloric acid, and in dilute potash solution, and gave a violet reaction with copper sulphate and caustic potash. The filtrate from this coagulum gave a further small coagulum when heated at 70°, for some time longer. This was filtered off, and after treating it in the same way as the first coagulum, was added to it. The total amount of coagulum, preparation 39, amounted to 0.63 gram, and after drying at 110° was found to contain, ash-free, 15.23 per cent. of nitrogen.

The filtrate from 39 was then dialyzed into alcohol, and the solution thereby concentrated. On adding an equal volume of strong alcohol, the proteid was precipitated. This was filtered off, washed with absolute alcohol and ether, and dried over sulphuric acid. It then weighed 0.72 gram which shows that the proteids had been almost wholly precipitated by dialysis and coagulation.

This substance gave a nearly clear solution with distilled water, not made clearer by adding a few drops of sodium chloride solution. With caustic potash and copper sulphate, a pink color was developed which had a distinct violet tinge, and was by no means so red as that given by pure proteoses and peptones.

The aqueous solution heated to 85° gave a flocculent coagulum which apparently represented most of the substance. From

this, it would appear that true proteoses are present in extremely small amounts.

Dried at 110°, this preparation, 40, contained, ash-free, 13.60 per cent. of nitrogen. Being thrown down by strong alcohol, it could scarcely be pure, and the nitrogen determination is only of value, as indicating that the coagulum mainly consisted of proteid.

Of these preparations, 25, 27, and 32, are unquestionably mixtures of phaseolin and phaselin. Excluding these three and also 38 and 40, evidently impure, the remaining agree fairly well, as is shown by the following table:

SUMMARY OF ANALYSES OF PHASELIN FROM THE KIDNEY BEAN.

	26.	28.	29.	30.	31.	33.
Carbon	....	51.57	....	51.59	51.98	....
Hydrogen	....	6.92	....	6.71	6.82	....
Nitrogen	14.57	14.48	14.81	14.84	14.53	14.85
Sulphur } Oxygen }	....	....	27.03	....	26.87	26.68	....
	.....	100.00	.....	100.00	100.00	.....

	34.	35.	36.	37.	38.	Average.
Carbon	51.38	51.37	51.41	52.19	51.27	51.60
Hydrogen	6.91	7.10	7.28	7.24	7.22	7.02
Nitrogen	14.67	14.71	14.59	14.79	14.32	14.65
Sulphur } Oxygen }	27.04	26.82	{ 0.47 / 26.25 }	25.78	{ 0.51 / 26.68 }	0.49 / 26.24
	100.00	100.00	100.00	100.00	100.00	100.00

It is probable that these analyses pretty closely represent the true composition of this proteid, the various preparations having been made under such diverse conditions as to exclude the possibility of their being mixtures of the phaselin with non-proteid substances.

Preparations 26 and 28 were precipitated by heat, 29 and 30 by acid. Preparations 31, 34 and 35 were thrown down by alcohol, extracted by water from the precipitate so produced, and separated from the solution—31 by acid, and 34 and 35 by dialysis in alcohol. Finally, 36, 37, and 38 were obtained by fractional dialysis in water.

There is some difficulty in deciding to what class of proteids phaselin should be assigned. It most nearly agrees with the

globulins, being precipitated by dialysis after nearly all the salts are removed, and thereby largely converted into an insoluble form. Complete precipitation is not accomplished, even by prolonged dialysis in distilled water, and it may be questioned whether the precipitation that occurs on dialysis in water, is not the result of transformation into "albuminate."

Nitric acid in sufficient quantity gives a precipitate which, on warming, does not dissolve in the manner characterizing proteoses. Saturation with sodium chloride, gives only a slight precipitate, but further addition of acetic acid, occasions an abundant precipitate. With copper sulphate and caustic potash a violet color is produced.

The coagulum produced by heat, dissolves in one-tenth per cent. hydrochloric acid when heated to 80°. The temperature at which coagulation commences, varies with the amount of salts present, a turbidity usually appearing between 40° and 50° in solutions which have been dialyzed until the greater part of the phaseolin had been separated. The ten per cent. sodium chloride extract of the bean-meal, became turbid at 52°–55°, flocks forming at 68°–70°. The aqueous extract of the meal, heated to 60° gave a turbidity but slightly increased by boiling. When ten per cent. of sodium chloride was added to the aqueous extract, turbidity occurred at 37° and flocks formed at 52°. The coagulation of this proteid by heat, proceeds very slowly and is completed only by very prolonged heating, for days even, at a temperature considerably higher than that at which flocks first appear.

Amount of Proteids in the Kidney Bean.

The quantities of these two proteids occurring in the kidney bean cannot be accurately determined, owing to the difficulties encountered in separating them. An approximate estimate is as follows:

1. A sample of freshly ground air-dry bean-meal yielded by combustion, 3.785 per cent. of nitrogen. Considering all the nitrogen to exist as proteids containing sixteen per cent. of this element, the proportion of proteids in the bean-meal would be $(3.785 \times 6.25 =)$ 23.65 per cent.

2. Twenty grams of bean-meal were treated repeatedly with

ten per cent. sodium chloride solution, until no more proteids could be extracted. The residue, after washing with water, alcohol, and ether, weighed, air-dry, 11.41 grams and contained 1.877 per cent. or 0.214 gram of nitrogen, equivalent to 1.338 grams of salt-insoluble proteid, which amounts to 6.69 per cent. of the meal. The salt-soluble proteids were accordingly (23.65 — 6.69 = 16.96) seventeen per cent. of the meal.

3. In making preparations 4, 5, 6, and 7, pp. 638–9, the phaseolin obtained from the salt extract amounted to 14.77 per cent. This when weighed was not altogether pure or dry, but on the other hand, a part of this proteid existing in the salt extract, was not recovered, so that it may be fairly assumed that the meal contains about fifteen per cent. of salt-soluble phaseolin. This deducted from the seventeen per cent. of total salt-soluble proteids, leaves two per cent. for phaselin, reckoned water-free, other proteids being present in very minute quantity.

4. The preparations 36, 37, 39, and 40, pp. 758–60, were obtained from one and the same portion, 400 grams, of bean-meal, after phaseolin had been as completely removed as practicable. These preparations after drying over sulphuric acid, weighed respectively 6.00, 1.60, 0.63, and 0.72 grams, their total weight being 8.95 grams, equal to 2.24 per cent. of the meal. Their average nitrogen content was 14.54 per cent., very nearly that of phaselin. Making liberal allowance for impurities and incomplete drying, they represent about two per cent. of phaselin.

5. Twenty grams of bean-meal were extracted as completely as possible with two tenths per cent. potash water. The washed and air-dry residue weighed 11.27 grams, and contained 0.91 per cent. or 0.1026 gram of nitrogen, equal to 0.611 gram of (water-free) proteid insoluble in alkali, or to 3.06 per cent. of the meal. The alkali-soluble proteid amounted therefore to (23.65 — 3.06 = 20.59) 20.6 per cent. of the meal.

6. On page 642 is recorded that the proteid insoluble in salt solution, but dissolved by two-tenths per cent. potash, 15, contained sixteen per cent. of nitrogen and accordingly had nearly the composition of phaseolin. It is, therefore, probable that the proteid undissolved by salt-solution, is phaseolin. On this assumption, the kidney bean examined, contains about 21.5

per cent. of phaseolin, and about two per cent. of phaselin.

7. The foregoing data are summarized as follows: The "white medium field bean" contains approximately:

Phaselin, salt-soluble	2	per cent.
Phaseolin, salt-soluble	15	"
Phaseolin, salt-insoluble, alkali-soluble	3.5	"
Phaseolin, insoluble in salt and in $\frac{2}{10}$ per cent. alkali	3	"
Total proteids	23.5	"

Schulze, Steiger and Maxwell have stated[1] that ten per cent. of the nitrogen of the seeds of the horse bean (*Vicia faba*) the vetch and the pea, exists in non-proteid form. Should such prove to be the case with the kidney bean, then its total proteids would be about twenty-one per cent. instead of 23.5 per cent.

Conclusion.

The kidney bean contains two globulins characterized by great solubility in very dilute saline solutions, and by yielding precipitates with acids which are soluble in sodium chloride solutions. One of these globulins, *phaseolin*, probably forms about twenty per cent. of the seed, and has the following composition, which is the average of analyses of twenty-four different preparations:

Phaseolin.

Carbon	52.58
Hydrogen	6.84
Nitrogen	16.47
Sulphur	0.56
Oxygen	23.55
	100.00

This is the proteid described by Ritthausen in 1884, to which he assigned very nearly the same composition as that above given.

The other proteid, *phaselin*, is much more soluble, remaining in solution after the phaseolin has separated. It is slowly coagulated by heat at temperatures varying with the amount of salts present and the rapidity of heating. It is precipitated by acids, on prolonged dialysis yields insoluble or albuminate modifications, and has more nearly the properties of a globulin

[1] *Versuchs Stationen*, **39**, 306.

than of any other recognized class of proteids. It has an unusually low nitrogen and high oxygen content as shown by the subjoined average of the analyses of eleven different preparations.

PHASELIN.

Carbon	51.60
Hydrogen	7.02
Nitrogen	14.65
Sulphur	0.49
Oxygen	26.24
	100.00

In addition to these two globulins, the extracts were found to contain an extremely small amount of *proteose*.

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A SAFETY ATTACHMENT FOR RIDERS.

BY CHAS. E. PARKER, PH.C.

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SOME years since, an attachment for manipulating the weighing rider of balances was introduced by Verbeck and Peckholdt. The arrangement, devised by the writer, and here described, appears to have some advantages in simplicity, lightness, and adaptability.

It consists of a piece of sheet brass cut in the shape shown in *b*, Fig. 1, to which is soldered a bit of hair-spring from a watch, *a*; and of a light glass rod, *m*, Fig. 3, secured in a position parallel to the beam behind and slightly above it.

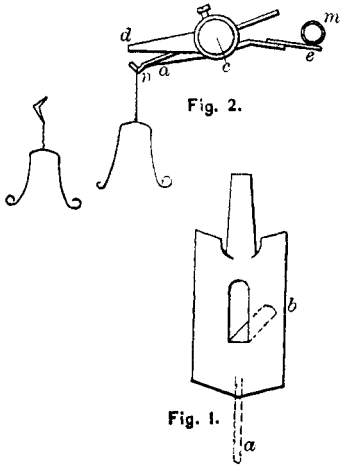

Fig. 2.

Fig. 1.

The piece of brass, *b*, is bent, as shown in Figs. 2 and 3, to form a sleeve upon the rod, *c*, together with a prong in apposition to the hook by which the rider is usually lifted, *n*, Fig. 2; and an extension, *e*, back under the rod, *m*, which thus limits the rotation of the sleeve and prong in one direction.

The operation is readily understood; the usual hook arrangement being converted into forceps