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DEPARTMENT OF THE ARMY
Fort Detrick
Frederick, Maryland

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METABOLISM DURING TYPHUS CONVALESCENCE

/Following is a translation of an article by Dr. H. Benedict and Dr. N. Suranyi of the First Budapest Medical Clinic under the direction of Prof. Friedrich v. Koranyi, in the German-language medical journal, Zeitschrift fur Klinische Medizin, (Journal of Clinical Medicine), No 48, 1903 pp 290-320./

XVI

Recently new material has been added to the problem of metabolism during typhus convalescence which causes this problem dealt with experimentally three years ago and brought to a certain conclusion to again become a current one. /See Note/. Svenson has obtained results with his respiration experiments using the Zuntz-Geppert apparatus, and conducting tests with albuminous metabolism confirming the main experimental results we published in the Munich Medical Weekly; the conclusions drawn from his experiment are in part the same as ours while in part they differ. /See Note 2/. If we revert to this subject, this is less in order to establish priority claims than in order to clarify this problem by referring to metabolism experiments as yet either published only partially or not at all, in a detailed manner or in a way it deserves to be published.

/Note 1: Munich Medical Weekly, 1899, Vols 6 and 7. Journal of Dietetic and Physical Therapy, Vol 1, No 6.
Note 2: Zeitschrift fur Klinische Medizin, Vol 43./

Our tests were designed primarily for practical purposes. How can convalescence be made more effective, was our question. This was our only theoretical interest in the problem at hand which appeared to have been answered by existing investigations to a fairly satisfactory degree. "The regeneration of body substance and its consequent fortification of the organism is the substance of convalescence". This is a fact which requires no medical observation, let alone scientific investigation. "During the fever state, the cellular stability is destroyed by toxic elements, its albumen is deadened by poisons. During convalescence, the albumen-starved cells again fill up with albumen and greedily appropriate it from the food". This was shown by earlier metabolism investigations. Albumen loss on the one hand, album retention on the other.

Numerous authors have already focused attention on the antagonistic nature of the fever-bearing and convalescent metabolism, among whom, at first, Fr. Muller /See Note 1/ in his metabolism research on cancer patients, furthermore Bauer /See Note 2/, Klemperer /See Note 3/, Dunschmann /See Note 4/, v. Noorden /See Note 5/, Puritz /See Note 6/, Chadschi /See Note 7/, etc. The "Handbook for Dietetic Therapy" (v. Leyden and Klemperer) /See Note 8/ contains the following: "We can say that metabolism among convalescents is the opposite of that noted in feverish individuals; in one case, there is the dying of cellular protoplasma, while in the other there occurs a regeneration.

/Note 1: Zeitschrift fur Klinische Medizin, Vol 16.
Note 2: The feeding of patients and dietetic cures. Zeimssen's Handbook of General Therapy, p 187.
Note 3: Zeitschrift fur Klinische Medizin, Vol 16.
Note 4: Considerations on the N Balance in Typhus Abdominales. Dissertation, Berlin, 1892.
Note 5: Pathology of Metabolism, p 125.
Note 6: Virchow's Archives, Vol 131.
Note 7: (Russian Dissertation,) St. Petersburg, 1888,
Note 8: Vol 2, p 415./

This knowledge, in our opinion, constitutes the positive scientific main result of our research. Only through it did it become possible to give an explanation of metabolism in typhus convalescence, showing us how to derive the reaction from the action, the counterwave from the wave and from these the nature of the feverish decomposition events.

Before we revert to these considerations, let us report on two of our tests extensively which will yield this conclusion beyond doubt. The first one was covered in our earlier publications by way of extracts (p 23 of the special reproduction).

Test Series No 1

Gregor Gorga, 22 years, medium grave typhus without complications, illness duration 28 days.

To create the least complicated conditions possible, we fed the patient continuously with liquids. We determined the N content of milk ourselves /See Note/; this and 300 cc of soup with an equally controlled N content formed the only N-containing source of nourishment. In addition, he received an emulsion of oleum amygdalarum dulcim without N content which we emulsified from small quantities of mucilago gummi arabici, and the amounts of which were varied according to calorie requirements. Varying quantities of milk sugar were added to this emulsion. As shown by the Tables we used milk free from albumen for this emulsion. We ate the emulsion ourselves for test purposes. Outside a certain reduction in appetite it appeared to be quite satisfactory. The patient likes it well. Occasionally, he suffers from constipation. Limitation of bowel movements with carbon emulsion unsuccessful; at the end of each test period, in the morning before weight determination, an enema was administered evacuating the incomplete stool and all the water.

/Note: Patients receive milk from a stable; it is mixed and boiled in a community kitchen in one-hectoliter boilers. The N content is the average value of 14-day long tests during which the N content varied only very slightly./

Efficiency was quite good; it was only poor during phases I and II, during which 17.06 and 18.03% respectively of the nitrogen introduced reached the bowel discharge. Later on, when the emulsion was largely replaced with ordinary milk, absorption improved accordingly (8.2% N loss in bowel discharge).

During phase Ia, the patient is unable to achieve an equilibrium due to being fed an excess of calories but insufficient albumina. The separation of nitrogen from the previous day's urine (first day of convalescence) still amounted to 10.03 grams: albumen exchange is lowered, however the balance remains negative (-2.55 grams).

Phase Ib. Without increasing N, the N-free calories are increased (by adding 35 grams of oleum amygdalarum dulc. and 45 grams of milk sugar). This addition corresponds to approximately 1 liter of albumenless milk.

The feeding consisted of the following elements: 6.68 grams N, 173.20 grams fat, 228.61 grams coal hydrates, 24 grams alcohol. Total caloric content: 2,866.

Feeding Table During Phase Ia

(1) Art der Nahrung	N g	(2) Fett g	(9) K. H. g	(3) Alkohol g
(4) 1000 ccm Milch . .	6,04	33,20	48,40	—
2000 ccm Emulsion .	—	105,00	135,00	—
(5) 600 ccm Suppe . .	0,52	—	—	—
(6) 300 ccm Wein . .	0,12	—	21,00	24,0
(7) Zusammen:	6,68	187,20	183,61	24,0

(8) Täglicher N-Gehalt: 6,68 g; Gesammtcaloriengehalt: 2368.

Legend:
1. Type of nourishment
2. Fat
3. Alcohol
4. Milk
5. Soup
6. Wine
7. Total
8. Daily N content: 6.68 grams; Total Calorie content: 2,368
9. Hydro-carbons

Phase Ia

Periode Ia.

(1) Tag der Reconvalescenz	Date 1898	(2) Harnmenge ccm	(3) Harn-N g	(4) Koth trocken g	(5) Koth-N g	(6) N-Einnahme g	(7) N-Ausgabe g	Differenz g
2.	18. März	3160	9,73	28,76	1,16	6,68	10,89	— 4,21
3.	19. „	2080	6,99	28,76	1,16	6,68	8,15	— 1,47
4.	20. „	2430	7,48	28,76	1,16	6,68	8,64	— 1,96
(8) Durchschnittlich:		2550	8,07	28,76	1,16	6,68	9,23	— 2,55

Legend:
1. Day of convalescence
2. Urine cu. cm
3. Nitrogen in urine
4. Dry feces
5. Nitrogen in feces
6. Nitrogen intake
7. Nitrogen separation
8. Averages.

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn-N g	(5) Koth trocken g	(6) Koth-N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz g
5.	21. März	2350	6,74	28,76	1,16	6,68	7,90	— 1,22
6.	22. „	2190	5,57	28,76	1,16	6,68	6,73	— 0,05
7.	23. „	3590	5,48	28,76	1,16	6,68	6,64	+ 0,04
8.	24. „	2180	5,60	28,76	1,16	6,68	6,76	— 0,08
(10) Durchschnittlich		2580	5,85	28,76	1,16	6,68	7,01	— 0,33

Legend:
1. Day of convalescence
2. Date 1898
3. Amount of urine
4. Nitrogen in urine
5. Dry feces
6. Nitrogen in feces
7. Nitrogen intake
8. Nitrogen separation
9. Difference
10. Average

On the first day, there was still a loss of albumen; during the succeeding three days, an albumen equilibrium was achieved. Albumen exchange during this period is at its lowest: 36.56 grams. This means 0.65 grams of albumen is decomposed per kilogram of body weight.

Altogether, a very low albumen deficit is noted during Phase I.

Few conclusions may be drawn from weight relationships. Weighing started during Phase Ib, since under favorable diuretic conditions an equalization of the water balance could be expected during the last fever period and the first four days of convalescence.

Phase Ib.	Starting weight	56,070 g
	Final Phase	56,100 g
	Gain	+ 30 g

However, since the patient must have lost 38 grams of "meat" according to a weight balance, this loss must have been covered by an equal number of grams of fat. Therefore, with only approximate values being involved, a total of 38 + 30 grams of fat = 68 grams in 4 days of deposits are involved, i.e., 17 grams per day.

Estimating approximately the number of calories used up, a calorie consumption of 48.76 calories per day per kilogram of body weight (without deducting calories in feces) results, including the loss of albumen and deducting fatty deposits.

Phase II was divided into three sub-phases, (convalescence days 9/10, 11/12, 13/14). The individual with a low N balance receives successively more albumen in his food. During three phases of two days each, an additional one-half liter milk was added to the food and the sugar and fatty contents corresponding to this one-half liter were removed from the oil-sugar emulsions.

The N supply, therefore, was raised three times by almost the same amount, an average of 3.01 grams of N, while fats and hydro-carbons remained constant.

Phase IIa

Daily Feeding: 1500 cu.cm, milk, 1200 cu.cm emulsion with 123 g oil and 157 g of milk sugar, 600 cu.cm neutral soup and 300 cu.cm of wine. This contains 9 65 g of N, 172.8 g of fat, 229.81 g of hydro-carbons and 24 g of alcohol. Total calorie content: 2963.

Legend: see chart, page 5.

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harn-menge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz
9.	25 März	2[illegible]70	5.31	42.33	2.31	9.65	7.62	+ 2.03
10.	26 "	3070	8.60	42.33	2.31	9.65	10.91	− 1.26
average		2720	6,95	42.33	2.31	9.65	9,26	− 0,39

Legend: Same as top of page 5.

Phase IIb

Daily Feeding: 2000 cu.cm milk, 1200 cu.cm emulsion with 105 g of oil and 135 g of milk sugar, 600 cu.cm of soup and 300 cu.cm of wine. Content: 12.51 g N, 171.2 g of fat, 232 g of hydro-carbons and 24 g of alcohol. Total calorie content: 3036.

Legend: see chart, page 5.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
11.	27. März	2910	8.35	42.33	2.31	12.51	10.66	+ 1.85
12.	28. "	2510	8.43	42.33	2.31	12.51	10.74	+ 1.77
average		2710	8.39	4 33	2.31	12.51	10,70	+ 1.81

Phase IIc

Daily Feeding: 2500 cu.cm milk, 1000 cu.cm emulsion with 88 g of Oil and 112 g milk sugar, 600 cu.cm Soup and 300 cu.cm of wine. Content: 15.69 g N, 171 g fat, 233.21 g hydro-carbons and 24 g of alcohol. Total calorie content: 3116.

Legend: see chart, page 5.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
13.	29. März	3270	10.27	42.33	2.31	15.69	12.58	+ 3.11
14.	30. "	2900	10.76	42.33	2.31	15.69	13.07	+ 2.62
average		3085	10,51	42.33	2,31	15,69	12,87	+ 2,87

The N exchange became unbalanced as it increased in parallel with the supply and returned to an equilibrium after the second day. In Phases IIb and IIc, equilibrium could no longer be attained. The nitrogen exchange remained at 8.39, and then at 10.51 grams so that on these last four days, larger quantities of albumen remained in the body.

Phase II:	Initial Body Weight	56.100 g
	Final Weight	56.550 g
	Gain	450 g

Total Gain	450.0 g.	Daily Gain	75.00 g
Meat contribution	299.8 g	Daily Meat contribution	49.98 g
Fat contribution	150.2 g.	Daily Fat contribution	25.02 g

The "meat" amounts to 66.6% of the total weight gain. 48.48 calories are used per kilogram of body weight.

Phase III covered a longer period of time (15th to 27th day of convalescence) and represented a direct continuation of earlier increasing albumen supply. Again, one-half liter of milk was added and the corresponding quantities of sugar and fat were omitted. The N supply was thus again increased by 3 grams per day, with the remainder of the food remaining constant.

Daily Feeding: 3000 cu.cm milk, 1000 cu.cm emulsion with 70 g of oil and 90 g of milk sugar, 600 cu.cm of soup and 300 cu.cm of wine. Content: 18.69 g N, 169.60 g fat, 235.40 g hydro-carbons and 24 g of alcohol. - Total calorie content: 3188.

Legend: same as chart on page 5

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken	(6) Koth N	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz
15.	31. März	2670	11,03	43,65	1,54	18,69	12,57	+ 6,12
16.	1. April	2700	11,72	43,65	1,54	18,69	13,26	+ 5,43
17.	2. „	3195	13,87	43,65	1,54	18,69	15,31	+ 3,38
18.	3. „	2580	10,65	43,65	1,54	18,69	12,19	+ 6,50
19.	4. „	2280	11,01	43,65	1,54	18,69	12,55	+ 6,14
20.	5. „	2740	9,97	43,65	1,54	18,69	11,51	+ 7,18
21.	6. „	2980	10,43	43,65	1,54	18,69	11,97	+ 6,72
22.	7. „	2470	8,82	43,65	1,54	18,69	10,36	+ 8,33
23.	8. „	3380	10,41	43,65	1,54	18,69	11,95	+ 6,64
24.	9. „	2950	10,12	43,65	1,54	18,69	11,66	+ 7,03
25.	10. „	2930	8,82	43,65	1,54	18,69	10,36	+ 8,33
26.	11. „	3140	10,33	43,65	1,54	18,69	11,87	+ 6,82
27.	12. „	3270	10,76	43,65	1,54	18,69	12,30	+ 6,39
average		2860	10,61	43,65	1,54	18,69	12,15	+ 6,54

N separation and albumen exchange remained at the same levels as before. N retention rose amounting to 6.54 grams per day.

Phase III. Initial body weight 56,550 g
Final body weight 59,400 g
Gain 2,850 g

Total gain	2850.0 g	Daily gain	219.2 g
Meat contribution	2499.6 g	Daily meat contribution	192.3 g
Fat contribution	350.4 g	Daily fat contribution	26.9 g

The "meat" amounted to 87.81% of the total gain. 48.98 calories were used per kilogram of body weight.

Phase IV (28th to 30th day of convalescence). Diet unchanged from previous period. Again, albumen supply was moderately increased by adding 2 eggs = 11.50 g albumen = 1.85 g N. To maintain fat supply at the same level, an emulsion quantity corresponding to the fat content of the eggs was omitted.

Daily feeding: 3000 cu.cm milk, 1000 cu.cm emulsion with 59 g of oil and 90 g of milk sugar, 2 eggs, with 1.85 g N and 11.18 g fat (according to Konig), 600 cu.cm soup, 300 cu.cm wine. Content: 20.54 g N, 169.78 g fat, 235.4 g hydro-carbons and 24 g alcohol. Total calorie content: 3238.

Legend: same as chart on page 5

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
28.	13. April	2890	10.52	45,83	1,87	20,54	12,89	+ 8,15
29.	14 "	3280	[illegible]	45,83	1,87	20,54	14,96	+ 5,58
30.	15 "	[illegible]	11,55	45,83	1,87	20,54	15,42	+ 7,12
31.	16 "	3275	10,32	45,83	1,87	20,54	12,19	+ 8,35
32.	17. "	2850	10,17	45,83	1,87	20,54	12,04	+ 8,50
33.	18 "	3110	11,76	45,83	1,87	20,54	13,68	+ 6,91
34.	19 "	2860	10,41	45,83	1,87	20,54	12,29	+ 8,25
35	10. "	2480	10,16	45,83	1,87	20,54	12,03	+ 8,51
36.	21 "	3250	10,86	45,83	1,87	20,54	12,70	+ 7,84
average		3020	10,98	45,83	1,87	20,54	12,85	+ 7,69

Here, too, it was shown that the freshly supplied albumen only contributed little to the exchange, and remained almost completely within the body. Albumen deposits were even greater than during the previous phase (7.89 N).

Phase IV: Initial weight 59,400 g
Final weight 61,450 g
Gain 2,050 g

Total Gain	2050.0 g	Daily gain	227.7 g
Meat contribution	2022.1 g	Daily meat contribution	227.7 g
Fat contribution	27.9 g	Daily fat contribution	3.0 g

The meat amounts to 98.63% of the total weight gain. 50.72 calories are used per kilogram of body weight. Here, almost the entire weight gain may be attributed to a gain in meat.

Phase V (37th to 47th day of convalescence). The N-free diet which heretofore consisted mainly of fat, was now modified so that instead of the fat, an equivalent quantity of hydro-carbons was added. Let us use Phase III as a reference. Since the patient began indicating that the liquid diet no longer suited him, we developed a diet with the same N content as that of Phase III. Main phase: 18.62 g N vs 18.69. An error crept into the calculations of the N-free substances. About 600 fat calories should have been replaced by an equal number of hydro-carbon calories, however, this substitution was not completely successful. Fats with a heat content of 633 calories were omitted and hydro-carbons amounting to 766 calories were added so that a positive imbalance of 133 calories occurred. As we hope to be able to prove during the detailed discussion of the N retention, this barely affected the reliability of the results obtained during the two test series.

Feeding Table. Phase V

(1) Art der Nahrung	N*) g	(2) Fett g	C H. g	Alkohol g
(3) 1000 ccm Milch	6,04	33,20	48,40	—
(4) 100 g Schinken	4,14	8,11	—	—
(5) 200 g Reis	2,22	1,76	156,96	—
(6) 230 g Weissbrod	3,73	1,05	126,78	—
(7) 30 g Milchzucker	—	—	90,00	—
(8) 55 g Butter	—	46,41	0,28	—
(9) 600 ccm Suppe	0,58	—	—	—
(10) 300 ccm Wein	0,12	—	0,21	24,0
(11) 2 Eier	1,85	11,18	—	—
(12) Summa:	18,62	101,71	422,63	[illegible],0

(13) *) Eigene Bestimmung, ausser in den Eiern.

Legend:

1. Type of Diet
2. Fat
3. Milk
4. Ham
5. Rice
6. White Bread
7. Milk Sugar
8. Butter
9. Soup
10. Wine
11. Two Eggs
12. Totals
13. Experimenter's Control, except in case of Eggs.

(Also see Next Table)

Since the albumen was, in the majority of cases, of a plant type, its utilization in the intestine was less complete than during the phase used as a reference (88 vs 91.8%). Albumen exchange decreased while albumen retention increased. The resulting conclusions about the albumen consuming effect of fats and hydro-carbons are evident and will be discussed during the description of the peculiarities of albumen exchange.

Daily N content: 18.62 g; Total calorie content: 3324

Legend: same as chart on page 5

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn-N g	(5) Koth trocken g	(6) Koth-N g	(7) N-Einfuhr g	(8) N-Ausgabe g	(9) Differenz g
37.	22. April	1340	10.85	38,90	2,21	18,63	13,06	+ 5,57
38.	23. "	1300	10.22	38,90	2,21	18,63	12,43	+ 6,20
39.	24. "	1500	9.14	38,90	2,21	18,63	11,35	+ 7,28
40.	25. "	1460	8,79	38,90	2,21	18,63	11,00	+ 7,63
41.	26. "	1150	8,81	38,90	2,21	18,63	11,02	+ 7,61
42.	27. "	1180	8.50	38,90	2,21	18,63	11,71	+ 7,92
43.	28. "	1060	8.45	38,90	2,21	18,63	10,46	+ 8,17
44.	29. "	1150	8.38	38,90	2,21	18,63	10,60	+ 8,03
45.	30. "	1250	8.40	38,90	2,21	18,63	10,61	+ 8,02
46.	1. Mai	1190	8.50	38,90	2,21	18,63	10,71	+ 7,98
47.	2. "	1030	7.42	38,90	2.31	18,63	9,61	+ 9,02
average		1290	8,86	35,90	2,21	18,63	11,07	+ 7,56

Again, we are at first only interested in an approximate overall balance.

Phase V:	Initial Weight	61, 450 g
	Final Weight	64, 300 g
	Gain	2, 950 g

Total Weight Gain	2950 g	Daily Gain	277.3 g
Meat contribution	2445 g	Daily meat contribution	222.3 g
Fat contribution	505 g	Daily fat contribution	55.0 g

Meat amounts to 80.15% of the overall gain. 42.26 calories are used per 1 kilogram of body weight.

The convalescent has gained the following weights:

	Totals:		Meat:	
Phase I (5th-8th day)	30 g	-	38.0 g =	
Phase II (9th-14th day)	450 g	+	299.8 g =	66.60%
Phase III (15th-27th day)	2850 g	+	2499.6 g =	87.80%
Phase IV (28th-36th day)	2050 g	+	2022.0 g =	98.60%
Phase V (37th-47th day)	2950 g	+	2445.0 g =	80.15%
From 5th to 47th day of convalescence	8330 g		7238.0 g	86.90%

The fat contribution was 1092 g (13.1%) for the weight gain of 8330 g spread over 43 days.

Note: A small error in the calculations discovered during the review explains the small deviation from those values given during our first work concerning this case (12% fat instead of 13.1%). Furthermore, in the calorie listing, it says "Phase VI = 46.61 calories"; this should be crossed out. (46.61 is the percentage value of those albumen quantities introduced by the albumen materials absorbed during Phase V.7

In estimating the calorie values, we did not deduct calories contained in the feces. For a moderately favorable absorption in this case we may assume an average of 10% of calories lost through feces. Following are the results:

	(1) Calorien-verbrauch:	(2) Durch Eiweiss gedeckt:	(3) Durch N-freie Substanz gedeckt:
(4) I. Periode	43,8	2,3 = 5,3 pCt.	41,5 = 94,7 pCt.
II. "	43,6	3,9 = 8,9 "	39,7 = 91,1 "
III. "	44,1	4,8 = 10,8 "	39,3 = 89,2 "
IV. "	45,6	4,7 = 10,3 "	40,9 = 89,7 "
V. "	38,0	3,7 = 9,7 "	34,3 = 90,3 "

Legend:
1. Calorie consumption
2. Covered by albumen
3. Covered by substance free of N
4. Phase I

Let us assume, according to Rubner and Fr. Muller, a 32-35 calorie consumption for a well-fed individual at rest, which indicates a calorie exchange rise of approximately 25% in this case. During the last phase, the calorie exchange again approaches the normal.

The next test series concern another individual, 10 days with, and 60 days without fever. The entire period is being covered, however, the discussion will at first concern only total decomposition conditions.

Stefan Hobor, 28 years, gravely ill, illness duration 34 days. Patient was the subject of this test from his 13th to his 20th fever day and from his 3rd to his 62nd day of convalescence.

This test had to be suspended 15 February since the patient failed to defecate, partly rejected milk and symptoms of a leg vein thrombosis appeared. The diet was now controlled so that he received approximately 1.5 liters of milk with lime water and a cocoa supplement; in addition, he received 100 cu. cm of cream, 3 teaspoons of milk sugar and 1 or 2 tablespoons of nutrose (approximately 11 g Nitrogen). Any metabolism was obviously impossible until the oedema was completely controlled. After 10 days, this oedema had disappeared completely and the vera cruralis was no longer pain sensitive even under pressure. Two isolated tests for

Phase I (Fever Phase)

Daily diet: 2500 cu.cm milk, 600 cu.cm soup, 600 cu.cm wine. Content: 15.77 g N, 84.0 g fat, 121.42 g hydro-carbons and 48 g alcohol. Total caloric content: 1,679.

(1) Krankheitstag	(2) Datum 1898	(3) Temp. °C Min.–Max.	(4) Harnmenge ccm	(5) Harn N g	(6) Koth trocken g	(7) Koth N g	(8) N-Einnahme g	(9) N-Ausgabe g	(10) Differenz g	(11) Anmerkung
13.	7. Febr.	38,3–40,2	1375	14,34	17,33	1,32	15,77	15,66	+ 0,11	(12)
14.	8. „	38,9–40,4	1000	16,80	17,33	1,32	15,77	17,12	– 1,35	0,5 Chinin
15.	9. „	38,8–40,5	1185	14,76	17,33	1,32	15,77	16,08	– 0,31	
16.	10. „	36,9–40	795	14,50	17,33	1,32	15,77	15,82	– 0,05	
17.	11. „	37,2–40,2	865	14,65	17,33	1,32	15,77	15,97	– 0,20	
18.	12. „	39,9–40,3	1600	25,57	17,33	1,32	15,77	26,89	–11,12	0,5 Chinin
19.	13. „	39,6–40,2	1280	19,26	17,33	1,32	15,77	20,58	– 4,81	0,5 Chinin
20.	14. „	39 –39,7	1490	17,11	17,33	1,32	15,77	18,44	– 2,67	
(13) Durchschnittl.:		36,5–40,2	1250	17,12	47,33	1,32	15,77	18,44	– 2,67	

Legend:
1. Day of illness
2. Date
3. Temperature °C Min.-Max.
4. Urine - cu.cm
5. Urine N content
6. Dry Feces
7. Feces, Nitrogen content
8. Nitrogen intake
9. Nitrogen separation
10. Difference
11. Remarks
12. 0.5 Quinine
13. Average

urine nitrogen on 29 March and 1 April yielded 13.83 and 13.14 g respectively. Therefore, the convalescence test could again be resumed.

The first 15 days of the convalescence tests were divided into 6 phases. The question needed to be answered: How does an increase of food free from N during the early period of convalescence and with a constant N intake affect the formation of albumen? The increase of the food free from N was accomplished in 5 steps. The test, therefore, is an appendix of Phases I, II and III carried out by Jorga during which only the albumen continued to increase unilaterally with the calorie content of the substances free from N remaining constant. The feces were collected for all 15 days, separated with carbon and processed.

Phase II

Daily nutrition consisted of: 2500 cu. cm milk, 50 g milk sugar, 600 cu. cm soup, 600 cu. cm wine, Content: 21. 31 g N, 117. 54 g fat, 171. 42 g hydro-carbons, 48 g alcohol. Total caloric content: 2, 678.

Legend: same as chart on page 5

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz g
3.	3. März	2120	13,36	29,05	0,97	21,31	14,33	+ 6,98
4.	4. „	2220	14,45	29,05	0,97	21,31	15,42	+ 5,89
average		2170	13,90	29,05	0,97	21,31	14,67	+ 6,44

Phase III

The nutrition of Phase II is increased daily by 100 g milk sugar: it contained 21.13 g N, 117.54 g fat, 271.42 hydro-carbons, 48 g alcohol. Total caloric content: 3, 087.

Legend: same as chart on page 5

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
5.	5. März	2495	16,50	29,05	0,97	21,31	17,56	+ 3,75
6.	6. „	1900	13,70	29,05	0,97	21,31	14,67	+ 6,64
average		2195	15,25	29,05	0,97	21,31	16,22	+ 5,09

Feeding Table. Phase IV

(1) Täglich gereicht	N g	Fett g	CH. g	Alkohol g
(2) 2500 ccm Milch	15,00	84,00	121,0	—
(3) 4 Eier	3,70	22,36	—	—
(4) 150 g Reis	1,66	1,32	117,72	—
(5) 100 g Milchzucker	—	—	100,00	—
(6) 600 ccm Suppe	0,32	—	—	—
(7) 600 ccm Wein	0,16	—	0,42	48,0
(8) Summa	21,18	107,68	339,14	48,0

(9) Gesammtcaloriengehalt; 3269.

Legend:
1. Daily intake
2. 2500 cu. cm Milk
3. 4 Eggs
4. 150 g Rice
5. 100 g Milk Sugar
6. 600 cu. cm Soup
7. 600 cu. cm Wine
8. Total
9. Total Caloric content.

Legend: same as chart on page 5

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz
7.	7. März	1990	16,16	29,05	0,97	21,13	17,13	+ 4,0
8.	8. „	2440	14,52	29,05	0,97	21,13	15,49	+ 5,64
average		2215	15,34	29,05	0,97	21,13	16,31	+ 4,82

Phase V

Substitution of 100 g Milk Sugar with isodynamic 49 g oleum olivarum in emulsion. - The nutrition contains: 21.13 g N, 151.68 g fat, 239.14 g hydro-carbons, 48 g alcohol. - Total caloric content: 3269.

Legend: same as chart on page 5

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N Einnahme g	(8) N Ausgabe g	(9) Differenz
9.	9. März	2270	[illegible]	29,05	0.97	21,13	15.43	+ 5.70
10.	10. "	2335	14.71	29,05	0.97	21,13	15,68	+ 5,45
11.	11. "	2195	13,68	29,05	0.97	21.13	14,65	+ 6,48
average		2270	14,28	29.05	0,97	21,13	15,25	+ 5,88

Feeding Table - Phase VI

Täglich gereicht	N g	Fett g	CH. g	Alkohol g
(1) 2500 ccm Milch	15,09	84.00	121,0	—
(2) 3 Eier	2,78	16.77	—	—
(3) 300 g Reis	3.32	2.64	234.44	—
(4) 30 g Butter	0.03	25.13	0,15	—
(5) 50 g Zucker	—	—	50,0	—
(6) 600 ccm Suppe	0,52	—	—	—
(7) 600 ccm Wein	0,16	—	0,42	48,0
Summe:	21,90	128,54	406,01	48,0

Gesammtcaloriengehalt: 5756.

Legend:
1. 2500 cu. cm Milk
2. 3 Eggs
3. 300 g Rice
4. 30 g Butter
5. 50 g Sugar
6. 600 cu. cm Soup
7. 600 cu. cm Wine

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N Einnahme g	(8) N Ausgabe g	(9) Differenz
12.	12. März	2520	13,86	29,05	0,97	21,90	14.73	+ 7,17
13.	13. "	3115	13,30	29,05	0,98	21,90	14.27	+ 7,63
average		2820	13,53	29,05	0,97	21,90	14,50	+ 7,40

Legend: same as chart on page 5

Phase VII

Feeding as before, except 100 g milk sugar, and 20 g butter were added. The nutrition contains: 21.92 g N, 145.61 g Fat, 506.1 g hydro-carbons, and 48.0 g alcohol. Total caloric content: 4327.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
14.	14. März	3260	12.32	29,05	0,97	21,92	13,29	+ 8,63
15.	15. "	2050	14.09	29,05	0,97	21,92	15,06	+ 6,86
16	16. "	2490	15,25	29,05	0,97	21,92	16,22	+ 5,70
17.	17. "	2910	12,38	29,05	0,97	21,92	13,75	+ 8,17
average		2930	13,62	29,05	0,97	21,92	14,59	+ 7,33

Legend: same as chart on page 5.

Upon successively increasing the calorie supply from 2,678 to 3,269, in Phases II-V, not only no decrease in N exchange was noted, but rather a small increase, (from 13.90 to 15.25, 15.34 and 14.28). The N exchange also decreased accordingly. However, when the calorie increase was raised in two steps by an additional 1,058 calories free of N, up to 4,327 = 75.5 calories per kilogram of body weight, the albumen production also rose with a slower decrease of the albumen exchange (7.40 and 7.33 g N per day, the greatest retention value of this series.)

During the last Phase (VII) the comparison of body weight with meat production began.

Initial Body Weight	57,480 g
Final Weight	58,460 g
Total Gain	980 g

Total Gain	980 g;	Daily Gain	245.0 g
Meat contribution	862 g	Daily meat contribution	215.5 g
Fat contribution	118 g	Daily fat contribution	29.5 g

The meat amounted to 87.04% of the total gain. The calculation of the calorie consumption yielded the very high value of 70.48 calories per kilogram! (not deducting calories contained in feces).

Phase VII forms the transition to a new test series (VII-IX). This is where we changed the nature of our problem: how does albumen exchange change if only the albumen content of the diet is either reduced or increased with an otherwise constant calorie content?

Phase VIII (18th-25th day of convalescence) differs from Phase VII primarily due to the lowering of albumen supply. A total of 4.88 g N less was provided while fat and hydro-carbon supply remained approximately at the same level.

Feeding Table. Phase VIII

(1) Täglich gereicht	N g	(2) Fett g	CH. g	Alkohol g
(3) 1500 ccm Milch . . .	9,06	49,80	72,60	—
(4) 3 Eier	2,78	16,77	—	—
(5) 400 g Reis	4,42	3,52	313,92	—
(6) 150 g Milchzucker .	—	—	150,0	—
(7) 75 g Butter . .	0,10	63,29	0,38	—
(8) 600 ccm Suppe . .	0,52	—	—	—
(9) 600 ccm Wein . . .	0,16	—	0,42	48,0
(10) Summa.	17,04	133,38	537,32	48,0

(11) Gesamtcaloriengehalt: 4215.

Legend: 1. Daily intake; 2. Fat; 3. 1500 cu.cm Milk; 4. 3 Eggs; 5. 400 g Rice; 6. 150 g Milk Sugar; 7. 75 g Butter; 8. 600 cu.cm Soup; 9. 600 cu.cm Wine; 10. Total; 11. Total calorie content: 4215.

Legend: same as chart on page 5.

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz g
18.	18. März	2410	9.48	22.33	0,96	17,04	10.74	+ 6.30
19.	19. „	2760	9.99	22.33	0,96	17,04	10,95	+ 6.09
20.	20. „	3240	12 47	22.33	0,96	17,04	13,43	+ 3.61
21.	21. „	3330	13,52	22.33	0,96	17,04	14 48	+ 2.56
22.	22. „	2760	11,83	22,33	0.96	17,04	12,79	+ 4,25
23.	23. „	2765	10,04	22,33	0,96	17,04	12,00	+ 5,04
24.	24. „	2620	10,82	22,33	0,96	17,04	11,78	+ 5,26
25.	25. „	2345	9,19	22,33	0,96	17,04	10,15	+ 6,89
average		2780	11,08	22.33	0,96	17.04	12.04	+ 5,00

Accordingly, albumen deposits decrease, however, the decomposition also decreases somewhat:

Initial Body Weight	58,460 g
Final Weight	59,800 g
Total Gain	1 340 g

Total Weight Gain	1,340 g;	Daily Gain	167.5 g
Meat contribution	1,176 g;	Daily meat contribution	147.0 g
Fat contribution	169 g;	Daily fat contribution	20.5 g

The meat amounts to 87.16% of the total weight gain. Caloric consumption per kilogram of body weight 66.58.

During Phase IX (26th-34th day of convalescence) the amount of albumen decreased considerably with the supply of calories free of N remaining constant; instead of 17.04 g of N, 28.29 g of N (+11.25 g N) were introduced.

Feeding Table. Phase IX

(1) Täglich gereicht	N g	(2) Fett g	C.H. g	Alkohol g
(3) 2000 ccm Milch	12,67	66,40	96,80	—
(4) 200 g Schinken	8,28	16,22	—	—
(5) 3 Eier	2,78	16,77	—	-
(6) 400 g Reis	4,42	5,52	313,92	—
(7) 95 g Zucker	—	-	95,0	—
(8) 63 g Butter	0,06	58,17	0,32	--
(9) 600 ccm Suppe	0,52	—	—	—
(10) 600 ccm Wein	0,16	—	0,42	48,0
Summa:	28,29	156,08	506,46	48,0

(11) Gesammtcaloriengehalt: 4589.

Legend:
1. Daily intake
2. Fat
3. 2000 cu.cm Milk
4. 200 g Bacon
5. 3 Eggs
6. 400 g Rice
7. 95 g Sugar
8. 63 g Butter
9. 600 cu.cm Soup
10. 600 cu.cm Wine
11. Total caloric content: 4589

Legend: same as chart on page 5

(1) Tag der Reconvalescenz	(2) Datum 1896	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz g
26.	26. März	1920	13,92	12,34	1,07	28,29	14,99	+13,30
27.	27. "	1970	13,99	12,34	1,07	28,29	15,06	+13,23
28.	28. "	2550	18,02	12,34	1,07	28,29	19,09	+ 9,20
29.	29. "	2030	19,75	12,34	1,07	28,29	20,82	+ 7,57
30	30 "	1950	18,00	12,34	1,07	28,29	19 07	+ 9,22
31.	31. "	2680	20,24	12,34	1,07	28,29	21,31	+ 6,98
32.	1. April	1970	17,37	12,34	1,07	28,29	18,44	+ 9,85
33.	2. "	2520	18,37	12,34	1,07	28,29	19,44	+ 8,85
34.	3. "	2505	16,94	12,34	1,07	28,29	18,01	+10,28
average		2250	17,40	34,34	1,07	28,29	18,47	+ 9,82

During a single Phase, the N retention rate, as well as the general body weight gain, reached their maximum.

Initial Body Weight	59,800 g
Final Weight	63,730 g
Total Gain	3,930 g

Total Weight Gain	3,930 g;	Daily Gain	436.70 g
Meat contribution	2,598 g;	Daily meat contribution	288.75 g
Fat contribution	1,332 g;	Daily fat contribution	147.95 g

The meat amounts to 66.13% of the total weight gain. Caloric consumption per kilogram of body weight 49.7.

Already during this Phase, a substantial fat retention rate and a lower value of the caloric exchange results, which is in agreement with the constant value found by Joipa.

Phase IX completes the tests conducted on Hober (high, constant caloric content; abrupt decrease and increase of albumen supply at peak of convalescence). It also marks the beginning of the third series. For a rich convalescent diet, free from albumen and nitrogen which presupposes large amounts of meat and fat deposits, the number of calorics becomes lower for constant albumen supply. How does the meat and fat fattening process react to this? And if the fattening process is to be terminated early, which was considered to be likely in our current findings, is it possible during advanced convalescence, to obtain purer meat gain by a continuous reduction of calories free from N without fat deposits?

Feeding Table, Phase X

Legend: same as chart on page 16

(1) Täglich eingeführt	N g	(2) Fett g	C. H. g	Alkohol g
(5) 2000 ccm Milch	12.07	66.40	96.80	—
(4) 200 g Schinken	8.26	16.22	—	—
(5) 3 Eier	2.78	16.77	—	—
(6) 300 g Reis	5.82	2.64	225.44	—
(8) 30 g Butter	0.03	25.32	—	—
(9) 600 ccm Suppe	0.53	—	—	—
(10) 600 ccm Wein	0.16	—	0.42	48.0
Summa.	27.17	127.35	322.66	48.0

(11) Gesammtcaloriengehalt: 3598.

Legend: same as chart on page 5

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz
35.	4. April	2680	20.20	26.56	1.21	27.17	21.41	+ 5.76
36.	5. "	2290	19.11	26.56	1.21	27.17	20.31	+ 6.86
37.	6. "	2220	19.26	26.56	1.21	27.17	20.47	+ 6.70
38.	7. "	2980	22.53	26.56	1.21	27.17	23.74	+ 3.43
39.	8. "	2180	20.64	26.56	1.21	27.17	21.85	+ 5.32
40.	9. "	2280	20.61	26.56	1.21	27.17	21.82	+ 5.35
41.	10. "	2250	18.23	26.56	1.21	27.17	19.44	+ 7.73
42.	11. "	2310	21.61	26.56	1.21	27.17	22.82	+ 4.35
average		2390	20.40	26.56	1.21	27.17	21.61	+ 5.56

Initial Body Weight	63,730 g
Final Weight	65,220 g
Weight Gain	1,490 g

Total Weight Gain 1,490.00 g; Daily Gain 186.25 g
Meat contribution 1,307.68 g; Daily meat contribution 163.46 g
Fat contribution 182.32 g; Daily fat contribution 22.79 g

The meat amounted to 87.76% of the total gain.
Caloric consumption per kilogram of body weight: 50.93.

Feeding Table, Phase XI

Legend:

(12) swiss cheese

(13) roll

Others: same as chart on page 16.

(1) Täglich eingeführt	N g	(2) Fett g	C. H. g	Alkohol g
(4) 240 g Schinken	9.93	19.46	—	—
(5) 9 Eier	8.94	50.31	—	—
(12) 100 g Schweizer Käse	4.12	29.49	1.46	—
(6) 100 g Reis	1.11	0.88		—
(13) 150 g Semmel	2.43	0.69	52.68	—
(9) 600 ccm Suppe	0.52	—	—	—
(10) 600 ccm Wein	0.16	-	0.42	48.0
(8) 85 g Butter	0.04	20.55	0.18	—
Summa:	27.24	130.38	162.20	48.0

(11) Gesammtcaloriengehalt: 2918.

Legend: same as chart on page 5

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz
43.	12. April	2410	22,94	23,15	1.22	27,24	23,16	+ 4,08
44.	13. "	2500	25,90	23,15	1.22	27,24	27,05	+ 0,19
45.	14. "	2410	25,73	23,15	1.22	27,24	26,59	+ 0,66
46.	15. "	2260	24.67	23.15	1,22	27.24	25,89	+ 1,35
47.	16. "	2800	25,68	23,15	1.22	27,24	26,90	+ 0,34
48.	17. "	1975	20,05	23,15	1.22	27,24	21,27	+ 5,97
49.	18. "	1740	20.43	23.15	1,22	27,24	21,65	+ 5,59
50.	19. "	1780	21,28	23,15	1,22	27,24	--	+ 4.74
51.	20. "	1620	18,26	23.15	1.22	27,24	19,48	+ 7,76
52.	21. "	1550	17,65	23.15	1.22	27,24	18,87	+ 8,37
53.	22. "	1460	18,29	23.15	1,22	27,24	19,51	+ 7,73
54.	23. "	1440	18,45	23.15	1,22	27,24	19,67	+ 7,57
55.	24. "	1650	19.23	(23,15	1.22	27.24	20,45	+ 6,79
56.	25. "	1610	19,34	23,15	1.22	27.24	20,56	+ 6,68
57.	26. "	2120	21,56	23,15	1,22	27,24	22,78	+ 4,46
58.	27. "	1900	21,74	23.15	1,22	27,24	22,96	+ 4.28
59.	28. "	1750	19,79	23.15	1,22	27.24	21,01	+ 6,23
60.	29. "	1890	21,62	23,15	1,22	27,24	22,84	+ 4,40
61.	30. "	1600	20,15	23,15	1.22	27,24	21,37	+ 5,87
62.	1. Mai	1760	20,75	23,15	1.22	27,24	22,97	+ 4,27
average		1910	21,16	23,15	1,22	27,24	22,38	+ 4,86

Initial Body Weight	65,220 g.
Final Weight	68,120 g
Weight Gain	2,900 g

Total Weight Gain	2,900.0 g;	Daily Gain	145.0 g
meat contribution	2,857.6 g;	Daily meat contribution	142.8 g
Fat contribution	42.4 g;	Daily fat contribution	2.2 g

The meat amounted to 98.59% of the total gain.
Caloric consumption per kilogram body weight 42.5.

The sudden decay of calorie supply from 4589 to 3598 (- 991, of which 956 calories free from N) during Phase X and from 3598 to 2912 (- 686 calories) during Phase XI results in the fact that while the meat diet continues on a reduced scale, the fat diet ceases and the decomposition of the substances free from N, the fats and hydro-carbons slowly adjust to the available supply.

From Phase IX to Phase X, the fat deposit rapidly decreases from 84.6% while the albumen exchange decreases by only 44.6%.

During Phase XI, there appears to be a balance in albumen in the making; however, here too, after a short-lived period of isolation the decomposition lags behind the supply. The body weight increase therefore is entirely a function of the meat supply. Therefore:

	Total Gain	Meat Gain	
Phases II - VI (3rd - 13th day)	- g	1742 g	
Phase VII (14th-17th day)	980 g	862 g	= 87.04%
Phase VIII (18th-25th day)	1340 g	1176 g	= 87.16%
Phase IX (26th-34th day)	3930 g	2598 g	= 66.13%
Phase X (35th-42nd day)	1490 g	1308 g	= 87.76%
Phase XI (43rd-62nd day)	2900 g	2858 g	- 98.59%

The weight gain from the 14th until the 82nd day amounted to 10,640 g; of this 8802 g = 87.7% was meat. Adding the meat content of the first 10 days, a meat gain of 10,544 g for all 60 days and of 175.7 g for an average day may be derived.

In estimating the calorie content we had to resort to a correction by deducting the calories contained in the feces. Unfortunately, this is merely an approximation. For an excellent utilization of the food, a deduction of 180 calories per day is probably too much rather than too little.

/Note: During the 5 Phases to be calculated, the solid feces amounted to a daily average of 25.08 g. Of this there are 6.75 g of albuminous substance. If we assume of the remaining 18.33 g, two-thirds to be fat (12.22 g) and one-third to be hydro-carbon (6.11 g), we obtain a total of 166 calories for all the feces./

Consequently:

	Calorie Consumption per kg of Body Weight	Albuminous Content			Substance free from N Content		
	Calories	Calories			Calories		
Phase VII	63.35	6.05	=	8.9%	61.30	=	91.1%
Phase VIII	63.50	4.85	=	7.9%	58.65	=	92.1%
Phase IX	49.72	7.45	=	15.9%	39.27	=	84.1%
Phase X	48.11	8.19	=	17.0%	39.92	=	83.0%
Phase XI	39.72	8.32	=	20.9%	31.40	=	79.1%

In this case, the calorie exchange is particularly high. The values given for Phases IX-XI still approximate those given by Jorga. However, during Phases VII and VIII the calculated value is so high that we were unable to find even an analogy in the pathology of the Basedow patients or patients under treatment with thyroid substances. As can be seen from the weight tables in these Phases, despite a large supply of material free from N, only a small amount of fatty substance, or none at all, could be calculated. This improved only during Phase IX. The high calorie values surprised us to the point that we believed that we had to assume water balance trouble due to water deprivation in the organism up to Phase VIII, covering up a possible fat deposit already in existence: obviously, calorie consumption would then also yield a lower calculated value. In fact, the considerable amount of diuretic materials so far present (2,930 and 2,780 cu.cm during Phases VII and VIII respectively) decreased during Phase IX to 2,250 cu cm per day.

In view of the figures recently published by Svenson it is questionable, however, whether these values are not within the realm of possibility?

These tests have proven sufficiently that energy consumption during typhus convalescence is particularly high. We again point to the material published three years ago, which retains its validity. We then protested against the assumption that the decomposition requirements of the convalescent in general are very low, based on our experiments. "What then, in the end, caused the enormous appetite of the convalescent" we wrote, "which allows only the thought of food to come to his mind for many weeks? Certainly not the lowered cell count of the body, a theory contradicted by our whole medical experience, also in contradiction with the norm opposed to an increased capacity for decomposition and decomposition requirements of the organism. Furthermore, the typhus convalescent gives the impression of an individual, starting during the second week, whose life functions are at least as active as those of the normal individual. His constantly moist skin, the increase in heat delivery caused by perspiration, which in part requires a compensating heat production, an inclination toward renewed temperature increases, the unsteadiness of heart and nervous activity, his restlessness, the frequently observed sexual excitation and inclination to pollutions among men recently again mentioned by Curschmann and which occurred in a particularly abnormal manner among two of our test subjects -- all this recalls conditions under which an increase in the oxidation activity has been observed, for example, among Basedow patients or those under treatment with thyroid substances". Furthermore: "During the convalescence albumen decomposition is merely lowered. The decomposition energy available for fats and hydrocarbons is correspondingly higher which is shown by the fact that the conditions for fat deposits have been made more difficult. Weight gains among typhus convalescents is thus based to a very large degree on meat consumption while the fat gain, even with ample nourishment, is not only in relative terms but also in absolute terms very small."

Hence the sentence: "For equal amounts of nourishment, the typhus convalescent gets richer in albumen and poorer in fat than an otherwise emaciated individual.

A case was reported on by A. Lowy in his "Metabolism Research Under Fever Conditions", which appeared to contradict the general opinion that metabolism during convalescence decreases, and which appears to offer support for our findings. Under fever conditions, oxygen consumption amounted to 5.72 g per kilogram during convalescence, and 5.82 g three weeks after the fever had subsided, hence more than under fever conditions, and considerably more than under normal conditions. An attempt was made to attribute this to the increased oxidation energy of the convalescent available for fats and hydro-carbons.

/ Note: Virchov's Archives 126. /

The fact that A. Lowy's experiments show no exception is involved, and that our approximate calorie calculations and the conclusions drawn were correct may be derived from A. Svenson's typhus convalescence gas exchange tests. We can see, from here, that after a short while, during which the oxygen consumption values decrease, after about 10 days O_2 consumption and CO_2 separation exceed the norm considerably. Very slowly, the values of the gas quantities present with an empty stomach increase; they reach a maximum after three to four weeks, when they exceed normal values by approximately 50% and then they slowly decrease to their physiological level. (This decrease was also shown by our calorie calculations). It appears that here, too, the intensity of the earlier illness exerts some influence on the duration of this phase as well as the relative values of the empty-stomach condition. In lighter cases, they do not increase as much and return faster to their normal value. - At the time of the high values under empty-stomach conditions, food consumption reaches a maximum (60 to 70 and even 90 calories). The amount of nitrogen present is still significant, although it is sometimes somewhat more than during the first phase of the low respiration values, while a strong gain in body weight is observed.

Even more important for our results and conclusions are the observations made on gas exchange following food intake. Food intake was proportional to oxidation increase which exceeds those values found among healthy individuals considerably. Quantitatively and qualitatively equal amounts of food, according to Svenson, cause an increase in oxidation by 40 to 70%, while the same individual, following his convalescence, only reacts with a 10 to 40% increase. Svenson found these figures to coincide with those found by Magnus-Levy among healthy individuals.

Svenson agrees with our opinion "that there is no economic budgeting at all; to the contrary, the impression is gained of an abundant exchange of materials and energy, a certain wasteful budget". (p 120). Furthermore: "In this reaction of the organism to food intake, we look in vain for traces of the organism's effort to budget economically: just the opposite. The reason for this significant increase in oxidation activity is still fully unknown." Svenson speaks of a particular excitability of the nervous system, and the inclination toward temperature increases as well as greater heart activity. Regardless of how salutary this agreement is to us, we would like to take this opportunity to emphasize our priority regarding this fact which we found first experimentally and which we expressed very clearly at an earlier date.

Svenson concludes his article with the following sentence: "The convalescent thus, all things being equal, releases more tension than the healthy individual and for the same amount of food, the body weight of the healthy individual would increase more than that of the convalescent". We believe that our way of expressing these relationships is more accurate.

A healthy individual with the same amount of food intake would probably gain more fat and altogether more solid substance, but would certainly not gain more weight. (See fattening experiment carried out by Krug on himself). /See Note 1/. In the Weil-Mitchell experiment, with an emaciated female subject reported on by Bleibtreu and during which the subject gained 14 kilograms within 24 days, one-third consisted of meat. /See Note 2/.

/Note 1: Noorden's Contribution to the Study of Metabolism, Vol 1, p 88.

Note 2: Pfluger's Archives, 41./

During the 3-4 week fattening tests carried out by Hirschfeld about one-third or one-fourth of the weight gain may be attributed to meat.

/Note: The Application of Overfeeding and Underfeeding Frankfurt, 1897./

Svenson's assumption should be modified so that the positive gain in decomposition activity during convalescence is offset by an increase in albuminous decomposition and probably also by an increase in fat and hydro-carbon combustion: rather, it is almost exclusively due to the latter. Albumen decomposition takes second place. During Jorga's test series, the calories provided by the albumen amounted to 10.8% of the total energy consumption; in Hobor's tests, during the phase of maximun calorie consumption 8.9 - 7.9%; these figures require no further commentary.

Albumen Fattening During Typhus Convalescence

Albumen enrichment of an individual convalescing from a feverish illness heretofore has always been considered from the same viewpoint as the albumen enrichment of any individual whose normal albumen level had decreased for some reason. The fact in each case is that there is an emaciated cell with a loss of albumen which accumulates albumen as a sponge soaks up water. This opinion is no longer shared by us following the considerations made above. How else would it be possible that for the same amount of albumen loss the metabolism started with an enriched diet leads to results which differ for a typhus convalescent as compared to a simply undernourished individual? Evidently, it is being neglected that this body composition at a given moment of the observation is merely the materially logical expression of an instantaneous phase in a series of energy events which had taken place before and which continued to occur throughout the current phase. It is, therefore, equally inadmissible to draw conclusions from the present state of the body, i.e., its current albumen and fat content on the changes in its makeup which it will undergo at a later point in time under a given regime just as it is impossible to conclude from the instantaneous position of a swinging pendulum what its direction and its distance traveled will be.

For the organism the re-establishment of its albumen equilibrium and that of its old energy level is involved whether albumen deprivation or simple inanition or even an acute fever-type illness is involved. Existing ample literature accordingly deals with albumen intake according to hunger, chronic malnutrition, anemics and acute infections under the single viewpoint of albumen deprivation of the organism. Noorden's opinion and that of his students, namely Krug, predominates in the field: /See Note 1/: the emaciated organism obeys an albumen exchange law which differs from that of the normally fed individual by adding another factor: the attraction force of the cells toward the albumen and the eagerness with which they hold on to it. This "force" has even been identified as the regeneration energy and Krug postulated a fundamental difference between these conditions and those in which an increase in the meat content is "forced" through abundant food. Noorden considers albumen retention in a convalescent so much as the specific regeneration energy that he poses the question whether we are able to force the body through ample nourishment to store albumen on a large scale, to fill the farcolem with contractive muscular substance, or to accelerate the multiplication of cells. /See Note 2/. However, he also shares the opinion that an albumen-rich diet in this case greatly enhances recovery.

/Note 1: Meat Fattening in Humans, Inaugural Dissertation, Berlin, 1893.

Note 2: The Pathology of Metabolism, p 180./

In our first report we tried to answer these questions and to prove that in order to understand the retention of albumen among convalescents, it is not necessary to introduce an imponderable concept into the laws of metabolism. We were first in announcing that "body restitution functions, i.e., albumen retention in the organism following typhoid fever is primarily based on a fattening process".

We are thoroughly familiar with fattening conditions among healthy individuals; let us formulate them as follows: "Fattening, i.e., the addition of body material among adults is feasible whenever more nourishment is introduced than the organism is able to decompose within that period of time. Any food deposits within the body is primarily based on such a disproportion between the decomposing forces of the organism and the material to be decomposed; whatever is left will be deposited throughout the body".

/Note: L. c./

Fat deposits normally are attained so easily because the decomposition capacity of substances free from nitrogen is somewhat more stable and limited; regardless of the increase in fat or hydro-carbons their decomposition can only increase very slightly.

As shown in the previous section, the ability of the cells to react to additional fat and hydro-carbons by increased decomposition is significantly higher as compared to normal patients whenever typhus convalescents are involved; hence, the reduced amount of fat deposits. This is not an opportune occasion to discuss the ultimate fundamental problems of metabolism; at any rate, a protoplasma function in the broadest sense of the word is involved which obeys the same laws as the other functions dependent on living substances. We hope not to be misunderstood if we attribute to it a sensitivity equal to any other. /See Note/. This is not a mere hypothesis but an expression of facts. In addition to the physiological heterogeneous stimuli produced by the nervous system -- for example, the enormous increase in fat and hydro-carbon combustion in muscular and thyroid feeding nerve activity -- the decomposition material introduced forms itself a stimulus for the decomposition functions. Thus, the decomposition, in apparent contradiction to the Voit-Pfluger law, is increased by the addition of fat and hydro-carbons, a fact which will not be discussed here regarding its history or theoretical foundation.

/Note: Our theoretical opinion on this subject agrees with Fr. Muller's: "Some Problems of Metabolism and Nutrition". Collection of Clinical Lectures, No 272, 1900./

We now see that in fever convalescents, not only the function itself, the combustion of material free of nitrogen is increased as compared to the normal, but also that the same stimulus, i.e., the same amounts of adequate food materials trigger a much stronger reaction than among healthy individuals. This state of increased sensitivity or reaction capability in the protoplasma functions preceding the decomposition of the material free of nitrogen in a broader sense is primarily what causes the peculiarities of the fat and hydro-carbon exchange in convalescents (increased exchange, decreased deposits). The inverse applies to albumen exchange.

Normally, only an insignificant amount of meat fattening, or none at all can occur since the cells have an enormous capacity to decompose albumen and adapt within a short time to large supplies. Nevertheless, here, too, we are dealing with an albumen fattening, although of lower proportions and shorter duration, if we suddenly increase the albumen supply at a given low albumen decomposition level. We thus achieve a lag of decomposition behind the supply up to the time of albumen equilibrium. Thus a more substantial meat fattening among humans has been achieved in only very rare instances, for example, by Bornstein /See Note 1/, while in animals (Henneberg and Pfeiffer) /See Note 2/ and Pfeiffer-Kalb /See Note 3/ obtained considerable results in this manner. In these cases, albumen decomposition increases proportionally with albumen supply so that fat and sugar are deposited in the form of fat surplus. Meat fattening thus only contributes very little to the overall weight gain. Similar results were obtained by adding calories free of nitrogen and the well known beautiful experiments conducted by Krug and Noorden are considered experimentum crucis. Krug was able to retain 3.3 g nitrogen and 20.6 g albumen upon adding to food containing 257.5 calories with constant N content (14.75 and 15.66 g nitrogen) 1710 calories free of N. His weight gain during the 15 test days amounted to 3100 g of which 1455 g were meat (approximately 47%). Similar results were obtained by Hirschfeld /See Note 4/. In these cases, probably only a reduction of the albumen decomposing protoplasm function due to the excitation of the "antagonistic metabolism members" is involved according to Verworn /See Note 5/

/Note 1: Berl. Klin. Wochenschrift (Berlin Clinical Weekly) 1897. Proceedings of the German Congress for Internal Medicine, 1900.

Note 2: Agricultural Journal, 1890, Vol 38.

Note 3: Agricultural Yearbook, 1892.

Note 4: The Application of Over and Under Feeding, Frankfurt, 1897.

Note 5: "There are two entirely different ways by which the suppression, the reduction of a life phenomenon can be achieved: first, the paralyzation of the members on which it is based, second the excitation of the antagonistic member of the biotonus." Thus reads an axiom derived by Verworn from his study of stimulus effects in primitive organisms, which we do not suggest to apply to protoplasma functions occurring in metabolism.

We, therefore, must attribute the additional decomposition of fat and hydro-carbons to that agent which in this type of over-feeding makes up for the excessive albumen.7

If we now imagine this ability of the protoplasma functions preceding the albumen decomposition to increase rapidly as a function of the supply of adequate food material greatly lowered, approximately to a degree which applies normally to fat decomposition, the first conditions for long lasting and important meat fattening are given. According to our investigation, this does not apply only to fever convalescents. It is equally applicable and even better substantiated than the opposite behavior of fat and hydro-carbon decomposition. While the latter, upon supplying food during convalescence, increases at a much greater rate than the normal, the former increases only slightly due to the addition of albumen, so that almost the entire excess remains non-decomposed as building material for the self-regenerating cells in the body.

The example by which we illustrated this behavior in our earlier reports is given in a more detailed manner below:

Test Series III

Jakob Wirker, 24 years, light illness.

Problem: If among convalescents, an increased attraction force in the cells for albumen is truly the primary retention mover, if they truly attract albumen at any cost, albumen retention should occur whenever food with insufficient caloric content but adequate average albumen content is supplied. It was now deemed appropriate in order to study this inversion of the albumen balance, to select the food in such a way that it would remain unchanged under fever and convalescence condition.

Phases I, II and III

Daily Food Supply: 2000 cu. cm milk, 2 eggs, 600 cu. cm soup.
Content: 14.43 g N, 77.38 g fat and 96.80 g hydro-carbon.
Total Caloric Content: 1490.

Legend: same as chart on page 5

Day of fever	(2) Datum 1897	Temperatur Min. — Max. °C.	(3) Harnmenge g	(4) Harn N g	(5) Koth trocken g*)	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz g
9.	15. Nov.	38 — 88,9	1150	13,82	48,20	2,19	14,48	15,51	— 1,08
10.	16. "	37,7 — 39,4	1100	16,89	48,20	2,19	14,48	19,08	— 4,65
11.	17. "	37,7 — 38,9	1070	14,36	48,20	2,19	14,43	16,55	— 2,12
12.	18. "	37,3 — 89,2	1200	20,66	48,20	2,19	14,48	22,85	— 8,42
13.	19. "	37,8 — 39,1	1350	20,01	48,20	2,19	14,48	22,20	— 7,77
average		37,7 — 89,1	1200	17,05	48,20	2,19	14,43	19,24	— 4,81
14.	20. Nov.	37,2 — 38,7	1400	18,24	33,8	0,64	14,43	18,67	— 4,42
15.	21. "	37,4 — 38,7	1420	16,07	33,8	0,64	14,43	16,71	— 2,28
16.	22 "	37 — 38,5	1300	18,11	33,8	0,64	14,43	18,75	— 4,32
17.	23 "	37 — 38,9	1430	17,47	33,8	0,64	14,43	18,11	— 3,68
18.	24. "	36,6 — 37,8	1540	16,77	33,8	0,64	14,43	17,41	— 2,98
average		37 — 38,5	1430	17,33	33,8	0,64	14,48	17,97	— 3,54

*) Feces limitation with carbon emulsion.

Legend: same as chart on page 5.

day of fever (Reconvalescenz)	(2) Datum 1897	Temperatur Min. — Max. °C.	(3) Harnmenge g	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz g
1.	25. Nov.	Fieberfrei	1500	16,17	17,94	0,53	14,43	16,70	— 2,27
2.	26. "	"	1840	17,93	17,94	0,53	14,43	18,46	— 4,03
3.	27. "	"	1955	16,28	17,94	0,53	14,43	16,81	— 2,38
4.	28. "	"	1700	16,47	17,94	0,53	14,43	17,00	— 2,57
5.	29. "	"	1660	15,80	17,94	0,58	14,43	16,33	— 1,90
6.	30. "	"	2040	15,35	17,94	0,58	14,43	15,88	— 1,45
average			1790	16,00	17,94	0,53	14,43	16,53	— 2,10

During the next phase, (IV) (7th to 10th day of convalescence), one liter Milk was added.

Phase IV

The food of the previous Phase was increased by 1000 cu. cm milk; Content: 20.51 g N, 110.78 g fat, 145.20 g hydro-carbon. Total Caloric Content: 2,151.

Legend: same as chart on page 5

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz
7.	1. Dec.	2080	16,05	16,77	0,51	20,51	16,58	+ 8,95
8.	2. "	3260	15,83	16,77	0,51	20,51	16,34	+ 4,71
9.	3. "	1960	16,05	16,77	0,51	20,51	16,56	+ 8,95
10.	4. "	2435	16,19	16,77	0,51	20,51	16,70	+ 3,81
average		2435	16,03	16,77	0,51	20,51	16,54	+ 8,97

Expenditures remained at exactly the same level as in the previous Phase; albumen decomposition failed to increase due to the additional material, however, the deficit disappeared and a fairly strong albumen deposit was noted (33.97 g N per day).

During the following Phase V, more albumen is introduced while the number of calories free of nitrogen was increased, however, not in proportion with the albumen increase.

Feeding Table - Phase V

(1) Täglich gereicht	N g	(2) Fett g	K. H. g
(3) 3000 ccm Milch . .	18,68	99,60	145,20
(4) 140 g Schinken . .	5,79	11,35	—
(5) 2 Eier	1,85	11,18	—
(6) 120 g Semmel . .	1,95	0,58	66,14
(7) 600 ccm Suppe . .	0,52	—	—
(8) Summa:	28,19	122,68	211,34

(9) Gesammtcaloriengehalt: 2780.

Legend:
1. Daily feeding
2. Fat
3. 3000 cu. cm Milk
4. 140 g Bacon
5. 2 Eggs
6. 120 g Rolls
7. 600 cu. cm Soup
8. Total
9. Total Caloric Content: 730

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz g
11.	5. Dec.	2550	14.43	30,68	1.49	28,19	15,98	+ 12.21
12.	6. "	2050	14.92	30,68	1.49	28.19	16,41	+ 11,78
13.	7. "	2380	15,52	30,68	1.49	28,19	17,03	+ 11.16
average		2310	14,97	30,68	1.49	28,19	16,47	+ 11,72

Legend: same as chart on page 5

Expenditures did not remain at the same level, therefore, the entire surplus, 73.25 g albumen per day were available to the body as building material for the self-reconstructing cells.

Feeding Table, Phase VI

Legend: same as Feeding Table Phase 5, above

(1) Täglich gereicht	N g	(2) Fett g	K. H. g
(3) 3000 ccm. Milch . .	18,08	99,60	145,20
(4) 140 g Schinken . .	5,75	11,85	—
(6) 175 g Semmel . . .	2,71	0,81	96,46
(5) 4 Eier	3,90	22,36	—
(7) 600 ccm Suppe . .	0,52	—	—
66 g Butter . . .	0,06	55,69	0,33
(9) Summa:	31,02	189,81	241,99

Total Caloric Content: 3552

(1) Tag der Reconvalescenz	(2) Datum 1898	(3) Harnmenge ccm	(4) Harn N g	(5) Koth trocken g	(6) Koth N g	(7) N-Einnahme g	(8) N-Ausgabe g	(9) Differenz
14.	8. Dec.	2860	15,75	30,68	1,49	31,02	17,34	+ 13,78
15.	9. "	2740	18,99	30,68	1,49	31,02	20,47	+ 10,55
16.	10. "	2840	17,92	30,68	1,49	31,02	19,41	+ 11,61
17.	11. "	2380	18,01	30,68	1,49	31,02	19,50	+ 11,[illegible]
average		2705	17,67	30,68	1,49	31,02	19,16	+ 11,86

Legend: same as chart on page 5.

*) Limited in conjunction with that of earlier Phase.

Upon increasing again the nitrogen supply during Phase VI -- evidently also that of the food calorie content -- the decomposition begins to rise very slightly, a tendency toward which had already been noted during the previous phase. However, this increase is so slight that the albumen deposits are still considerable (74.13 g albumen per day).

This experiment shows the following: for a given diet, the typhus patient, at the end of his illness adapts himself to a certain albumen exchange which becomes the determining factor for future albumen balancing. He now has a tendency to persist on this exchange level. If the calorie supply is inadequate, he experiences an albumen exchange deficit like any other healthy individual. A "tendency" to pull in albumen cannot be recognized. Upon increasing the albumen supply, the decomposition does not increase or only very little. During three different albumen supply phases, namely, 90, 128 and 176 g, the expenditures remained at approximately the same level, namely 103 g. In one case, there was a deficit, in the second and third cases, an increasing retention rate. Almost the entire surplus was deposited as the fat added to the food of a normal individual would have been almost entirely deposited.

The first phases of the Jorga case, will illustrate this fact even better than the Wirker case.

The patient entered with a nitrogen exchange rate of 9.73 g into his convalescent period. Upon receiving 2388 calories and 6.68 g N, he is unable to attain an equilibrium, however, upon receiving an additional 518 calories free of nitrogen, he reaches an equilibrium for a daily nitrogen exchange of 5.55 g; in this case, therefore, albumen equilibrium was reached from the 6th-8th day of convalescence without the tendency of the cells to pull in albumen having had any disturbing effect. - When we increased the albumen slowly during the three transitional steps of Phase II, the expenditure again rose in proportion with supply. This forms the content of subdivisions a), b) and c) of Phase II. Only starting at the then attained albumen exchange level of 10.51 which corresponds approximately to that albumen exchange at which the body entered the convalescence period, the increased addition of albumen supply no longer follows an increase in exchange, but that of a deposit (Phases IIc and III). Below this albumen exchange, the behavior of the albumen exchange was the same as that of normal individuals. Albumen equilibrium could have been attained for any supply level. Above this albumen exchange, however, a positive nitrogen balance always results. In our earlier report we believed to be unable to express this any better than with the words that "the upper limit of a potential albumen balance in convalescence has been shifted to abnormally low levels."

During Phase IV, albumen was added to the food; of the surplus of 1.85 g nitrogen, the greatest portion (62%) was deposited, while 38% was used to increase the exchange. Albumen retention, therefore, is greater in this Phase than in the preceding one. The calculation looks even better for the albumen fattening effect of the additional material if we calculate only the deposits gained from the reabsorbed albumen, since the N content of the feces during this period was somwhat higher than during the earlier third Phase.

In the Hobor tests, the second test series was used to answer the question to what degree a change in nitrogen supply was used to affect the exchange and the deposit values with the supply of calories without nitrogen remaining constant. Maintaining the calorie level free of nitrogen constant we obtained:

	Intake	Expenditures	Retention
Phase VIII	17.09	12.04	5.0
Phase VII	24.92	14.59	7.33
Phase IX	28.29	18.47	9.82

The intake differential between Phases VII and VIII was 4.88 g. Of these, 2.33 g were deposited, i.e., 47.8%.

The intake differential between Phases VII and IX was 6.37 g; of this 20.49 g were deposited, i.e., 39.2%.

Here, too, an incomparably larger portion of the addition was deposited than would have been the case under normal conditions; the fact that not the entire difference is used for deposits as in Phases IV and V in Wirker's case, and Phases IIc and III in Jorga's case, but a major portion is being decomposed may be explained by the fact that a later time period of the convalescence is involved. The decomposition to deposit ratio approaches that found by Jorga during convalescence Phase IV (28th-36th day). In a well advanced convalescence the decreased sensitivity of the albumen decomposition through additional material makes room for normal conditions.

Regarding the effect of substances free from nitrogen on the nitrogen deposit, consideration should be given primarily to the first and third series of the Hobor experiment.

During the first series (Phases II-VII) the number of calories free from nitrogen was increased in steps with the nitrogen content of the food remaining constant.

	Total Calories	Nitrogen Intake	Nitrogen Expenditure	Difference
Phase II	2678	21.31 g	14.78 g	+ 6.44 g
Phase III	3078	21.31 g	16.22 g	+ 5.09 g
Phase IV	3269	21.13 g	16.31 g	+ 4.82 g
Phase V	3269	21.13 g	15.25 g	+ 5.88 g
(Instead of 100 g of milk sugar, 44 g of isodynamic Fat)				
Phase VI	3756	21.90 g	14.50 g	+ 7.40 g
Phase VII	4327	21.92 g	14.59 g	+ 7.33 g

The Table refers to the 3rd to 17th day of convalescence. It is highly interesting that the great increase of calories free from nitrogen by and large have no particular affect. Especially the slow increase of the albumen decomposition during Phases III, IV and V requires an explanation. We think less of a later flushing out than of the fact that Hobor's albumen exchange which, during the very early convalescence days prior to the corrected experiment and with an intake of approximately 11 g, varied between 13 and 14 g nitrogen due to the sudden increase of nitrogen supply by 10 g increased slightly more, despite the increased intake of material free from nitrogen. Neither for Wirker nor for Jorga the increase of albumen intake was that pronounced. On the other hand, during the other tests (Phases III and IV, Jorga, Phases IX and XI Hobor) for an absolute and relative increase in nitrogen supply the decomposition at first rises slightly, but decreases later. In this series it can obviously not be decided whether the decomposition would have decreased without an increase in calories free fron nitrogen.

Let us compare the major differences, leaving aside Phase II as a transitional Phase:

	Calories	Nitrogen Intake	Nitrogen Separation	Difference
Phase III	3078	21.31	16.22	+ 5.09
Phase VII	4327	21.92	14.59	+ 7.33

An excess of 1249 calories thus merely raised the N deposit by 2.24 g of nitrogen. The difference in the nitrogen intake was 0.61 g; therefore, a corresponding deduction must be made from these 2.24 g nitrogen.

During the third series (Phase IX and XI) the number of calories free from nitrogen was reduced in steps with the N content of the food remaining constant.

	Calories	Nitrogen Intake	Nitrogen Expenditure	Difference
Phase IX	4589	28.29 g	18.47 g	+ 9.82 g
Phase X	3598	27.17 g	21.16 g	+ 5.56 g
Phase XI	2912	27.24 g	22.39 g	+ 4.86 g

A greater economy effect is shown here: the sudden calorie decline of 1677 reduced deposits almost by 50%; the difference amounted to 4.96 g. Again, a fraction of the difference, approximately 0.40 g may be attributed to the small reduction of nitrogen supply (27.24 instead of 28.29 g), however, a very substantial economy effect of the calories free from nitrogen is noted which is greater than, for example, in Krug's case (in these 1710 calories free from nitrogen saved 3.3 g of nitrogen per day) and is considerably greater than at the beginning of the convalescence.

In addition, any discussion of the economy effects of the fats and hydro-carbons should include the two first Jorga convalescence phases.

With 6.68 g of nitrogen and 2368 of calories, he still registered a nitrogen deficit. Adding 518 calories free from nitrogen yielded on the second day, with a lowering of the albumen exchange, nitrogen equilibrium. Certainly, an economy effect is present, however, we believe that Jorga could have attained equilibrium conditions with 2368 calories, perhaps with a slower decrease in the albumen exchange. It is not admissible to consider the entire ? 22 g nitrogen as a saving resulting from 518 calories.

Obviously, the effect of isodynamic quantities of fat and hydrocarbons on the nitrogen exchange is not invariable: hydro-carbons are greater albumen economizers than fat: a decision now had to be made whether in typhus convalescence the same law applies. Let us discuss two tests related to this phenomenon: Phases IV and V by Hobor and Phases III and V by Jorga.

Hobor Test

	Food N	Fat	Hydro-carbon	Alcohol	Calo-ries	N Expen-diture	Bal.
Phase IV (7th-8th da)	21.12	107.68	299.14	48.0	3269	16.31	+ 4.82
Phase V (9th-11th da)	21.13	151.68	239.14	48.0	3269	15.25	+ 5.88

That the N retention rate is greater if fat is added than in isodynamic CH quantities is not surprising since the N exchange in general was on the decrease. Furthermore, we were able to prove by means of the first Hobor test series that especially at the beginning of the convalescence the economy effect of the calories free from N is relatively smaller. In addition, the combustion value the substances exchanged is quite low (410 calories). Therefore, we are unable to consider this test reliable, although it lasted only a very short time. The Jorga test is equally explicit.

Jorga Test

	N Intake	Fat	CH	Alcohol	Calo-ries	Uric N	Feces N	Bal.
Phase III	18.69 g	169.60 g	235.41 g	24.0 g	3188	10.61 g	1.54 g	+6.54 g
Phase IV	18.63 g	101.71 g	422.63 g	24.0 g	3324	8.86 g	2.21 g	+7.56 g

We already mentioned the error through which, during the CH phase, an excess of 136 calories was supplied, however, this is of no consequence in view of the excellent results.

During the fat period, 17.15 g nitrogen are reabsorbed and 6.54 g are deposited. During the CH period, only 16.42 g of nitrogen are reabsorbed, of which 7.56 g are deposited.

During the fat period, 38.25% and during the CH period, 46.61% hence almost half the absorbed albumen is deposited; the latter is the best ratio not only in the Jorga test but also in all test series. As shown by the calculation of calorie consumption, it was even lower during Phase V than during Phase III, while fat deposits were greater. The small surplus of food calories during Phase V can therefore not be made responsible for the effective meat fattening phase; it is therefore, unnecessary, both here and under normal conditions to attribute to the hydro-carbons a much more significant effect on N deposits than to fats.

We were also successful in proving experimentally that between the meat fattening of adults and the rapid albumen exchange of typhus convalescents a fundamental difference does not exist. Here, as well as there, a fattening is involved, a disproportion between the decomposing functions of the organism and the supply, so that albumen retention is primarily a passive event. Obviously, during the reconstruction of the cells, other "forces" are active. The type of albumen retention shown merely indicates the mechanism through which the organism provides itself with the raw material. It appears indicated to note that **a purely passive fattening is unknown.** Even under normal fat fattening, no such thing is involved. The reduction of hydro-carbon into fat requires as much the active protoplasma activity as the transformation of the fats found in the serum of a soluble modification into unsoluble fatty deposits. It is, therefore, arbitrary if we establish a difference between passive fat fattening and active meat enrichment, as is often done. The first instant for both is a passive one; It must be determined whether and how much construction material is withheld from the organism's decomposition process. The second one is an active phenomenon in the protoplasma of certain cell structures about which we do not have any detailed information. Evidently, great quantitatively differences are involved, which may simulate fundamental differences. It makes sense that the living protoplasma, full of energy, is the carrier of the life phenomena, and is harder to vanquish than the fat designed merely to cover certain reserves.

We are not alone in our opinion on albumen deposits among convalescents. Following the publication of our speech, we received the simultaneously published work by Rosenfeld entitled "Meat Fattening Conditions". /See Note/. The intelligently written essay arrived at nearly the same end results by way of logic which we had obtained one year earlier by experimental means. Rosenfeld also does not assume any particular regeneration force of the cells as the prime mover; the conditions under which the body replacement takes place are the same as those of the meat fattening among healthy individuals. "They come under the same laws as the meat fattening amond adults."

/Note: Berlin Clinic, January 1899./

The peculiarities of metabolism among typhus convalescents therefore may be attributed to two factors:

1. An increase in the oxidation processes as related to substances free from nitrogen has the following results: a) fat deposits are reduced; b) an albumen saving effect becomes particularly eclatant upon increasing the supply. As shown by a comparison of Phases I and II in the Hobor tests, this albumen saving effect of the food free from nitrogen is far more pronounced at the advanced stage of convalescence than at its beginning. Svenson's findings whereby the consump-

tion of oxygen only rises starting with the second week, and increases considerably with the supply of food also appears to support the theory that this increased sensitivity of the functions preceding these decompositions only become fully effective during the latter portion of the convalescence.

2. During the early phases of convalescence, the peculiarities of the typhus albumen exchange becomes the determining factor, the sole responsible factor, or, during the normal fever diet, in moving toward a low value. The difference between the albumen introduced and this somewhat "critical" status of the albumen decomposition is the only factor determining the amount of albumen retention, since albumen metabolism, although it has reached this low point, has lost its own excitability, i.e., its ability to react to an increase in supply with augmented decomposition, and only regains this capacity during the convalescence.

Therefore, there exists an antagonistic relationship between these two components of metabolism whose resultant is an increase in the rapid albumen retention rate.

(to be continued)

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