

**On the warm saline springs of Nauheim : their action on the healthy and morbid organism and their employment in scrophulous, rheumatic and uterine diseases / by F.W. Beneke ... translated and abridged from the German by S. Sutro.**

**Contributors**

Beneke, F. W. 1824-1882.  
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**Publication/Creation**

London ; Edinburgh : Williams & Norgate, [1860]

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ON  
THE WARM SALINE SPRINGS  
OF  
N A U H E I M,  
(NEAR FRANKFORT <sup>o</sup>/M.)

THEIR ACTION ON THE HEALTHY AND MORBID ORGANISM  
AND THEIR EMPLOYMENT  
IN SCROPHULOUS, RHEUMATIC AND UTERINE DISEASES.

BY

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of London, of the medical societies at Dresden, Athen, Pesth, Philadelphia  
etc. etc. etc.

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TRANSLATED AND ABRIDGED FROM THE GERMAN

BY

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WILLIAMS & NORGATE  
14, HENRIETTA STREET, COVENT GARDEN, LONDON,  
and  
20, SOUTH-FREDERICK STREET, EDINBURGH.

THE WARM SALTINE SLINGS

N A U H E I M.

(NEAR FRANKFORT AM.)

THEIR ACTION ON THE HEALTHY AND SICKEN ORGANISM  
AND THEIR EMPLOYMENT

IN SCROPHULOUS, RHEUMATISM AND OTHER DISEASES

F. W. BENKE, M. D.

TRANSLATED AND ARRANGED FROM THE GERMAN

E. SUTHO, M. D.

Printed by AUG. OSTERRIETH,  
Frankfort o. M.

WILLIAM & NORRIS

11 NASSAU STREET, NEW YORK

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## PREFACE OF THE AUTHOR.

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THE following pages form the abstract of a work, I have lately published in Germany on the saline springs of Nauheim, a village situated near Frankfort o/M., on the Main-Weser railroad. The abstract, written by Dr. SUTRO, contains and explains so clearly all the principal results of my investigations on the effects of the sources, that I am greatly indebted to him for the skilful performance of his task, and that it will be scarcely necessary for the reader, to refer to the original German work. Those, however, who wish to acquire a more accurate insight into the physiological and chemical researches, which I have instituted on the effects of the Nauheim springs on the healthy organism, must, of course, avail themselves of the original work. I cannot deny, that I lay a great stress upon investigations of this kind, as they are indispensably necessary for a more accurate and scientific knowledge of the effects of the German Spas, than has been available hitherto. — Experience in medical questions ranks first; but the time has arrived, when experience ought to have a physiological foundation, else it will no longer satisfy alone the scientific physician. Thus I may hope, that my English colleagues will find in the following pages some satisfaction, as I have endeavoured to base facts of experience upon physiological study, and I am happy to state, that the harmony of both of them is as complete, as possible.



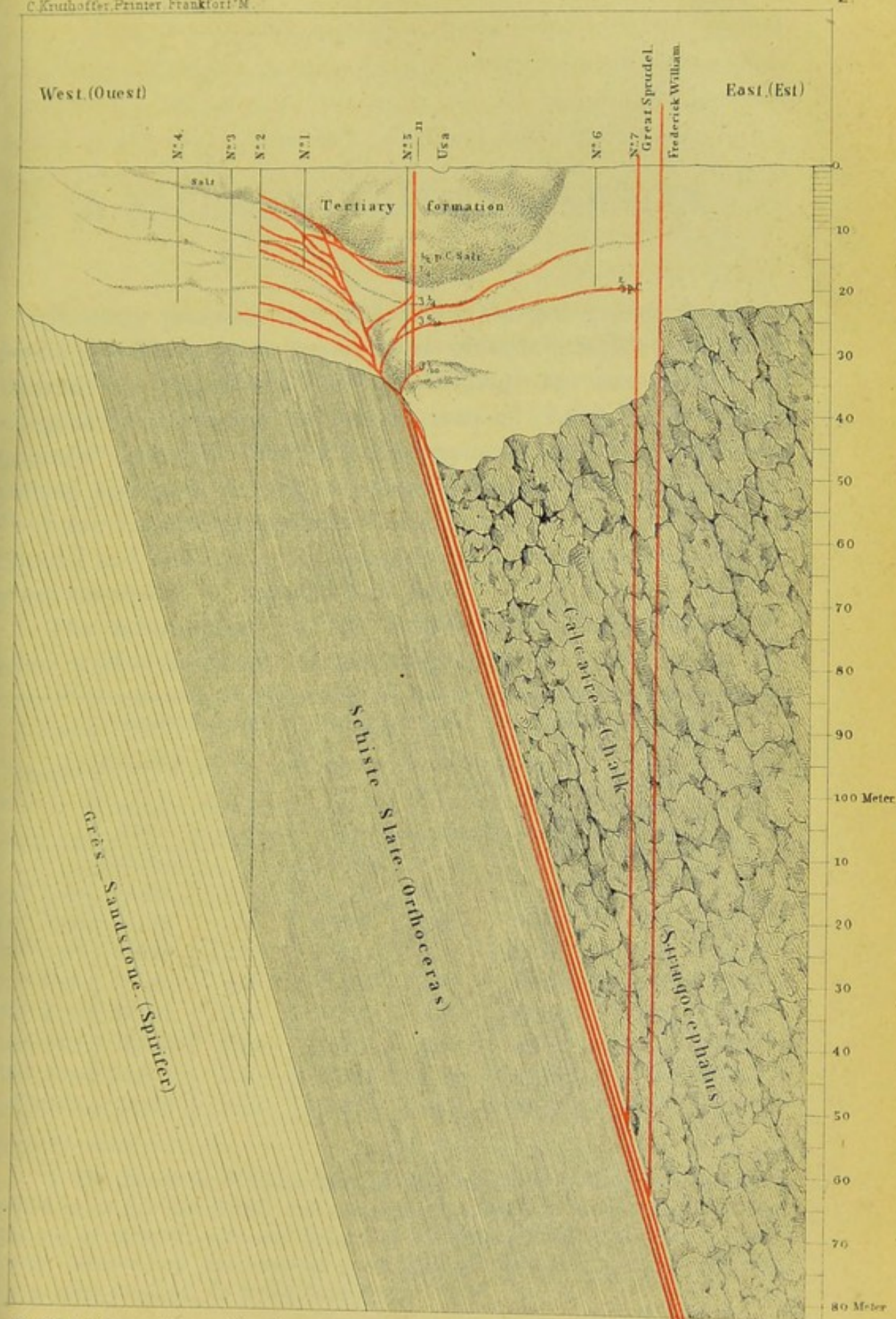
Besides I am very much indebted to Dr. SUTRO for his kindly contributing to spread the fame of the Nauheim springs, which really deserve the attention of medical men, and, I am sure, will soon take their rank amongst the most powerful saline springs of Germany. The air at Nauheim is healthy, the place being protected by the Taunus-mountains and opening into the rich valley, called "the Wetterau". The accommodation as regards lodgings, &c. &c. equals that of other bathing places of Germany.

I shall not omit, to publish further observations and experiments on the effects of the Nauheim springs on the healthy and morbid organism. But in order to arrive at results, which can be depended upon, the physician of the Spaa must be supported by the ordinary medical attendants of the patients, and I beg leave therefore to ask my English colleagues, to send with the patient a history of the case, as well as to give an account of the general results of the course some months after the patients return.

*Marburg, Electoral Hesse, March 1860.*

Dr. BENEKE.

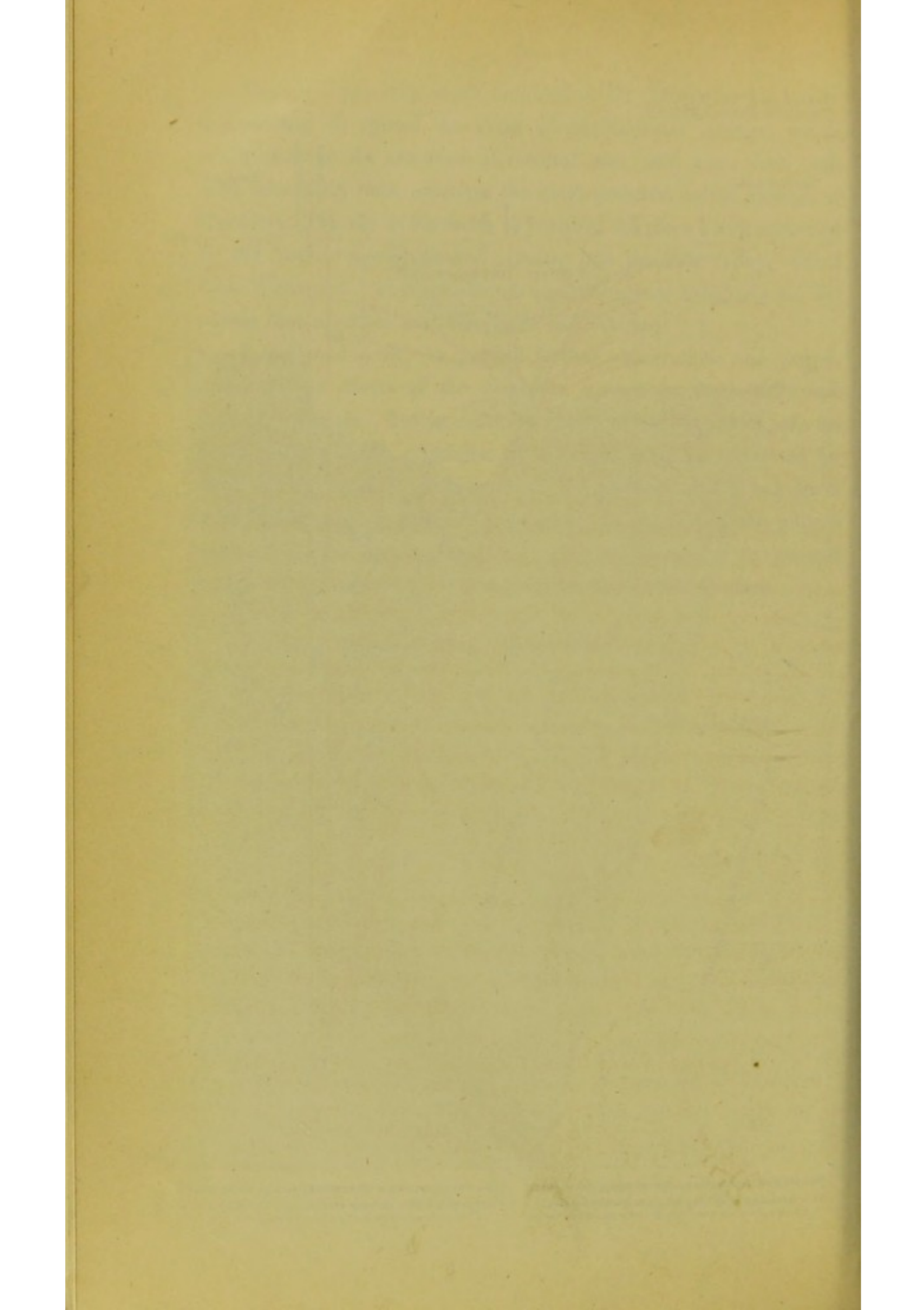




Profil des formations géologiques dont  
les sources de Nauheim proviennent.  
(Les lignes rouges indiquent l'eau ascendante.)

Section across the geological formations  
from which the saline springs of Nauheim issue.  
(The red lines indicate the ascending saline water.)





## I. NAUHEIM'S CURATIVE RESOURCES.

NAUHEIM possesses now five saline thermal springs for therapeutic use. Three (with temperatures of 96,44°; 90,32°; and 82,04° Fahrht.) are exclusively used for bathing; the two others, the so called "Cur-brunnen" (cure-well, temper. 72,05° F.) and "Salz-brunnen" (salt-well, 72,50° F.) are employed internally. The three bathing springs issue forth as powerful foaming bubblers (Sprudel). They are respectively named: Frederik-William Sprudel \*), great Sprudel and small (or gas-) Sprudel and are distinguished by their great abundance of carbonic acid gas.

The measurement of Mr. Schreiber, the Inspector of the saline works, furnished the following results in 1858:

Date.	Little Sprudel.		Great Sprudel.		Fred. Will. Sprudel.		State of Barometer.
	Quantity of saline water.	Percentage of chloride of sodium.	Quantity of saline water.	Percentage of chloride of sodium.	Quantity of saline water.	Percentage of chloride of sodium.	
	Cub. feet.		Cub. feet.		Cub. feet.		
10th Febr.	21,484	2,30	31,726	2,75	33,264	3,80	334,8'''
12th Mrch	20,396	2,25	30,404	2,75	32,788	3,90	333,8'''
10th April	19,128	2,30	29,963	2,85	31,838	3,85	331,0'''
15th May	18,843	2,20	31,726	2,85	33,739	3,90	331,0'''
12th June	16,202	2,20	32,166	2,90	31,363	3,90	333,5'''
10th July	14,960	2,15	33,048	2,90	32,313	3,80	329,5'''
16th Aug.	11,804	2,15	32,166	2,85	32,788	3,85	335,0'''
4th Sept.	12,814	2,10	31,726	3,00	31,838	3,80	336,0'''

\*) The Frederik William Sprudel was bored later (1855) than the so called great Sprudel (1846), and surpasses the latter in its quantity of water, amount of carbonic acid and height of bubbling (44 feet), so that it would justly deserve now the name of great Sprudel. However the original names have been retained, to avoid confusion.



As a full bath requires about twenty cubic feet of the saline water, we can easily calculate what number of baths might be daily given, though half the brine is used for the salt-works during the bathing season.

The "Cure-well and Salt-well" furnish the following quantities of saline matter in 24 hours, according to the measurements undertaken by Mr. Inspector Schreiber on the 15th of October 1858:

viz. the "Cure-well": 2578 cubic feet.

the "Salt - well": 1948 cubic feet.

The quantity of carbonic acid escaping in its gaseous state out of the Sprudels cannot be determined with the same exactitude. Direct measurements are very difficult and have not been attempted lately. But according to former analyses by Professor Bunsen, Rud. Ludwig and Inspector Schreiber, the quantity may be approximatively calculated as follows:

*for the little Sprudel* with 17000 cub. feet of saline water on an average 17,000 cub. feet of gas,

*for the great Sprudel* with 31,000 cubic feet of brine on an average 45,500 cub. feet of gas,

*for the Fred. Will. Sprudel* with 32,000 cub. feet of brine on an average 48,000 cub. feet of gas.

The preceding numbers give us an idea of the enormous quantity of *carbonic acid* contained in the Nauheim springs, and we have almost to regret its not being employed for technical purposes, as it is mostly allowed to be wasted. The carbonic acid, used for therapeutic purposes, is at present only taken from the "little Sprudel". It is received by a gasometer and conducted through pipes into the building destined for gas-baths, gas-douches &c.

As regards the *chemical composition* of the *bathing springs*, we are indebted for the following analyses to Professor Bromeis of Marburg and to Mr. Avenarius, Inspector of the salt-works at Nauheim. The composition of those saline springs is added, which are frequently compared with Nauheim, as regards their effects. In a pound of 16 ounces or 7680 grains are contained:



16 ounces (7680 Grains) contain:

Constituent parts.	Naueheim.			Oehnhausen (Rehme).	Kissingen.	Kreuznach.		
	Frederik- William Sprudel. (Avenarius)	Great Sprudel. (Bromeis)	Little Sprudel. (Bromeis)	Saline thermal spring. (Bischof)	Foaming- Sprudel. (Kastner)	Oranien- spring. (Liebig)	Karlshall- spring. (Prästinari and Osann)	Theodors- hall- spring. (Düding)
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Chloride of sodium . . . . .	265,42	181,24	152,45	256,39	107,515	108,705	59,675	57,191
Chloride of potassium . . . . .	1,46	4,02	2,07	—	0,98	0,46	0,41	0,297
Chloride of calcium . . . . .	21,96	14,86	13,17	—	3,99	22,74	9,16	14,70
Chloride of magnesium . . . . .	3,91	2,60	2,67	8,28	24,51	—	3,31	4,41
Bromide of magnesium . . . . .	0,072	0,077	0,084	0,0049(?)	0,062	1,780	1,367	?
Jodide of magnesium . . . . .	—	—	—	—	—	0,0124	—	—
Jodide of sodium . . . . .	—	—	—	—	—	—	0,043	0,031
Sulphate of potassium . . . . .	—	—	—	0,361	—	—	—	—
Sulphate of lime . . . . .	0,437	0,399	0,838	22,99	—	—	—	—
Sulphate of magnesia . . . . .	—	—	—	19,99	—	—	—	—
Sulphate of sodium . . . . .	—	—	—	—	25,307	—	—	—
Bicarbonate of lime . . . . .	18,201	16,38	14,138	6,67	1,65	0,255	0,611	2,149
Bicarbonate of magnesia . . . . .	—	—	—	3,85	6,412	0,130	0,490	0,199
Bicarbonate of iron (protoxyde) . . . . .	0,384	0,507	0,290	0,513	0,355	0,356	0,364	0,218
Bicarbonate of maganese . . . . .	traces.	0,154	0,070	0,010	0,0008	—	—	traces.
Silicium . . . . .	0,192	0,161	0,103	0,357	—	0,999	0,033	0,099
Organic substances . . . . .	traces.	traces.	traces.	—	0,864	—	1,471	—
Total . . . . .	312,045	220,416	185,908	313,440	171,851	135,541	75,572	79,350
* Temperature . . . . .	96,44° F.	90,32° F.	82,04° F.	87,08° F.	67° F.	54,5° F.	77° F.	70,25° F.
Carbonic acid escaping in the form of gas in 24 hours . . . . .	48000 C.-f.	45000 C.-f.	17000 C.-f.	4737 C.-f.	30,737 C.-f.	?	?	?
Carbonic acid fixed under atmosphaeric pressure in 25 Cub.-feet of brine . . . . .	7,47 C.-f.	13,32 C.-f.	23,5 C.-f.	21—27 C.-f.	21,28 C.-f.	?	?	?

\* Temperature . . . . .  
Carbonic acid escaping in the form of  
gas in 24 hours . . . . .  
Carbonic acid fixed under atmosphaeric  
pressure in 25 Cub.-feet of brine . . . . .



I have ascertained the temperature of the three Nauheim Sprudels by careful observations made April 28th 1858 with Greiner's normal thermometer. I did not find the springs quite constant in their temperature. Thus the temperature of the Frederik-William-Sprudel amounted to 96,71° F. (35,95° Cels.) on the 8th of Sept. 1857, that of the great Sprudel to 89,96° F. (32,2° Cels.) and that of the little Sprudel to 83,48° F. (28,6° Cels.). According to Ludwig the Frederik-William-Sprudel possessed a temperature of 101,75° F. (38,75° Cels.) in 1855. the great Sprudel 91,58° F. (= 33,10° Cels.), the small Sprudel 84,65° F. (= 29,25° Cels.). — It is further to be observed that the brine arrives in the baths somewhat cooler than at its issue from the ground. From 9 different measurements the following is the average present temperature of the water in the baths:

Fred.-Will.-Sprudel . . .	94,10° F. (= 34,5° Cels.)
the great Sprudel . . .	88,55° F. (= 31,42° Cels.)
the little Sprudel . . .	79,88° F. (= 26,6° Cels.)

A comparison of the saline Spas above mentioned shows a great similiarity between Nauheim and Oeynhausien (Rehme). The former possesses however this great advantage over all other analogous Spas, that within a space of scarcely 400 square feet 3 warm saline springs issue, ready for immediate use, whilst their different temperatures afford opportunities of modified employment in various diseases.

The carbonic acid so abundantly contained in the baths is a highly important therapeutic agent furnished by nature and unattainable by art, whilst heat and saline ingredients might be artificially imitated and no doubt with good effect. If we examine the amount of ingredients contained in the principal Kreuznach springs, we are at once struck by their comparatively small proportion of saline matter, by their low temperature and lastly by the absence or scarcity of carbonic acid gas. On the other hand the jodide of magnesium and of sodium, which they possess (0,04 and 0,012 gr. respectively in a pound of water) together with a not inconsiderable amount of bromine imparts to them a distinctive peculiarity.

These Kreuznach springs artificially warmed for bathing have no doubt produced excellent effects in many morbid conditions.



But it is not denied, even by the reports of the Kreuznach physicians, that the most important curative effects have been produced by adding Kreuznach mother-lye\*) or lye-salt to the baths. This would justify the assumption that an equally favourable result might have been produced anywhere else by simply employing baths prepared with the same mother-lye.

I mention this, not to disparage Kreuznach, which will always remain an excellent resort of valetudinarians, but because I think, that as physicians we ought clearly to distinguish whether we send invalids to a Spa for the employment of remedies unobtainable elsewhere, or principally for change of air, of diet, for enjoyment of fine landscapes &c. &c. Science must at last separate those cures brought about by the innate virtues of the springs, from those obtained through artificial additions or even through powerful pharmaceutical remedies, as Zittman's Decoction &c. Otherwise the just confidence reposed in the healing effects of the Spas must be ultimately shaken. On the other hand the frequent employment of mother-lye in Kreuznach has often occasioned the view, as if those additions of mother-lye to the baths constituted their chief efficacy, and consequently such additions were also sometimes proposed for Nauheim, without duly weighing the difference of the respective ingredients of the two, the one possessing from 3 to 4 percent of chloride of sodium and a considerable amount of carbonic acid, and the other only  $1\frac{1}{2}$  percent of chloride of sodium and very little of the latter gas.

A full bath of 20 cubic feet of brine, weighing 1040 pound (1 Cub. f. of water of 88–90° F. calculated as = 52 pounds) contains in Nauheim by mixing the Fred. William and Great Sprudel 36,02 pounds of solid ingredients (266 grains to one pound), whilst the same amount of water in Kreuznach only contains 18,3 pounds of solid ingredients (if the Oranien-spring be employed), or 10,8 pounds (if the Theodorshall-spring be used). In order to obtain the same amount of ingredients in Kreuznach,

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\*) "Mother-lye" means the saline residue left after a certain concentration of the brine, when the chief portion of chloride of sodium has been removed by crystallisation. The *salt of the mother-lye* is obtained by concentrating the mother-lye.



as is naturally contained in the Nauheim bath, we should have to add 9 quarts (= 18 pints) of mother-lye to a bath from the Oranien-spring, and 13 quarts to a bath of the Theodorshall-spring.

It is thus a decided error to attempt further adding to the strength of the Nauheim baths, which are already so powerful, excepting such cases, which require a most powerful irritation of the skin.

The different composition of the bath-springs in the two respective Spas has already been noted. The following table shows the difference existing in the ingredients of the two mother-lyes.

	Mother-lye of <i>Kreuznach.</i>	Mother-lye of <i>Nauheim.</i>
Chloride of sodium . . .	122,2656 grains,	72,1151 grains.
Chloride of potassium . .	130,8672 "	132,6338 "
Chloride of calcium . . .	2014,0800 "	2302,2263 "
Chloride of magnesium . .	287,5392 "	269,0303 "
Bromide of sodium . . .	65,9712 "	— —
Jodide of sodium . . .	undetermined small quantity.	— —
Bromide of magnesium . .	— —	6,7584 "
Sulphate of lime . . . .	— —	5,7600 "
Chloride of manganese . .	— —	} Traces.
Chloride of aluminium . .	— —	
Chloride of iron . . . .	— —	
Organic substances . . .	— —	4,6080 "
Water . . . . .	5059,2768 grains,	4885,8686 "

It would be highly desirable to establish by scientific researches, made on the spot, whether the Kreuznach baths exhibit their specific effects through the addition of the mother-lye in general, or more exclusively through the presence of Bromine in the lye.

The Nauheim Sprudel is thus distinguished from the Kreuznach springs by its great amount of saline and gaseous constituents and by its natural warmth.

The Rehme spring approaches it nearest in physical qualities, whilst the Soolen-Sprudel of Kissingen only shares the advantage of its abundance of carbonic acid. Though the



Nauheim Sprudel issues with crystalline clearness, it soon becomes turbid and yellowish by being exposed to the influence of the atmosphere. A sediment composed of carbonate of iron and of lime precipitates in a short time. The escape of carbonic acid gas and the rapid absorption of atmospheric oxygen occasion this change. The precipitate may be caused to form more speedily by shaking or stirring the water, thus the above explanation becomes confirmed.

Though the baths still maintain the integrity of their principal constituents, it is nevertheless desirable to furnish the water in the same purity with which it issues from the ground, and therefore we shall soon have contrivances to prevent its decomposition.

The Nauheim Bath-springs (Fred. Will., great and small Sprudel) are employed in the following manner:

1) In the form of *full-baths* with temperatures of 80–94° F. The baths are made of wood and varnished with oil-colour, in order not to be destroyed by the brine. Each bath contains 20 cubic feet of salt-water. The spring No. 7 (great Sprudel) runs in at the bottom, the two others at the upper border of the baths. Duration of a bath : from 5 minutes to an hour. The filling takes place before the entrance of the invalid.

2) In the form of so called "*stream-baths*". During the whole time of bathing fresh brine continues running into the bath at one end, whilst a similar quantity constantly flows out at the other. These baths exert a particularly exciting effect on the sensitive cutaneous nerves, by constantly surrounding the body with newly arriving brine and carbonic acid. Their employment requires caution.

3) In the form of *hip-baths* (sitting baths).

4) In the form of *external* and *internal douches*.

The external douches are administered by means of press-pumps; the internal (for womb or vagina) are given in the full-bath or on stools constructed for the purpose. I consider the isolated administration of the douche especially valuable, as it exerts a powerful effect on the uterus.

5) In the form of *local fomentations*, or *general covering of the whole body*. For this purpose the brine is sent, in well closed vessels, into the houses of the valetudinarians and there employed



according to order. Little experience has at yet been obtained from this kind of administration. But the cutaneous surface, as well as the nutritive processes of certain internal organs seem to be powerfully affected by it.

Very shortly a gas-vapour-bath will be constructed and complete our therapeutic apparatus. In a spacious hall the brine will fall from a height of 60 feet and splash on artificial spots of resistance, so as to fill the space with saline vapour. This vapour will be inhaled for stated periods by patients affected with certain cutaneous and pulmonary complaints.

The following use is made of the enormous quantity of carbonic acid gas constantly escaping :

- 1) *Full gas-baths* are prepared by conducting the carbonic acid into capacious, well closed wooden reservoirs, where the patient is seated with his head outside the bath. Appropriate ventilation provides for the respiration of healthful atmospheric air, whilst the body is acted upon by the powerfully penetrating stream of carbonic acid gas.

- 2) Uterine-gas-douches.

- 3) Gas-douches applied to other organs, as the eyes, the nasal or the auditory mucous membrane, the extremities &c.

Besides the above natural curative resources furnished by Nauheim, the physician sometimes feels the necessity of either modifying the remedial means at his disposal, or of employing appropriate remedies to assist in the restoration of health.

In this respect the following measures are resorted to :

- 1) The single saline bath is *diluted* by the addition of common warm water. Experience has taught me, that certain patients are too powerfully affected by the simple baths, especially at the commencement of the course. And for those I found a bath of one or one and a half percent of brine [such as Kreuznach furnishes in natura] the most appropriate.

- 2) The simple saline bath is as much as possible deprived of its carbonic acid by early filling and stirring, whilst windows and doors are opened.

Though a considerable quantity of carbonic acid, is wasted by the mode of collecting the brine in a baignoire, some patients with very sensitive respiratory organs could only use these baths



with advantage after the removal of carbonic acid in the above manner. I may however add, this measure was only requisite in very few cases.

3) The simple saline bath is *strengthened* by the addition of mother-lye. If about six quarts (5,238 litres) of mother-lye be added to a full bath, a sharp itching sensation is felt at those parts of the skin, which are slightly denuded of epidermis; and even healthy portions experience a kind of caustic sensation, especially if rubbed with the water.

If the mother-lye be employed by itself for nightly applications to single parts of the body, a peculiar papulous eruption arises, which mostly hardens into whitish yellow crusts, without any previous discharge of fluid. This intensity of effect is no doubt principally due to the chloride of calcium contained in the mother-lye.

If we look at the considerable amount of efficacious constituents possessed by a simple bath, and if we examine the results of my observations on the effects of the mother-lye-bath (as communicated below), I shall be justified in my decided opposition to the too frequent and indiscriminate employment of mother-lye. I shall adduce proofs of the influence of the *simple* saline baths on the vital organic functions. Unless great caution be used in artificially increasing this influence, injurious consequences will ensue, as I myself witnessed on several occasions. In most of those cases seeking relief at Nauheim, the plain brine bath will fully answer the purpose.

4) Besides the saline baths we employ cold *shower-* or *rain-douches*, cold *hip* and *rain-baths* and cold *uterine douches*. A contrivance for cold rain or shower douches is adapted to each bath at Nauheim, and in many instances I found great advantage in availing myself of it. The cold hip and rain-baths are administered in separate tubs, the uterine douches on the stools above mentioned.

The further perfection of these arrangements will the more be called for, as in many cases they form indispensable aids for attaining a completely successful cure.

### The Drinking-Springs of Nauheim.

To the subjoined analyses of the springs I again add those of some other spas of the same class, frequently brought in comparison with Nauheim.



16 ounces (7680 Grains) contain:

Constituent parts.	Naheim.		Kissingen.		Homburg.		Kreuznach.		
	Curewell. (Bromeis)	Curewell artificially diluted.	Saltwell. (Bromeis)	Saltwell artificially diluted.	Ragoczy. (Liebig)	Pandur. (Liebig)		Elisabeth- spring. (Liebig)	Ludwigs- well. (Will & Fresenius)
Chloride of sodium . . . .	109,923	58,413	141,822	74,363	44,713	42,399	79,154	84,461	72,883
Chloride of potassium . . . .	4,047	2,024	5,479	2,739	2,203	1,835	—	2,198	0,624
Chloride of calcium . . . .	8,215	4,243	10,714	5,492	—	—	7,756	9,506	13,389
Chloride of magnesium . . . .	2,155	1,173	2,102	1,146	2,333	1,625	7,767	6,001	4,071
Bromide of sodium . . . .	—	—	—	—	0,064	0,054	—	—	—
Bromide of magnesium . . . .	0,295	0,148	0,400	0,200	—	—	—	—	Jodmag. 0,035 0,278
Sulphate of soda . . . .	—	—	—	—	—	—	0,380	—	—
Sulphate of magnesia . . . .	—	—	—	—	4,508	4,590	—	—	—
Sulphate of lime . . . .	0,740	0,548	0,775	0,565	2,990	2,307	—	0,225	—
Nitrate of soda . . . .	—	—	—	—	0,071	0,027	—	—	—
Phosphate of lime . . . .	—	—	—	—	0,043	0,040	—	—	—
Bicarbonate of lime . . . .	11,558	7,540	11,904	7,713	8,148	7,793	10,982	9,796	1,693
Bicarbonate of iron (protoxyde) .	0,199	0,269	0,199	0,269	0,242	0,202	0,460	0,390	0,199
Bicarbonate of manganese(protoxyde)	0,027	0,014	0,061	0,030	—	—	—	—	0,009
Carbonate of magnesia . . . .	—	0,194	—	0,194	—	—	2,011	0,046	1,351
Chloride of lithium . . . .	—	—	—	—	0,153	0,129	—	—	0,613
Silicium . . . .	0,115	0,119	0,153	0,137	0,099	0,031	0,315	0,125	0,129
Sum total . . . .	137,274	74,702	173,609	92,848	65,702	61,299	108,829	112,752	94,023
Temperature . . . .	72,05° F.	59,00° F.	72,5° F.	60,11° F.	51,12° F.	51,12° F.	50,00° F.	50,86° R.	54,5° F.
Carbonic acid escaping in the form of gas . . . .	?	?	?	?	?	?	?	?	?
Carbonic acid fixed under the pressure of one atmosphere by atmospheric pressure . . . .	14,267 Gr.	12,319 Gr.	17,267 Gr.	13,818 Gr.	17 5 Gr.	20,2 Gr.	21,48 Gr.	18,42 Gr.	?

The above analysis are transcribed from the works of Bode, Helft, Engelmann and Dr. Friedli's pamphlet: "On the pharmacodynamic influence of the Springs of Homburg", 1857.



A comparison of the above Spas will be very instructive. They are all employed against pretty well the same or similar complaints. Chloride of Sodium forms the principal ingredient in all of them. The Kissingen springs differ from the others in containing no chloride of calcium, but instead : sulphate of magnesia and rather more sulphate of lime than the others. If we compare the quantitative proportions of the various ingredients, we can, by careful observation, easily explain the different effects through them.

The two Nauheim springs abound most in solid constituents. The cure-well contains more than double the amount of Kissingen's Ragoczy or Pandur; it contains almost a third more than Kreuznach's Elisen-Spring. The salt-well even contains treble the quantity of the Pandur, more than half of Homburg and almost double as much as the Kreuznach springs.

But is such an abundance of ingredients a recommendation for a drinking fountain? According to all our present experience certainly not, at least for the generality of patients. And if Ragoczy, Homburg and the Kreuznach springs show by their universal reputation, that they are as a rule easily borne and confer great advantages, whilst Nauheim's drinking springs occasionally produce gastric catarrh, abdominal oppression, want of appetite &c., are we not justified in concluding, that this unfavourable result is solely due to the excessive amount of solid ingredients? My observations only comprise the short space of two summers, but made with care in the treatment of 320 patients, they have convinced me, that Nauheim's *drinking* springs do not generally agree with the digestive organs, and as the cause of this unpleasant result is not to be found in the quality but in the quantity of our „Cure-well” and „Salt-well” the idea naturally occurred to render them more suitable by dilution with ordinary spring water. I was the more justified to expect a good result from this dilution, especially of the “Cur-brunnen”, as half its amount of solid ingredients greatly resembles the full quantity of constituents contained in Kissingen's Ragoczy. My anticipation was not deceived. From a sufficient number of careful observations I feel justified in positively stating *that in our artificially diluted “Cur-brunnen” we possess a curative agent perfectly equal*



to *Ragoczy* in its effects. At the same time the relatively greater proportion of ingredients in the natural spring offers us this advantage, that we are able to adapt the amount of saline ingredients to the requirements of each individual case.

For the artificial dilution of the springs I have selected a water distinguished by a pleasant taste, perfect clearness and containing a small amount of iron. This water which is always kept ready at the springs, consists according to the analysis just concluded by Mr. Inspector Avenarius of the following ingredients.

With a specific gravity of 1,00139 and a temperature of 50—54° F. it contains the following ingredients in a pound (of 7680 grains) :

Chloride of sodium . . . . .	= 6,903 grains.
Chloride of potassium . . . . .	= trace.
Chloride of calcium . . . . .	= 0,271 „
Chloride of magnesium . . . . .	= 0,190 „
Bromide of magnesium . . . . .	= — — „
Bicarbonate of soda . . . . .	= traces.
„ „ lime . . . . .	= 3,522 „
„ „ protoxyde of iron . . . . .	= 0,340 „
„ „ manganese . . . . .	= — — „
Sulphate of lime . . . . .	= 0,357 „
Silica . . . . .	= 0,123 „
Silicate of alumina . . . . .	= — — „
Arsenate of iron . . . . .	= — — „
Organic substance . . . . .	= 0,033 „
Nitric acid . . . . .	= traces.

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Sum total of solid ingredients . . . = 12,126 grains.

Carbonic acid fixed by atmospheric pressure 10,370 „

This water mixed in equal proportions with *Nauheim's* drinking springs produces a composition very little differing (especially as regards the diluted *Cur-brunnen*) from that of *Ragoczy*, as a glance at the comparative tables, given above, will show. But I shall prove below, that this similarity likewise exists in their respective efficacy. I will just mention on this occasion, that ever since I employed *Nauheim's* drinking springs in a modified form, I found them to be extremely valuable remedies. The temperature



of the diluted springs is on an average 59—60° F. It slightly varies according to the temperature of the diluent, which of course partially depends on atmospheric influences.

This temperature is in general more advantageous than that of the Kissingen or Homburg springs, which being 8° lower (viz. 50—51° F.) are often found too cold in their natural state.

Besides the two saline springs mentioned *Nauheim* possesses a *third drinking spring*, which has yet to be mentioned. It differs greatly from the others, containing very few ingredients, and among these carbonate of soda and free carbonic acid prevail. It is therefore called "*Alkaline acidulous spring*." According to Professor Bromeis of Marburg it possesses a temperature of 66,9° F. (19,4° Cels.) a specific gravity of 1,0011 and contains the following ingredients in a pound (of 7680 grains):

Bicarbonate of lime . . . . .	2,5069 grains.
„ „ protoxyde of iron . . . . .	0,0768 „
„ „ „ „ manganese . . . . .	trace.
„ „ soda . . . . .	1,8831 „
„ „ soda-magnesia . . . . .	1,3624 „
Sulphate of lime . . . . .	0,1036 „
Chloride of potassium . . . . .	trace.
„ „ sodium . . . . .	1,5260 „
„ „ calcium . . . . .	0,1613 „
Bromide of sodium . . . . .	slight trace.
Silica . . . . .	0,0691 grains.
Organic substances . . . . .	small quantity.

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Sum of solid ingredients 7,6892 grains.

Carbonic acid (fixed by atmospher. pressure) . . . . .	7,1301 gr. (15,2742 cub. inch).
Nitrogen . . . . .	0,0384 „ (0,1360 „ „ ).

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Sum of all constituents 14,8577 grains.

Water . . . . . 7665,1423 „

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7680,0000 grains.

Little use has yet been made of this spring, and its effects have therefore to be ascertained by further observations. According to its constituents it might be compared with the Grande Grille



of Vichy, from which however it differs by its lower temperature and its inferior amount of carbonate of soda.

*The mineral spring of Schwalheim* (a little village about two  $\frac{1}{4}$  miles distant from Nauheim) is generally also enumerated as belonging to Nauheim's drinking springs.

The water may be quaffed at the source or at the drinking hall of Nauheim, whereto fresh supplies are daily sent from the spring in well closed jars. It possesses a specific gravity of 1,0022 and a temperature of 51,12° F.

It rises in a shaft with a great abundance of carbonic acid. Indeed it surpasses most of our acidulous springs by its considerable amount of carbonic acid. According to Liebig's analysis\*) it contains in a pound (of 7680 grains):

Chloride of sodium . . . . .	11,9465 grains.
Sulphate of soda . . . . .	0,6215 „
Chloride of magnesium . . . . .	1,0826 „
Carbonate of magnesia . . . . .	0,4185 „
„ „ lime . . . . .	4,3139 „
„ „ protoxyde of iron . . . . .	0,0878 „
Silica. . . . .	0,1489 „

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Sum of solid ingredients 14,6188 grains.

Carbonic acid (fixed by atmosph.

pressure) . . . . . 22,7258 gr. (49,44 cub. inches).

Frequent use is made at Nauheim of this spring, and I shall refer to its medical effects below. In Germany, and more still in France it has been in great request of late years. Nearly 200,000 jars are annually exported. But in general it is rather used as a pleasant beverage, than for medical purposes, though its curative efficacy well deserves consideration.

In conclusion I may state, that not only all foreign mineral waters are to be obtained at the drinking hall, but likewise excellent *goats whey*, prepared by a native of Appenzell.

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\*) S. Bode: "Bad Nauheim &c. 1853" p. 119.



## II. RESEARCHES

### CONCERNING THE EFFECTS OF THE NAUHEIM SPRINGS ON THE HEALTHY HUMAN ORGANISM.

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In order fully to appreciate the influence of a remedy on the morbid frame, we ought necessarily to examine its action on the normal state of our body.

Our present pathological knowledge furnishes the axiom, that the vital principles of the morbid organism obey the same laws as those of the healthy organism. The phenomena differ only, because the conditions of life are more or less altered in the morbid frame. Under such circumstances a remedy will act differently on the morbid than on the healthy economy. For instance, if sugar or chloride of sodium should abound in the circulating fluid, a different reaction will be produced by the introduction of a mineral water into the system from that, to be expected in a normal condition of the blood. A weak nervous system will react differently against irritating influences, than strong and normal nerves.

Nevertheless the mode of action must in all cases be manifested by distinct and essential phenomena.

If we look at the considerable differences of the healthy, as well as of the diseased organisms and if we can scarcely trace an exact limit between health and disease : we are still more compelled to recognise the importance of ascertaining the effect of an untested remedy on the healthy organism. By introducing a remedy we add a new condition of life. And however the resisting medium may differ in the various constitutions : some result of this new condition must ensue and become perceptible.



Led by these reflexions I have commenced studying the effects of the Nauheim springs by experiments on "healthy" individuals. This mode of investigation has been lately pursued in several spas, in order to obtain a more thorough knowledge of the exact efficacy of the remedial agents contained in the springs. Much information has already been obtained by these researches, though they are all weakened by the common defect of being too solitary, not sufficiently multiplied and not repeated with different persons. For this reason I have instituted my investigations at least on three different individuals. Even this number is far too small for acquiring absolutely correct views. But when a remedy produces thoroughly analogous results in three separate individuals of different constitutions, a great degree of probability is obtained, whilst the differences that were noticed served as a spur for further researches.

Through these only rules may be laid down.

I have made my experiments at two different seasons, in April and September of last year (1858). They lasted three weeks each time.

During the first series the experiments were made on Dr. Mumm from Josbach, Dr. Mannel from Quentell, and on myself. During the second series Dr. Bartsch from Zierenberg was substituted for Dr. Mannel. In both instances the first period of six days was only employed to ascertain our respective normal conditions. In the first series we devoted the second period to the investigation of the effects of the *simple warm saline bath*; the third period to the study of the *saline bath mixed with mother-lye*. In the second series we investigated in the second period the effects of the "*Cur-brunnen*" (*cure-spring*), and in the third period the *combined effects of the Cur-brunnen and the simple saline bath*.

The first day of each series was not employed for investigation, because our different organisms were first to be put under the same regimen, at least for a full day, before we could expect any exactitude of results from our comparisons. Neither did we devote the first day of each succeeding week to experiments, as we considered a day of rest necessary after 6 days of work. Thus out of three weeks three times six days remained for our investigations. Diet and regimen were however also regulated



in the free days, and were almost the same as on the experimental days.

During each series we all three invariably led the same life. Time of rest, and of exercise in the open air, the quantity of food and of beverages were quite identical.

The amount of nourishment was carefully weighed, but adapted to the individual desires, and consequently it was different both in the various days and individuals. The quantity of beverages allowed to each was almost the same and admitted of very little change. But where this change occurred it was due to an intense feeling of thirst, which, as it happened at a certain period of each series, might be considered as the result of the cutaneous function being considerably increased through the high atmospheric temperature. The quantity of bread, butter and sugar consumed was almost the same every day and determined by weight. The food taken during dinner was weighed as a whole, and consisted of meat (roast or boiled), potatoes, fresh vegetables and pastry. The kind of dishes varied according to the usage of a simple German household. For supper each of us took tea, bread and butter and two eggs, which were likewise weighed, without their shells.

For breakfast and after dinner we took coffee of a fixed strength. The quality and quantity of the food ingested being thus carefully determined, the relative state of metamorphosis of matter was at first studied in each period. The quantity excreted through the kidneys, intestines, skin and lungs was carefully weighed, not only for the whole space of 24 hours, but also separately in the morning, afternoon and night of each day. To obtain a still clearer insight into the process of assimilation, the urine evacuated at certain hours was subjected to a further analysis. Each single urinary evacuation (ten every day) was examined with reference to quantity, color, reaction and specific gravity, whilst the proportions of urea, uric, sulphuric and phosphoric acids, and chloride of sodium were determined only from the whole amount of urine passed during the 24 hours. It was also invariably tested for the presence of any abnormal ingredient (as albumen, sugar &c.). Lastly the varying frequency of the pulse and of respiration (in a sitting posture) was examined as carefully as possible at a fixed hour each day; partly to elucidate the direct influence of the bath



on the circulation and respiration and partly to further appreciate several phenomena connected with the metamorphosis of matter.

For weighing ourselves and all larger quantities of food &c. we made use of an excellent instrument by J. Pintus (of Brandenburg on the Havel). This balance, though charged with a weight of 75 kilogrammes (about 150 pounds) will indicate a further addition of even one gramme (about  $15\frac{1}{2}$  grains). The single solid constituents of urine (with the exception of uric acid) were determined by the triturating method. We employed the excellent triturated solutions of Mr. Oswald Hautz of Dresden, exclusively in the second series of investigations, and partially in the first. No triturating method used for the analysis of urine can possess that degree of exactitude which we should obtain by determining for instance the quantity of sulphuric acid according to the ordinary method (by weight). Nevertheless the several double analyses, together with the uniform *modus operandi* have convinced me, that the numbers we obtained by the triturating method are very near the truth, and especially admit of such exact comparisons as perfectly to answer our purpose.

I greatly regret being unable to communicate our relative bodily temperatures during bathing and drinking. But our time was already so much occupied by the other investigations, that we could not carry on exact measurements of temperature. I hope to supply this deficiency at a future period.

As regards the persons, on whom the observations were made the following short sketch may be useful:

Dr. *Mumm* is 25 years old, with a height of 180 centimetres and a weight of 131 pounds (= 65,5 kilogrammes). During the first period of investigation he suffered with tardiness of intestinal functions. In all other respects he is perfectly healthy.

Dr. *Mannel* is 24 years of age with a height of  $181\frac{1}{2}$  centimetres and a weight of 152 pounds (= 76 kilogrammes). Notwithstanding his robust frame and ruddy complexion he often suffers with congestion to the head and derangement of the liver, as shown by slight icteric symptoms. His intestines inclined to costiveness during the investigations. In all other respects his health was undisturbed at the time.



Mr. *Bartsch*, studiosus medicinae, is 23 years old, 177 $\frac{1}{2}$  centimetres high and weighs 143 pounds (= 71,5 kilogr.). His health is excellent in every respect. Two years ago he passed through a very severe typhus.

As regards B, he is 35 years old, 181 centimetres high, and weighs 125 pounds (= 62,5 kilogr.). He may be considered healthy on the whole, though his abdominal functions are not always performed regularly. His nervous system is less strong than that of my colleagues.

## 1. Effects of the simple warm saline bath of Nauheim

(at a temperature of  $25^{\circ}$  Réaum. =  $88^{\circ}$  Fahr.)

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If a certain determined mode of living be pursued during six days and if in other six days, following the former as near as possible, the very same mode of living be persisted in, we may conclude, that — all other external relations being equal in both periods — if a foreign agent be caused to act on the organism, in the second period : certain differences exhibited by the organism in that second period, must be due to the action of that agent. It is certainly to be admitted, that the human organism never offers exactly the same relations one day as the second day, even under the most identical conditions of life and states of atmosphere. If therefore we designate any of its functions by a number, we have always to reckon upon fluctuations within a certain limit. These small differences between the results of two series of observations cannot be put down a priori as resulting from the action of a foreign agent. In order to arrive at this conclusion the difference must be of a certain magnitude.

In our observations the relations of our organisms were watched during 6 days, whilst pursuing a certain fixed mode of living, and then again during 6 days with the same mode of living and the additional daily use of a warm saline bath of Nauheim (with a temp. of  $25^{\circ}$  Réaum.) during half an hour. The differences observed in our organisms during the second period we had therefore to ascribe to the action of the saline bath, supposing that they exceeded the limits of natural fluctuations, that they corresponded in the three persons, and that they were not caused by disturbing influences.



Unfortunately we did not remain perfectly free from such deranging influences. The change of the atmospheric temperature as well as the irregular action of the alvine functions with Ma. exerted such an influence. However we were enabled to calculate pretty accurately the influence of the higher temperature on the cutaneous function, as also that of the disturbed alvine evacuation on the proportionate weight of the body, and, having regard to this calculation, we arrived at the following principal conclusions with reference to the general effects of a simple saline bath :

1) *The simple saline bath of Nauheim produces in general only little increase or acceleration of organic metamorphosis. But the curve indicating the intensity of metamorphosis at different periods of the day experiences a considerable, and as it appears, very significant change, viz. organic metamorphosis is shown by the following table to be considerably accelerated during the morning (that is : the period of the day in which the bath is taken) but retarded in the afternoon.*

*Total waste of effete organic matter*

a) On the normal experimental days\*).

	from 7 to 1 o'clock	1 to 7 o'clock.	7 to 7 o'clock.	in 24 hours.
by B.	652 Grmm.	892 Grmm.	1188 Grmm.	2732 Grmm.
by Mm.	836 "	990,2 "	949,5 "	2776 "
by Ma.	755 "	885 "	1224 "	2864 "

b) On the bathing days.

by B.	740 G. (+ 88)	882 G. (— 10 G.)	1237 G. (+ 49 G.)	2859 G. (+ 127 G.)
by Mm.	1067 " (+ 231)	976 " (— 14,2 ")	983 " (+ 33,5 ")	3026 " (+ 250 ")
by Ma.	919 " (+ 164)	805 " (— 80 ")	1375 " (+ 151 ")	3099 " (+ 235 ")

\* ) These numbers, as all similar future, ones are calculated at an average of six single numbers (obtained on the six experimental days.)



These numbers however express only very approximatively the true effects of the saline bath, especially as regards its influence on the retardation of organic metamorphosis in the afternoon.

The high atmospheric temperature during the bathing days acted here as a very disturbing agent. For had the cutaneous function not been considerably increased by it, the deficiency in the waste of the afternoon would have been much more considerable. At the same time we may calculate with great certainty, that the increased organic waste solely due to the bath did not amount respectively to + 127, + 250 and + 235 grammes, but only to + 105, + 199 and + 138 grammes. The daily fluctuations of the bodily weight, as occasioned by the varying waste of the organism, are shown by the adjoined graphic drawing. (The weight of the body is marked at 0 every morning at 7 o'clock in each period of investigations.)

2) *The increased organic metamorphosis induced an increased desire for food.*

As regards the consumption of food and beverages we always endeavoured to adapt it to our natural wants, the quantities having been invariably weighed or measured before being taken. The fluids consisted regularly every day in : 470 cc. of coffee with 30 cc. of milk ; 380 cc. of tea with 20 cc. of milk ; 100 cc. of wine and 730—760 cc. of water. We consumed in the normal day on the whole

*B.* daily 1733 gmm. of fluids & 965 gmm. of solids, *total* 2698 grammes.

*Mm.* " 1733 " " " 975 " " " " 2708 "

*Ma.* " 1760 " " " 1102 " " " " 2862 "

Thus the increase of consumption in the bathing days amounted to:

125,142 & 90 grammes as regards fluids, and to

47,103 & 54 " " " solids.

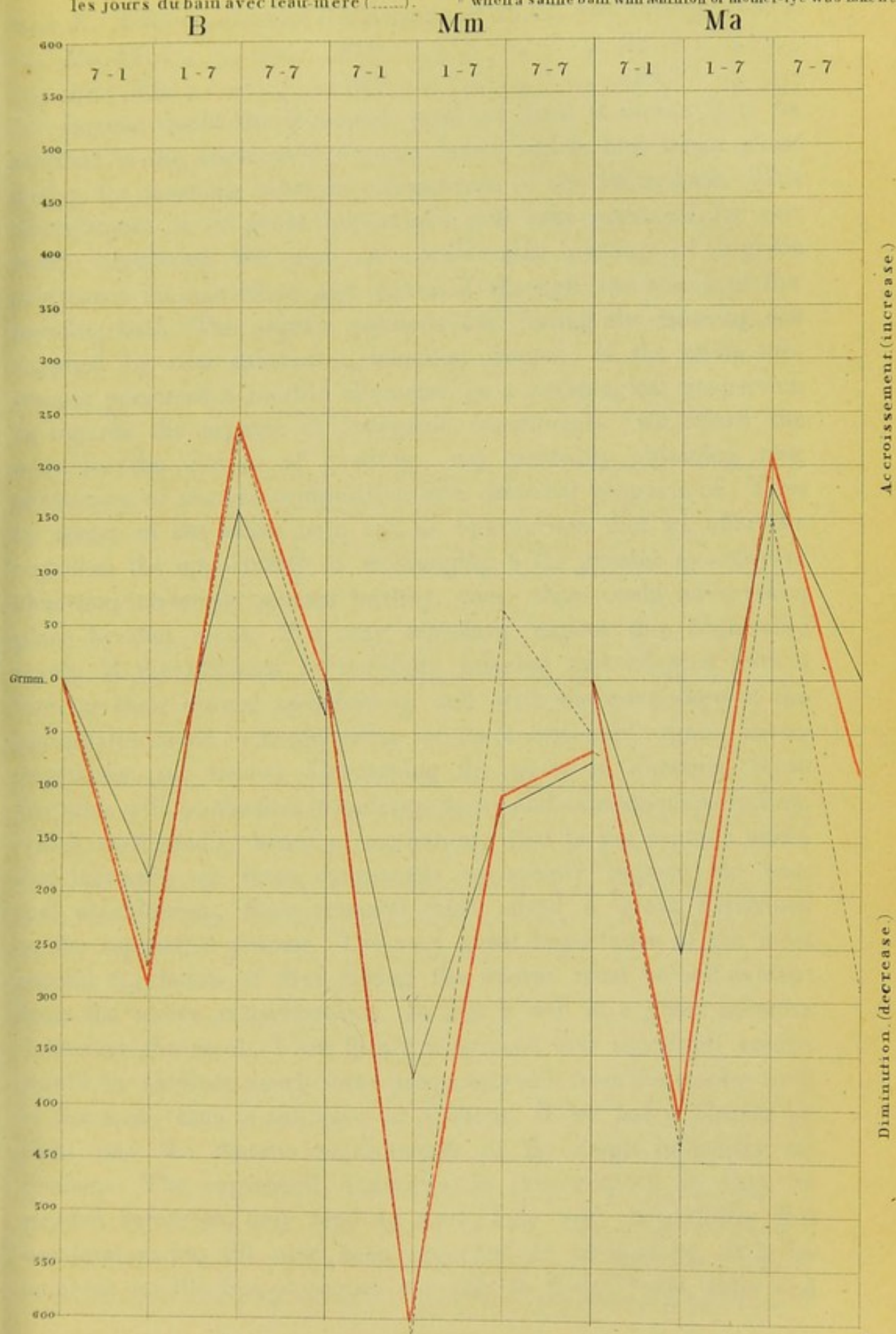
Almost this whole increase took place at dinner (1 p. m.).

*Increase of consumption between 1—7 p. m. during the bathing days:*

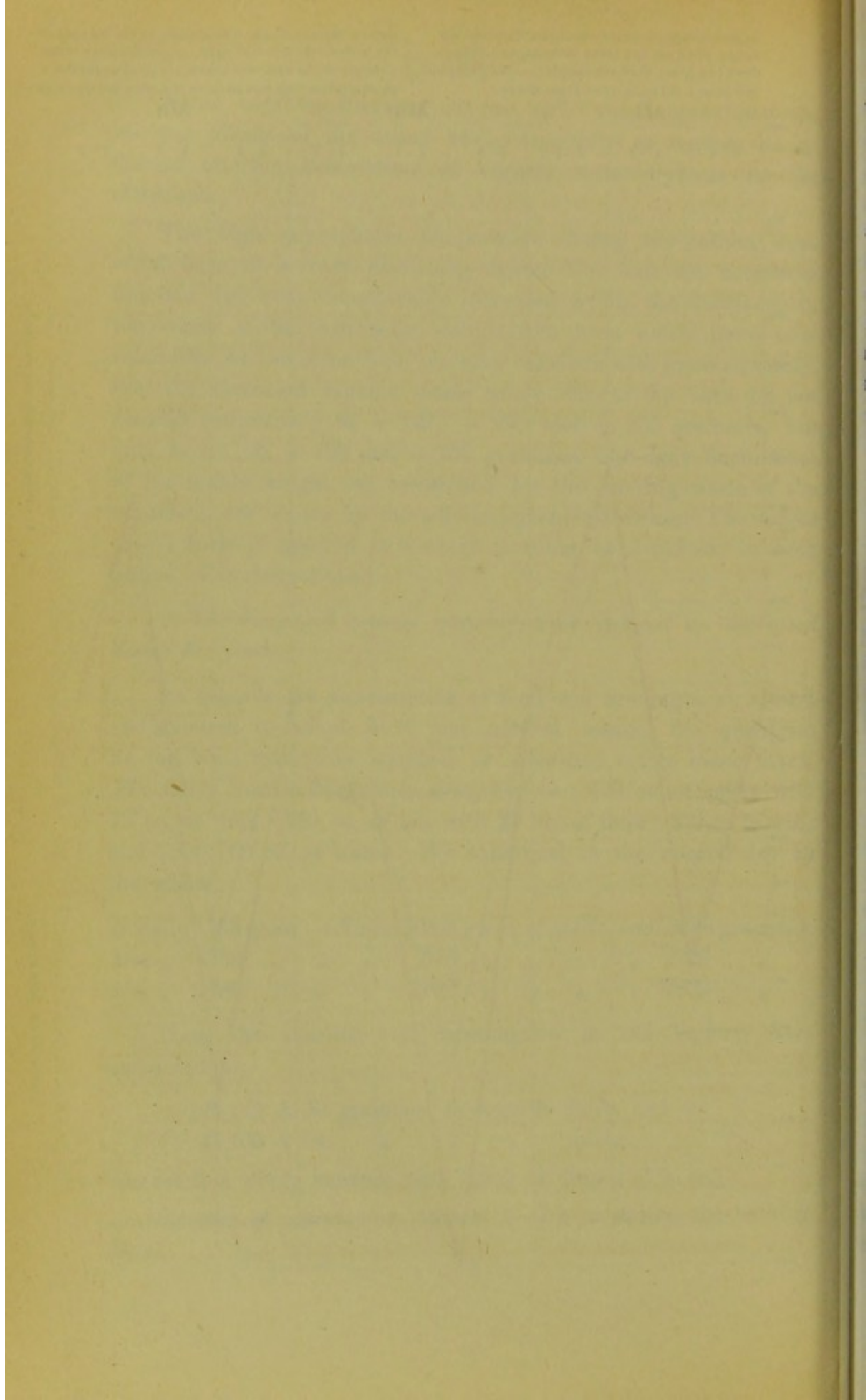


Lignes indiquant les variations du poids du corps pendant les jours ordinaires (—), pendant les jours du bain simple (—), et pendant les jours du bain avec l'eau-mère (.....).

Curves indicating the variations of the weight of the body on the normal days (—), on the days when a simple saline bath was taken (—), and on the days when a saline bath with addition of mother-lye was taken (.....).







with *B.* 108,3 cc. of water & 56,0 gmm. of solids; *total* 164,3 grammes.

" <i>Mm.</i>	141,7	"	"	"	83,9	"	"	"	"	225,6	"
" <i>Ma.</i>	50,0	"	"	"	49,8	"	"	"	"	99,8	"

Beyond doubt the increased want of food at dinner is to be ascribed to the augmented organic waste which had taken place during the morning hours in consequence of the saline bath. This circumstance is of great importance and may serve us for correctly regulating the diet. A considerable portion of organic substances become effete and excreted through the action of the morning bath. The organic portions lost during the morning are supplied by new substances taken at dinner. If the effete substances possessed a morbid character or a pathological proportion as regards the organic or inorganic constituents, we afford the economy the chance of possibly, nay probably obtaining new substances of normal composition and chemical proportions. Thus by means of the saline bath and an appropriate diet we offer the organism the opportunity of exchanging a far greater quantity of abnormal materials against healthy ones, than could have taken place by diet alone. We may especially expect this favourable result, if the aliments be carefully selected and adapted with a view to their normal assimilation, and with the advantage of the phosphates saved in consequence of the accelerated organic metamorphosis (see below). Concerning the waste in question, those particles will be the first to undergo decay and subsequent excretion, which most readily admit of oxydation, that is the organic acids, and inasmuch as these compounds apparently impede the normal assimilation, their removal must afford a great assistance to the reparative process. The very great importance of the most careful regulation of diet during the course must be self-evident from the above considerations. In fact it will in a great measure determine the result. I am firmly convinced that successful results would be obtained much more frequently still from the employment of the spas, than is the case at present, if we had a clearer insight into the dietetic requirements of the single unhealthy organisms. The superficial directions in this respect, as they lie printed before us, only tend to show, how very imperfectly this desideratum has till now been regarded or understood. It is incumbent on the Spa-physician, not only to *forbid* "acid, salty and



other indigestible kinds of food", directions which every intelligent patient may give himself, but to order certain aliments with a view to the individual requirements of each separate morbid frame.

3) *Heightened metamorphosis is principally shown, as a rule, by the increased renal excretions.* As regards the single constituents of the urine, the amount of urea is invariably increased, but to a very small extent; that of phosphoric acid however constantly diminished. The differences in the quantity of uric acid, chloride of sodium, and sulphuric acid are inconstant. These differences are however so inconsiderable that they may be thought of little moment. The above is proved by the following table :

*Average daily excretions:*

a) On the normal experimental days

	through skin & lungs.	through intestines.	through the kidneys						
			quantity of urine.	sum of solid ingredients (according to Trapp).	urea.	uric acid.	phosphoric acid.	sulphuric acid.	chloride of sodium.
by B.	1276 g.	163 g.	1247 CC.	45,17 g.	28,6 g.	0,296 g.	2,67 g.	1,59 g.	11,09 g.
by Mm.	1488 "	105 "	1134 "	48,94 "	31,7 "	0,107 "	3,406 "	1,71 "	9,73 "
by Ma.	1301 "	21 "	1484 "	57,62 "	34,1 "	0,202 "	4,14 "	2,02 "	13,8 "

b) On the bathing days

by B.	1515 g.	178 g.	1121 CC.	45,47 g.	29,46 g.	0,288 g.	2,39 g.	1,43 g.	11,16 g.
by Mm.	1553 "	109 "	1312 "	52,37 "	33,99 "	0,009 "	3,20 "	1,77 "	10,97 "
by Ma.	1564 "	122 "	1355 "	57,34 "	37,2 "	0,250 "	3,62 "	2,12 "	12,9 "



With reference to the numbers furnished by the above table we have to offer the following remarks concerning the *cutaneous, pulmonary and renal* excretions. During the bathing days the cutaneous functions were invariably *increased*: viz.

with *B.* to the amount of 239 grmm.

" *Mm.* " " " " 65 "

" *Ma.* " " " " 263 "

It was otherwise as regards the renal function, which showed *decrease* with *B.* and *Ma.* *increase* with *Mm.*

viz. decrease of 126 cc. with *B.*

increase of 178 cc. with *Mm.*

decrease of 129 cc. with *Ma.*

Considered by themselves these numbers would lead to the conclusion, that the increased organic waste, due to the saline bath leaves the organism *either* through the skin *or* through the kidneys. But if we take into account the heightened atmospheric temperature, already alluded to, this conclusion only becomes conditionally correct, and we have to modify it thus : *It depends on certain circumstances, whether the particles prepared by the saline bath for excretion leave the economy principally through the medium of skin and lungs, or principally through the kidneys.* Thus we could not determine, whether the saline bath promotes by itself a predominant increase of renal or cutaneous function. As different modes of excretion took place during the bathing days, though we all three lived in a similar manner; as besides, notwithstanding the higher atmospheric temperature and consequent increased cutaneous function, considerable increase of renal excretion took place with *Mm.*, we may conclude in general that *individual differences* have exercised their influence here. We must assume in the present case, that the saline bath had a peculiar diuretic effect on *Mm.*, so that his cutaneous function was not as much increased by the higher temperature, as was the case with *B.* & *Ma.* But I even dare to draw a further conclusion. It is proved by the considerable increase of renal function with *Mm.* and the further circumstance, that even under the use of mother-lye baths (as will be shown below) cutaneous excretion was not increased, nay constantly diminished on the contrary, whilst the renal



function was as constantly augmented: *That the saline bath occasions by itself either no or only a very inconsiderable increase of cutaneous excretion.* Though opposed to generally received opinions and apparently unjustified by the above table, this conclusion will find confirmation if we consider the relations of the quantity of urine and cutaneous and pulmonary excretions at the different periods of those days, in which the saline baths were taken. Our investigations furnished the following results:

### Excretions

#### a) on the normal experimental days

	through the kidneys			through skin & lungs		
	from 7 in the morning to 1.	from 1 to 7 afternoon.	from 7 to 7 evening till morning.	from 7 to 1.	from 1 to 7 afternoon.	from 7 to 7 evening till morning.
by B.	305,1 Gm.	433,0 Gm.	554,5 Gm.	347,2 Gm.	424,6 Gm.	504,3 Gm.
by Mm.	444,8 "	353,9 "	384,5 "	391,5 "	577,7 "	518,9 "
by Ma.	467,1 "	429,0 "	647,2 "	288,7 "	455,9 "	555,7 "

#### b) on the bathing days

by B.	435,8 Gm.	312,9 Gm.	418,5 Gm.	304,1 Gm.	569,3 Gm.	640,4 Gm.
by Mm.	654,9 "	308,6 "	400,5 "	376,3 "	615,9 "	560,9 "
by Ma.	595,4 "	299,6 "	519,3 "	315,1 "	505,7 "	741,8 "

The above numbers clearly show, that just during that period of the day, in which the bathing took place (in the morning) when metamorphosis rose highest in consequence of the saline bath, the renal function was invariably increased, but not the cutaneous and pulmonary excretions.



The cutaneous and pulmonary excretions (between 7 a. m. and 1 p. m.) was decreased with B. by 43,1 gm.

„ decreased with Mm. „ 15,2 gm.

„ increased with Ma. „ 26,4 gm.

*The renal excretions* (water and solid constituents) on the contrary experienced during the same period :

with B. an increase of 130,7 gm.

with Mm. an increase of 210,1 gm.

with Ma. an increase of 128,3 gm.

No disturbing influences took place during this period of the day, in the second series of experiments; all vital relations were the same, the saline bath was the only addition. Can we therefore arrive at any other conclusion but this: that the saline bath chiefly promotes the renal functions. The proportions observed during the afternoon and evening do not oppose this conclusion. They must in my opinion be exclusively considered as due to the heightened atmospheric temperature.

*The renal excretions* experienced during the bathing days:

from 1 to 7 in the afternoon,				from 7 evening to 7 morning,			
with B.	a decrease of	120,1	gmm.	with B.	a decrease of	136,0	gmm.
„ Mm.	„ „	45,3	„	„ Mm.	an increase „	16,0	„
„ Ma.	„ „	129,4	„	„ Ma.	a decrease „	127,9	„

During the same days *the cutaneous and pulmonary excretions* experience :

from 1 to 7 in the afternoon,				from 7 evening to 7 morning,			
with B.	an increase of	144,7	gmm.	with B.	an increase of	136,1	gmm.
„ Mm.	„ „	38,21	„	„ Mm.	„ „	42,0	„
„ Ma.	„ „	49,8	„	„ Ma.	„ „	186,1	„

These proportions must be considered as purely vicarious. The high atmospheric temperature forces the skin to increase its excretion, and substances which would otherwise be transferred to the kidneys for elimination, are now partially used for the former organ. If then these proportions do not invalidate the above conclusion, whilst the results observed during the morning hours, serve as a decided confirmation of it I feel justified in stating the following opinion : *the increased organic waste due to the saline bath is chiefly excreted by the kidneys, and only under*



*peculiar or particularly favouring influences (as high atmospheric temperature) it finds its outlet in a greater or less degree through the skin.* But it must be distinctly stated that this only refers to the sum total of excreted materials. Our further communications will make it appear as highly probable that the excretion of carbonic acid through the skin and lungs becomes increased in consequence of the saline bath. If notwithstanding this circumstance the sum total of cutaneous and pulmonary excretion be not increased, it clearly follows, that a proportion of water corresponding in weight to the increased excretion of carbonic acid must be removed from the organism through another channel (the kidneys).

The other numbers speak for themselves and require no further explanation, for they tell us : that the acceleration of metamorphosis, as caused by the saline bath, is *on the whole* inconsiderable at least in as far as can be judged from the quantitative proportions of the urinary constituents. One circumstance however must be noticed; viz. the *diminished excretion of phosphoric acid*. Under the influence of the saline bath, thus the organism gains that amount of phosphoric acid. I will add here, that according to the latest researches made by Dr. Wimmer of Rothenfelde on the effects of the saline bath, this diminished excretion of phosphoric acid *is exclusively due to a diminished excretion of the phosphate of lime, and not to a diminution of the excretion of phosphates of alkalies or of phosphates of magnesia*. We meet here again with a confirmation of the view formerly asserted by me\*) viz. that certain kinds of accelerated metamorphosis occasion a diminished excretion of phosphoric acid and more especially of phosphate of lime. The important relation of phosphoric acid (and especially of phosphate of lime) to the process of assimilation (formation of tissues) gives this observation a peculiar weight. This lessened waste of phosphoric acid plays no doubt an important part in the efficacy of the saline bath, influencing the nutrition of the organism and consequently *the relative weight of the body*.

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\*) S. F. W. Beneke on the physiology and pathology of phosphate of lime, Göttingen 1851; History of the development of oxaluria: Göttingen 1852; on the effects of the North-Sea baths. Göttingen 1854.



If any agent promotes metamorphosis in such a manner as to increase proportionally every excretion, the weight of the body will remain unaltered as long as a corresponding increase of ingested food takes place. If the supply fails to cover the increase of waste, the weight of the body will necessarily decrease. But if the ingested food exceeds the waste, the weight of the body *may possibly increase*. But it *may quite as well decrease*, for it is proved, that luxurious living forms an impediment to the process of metamorphosis, so as actually to diminish the weight of the body, as I have shown by former experiments (oxalic acid being imperfectly oxydised, the phosphates of the earths are excreted in a morbidly increased proportion and the assimilation or formation of tissue consequently impaired). But if an agent increases all the excretions with the exception of that one so necessary for the assimilation of new tissues, viz. phosphoric acid and its combinations: this retention of phosphoric acid in the system must occasion a different relation as regards the nutrition and weight of the body. If during the employment of the agent in question the ingested food exactly corresponds to the waste, the weight of the body can scarcely be expected to increase. — Nevertheless the gain of phosphates will benefit the organism for the future time. It can not be indifferent as regards the *quality* of the newly formed tissues, which have to substitute the effete particles, and it will promote *the further assimilation of tissue*, after the employment of the agent in question ceases. If, however, under these circumstances the supply exceeds the waste only in a small degree, there is every reason to expect an increase of organic assimilation, that is *increase* of weight, and that this may in fact take place under the influence of the simple saline bath, I shall proceed to prove. The soil of the agriculturist offers many analogies to the human organism. The agricultural operations for the production of certain fruits tend to establish a *necessary proportion of the constituents* of the soil. The waste of certain ingredients has to be diminished, whilst others are to be increased by deliquescence and manuring etc. Many of our Spa-cures have a very similar tendency. Like the air and baths of the North-Sea the warm saline bath seems to promote the gain of phosphates in the organism.



This theoretical reasoning is apparently unsupported by our experiments. B. experienced an absolute gain of weight of 10,8 gmm. per day during the bathing days, and relatively to the normal experimental days a proportionate daily increase of 44,8 gmm. But Mm. and Ma. suffered an absolute daily diminution of weight viz. 73,5 and 94 gmm. respectively and a relative diminution of 5,7 and 91,8 gmm. But these proportions of weight were most probably due with B. and Mm. to an increase and decrease of the water contained in the organism, and with Ma. to the increased alvine secretions in the second series of experiments. A decided decrease of 91 gmm. of substance would have been demonstrated by a greater increase of the excretion of urea. But though our investigations in question did not throw a light on this circumstance, I have obtained the requisite information by *carefully determining the weights of the patients* who had resorted to Nauheim. From these the following results were arrived at:



Name, sex and age.	Disease.	Remedies employed.	Days of first & second weighing.	Weight at first & second period	Difference of weight.
Mrs. Sch. 23 years of age.	Amenorr- hoea. Sterilitas. Polysarcia.	25 saline baths.	5th of June to 17th of July. 42 days interval.	104 pounds 200 gmm. 96 pounds.	decrease of 8 pounds 200 gmm.
Mr. V. 32 years of age.	Eczema chronic.	36 sal. baths in 16 of which mother lye was added; 12 to 18 ounce of Curbr. daily.	27th July to 25th Aug. 29 days.	144 pounds 225 gmm. 138 pounds 224 gmm.	decrease of 6 pounds 1 gmm.
Mr. K. 33 years of age.	Atrophia muscul. neurot. irreg.	21 saline baths; whey; occasionally Curbrunnen.	3d July to 25th July. 22 days.	133 pounds 208 gmm. 130 pounds 200 gmm.	decrease of 3 pounds 8 gmm.
Mary S. 14 years of age.	Blephara- denitis. Scrophu- losis.	32 saline baths (24 of which with addition of mother lye).	21th May to 19th June. 29 days.	83 pounds 20 gmm. 80 pounds 50 gmm.	decrease of 2 pounds 470 gmm.
William T. 11 years of age.	Angina ton- sillaris. Difficult hearing.	32 sal. baths 11 of which with addit. of mother lye 19 times 6 ounce of Curb.	22th June to 23th July. 31 days.	47 pounds 270 gmm. 46 pounds 30 gmm.	decrease of 1 pound 240 gmm.
Otto S. 11 years of age.	Chlorosis. Debil. gener. (ex scrophul)	17 saline baths Schwalheim water. Whey for 10 days.	20th May to 19th June. 29 days.	61 pounds 146 gmm. 59 pounds 450 gmm.	decrease of 1 pound 196 gmm.
Charles B. 8 years of age.	Congenital cataract. Scrophu- losis.	26 saline baths.	19th July to 20th Aug. 32 days.	50 pounds 270 gmm. 49 pounds 110 gmm.	decrease of 1 pound 160 gmm.
Francis M. 6 years of age.	Debil. general. (scrophulos.)	15 saline baths.	19th July to 17th Aug. 29 days.	38 pounds 455 gmm. 38 pounds 216 gmm.	decrease of 239 gmm.



Name, sex and age.	Disease.	Remedies employed.	Days of first & second weighing.	Weight at first & second period.	Difference of weight.
Minna S. 9 years of age.	Indurat. lob. sup. pulm. sin. Scrophul.	23 saline baths.	21st May to 19th June. 29 days.	40 pounds 102 gmm. 39 pounds 444 gmm.	decrease of 158 gmm.
James R. 11 years of age.	Atrophia evolutionis extrauterin. Polypionia.	28 saline baths.	21st May to 23d June. 33 days.	37 pounds 112 gmm. 36 pounds 457 gmm.	decrease of 155 gmm.
Mathilde H. 11 years of age.	Scrophulos. Anchylosis ex femoro- coxalg. Abscess. chronic.	27 saline baths.	6th July to 10th Aug. 1857. 35 days.	41 pounds 485 gmm. 41 pounds 466 gmm.	decrease of 19 gmm.
Emil W. 8 years of age.	Kyphos. Pott. ex insult. mechanic Scrophulos.	about 18 saline baths and daily 8 to 10 ounces Curbrunnen.	14th July to 8th Aug. 1857. 25 days.	39 pounds 366 gmm. 39 pounds 366 gmm.	No change.
Fanny S. 8 years of age.	Kyphos. Pott. Chlorosis.	27 saline baths.	12th July to 15th Aug. 34 days.	28 pounds 333 gmm. 28 pounds 351 gmm.	increase of 18 gmm.
Mr. F. 40 years of age.	Caries in articul. pedis.	28 saline baths (in 23 mother-lye was added). Schwalheim water.	4th Aug. to 5th Sept. 32 days.	91 pounds 230 gmm. 91 pounds 255 gm.	increase of 25 gmm.
Ann v. K. 4 years of age.	Eczem. impetig. Scrophulos.	30 saline baths. Occas. Curbrunnen.	11th June to 16th July. 35 days.	32 pounds 410 gmm. 32 pounds 460 gmm.	increase of 50 gmm.
Mathilde H. 12 years of age.	Scrophulosis &c.	32 saline baths.	5th July to 9th Aug. 1858. 35 days.	46 pounds 225 gmm. 46 pounds 365 gmm.	increase of 140 gmm.



Name, sex and age.	Disease.	Remedies employed.	Days of first & second weighing.	Weight at first & second period.	Difference of weight.
Sophia S. 5 years of age.	Eczem. chronic.	18 saline baths Curbrunnen daily.	23d May to 19th June. 29 days	26 pounds 482 gmm. 27 pounds 205 gmm	increase 223 gmm
Augustus B. 6 years of age.	Scrophu- losis. Chlorosis.	22 saline baths.	19th July to 20th Aug. 32 days.	39 pounds 360 gmm. 40 pounds 140 gmm	increase 280 gmm.
Charles W. 12 years of age.	Scrophu- losis. Chlorosis (formerly Epilepsia.)	18 saline baths; 8 to 16 ounces whey daily.	17th Aug. to 9th Sept. 23 days.	53 pounds 280 gmm. 54 pounds 100 gmm.	increase 320 gmm.
Sophia v. K. 3 years of age.	Scrophu- losis. Ophthalmia.	18 saline baths; 4 to 6 ounces Cur- brunnen for 6 days.	11th June to 16th July. 35 days.	26 pounds 450 gmm. 27 pounds 320 gmm.	increase 370 gmm.
William W. 11 years of age.	Slight de- gree of scrophu- losis.	28 saline baths with a small addi- tion of mother-lye.	7th July to 2d August 26 days.	60 pounds 315 gmm. 61 pounds 215 gmm	increase 400 gmm
William H. 13 years of age.	Slight de- gree of scrophu- losis.	28 saline baths twice Curbrunnen 19 times whey.	30th June to 27th July. 27 days	58 pounds 360 gmm. 59 pounds 270 gmm.	increase 410 gmm.
Lucas B. 6 years of age.	Olecranar- throcae. Scrophu- losis.	19 saline baths occas. Curbrunnen	3d Aug. to 7th Sept. 35 days.	34 pounds 145 gmm. 35 pounds 145 gmm.	increase 1 pound.
Emil W. 9 years of age.	Kyphosis Pott. &c.	28 sal. baths (24 with add. of mother- lye) daily 6 to 18 ounces whey.	7th July to 2d Aug. 1858. 26 days.	42 pounds 10 gmm. 42 pounds 30 gmm	increase 1 pound 20 gmm.



Name, sex and age.	Disease.	Remedies employed.	Days of first & second weighing.	Weight at first & second period.	Difference of weight.
Mr. A 40 years of age.	Laryngitis chronic.	28 sal. baths (10 with add. of mother- lye) 6 to 18 ounces Curbrunnen.	12th June to 10th July. 28 days.	142 pounds 66 gmm. 143 pounds 101 gmm.	increase 1 pound 35 gmm.
Maurice L. 15 years of age.	Spondylar- throcace.	28 saline baths.	1st to 16th Aug. 16 days.	48 pounds 215 gmm. 49 pounds 283 gmm.	increase 1 pound 68 gmm.
Miss H. 25 years of age.	Rheumatis- mus vagus.	28 saline baths. Occas. Curbrunnen.	9th July to 11th Aug. 33 days.	107 pounds 33 gmm. 108 pounds 175 gmm.	increase 1 pound 142 gmm.
Mr. M. 19 years of age.	Angina faucium. Baryaecoea.	30 sal. baths (17 with mother-lye) 6 to 15 ounces Curbrunnen.	17th June to 18th July 31 days.	114 pounds 410 gmm. 116 pounds 120 gmm.	increase 1 pound 210 gmm.
Mary B. 9 years of age.	Slight degree of Scrophu- losis.	24 saline baths.	19th July to 20th Aug. 32 days.	59 pounds 140 gmm. 60 pounds 395 gmm.	increase 1 pound 255 gmm.
Joseph K 12 years of age.	Scrophu- losis. Baryaecoea.	26 saline baths 6 to 8 ounces Curbrunnen for 23 days.	17th June to 14th July 27 days.	54 pounds 35 gmm. 55 pounds 305 gm.	increase 1 pound 270 gmm.
Max H. 11 years of age.	Scrophu- losis.	34 sal. baths 3-4 ounces Curbrunnen for 24 days.	30th June to 2d Aug. 33 days.	63 pounds 310 gmm. 65 pounds 160 gmm.	increase 1 pound 350 gmm.
Mr. S. 29 years of age.	Paresis ex- trem. infer. ex affect. rheumat. in- tegument. medull spin.	16 saline baths.	18th July to 6th Aug. 19 days.	88 pounds 320 gmm. 90 pounds 223 gmm.	increase 1 pound 403 gmm.



Name, sex and age.	Disease.	Remedies employed.	Days of first & second weighing.	Weight at first & second period.	Difference of weight.
Charles V. 8 years of age.	Scrophu- losis.	28 sal. baths twice Cur- brunnen 8 to 15 ounces whey 25 times.	17th June to 13th July 26 days.	43 pounds 282 gmm. 45 pounds 240 gmm.	increase 1 pound 458 gmm.
Gustavus K. 14 years of age.	Scrophu- losis in a high degree.	31 saline baths 9 to 18 ounces Curbrunnen daily.	22d June to 24th July. 32 days.	102 pounds 430 gmm. 105 pounds 390 gmm.	increase 2 pounds 460 gmm.
Mr. R. 34 years of age.	Scrophu- losis.	20 sal. baths (14 with add. of mother- lye) 8 to 12 ounc. Curbr. 18 times.	14th Aug. to 4th Sept. 21 days.	122 pounds 160 gmm. 125 pounds 200 gmm.	increase 3 pounds 40 gmm.
Miss H. 26 years of age.	Rheumatis. Tubercul. pulmon. incip.	18 sal. baths 24 times whey and Schwalheim water.	19th July to 20th Aug. 32 days.	101 pounds 320 gmm. 104 pounds 455 gmm.	increase 3 pounds 135 gmm.
Mr. G. 26 years of age.	Pityriasis. Scrophu- losis.	24 sal. baths 25 times 4 to 16 ounces Curbrunnen, 12 times whey.	12th Aug. to 5th Sept. 25 days.	102 pounds 33 gmm. 105 pounds 225 gmm.	increase 3 pounds 192 gmm.
Mr. B. 16 years of age.	Scrophu- losis. Neuromata	27 sal. baths (15 with add. of moth.-lye) 6 to 9 ounces of Curbr. 26 times.	31st July to 9th Sept. 40 days.	105 pounds 45 gmm. 108 pounds 420 gmm.	increase 3 pounds 375 gmm.
Eliza S. 13 years of age.	High degree of Scrophu- losis after an acute disease pro- bably with tuberculosis in the apex of the right lung.	28 saline baths; daily 8 to 12ounc. of whey.	6th July to 13th Aug. 38 days	60 pounds 40 gmm. 64 pounds 355 gmm.	increase 4 pounds 305 gmm.



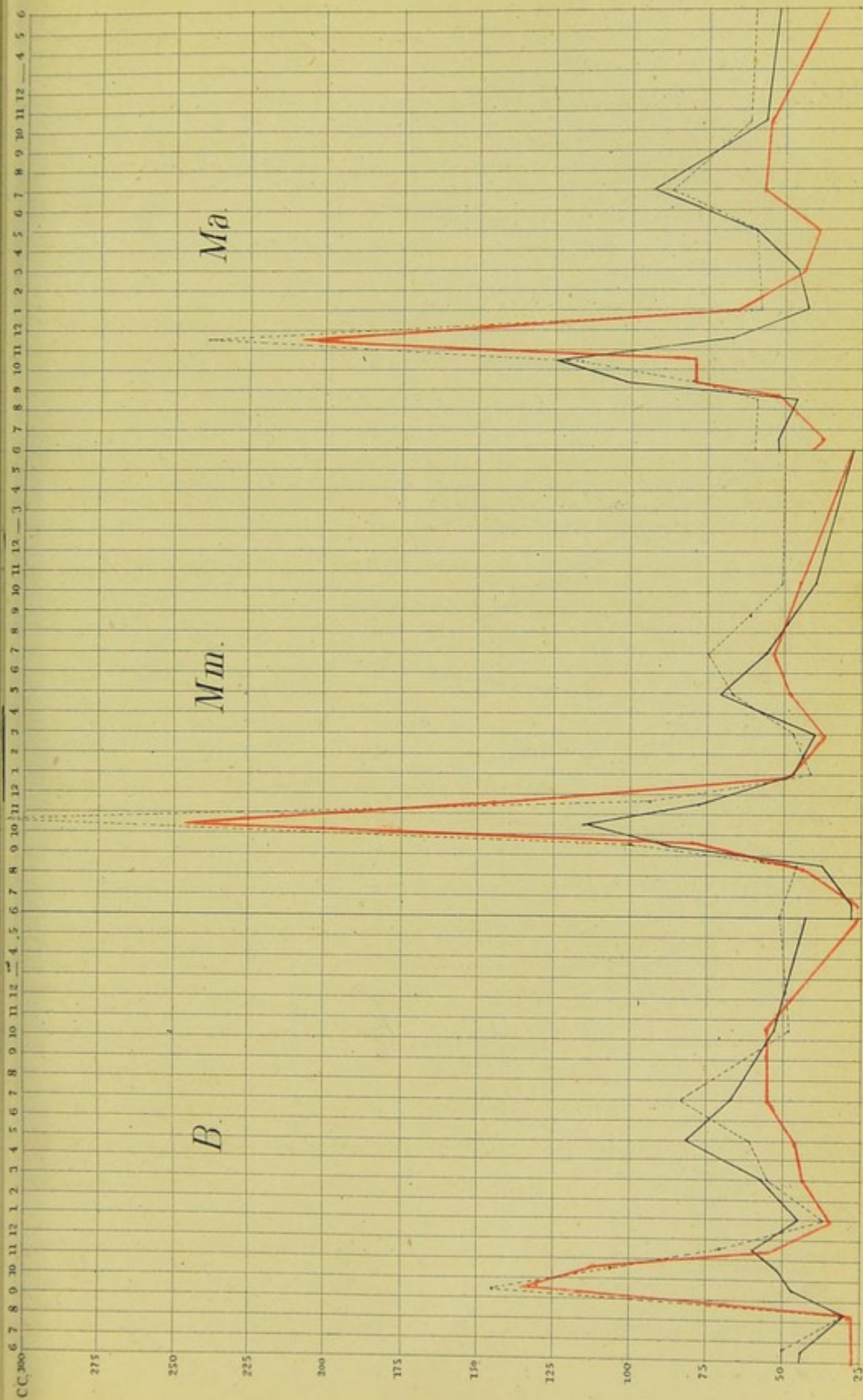
These observations made with all due care (in reference to dress, period of the day etc.) certainly show the weight of the body not to be invariably or exclusively influenced by the saline baths in the same way. But we are justified in the conclusion that *the saline bath does not impede the body in increasing its weight nor favour the increase in every instance.*

Even if we exclude all those cases in which the difference of weight only amounted to 250 gmm. (which might possibly depend on accidental circumstances), a sufficient number remains to justify the above conclusion and I confidently assert, that the quantity of phosphate of lime gained by the organism through the saline baths, is of the highest importance, as regards the increase of weight of the body. It is the gain of phosphate of lime which probably plays the most considerable part in the cure of scrophulous ulcers, caries of bones etc. brought about by the use of the saline baths.

4) *The curves representing the solid ingredients of the urine, excreted hourly, are subject to considerable variations in consequence of the use of the saline bath.*

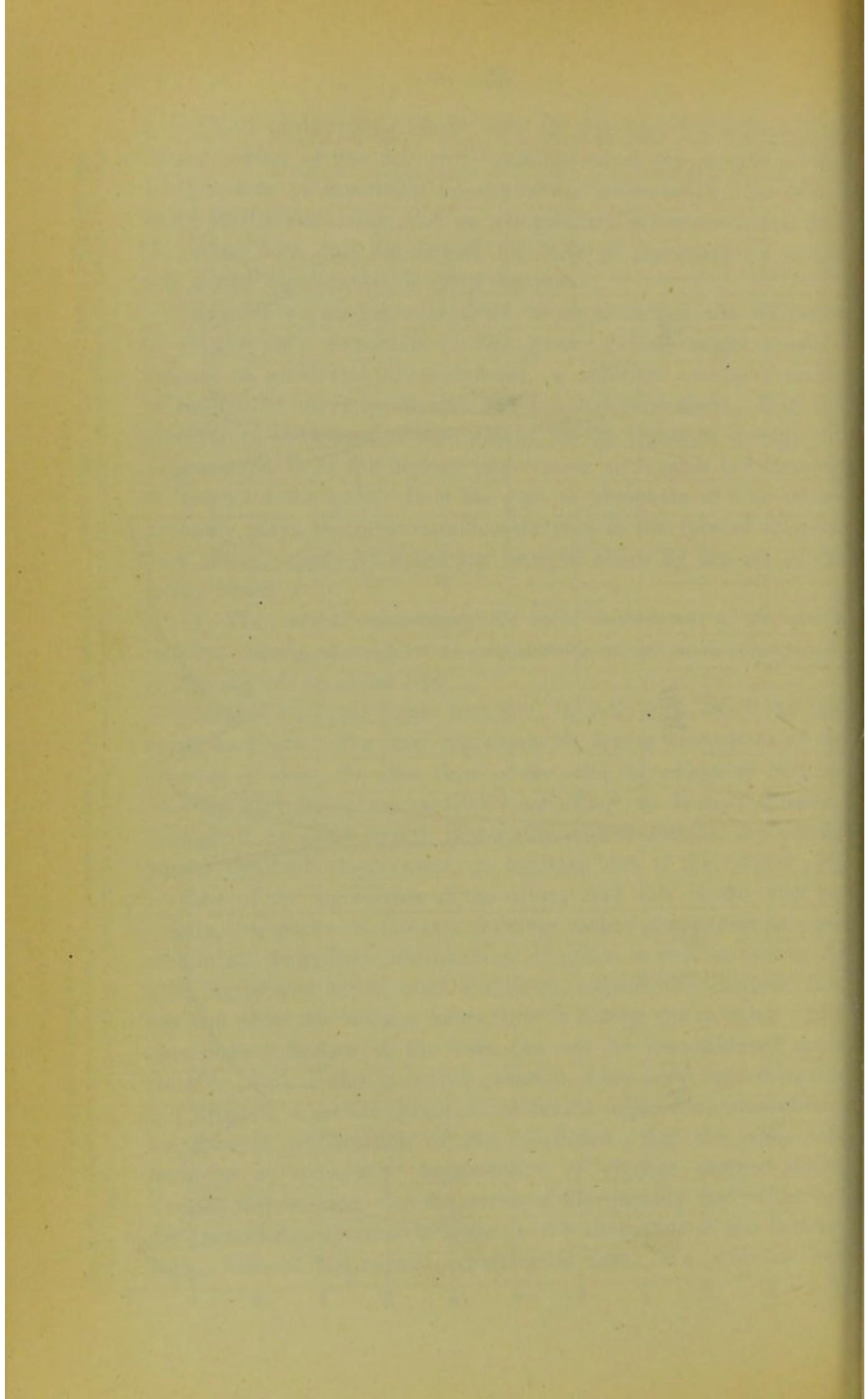
Instead of many single numbers, I will only allude to two curve-drawings. The one represents *the hourly fluctuations of the quantity of urine, the other those of the solid ingredients of that excretion.* The latter are calculated according to Trapp's formula. Though it does not furnish thoroughly correct results, we obtain by its constant employment an accurate idea of the *relative proportions* of the ingredients of the urine, and this is the chief requisite. A glance at the two drawings makes it apparent at once that in all three cases the quantity of urine, as well as that of its solid ingredients experienced a uniform, considerable increase during and after the bathing hours, that is during the morning. The immediate influence of the bath can not be demonstrated more clearly. And if the increased quantity of the solid ingredients of the urine is a certain proof of increased organic metamorphosis, we have a confirmation of the conclusion, that *the saline bath produces an immediate augmentation of organic metamorphosis.* Besides this we find, that the curve of the quantity and of the solid ingredients of urine is lower in the afternoons of the bathing days, than of the normal experimental days. We will lay less



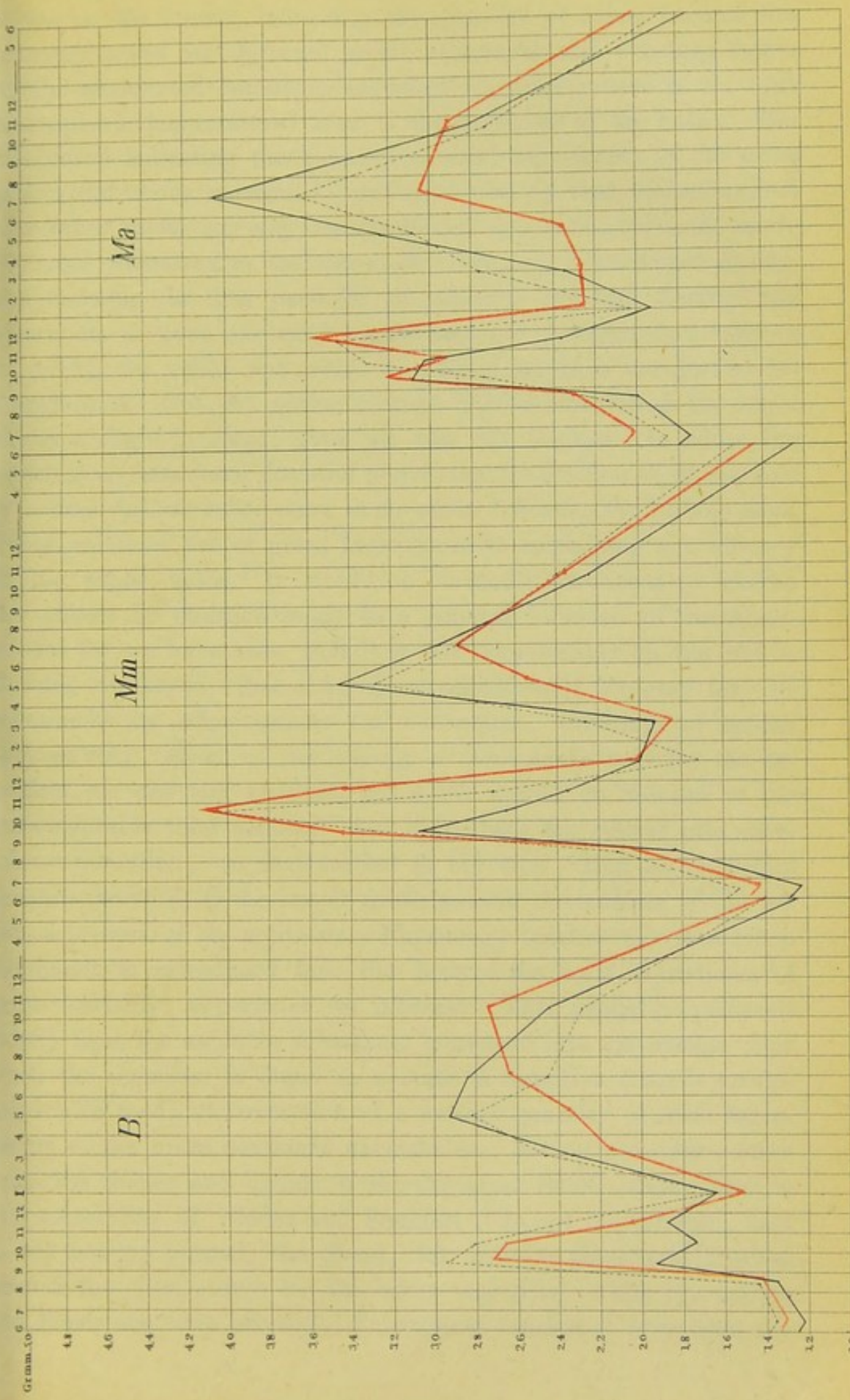


Lignes indiquant les variations de la quantité des urines évacuées par heure pendant les jours ordin. (—), p.l.j. du bain simple (—), et p.l.j. du bain avec l'eau-mère (-----).  
 Curves indicating the hourly fluctuations of the quantity of urine, (Normal days, —, simple saline bath, —, saline bath with add. of mother-lye = -----)



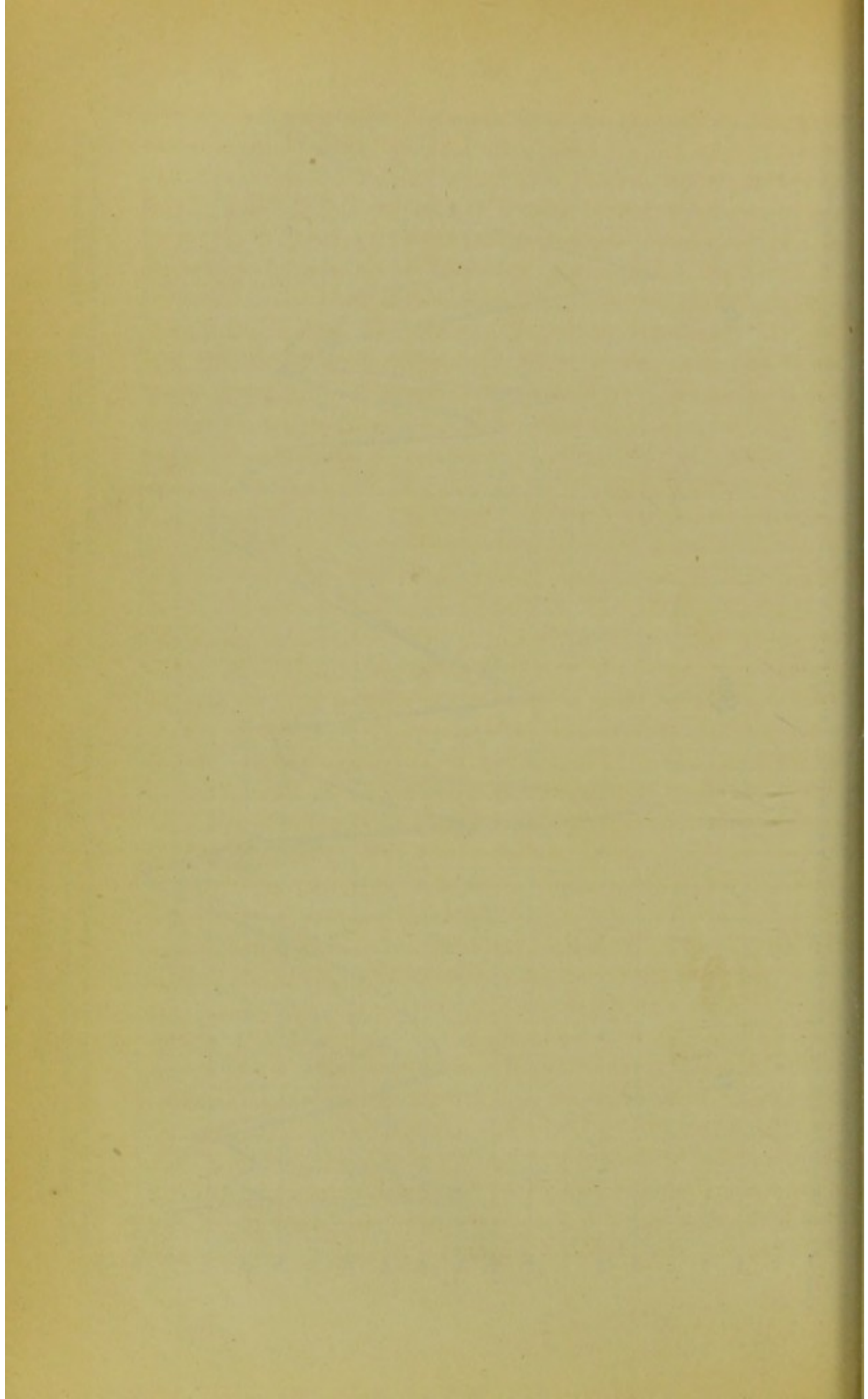






Lignes indiquant les variations de la quantité des parties solides des urines évacuées par heure, pendant les jours ordin. (—), p.l.j. du bain simple (—), et pendant les jours du bain avec l'eau-mère (-----).  
 Curves indicating the hourly fluctuations of the solid constituents of urine. (Normal days, —; simple saline bath, —; mother-lye, -----)







stress on the curves, indicating the quantity of urine, because this quantity owed its decrease in the afternoons and evenings rather to the augmented cutaneous excretion (in consequence of the high atmospheric temperature) than to the influence of the baths. But the curve indicating the quantity of solid ingredients of the urine places the above sentence beyond all doubt, viz. that, if a *saline bath was taken in the morning, metamorphosis was increased in the morning and decreased in the afternoon*. The loss experienced during the morning is thus partially or entirely repaired during the afternoon, or even exceeded by the increase. As regards the hours of night, we could not arrive at a fixed result in our former investigations. But the curve of solid ingredients during the night shows a slight increase, thus we can not hesitate, to adopt the conclusion (considered doubtful above) that *decidedly a slight increase of metamorphosis takes place in the nights following the bathing days*. These relations are of great importance in explaining the efficacy of the saline baths. It would be decidedly erroneous to ascribe the effects in question *solely* to a general increase of metamorphosis, for we have seen, that it is not considerable on the whole. Besides we know, that a far more considerable increase may be occasioned by other means (as water-cure, drinking of saline-springs etc.). Even to the saving of phosphoric acid for the organism we can not attribute too much weight on account of the inconsiderable total amount. But if we take the curves into careful consideration, we shall be led to the view, that *an important curative point is to be sought in the greater fluctuations of the nutritive process of the organism*. Physiology teaches us, that when nutriment is introduced into the body, the solid ingredients of urine speedily experience an increase. This probably proceeds chiefly from the oxidable substances conveyed into the system. But when the organism is found in a state of inanition (that is unsupplied with food), the excretion of a certain quantity of solid ingredients of the urine continues nevertheless, having no other source than the tissues and liquids of the organism itself. According to the researches of Bidder and Schmidt it is not improbable, that in the healthy animal, the blood, fat, cellular tissue and muscles furnish the chief source for the effete materials, while the nerves and bones are only affected, if inanition reaches a very high de-



gree and even then the decrease is scarcely perceptible. Our normal experimental days showed, that the organism entered into a slight degree of inanition during the forenoon even with our ordinary diet. But if in addition a saline bath was taken for half an hour, the body decreased still more in weight (by 88,232 and 164 gramm. respectively) so that the total decrease of bodily weight amounted in the morning to 280,5, 620,8 and 413 gramm. respectively. Proportionately with this the solid ingredients of urine increased in the same period. By means of the method of Trapp the numbers obtained were:

a) in the normal days

B.	M.	Ma.
10,75 gmm. —	14,8 gmm. —	15,4 gmm.

b) in the bathing days

12,52 gmm. —	18,03 gmm. —	17,6 gmm.
difference + 1,77 gmm.	+ 3,02 gmm.	+ 2,2 gmm.

It is clear, that this bodily decrease and the additional amount of solid ingredients excreted with the urine (though only calculated approximatively) during the morning hours, can have no other source, but the destruction of a certain quantity of organic substance. Thus we may form the conclusion, *that in consequence of the saline bath taken in the morning a greater amount of bodily substance is transformed into effete material and excreted, than in those days, in which no baths were taken.*

The practical consequences of those data found by our experiments were already discussed above. Now it is true, that we possess a number of other agents, increasing the metamorphosis as well as the saline baths; these agents likewise seem to induce a partial saving of phosphates in the organism. At least I may assume this as regards sea-air according to my own experiments on its effects. But the sea-air excites the nervous system during the whole day; cold water deprives the organism of warmth and does not agree with many digestive organs; bodily exercise occasions a greater consumption of power, and in both latter instances the excretion of phosphoric acid does not seem diminished, but rather increased. The saline bath acts differently from each of those agents. It imparts a stimulus to the metamorphosis by the



excitation of the nervous system; its immediate effects are ended in a few hours; it does not induce an increase of consumption of power. A short time however after its employment it allows the organism a corresponding restitution of the lost materials. And as this restitution may include a replacement of morbid materials by normal ones if the ingestion of nutriments be carried out very carefully and judiciously, we may possibly influence thereby the morbid economy most successfully. Thus we arrive to a correct knowledge, as it seems, of the special and different effects of the saline baths from others and similar agents.

Further experiments will have to show, what resemblance simple warm baths may have in their action to the warm saline baths, with their additional great quantity of carbonic acid. If on the other side anybody would be of opinion that inanition could by itself produce the same effect as the saline baths, he would be doubly mistaken, for in the first instance this state does not occasion an acceleration of metamorphosis in a given time, and on the other hand it is invariably accompanied by debility of the organism, whilst the saline bath prevents this condition through its stimulating effect on the nervous system.

5) *The frequency of the pulse becomes immediately diminished through the effect of the simple saline baths of Nauheim. Besides the curve indicating this frequency during the whole day is indirectly influenced in a very significant manner.*

Through observations made on 50 to 60 patients and others the author has established the positive fact, that in the bath itself a decrease of the frequency of the pulse by 2—10—20—25 beats per minute *unvariably* takes place. As regards however this frequency in the other periods of the bathing days, the following conclusions may be drawn:

1) If it be assumed as a fact, that the warm (31—32° Cels.) saline bath, with its carbonic acid produces a direct diminution of the frequency of the pulse, it seems equally certain, that this diminution yields to an absolute increase of frequency in those hours, which immediately follow the bath.\*)

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\*) If the bath be taken near noon, as was the case with Ma., the generally increased frequency of pulse during that period of the day was more intense than usually, in the bathing days.



2) The frequency of the pulse during the afternoon of the bathing days is absolutely and not inconsiderably higher, than on the normal days.

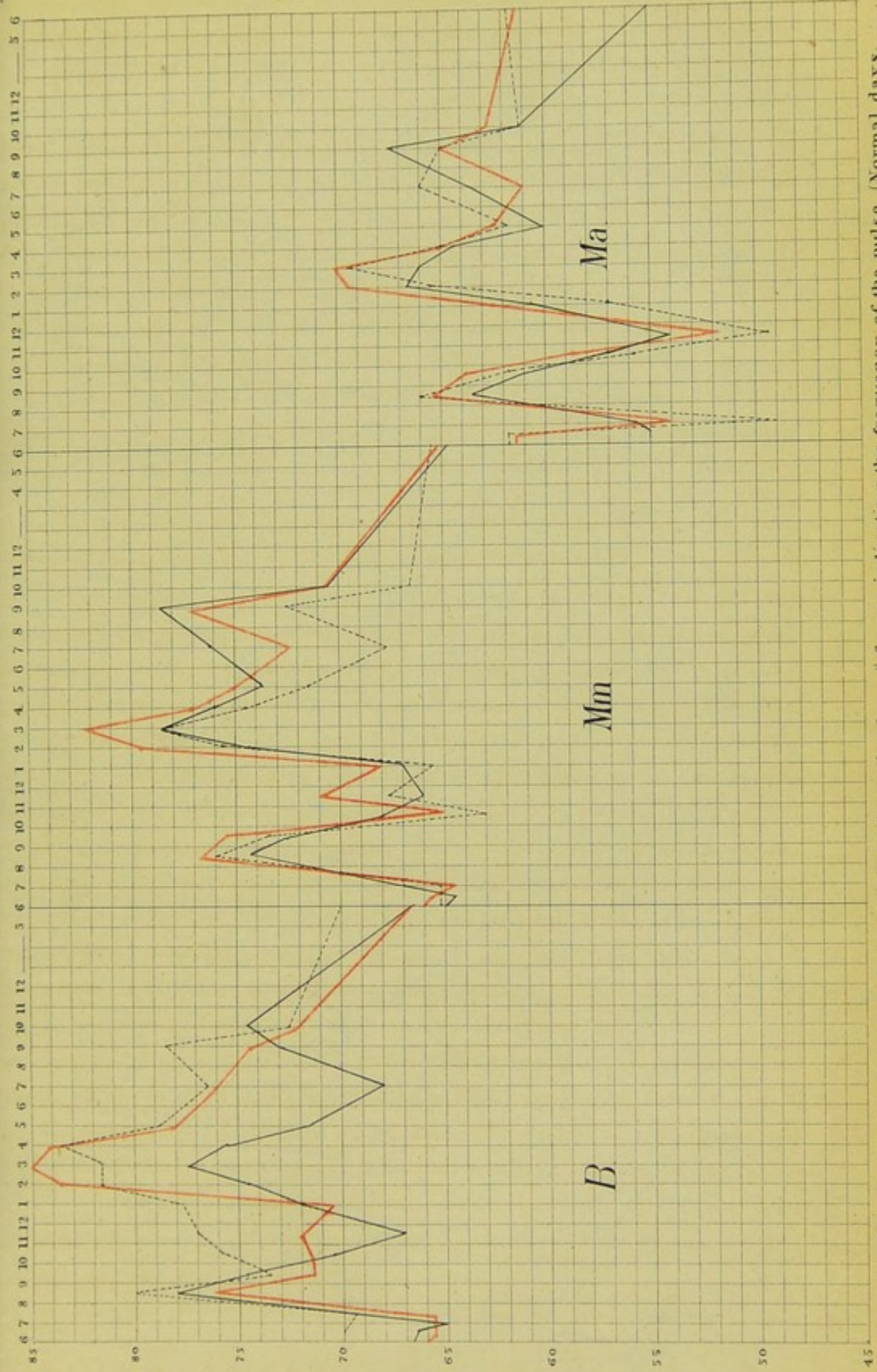
The details are shown by the graphic drawing.

It is well known, and at first established through the experiment of E. H. Weber, that irritation of the Vagus causes retardation of the contractions of the heart, whilst an obstruction of its action produces acceleration of the heart's movement. As then the whole surface of the body experiences an unusual irritation in the warm saline bath, it is more than probable, that this irritation is communicated to the central nervous system and perhaps especially to the ramification of the Vagus. Thus the cutaneous irritation in itself might become a cause of the retarded frequency of the pulse.

The irritation of the central part of the nervous system, through the action of the saline bath on the skin is indeed placed beyond all doubt.

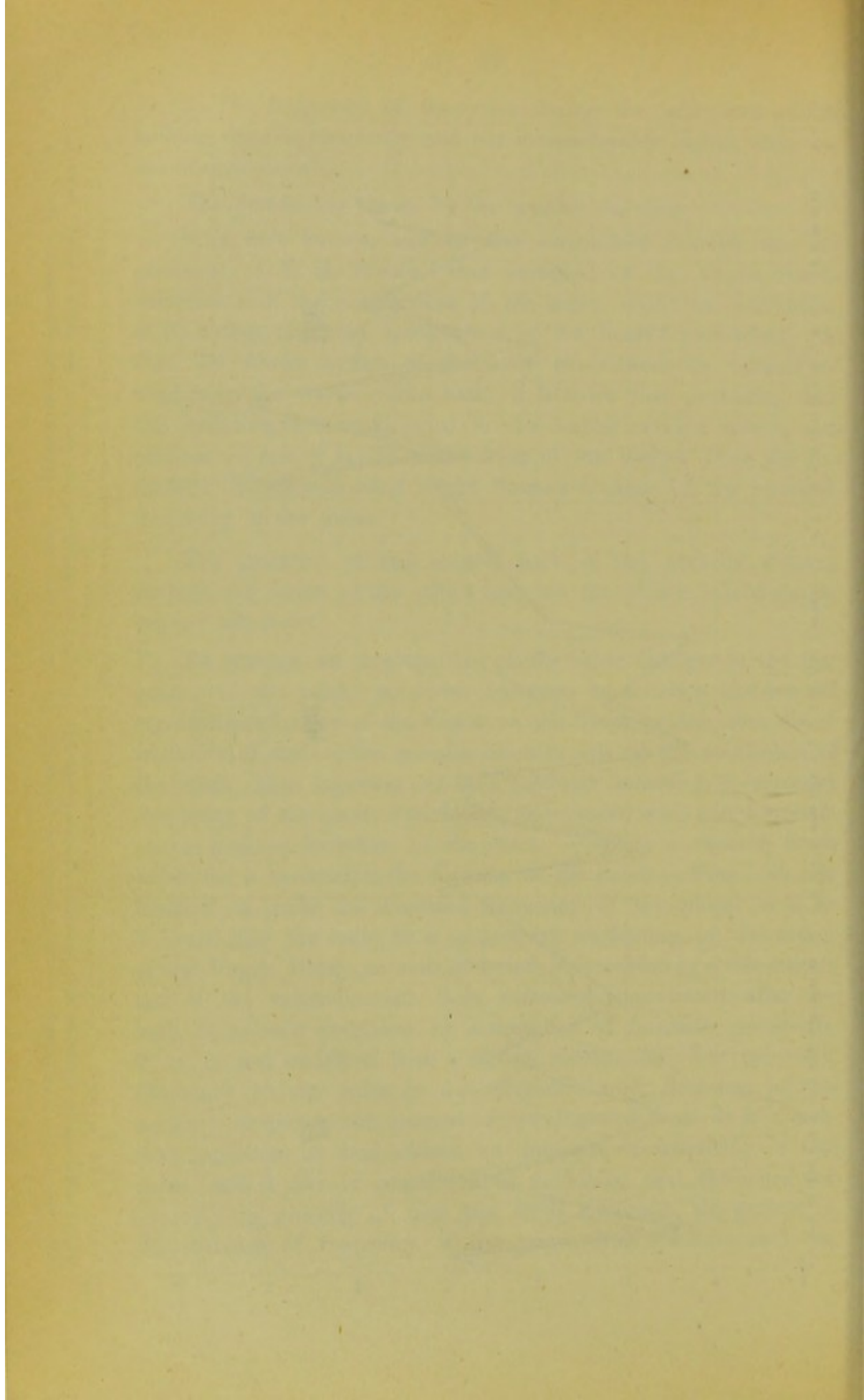
To attempt an explanation of the other changes in the frequency of the pulse, we have, however, to consider besides the regulating influence of the Vagus on the heart's action, that direct irritation of the cardiac ganglia likewise acts on the movement of the heart. Thus ingestion of food produces immediately increased frequency of the pulse. The blood impregnated with new materials causes a direct irritation of the heart. — Thus a twofold cause exists for a variation in the function of the heart. — Now I do not hesitate to refer the increased frequency of the pulse for 2 or 3 hours after the baths to a momentary weakening of the action of the Vagus. Every nervous irritation is succeeded by a relaxation; and if the valetudinarian feels refreshed immediately after the bath, he is soon overtaken by a sensation of lassitude, especially if he is not endowed with a strong constitution. The increased frequency of the pulse in the afternoon may, however, on the contrary be put to the account of the ingested food. It is a fact, that ingestion of food causes an increase of frequency of the pulse, and it may be considered as doubtless, that the more the economy is wanting of new and fresh materials, the greater is this increase of frequency of the pulse. Now we have seen the



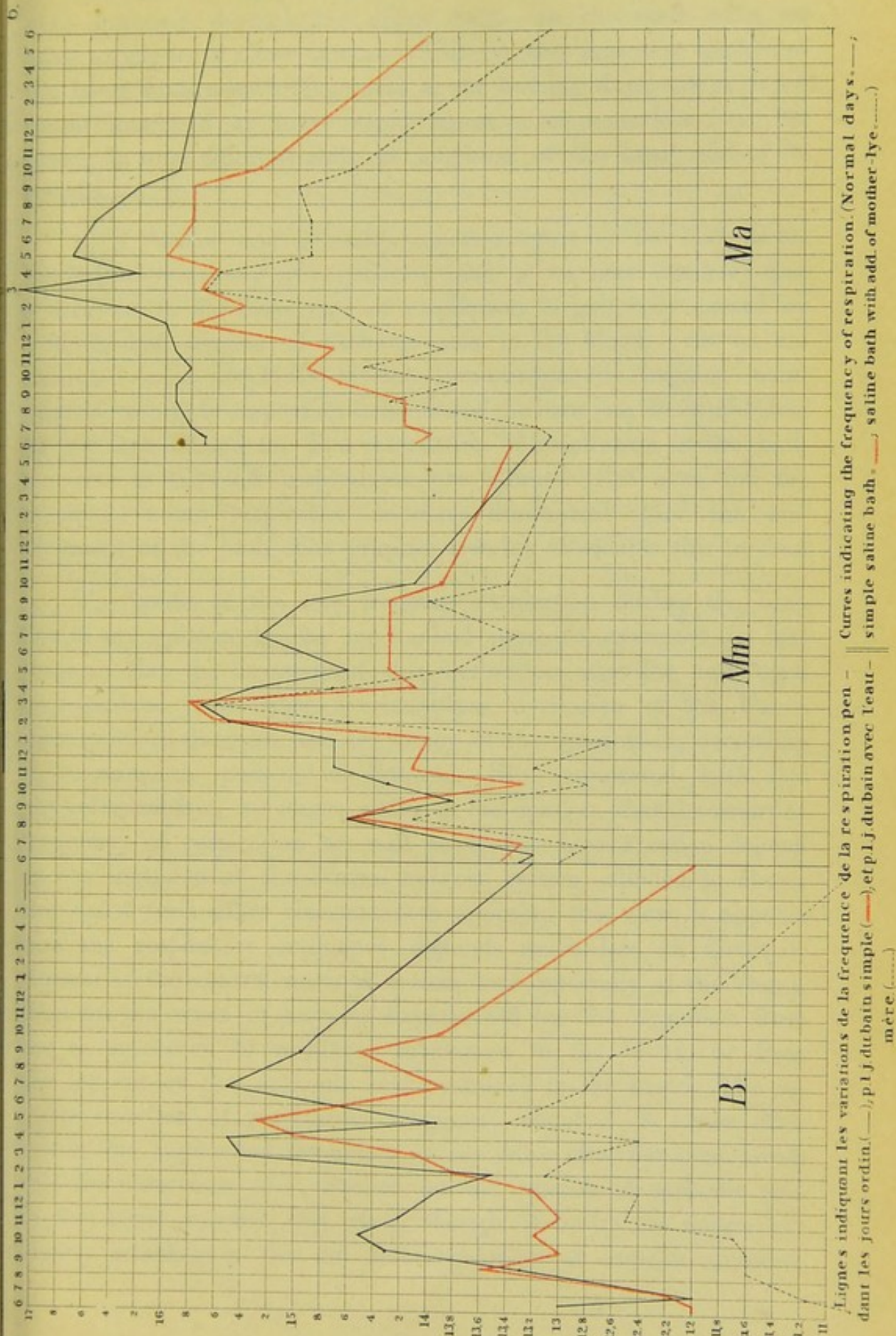


Lignes indiquant les variations de la fréquence du pouls pendant les jours ordin. (—), pl. j. du bain simple (—), et pl. j. du bain avec l'eau-mère (---). Curves indicating the frequency of the pulse. (Normal days. —, simple saline bath. —, saline bath with add of mother-lye. ---.)

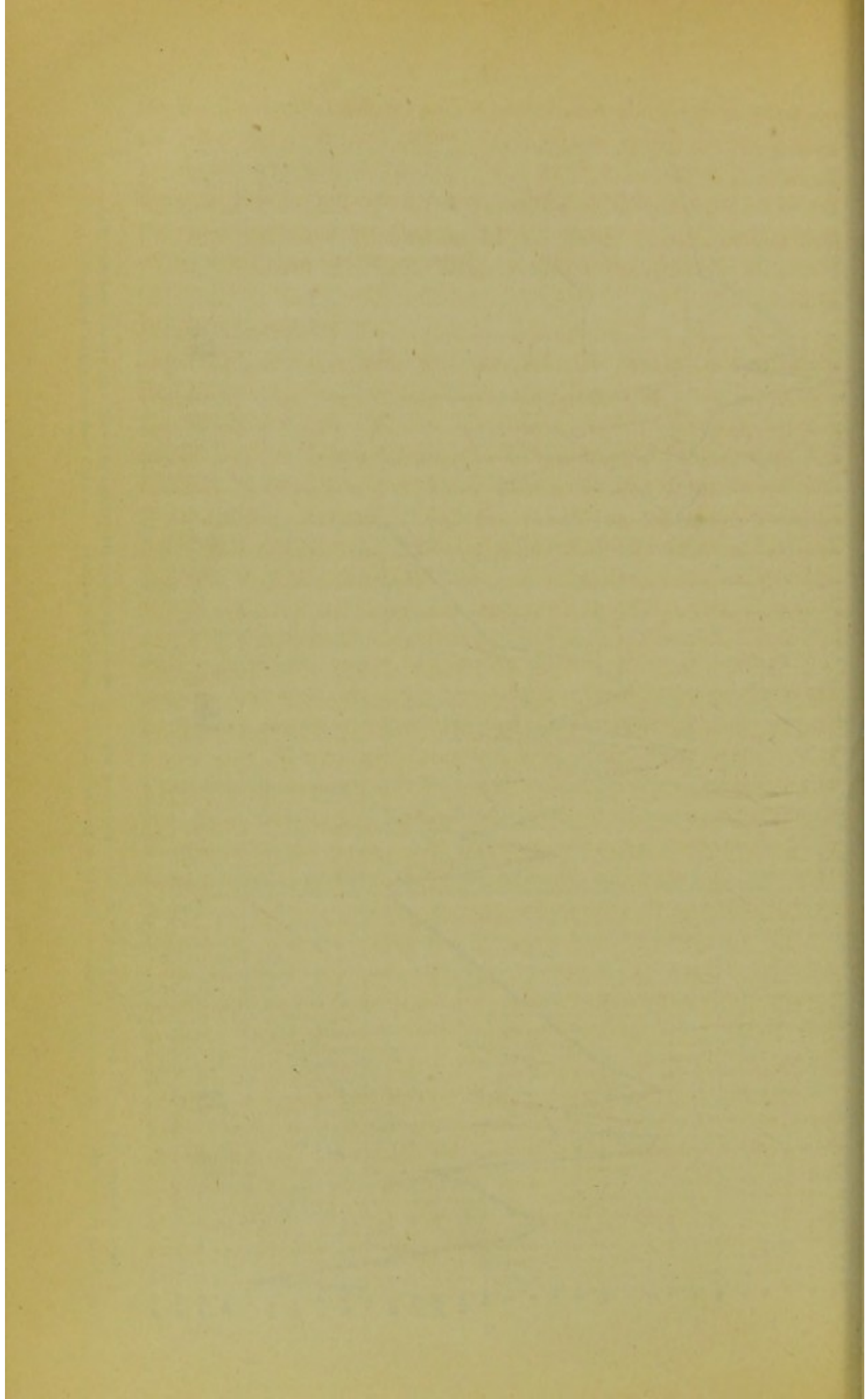














ordinary state of inanition between breakfast and dinner considerably increased through the saline baths. In the same ratio we have to expect a more intense effect on the muscular power of the heart from a satisfying meal at the bathing days, either owing to an increased or more rapid ingestion of materials into the blood, or to a different state of nutrition of the heart and of its ganglia.

6) *A further and probably constant effect of the bath is the diminished frequency of respiration*, and if we may assume, that a decrease in the frequency of respiration is generally caused by a diminished tension of carbonic acid in the blood, (viz. an accelerated metamorphosis of the non-nitrogenous organic compounds) a highly important influence of the bath may be established by the fact alluded to. The retardation of respiration in the bath amounts to 0,3–1,3 respirations per minute. But even for the whole 24 hours respiration becomes diminished after the employment of the bath. The graphic drawing elucidates this further.

The cause of the less frequent respiration during the bath lies in my opinion in the mechanical pressure exercised on the thorax. But the duration of this diminution after the bath must be explained from other considerations. Irritation of the Vagus may possibly diminish the frequency of the respiration, according to experiments undertaken hitherto. Still connected with this physiological fact, we might arrive at the opinion, that the retarded frequency of respiration as well as of the heart's action depend on the irritation of the central nervous system, alluded to above. But apart from other circumstances opposing this view, it appears that the respiratory frequency depends much less on direct irritation of the central nervous system and especially of the Vagus, than on the want of oxygen experienced by the organism from the accumulation of oxydable substances in the blood, or from the tension of the carbonic acid contained in the blood. The regular increase of respiratory frequency about 2–3 hours after meals, the augmented frequency of the pulse after the same meals and the researches of E. Becher on the tension of carbonic acid in the blood support this view, though it is by no means yet clearly established, that an increased want of oxygen promotes



the respiratory frequency. But if we assume the above explanation to be correct, we can easily understand the decreased respiratory frequency after the saline bath. The organic metamorphosis being directly accelerated by it, the disposable molecules have experienced an increased change. Thus the organism is less in want of oxygen after the bath than in the same periods of a non bathing day and thus respiration need not be performed quite as frequently as usual. \*)

It is not impossible, however, that the decreased respiratory frequency may be due likewise to an increased excretion of carbonic acid through the skin in consequence of the saline bath; nay, I am very much inclined to believe this to be the case. Unfortunately, however, it was not possible to determine the amount of carbonic acid excreted through the lungs and skin. Thus the question remains open. With regard to the diminished tension of carbonic acid in the blood during the bathing-course in general, I may add, that in many patients suffering at the commencement of the course with foetid breath, I found a gradual diminution of this unpleasant symptom during the use of the baths. I may consider this as a confirmation of my view. I firmly believe, that the symptom alluded to must exclusively be ascribed to a retarded metamorphosis of organic non-nitrogenous acids (as lactic, acetic, butyric acid, &c.), so as to cause their excretion through the mucous membrane of the lungs. Now we can hardly have any doubt, that if the blood be overloaded with these substances the tension of the carbonic acid in the blood must consequently be greater, as it ought to be in the normal state, it being well understood, that

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\*) Virchow has lately found, that after the cold sea bath the frequency of respiration and pulse becomes likewise diminished. As the temperature of the body becomes lowered, he does not form any decision on the above diminished frequency. Single experiments have shown to me, however, that in the warm saline bath (31—32° Cels.) the temperature of the body experiences a slight decrease. The decrease of temperature in the mouth amounted in the first 5 minutes of the bath to 0,6°—0,4° Cels., in the last 20 minutes to 0,1° Cels. In Virchow's experiments the temperature diminished in the sea bath by 1,6°—2° Cels. I can not coincide in regarding this slight diminution of temperature, as the cause of the diminished frequency of the pulse and prefer to adopt the view expressed above.



all these substances are converted into carbonic acid and water in the regular course of their metamorphosis. On the other hand, in the same ratio, the diminution or accelerated metamorphosis of those substances must cause a diminution of the quantity of carbonic acid contained in the blood, and as the former very probably takes place during the bathing-course, the latter will follow as a consequence.

I am very well aware of the hypothetical character of these explanations. But I wish only to direct the attention of my colleagues to the object, believing myself, that it may form a very important part in the explanation of the efficacy of the bath.

An abnormal quantity of organic acids and their retarded oxydation especially prevails with persons of a weak nervous system and also with gluttons. No doubt the assimilation process of the organism must be impeded thereby. Perhaps the hypothetic "acrimonies" of the older physicians may be partially due to these substances. Out of numerous practical observations I might feel justified in drawing the conclusion, that the pathological increase of the above acids especially impedes the formation of coloured blood corpuscles, whereby a chlorotic condition is induced. The interesting observation lately made of an accumulation of these acids in leucaemic blood serves as a confirmation. However, this is not the place to enter more deeply into considerations of this kind; I may only repeat, that we must not forget to pay attention to the object in question, which, though of the greatest importance, has been totally neglected hitherto in the investigation of the effects of the saline bath. \*)

7) *The effect of the simple saline bath is not caused by absorption of saline particles, nor of water in the bath.* For it is proved by careful investigations, in regard to which the reader is referred to the original German work of Dr. Beneke,

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\*) It needs scarcely to be remarked, that the non-nitrogenous organic acids arise as well from the nitrogenous as from the non-nitrogenous food. The latest chemical researches furnish very interesting results in this regard. According to these the Glycocoll is to be considered an amido-acetic acid, the Leucin as an amido-capronic-acid, and a compound, analogous to Leucin, discovered by Gorup-Besauz about 2 years ago in the pancreas, as amido-valerianic acid.



1) that no chloride is imbibed in the bath, at the utmost some carbonic acid;

2) that very little or no water is imbibed by the body in the bath. This is shown by comparing the quantity of water absorbed and excreted in both periods of examination (p. 95—96 of the orig. work), and from the weight of the body before and after the bath (p. 98). The highest proportion of water taken up in the bath may amount to 32 grammes (p. 99), and to this small amount we can certainly not attribute the effects of the saline bath.

If then the saline bath does not produce its effects by the absorption of water, nor of the ingredients contained in it, we can only explain the results observed : *from its action on the nervous system* in consequence of the irritation of the cutaneous nerves. All the other functional changes may be readily explained from this primary action.



## 2. On the effects of the warm saline bath with the addition of mother-lye.

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Not content with the irritation produced by the simple saline bath on the cutaneous nervous system, frequent attempts were hitherto made to heighten its effects by the addition of mother-lye. No doubt the irritation becomes more intense, but no clear view was formed as regards its direct action. To obtain this, it was necessary to investigate the effects of this addition on the healthy organism. We therefore took for 6 days baths with mother-lye, after having taken simple saline baths for 6 days previously. We added to the first three baths 6 litres, to the 4th 9 litres, to the 5th and 6th again 6 litres of mother-lye. The mode of life remained the same as on the other experimental days. We were fortunate enough in this 3d series of experiments, to obtain an atmospheric condition pretty similar to that of the normal experimental days.

Only one anomaly, caused by intestinal constipation of Ma. during the first series of experiments, forced us to make a correction in the third series for comparison's sake with the first (see German edition). After this correction we arrived at the following results :

1) *The effect of the mother-lye-bath differs in general according to the higher or lower degree of resistance offered by the nervous system.* If this is powerful enough to tolerate a considerable irritation of the cutaneous nerves, nearly all effects produced by the simple saline bath will be heightened. But if the nervous system does not possess sufficient power to resist this increased irritation, general and special symptoms of overexcitement and



debility will appear, which of course will neutralise every good result, that might have been obtained from the simple saline bath.

2) If the irritation produced by the mother-lye-baths is well adapted to the individual using it, *metamorphosis in general becomes accelerated*, and besides the curves of the daily variations of the weight of the body obtain a similar and not inconsiderable modification, analogous to those resulting from the simple saline bath. — The increased metamorphosis, however, under the use of the mother-lye-bath is by no means considerable. It may be shown approximatively by the following numbers. Whilst during the simple saline bath an increased consumption of 47,103 and 54 grammes of solid substances was necessary to repair the loss of effete materials, an increase of 99,108 and 83 grammes respectively was necessary during the mother-lye-bath, a difference not very considerable. The variation in the amount of fluids can not be taken into account, as it depended on the different cutaneous function, which was particularly high during the simple bathing days. Further elucidation is found in the following table :

*Total consumption by the organism*

a) On the normal experimental days.

	from 7 a. m to 1. p. m.	from 1 to 7. p. m.	from 7 p. m to 7 a. m.	Total in 24 hours.
by B.	652 Grmm.	892 Grmm.	1188 Grmm	2732 Grmm.
by Mm.	836 "	990,2 "	949,5 "	2776 "
by Ma.	755 "	885 "	1224 "	2864 "

b) On the days of the mother-lye-baths.

by B.	750,5 G. (+ 98,5)	810,9 G. (— 81,1)	1263,5 G. (+ 95,5)	2824,96 G. (+ 92,9)
by Mm.	1082,7, (+ 246,7)	733,8, (— 256,4)	1150,3, (+ 200,8)	2966,8, (+ 190,8)
by Ma.	952,9, (+ 197,9)	804,8, (— 80,2)	1464,3, (+ 240,3)	3222, (+ 358)



The table speaks for itself. Only a possible error must be mentioned. It might seem as if the *retardation* of metamorphosis was greater in the afternoons of the mother-lye-baths, than of the simple saline baths. But this is not the case. For the difference is accounted for by the high temperature of the simple bathing days, causing increased excretions of the skin in the afternoons.

The diminished waste amounted :

	B.	Mm.	Ma.
a) in the afternoons of the simple bathing days .	— 10 gmm.	— 14,2 gmm.	— 80 gmm.
b) in the afternoons of the mother-lye-baths . .	— 81,1 "	— 256,4 "	— 80,2 "
Difference	+ 71,1 gmm.	+ 142,2 gmm.	+ 0,2 gmm.

Without the disturbing atmospheric influence in the simple bathing days such great differences would not have appeared, and we are therefore not justified, to conclude from the numbers obtained, that metamorphosis is more retarded in the days of the mother-lye-baths than in the days of the simple saline bath. Nay, we further observed that in the afternoons of the mother-lye-baths the excretion of the solid urinary constituents was not only not diminished in comparison with that of the simple bathing days, but even increased, and it becomes therefore very improbable, that a retarded organic metamorphosis takes place in the afternoons of the mother-lye-baths.

3) The increased metamorphosis in general is here also shown by a *greater want of food and by a decidedly augmented renal excretion*, which causes a diminution of the cutaneous and pulmonary excretions. With regard to the solid urinary constituents it is *urea and sulphuric acid which constantly experience a somewhat more considerable increase, than in the saline bathing days, whilst uric acid and chloride of sodium appear in a rather diminished quantity in the urine.*

These proportions are clearly elucidated by the following table :



*Daily excretions*

a) In the normal experimental days:

	through skin & lungs.	through intestines.	through the kidneys						
			quantity of urine.	sum of solid constit.	urea.	uric acid.	phosphoric acid.	sulphuric acid.	chloride of sodium.
by B.	1276 g.	163 g.	1247 CC.	45,17 g.	28,6 g.	0,296 g.	2,67 g.	1,59 g.	11,09 g.
by Mm.	1488 "	105 "	1134 "	48,94 "	31,7 "	0,107 "	3,406 "	1,71 "	9,73 "
by Ma.	1301 "	21 "	1484 "	57,62 "	34,1 "	0,202 "	4,14 "	2,02 "	13,8 "

b) In the days of the mother-lye-baths:

by B.	1179,5 g.	171,6 g.	1427,5 CC.	46,62 g.	30,25 g.	0,215 g.	2,79 g.	1,70 g.	10,31 g.
by Mm.	1161,4 "	132,5 "	1619,5 "	53,52 "	34,96 "	0,0028 "	3,31 "	2,02 "	9,64 "
by Ma.	1287,5 "	80,5 "	1795 "	59,42 "	36,44 "	0,021 "	3,35 "	2,24 "	13,3 "

This table clearly shows, that the considerable irritation of the cutaneous nerves does not produce by itself an increase of cutaneous excretion, as has been hitherto assumed. Increased secretion by the skin does not depend on the bath but on accidental circumstances, such as heightened atmospheric temperature, strong bodily exercise &c. But I beg to remark, that with the diminished pulmonary and cutaneous excretion in general a diminished excretion of carbonic acid is by no means proved, for the diminution, which is shown in the above table, may only be due to a comparatively greater quantity of water being removed through the kidneys. By the fact, that frequency of respiration becomes diminished even more under the use of the mother-lye-baths, than under that of the simple saline baths, it even becomes probable, that the excretion of carbonic acid through the skin was in general increased. Hypothetical, however, as this view is, by our



observations, the mother-lye-bath is simply shown to act as a proportionately powerful diuretic\*), and further conclusions must be guarded against.

4) *The constant proportionate decrease of phosphoric acid in the urine under the influence of the simple saline bath ceases under the influence of the mother-lye-bath to continue constant, nay it sometimes even experiences an increase.* This is an observation of great importance, if we consider the essential relation which phosphoric acid bears to the reparative process of the organism. In general I found, that if the mother-lye-bath agreed with the individual, the quantity of phosphoric acid excreted by the urine is not only not greater, but even occasionally smaller, than under the influence of the simple saline bath. The organism thus gains as much and even sometimes more phosphoric acid (phosphate of lime) than under the influence of the saline bath alone. But if the mother-lye-bath produced too great an irritation on the nervous system, over-excitement follows, and consequently a greater quantity of phosphoric acid is excreted than under the use of the simple saline bath and sometimes even more, than is the case under normal conditions. Thus the organism, instead of gaining, actually loses phosphoric acid (phosphate of lime).

Dr. Neubauer has lately proved, that in a great number of nitrogenous and nonnitrogenous compounds, ingested as food, oxalic acid appears as a regular product among others by treatment with permanganate of potash. Permanganate of potash, as it is well known, enables us, to imitate and elucidate approximatively the organic process of oxidation. The supposition naturally occurs,

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\*) From several observations of the general function of the skin, as well as of the so called "bath-eruptions" and likewise of the condition of excoriated parts of the skin, it has appeared to me highly probable, that the whole organic metamorphosis in the cutaneous and subcutaneous tissue becomes considerably increased, both by the simple saline and by the mother-lye-baths. If then any extraneous influences, such as heightened atmospheric temperature, bodily exercise, etc. increase the cutaneous secretion, a part of the metamorphosed products will leave the body through the skin; otherwise these products reënter the blood and are expelled from the organism by means of the kidneys.



that oxalic acid as regularly appears in the organism itself. This is made probable by several observations, especially by the very frequent appearance of oxalate of lime in the urine of diseased persons. The strong affinity of oxalic acid to lime makes it natural, that if it comes in contact with phosphate of lime, it will at once combine with lime, forming oxalate of lime. If then oxalic acid remains any length of time in the organism, that is to say without being rapidly oxydized (transformed into carbonic acid), it will combine with a greater or less quantity of lime, eventually liberating the proportionate quantity of phosphoric acid, which had previously been combined with the lime. Till lately this appearance of oxalate of lime in the blood has been frequently disputed. But the positive proofs furnished by Garrod, Parkes and Ducheck must have dispelled these doubts. Further elucidation is obtained by a beautiful discovery of Neubauer, viz. that small quantities of oxalate of lime are kept in solution by phosphoric acid, and that they probably circulate in the blood, as well as pass through the renal capillaries, in consequence of their being held in solution by this acid. The above affords a material confirmation to the view, which I based some years ago on a great number of examinations of urine viz: that the quantity of oxalic acid in the organism bears a direct relation to the proportionate excretion of phosphate of lime; and as this salt has an undoubted reference to the formation of tissues, the importance of this circumstance with regard to the reparative process of the body becomes established. The different bases with which phosphoric acid is apt to combine serve as an explanation, how the acid, though partially expelled from its combination with lime by oxalic acid, nevertheless appears in the urine as a monobasic or bibasic salt.

As in oxaluria the disproportionate amount of lime in urine does not appear only in the form of oxalate, but in a great part as phosphate of lime, we must form the conclusion, that the tri-basic phosphate of lime circulating in the blood, becomes now excreted in the urine as a monobasic or bibasic salt. If oxalic acid increases in the blood, it attracts the lime and prevents it from entering into organic assimilation, and thus a greater amount of lime becomes effete and removed by the kidneys. If, however, in a later period of metamorphosis the part of the oxalic acid becomes



oxydized into carbonic acid, it yields its base (lime) again to the now stronger affinity of phosphoric acid.

Thus any condition tending to impede the oxidation of oxalic acid into carbonic acid in the organism must, as a consequence, favour the excretion of oxalate of lime through the urine and the increase of phosphates in that liquid, as I have shown elsewhere.

Now as one of the most frequent and important causes of this retarded oxidation I must emphatically point out the weakening of the nervous system. Thus if the irritation caused by the mother-lye be proportionately too strong for the individual organism, metamorphosis may be increased for the moment, but ultimately retardation and relaxation must ensue as a consequence of the previous overexcitement and with it the injurious increase of oxalic acid. We therefore find phosphoric acid not diminished, but even increased in the urine. Such an overexcitement and subsequent depression took place in consequence of the mother-lye-bath with B. and even persisted for some time, whilst with Ma. and Mm. this untoward effect was only transitory and appeared in that day only, in which 9 litres of mother-lye were added to the saline bath instead of the usual six. The increased excretion of phosphoric acid by B. on that occasion is accordingly to be accounted for by that overexcitement of the nervous system.

The correctness of this view I have seen more and more confirmed in practice, and it also serves to explain, how in weakened individuals or wherever organic metamorphosis suffers retardation, a decrease of the bodily weight and deficiency of reproduction are accompanied by an increased excretion of phosphates, and almost invariably of more or less oxalate of lime with the urine.

If it should be urged in opposition to my theory, that in physiologico-chemical investigations so much weight ought not to be attached to such inconsiderable differences of the excreted phosphoric acid, as I have observed in my investigations, I readily admit the justice of this objection, however carefully the quantities of phosphoric acid were determined by us. But as I find material confirmation of my views by medical practice in general, as well as by observations lately made in the most different diseases at Nauheim, I am induced to lay much stress on the slight dif-



ferences of the numbers found by us. Here it might be remarked, that all these numbers do not possess any absolute value, they are only sketching the effects of the agents employed and have to be verified by further investigations and an abundant field of practical experience.

5) *The changes, shown by the curves in the quantities of urine excreted hourly and of their solid constituents in consequence of the mother-lye-baths, are similar to these observed as following the use of the simple saline bath and equally significant. A glance at the graphic drawing (see above) will serve as an elucidation.*

6) *The mother-lye-baths exercise a direct effect on the frequency of the pulse similar to that of the simple saline baths, but indirectly individually different influences are observed.*

The decrease of the frequency of the pulse during the bathing hours amounted

	with B.	with Mm.	with Ma.
on the normal experimental days to	3,7 beats	4,3 beats	3,1 beats
on the saline bathing days to	5 „	9,7 „	7 „
on the days of the mother-lye-baths to . . . . .	6,5 „	10,6 „	6,4 „

As regards the indirect effects the following results were obtained in different individuals:

a) The irritation was too great, causing the innervation of the Vagus to be weakened, and consequently *an increased frequency of the pulse* took place for a longer period of time. With individuals of a weak constitution this frequency may be gradually raised even to a fever-point. We should then have to deal with a fever from weakness or overexcitement.

b) The irritation was adapted to the individual, but occasioned a more or less lasting irritation of the Vagus (probably proceeding



from the skin\*) and in consequence a *diminished frequency of the pulse*.

c) The irritation induced an increased organic waste and if this was not repaired by an adequate supply, debility of the function of the heart ensued. In this case after the single meals *greater fluctuations took place in the decrease and increase of the frequency of the pulse*, but in general an ultimate slight decrease.

7) *The frequency of respiration invariably decreases more considerably under the influence of the mother-lye-bath, than under that of the simple saline bath*, probably also in consequence of a diminished tension of carbonic acid in the blood.

If we examine the above delineation, we find the frequency of respiration invariably decreased with B., Mm. and Ma. With Mm. and Ma, who both enjoyed uninterrupted good health during the mother-lye-baths, with the exception of half a day, I attribute this diminution solely to a diminished want of oxygen in the organism. But as regards B., I cannot help again recurring to that distinctly pronounced overexcitement of the nervous system, though the diminished frequency may also be partially due to a lessened want of oxygen. It is well known, that exciting causes (for instance mental emotions) are apt to accelerate the act of respiration; in the same way depressing or weakening influences seem not but to retard this frequency, and to this weakening influence of the mother-lye-bath I ascribe in a great measure the considerable retardation of the respiratory function with B.

I did not omit to calculate for each experimental period the average of pulse and respiration, and from this the relation between the two functions. Though the numbers can not claim absolute correctness, the proportions afford the value of just comparison and permit an important insight into the effects of the mother-lye-baths.

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\*) This excitation of the cutaneous nerves is not a mere hypothesis. In a patient, suffering from superficial scrophulous ulcerations of the arm, these places were almost completely dry in the morning before the bath, but immediately after bathing an abundant serous secretion took place in them and persisted the whole day.



The proportions between respiration and pulse were

a) in the normal experi-	with B.	with Mm.	with Ma.
mental days . . . . .	as 1 : 5,08	as 1 : 4,9	as 1 : 3,8
b) in the days of the saline			
baths . . . . .	1 : 5,5	1 : 5,1	1 : 4,1
c) in the days of the mother-			
lye-baths . . . . .	1 : 6,3	1 : 5,1	1 : 4,2

Thus the proportion found in the normal days with M. 1:4,9 (14,5 respirations : 71,9 pulsations) is very near the usual state; likewise with B. But with Ma. the respirations were 16,1 and pulsations 61,1 per minute. The slight disturbances of health at that period above alluded to, are probably connected with this disproportion. But whilst in the two series of bathing days Mm. shows proportions nearly normal (14,2 : 72,9 and 13,7 : 70,3) and Ma. approaches nearer the norm (15,1 : 62,4 and 14,5 : 61,1) B. removes more and more from it, and especially under the influence of the mother-lye-baths. This condition we must consider as morbid, and we can not doubt, that if this disproportion of increased circulation and retarded respiration were allowed to continue for any length of time, retarded organic metamorphosis would necessarily ensue. Organic oxidation would in that case be carried on imperfectly, the more so, as probably in consequence of the accelerated circulation a greater quantity of oxidable substances would leave the tissues and enter the blood, than under ordinary circumstances. This was actually shown to be the case during the mother-lye-baths taken by B. Thus the fatiguing effect of the mother-lye-baths on many individuals and the retarded metamorphosis observed in consequence finds a ready explanation. As regards those cases, however, in which decreased respiratory frequency could not be ascribed to any weakening influence, I refer to the remarks made above (p. 41) and I believe, that in them we have to assume also an accelerated metamorphosis of the non-nitrogenous compounds of the blood.

8) *The feeling of ease perceived at first is soon succeeded under the use of the mother-lye-baths by a sensation of fatigue with some individuals, whilst with others the original feeling persists.*

That B. felt himself less well and hearty during the mother-lye-baths than during the saline baths was already mentioned, and



could only be ascribed to the influence of the mother-lye-baths. I have to add here, that the feeling of exhaustion did not cease with the baths, but persisted for some days afterwards. I observed this in a still higher degree with patients, who made an imprudent use of the mother-lye-baths. It only shows, that the excessive irritation, exercised on the nervous system, produces durable weakness, similar to that due to overexertion of the nerves. Thus great caution ought to be used in employment of the mother-lye. — Mm. and Ma. only felt a disturbance of their usual good health in that day, in which 9 litres of mother-lye were added to the bath, instead of the usual six. In that particular day they felt greatly enervated for some hours after taking the bath. — The same result was shown in patients; nay I have seen some using mother-lye-baths with 10 litres of mother-lye for some time without the least appearance of fatigue. Hence the different power of resistance against certain stimulating causes possessed by individual nervous systems becomes evident. However, even on the other days of the mother-lye-baths M. and Ma. had a greater desire for rest in the evening than during the simple bathing days. Thus even when no personal feeling of fatigue or derangement is felt during the day, we might perhaps assume a somewhat diminished bodily power or activity under the use of the mother-lye-bath.

9) *The effects of the mother-lye-baths are not produced by absorption of water or salt.* The non-absorption by the organism in the simple saline-bath of either salt or water was already alluded to above (p. 43); most accurate observations by weighing the body before and after the baths, by comparing the quantities of water taken and excreted during the normal experimental days and the mother-lye-bathing-days, &c., lead to the same results in this series of observations.



### 3. On the effects of the cur-brunnen (Cure-spring) of Nauheim.

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THE investigations to be communicated now, were undertaken from August 24th to September 15th 1858. The same persons were subjected to the experiments as in the former series, with the exception of Ma., for whom Ba. was substituted. Diet and regimen were similar to those in the former experiments. Only bodily exercise was somewhat increased now. The hours from 6 $\frac{1}{2}$  to 8 in the morning and from 11 $\frac{1}{2}$  till 1 in the afternoon were spent in quiet walks without any particular exertion. These hours were spent at home in the former experiments.

We wished to explore the effects of the spring on the healthy organism, and afterwards the modification of these effects if the drinking is combined with the saline bath.

Our mode of proceeding was the same as before. But the results obtained by B. and Mm. in the normal experimental days of the previous spring were *not* laid down as the base of the present investigations. On the contrary a new series of normal experimental days was instituted, and the result proved, how inadmissible it would be, to compare distant series of experiments with each other in investigations of this kind. But besides other causes we were induced, to institute a new series of normal experimental days, because we wished to take the cure-spring under the same circumstances, as the valetudinarians, viz. with an easy bodily exercise. Thus we had to spend the drinking-time (from 6 $\frac{1}{2}$  to 8) with walking, which was not done in our former normal



experimental days. In this series we were likewise not quite free from disturbing influences, which were caused by change of temperature. This was lower in the normal experimental days, than in the two following periods of 6 days, and it admits of no doubt, that in a great measure it was due to that circumstance, that the cutaneous function was more considerable in the two last periods, than during the normal experimental days. I have endeavoured, to eliminate this source of error as much as possible. But in what dose and form ought we to take the cure-spring? I have already mentioned above as the distinct result of my medical experience, that the cure-spring possesses in its unmixed composition too great an amount of solid constituents for many individuals and is therefore apt, to cause gastric catarrh, abdominal oppression, want of appetite. But diluted it has rendered me the most material services, without ever causing any gastric disturbance. Mixed with equal proportions of a certain drinking fountain it obtains a composition very similar to that of Ragoczy. I believe therefore not to be mistaken, if I promise a very extensive employment to this diluted cure-spring. With this we made our experiments. We took daily in the morning 300 cc. of cure-spring and 300 cc. of water (in pauses of  $\frac{1}{4}$  of an hour three times 100 cc. of cure-spring and 100 cc. of water) out of our usual graduated drinking glasses. To lose as little carbonic acid as possible, the glass was first filled half with ordinary water and then the cure-spring was added.

The following were the results at which we arrived:

1) *The drinking of 600 cc. of diluted cure-spring in the morning does not produce a diminution of the weight of the body, but on the contrary, in most instances, an increase.* In the morning and afternoon hours the waste of the system increases, but during the night the excretions diminish again.

The following table will elucidate this proposition:



*Total waste of the organism :*

a) on the normal experimental days:

	from 6,30 a. m. to 1 p. m.	from 1 to 7 p. m.	from 7 p. m. to 6,30 a. m	Total
B.	Gmm. 733,2	Gmm. 924,5	Gmm. 1324,5	Gmm. 2982,2
Mm.	873,5	1029,0	1209,4	3111,9
Ba.	789,4	840,6	1581,3	3211,3

b) on the cure-spring-days:

B.	1104,0 (+ 370,8)	1144,7 (+ 220,2)	1394,8 (+ 70,3)	3643,5 (+ 661,3)
Mm.	1313,9 (+ 440,3)	1219,5 (+ 190,5)	1075,8 (— 133,6)	3609,2 (+ 497,3)
Ba.	1158,5 (+ 369,1)	1180,7 (+ 340,1)	1416,2 (— 165,1)	3755,4 (+ 544,1)

From the adjoining graphic drawing it is shown, that the imbibition of the Cur-brunnen does not cause the weight of the body to be lower at noon, as is the case in the normal experimental days, but in one instance somewhat higher, than at the first weighing in the morning. This circumstance is not without importance as regards the diet of the valetudinarian. In the evening at 7 the weight is very similar to that of the normal days.

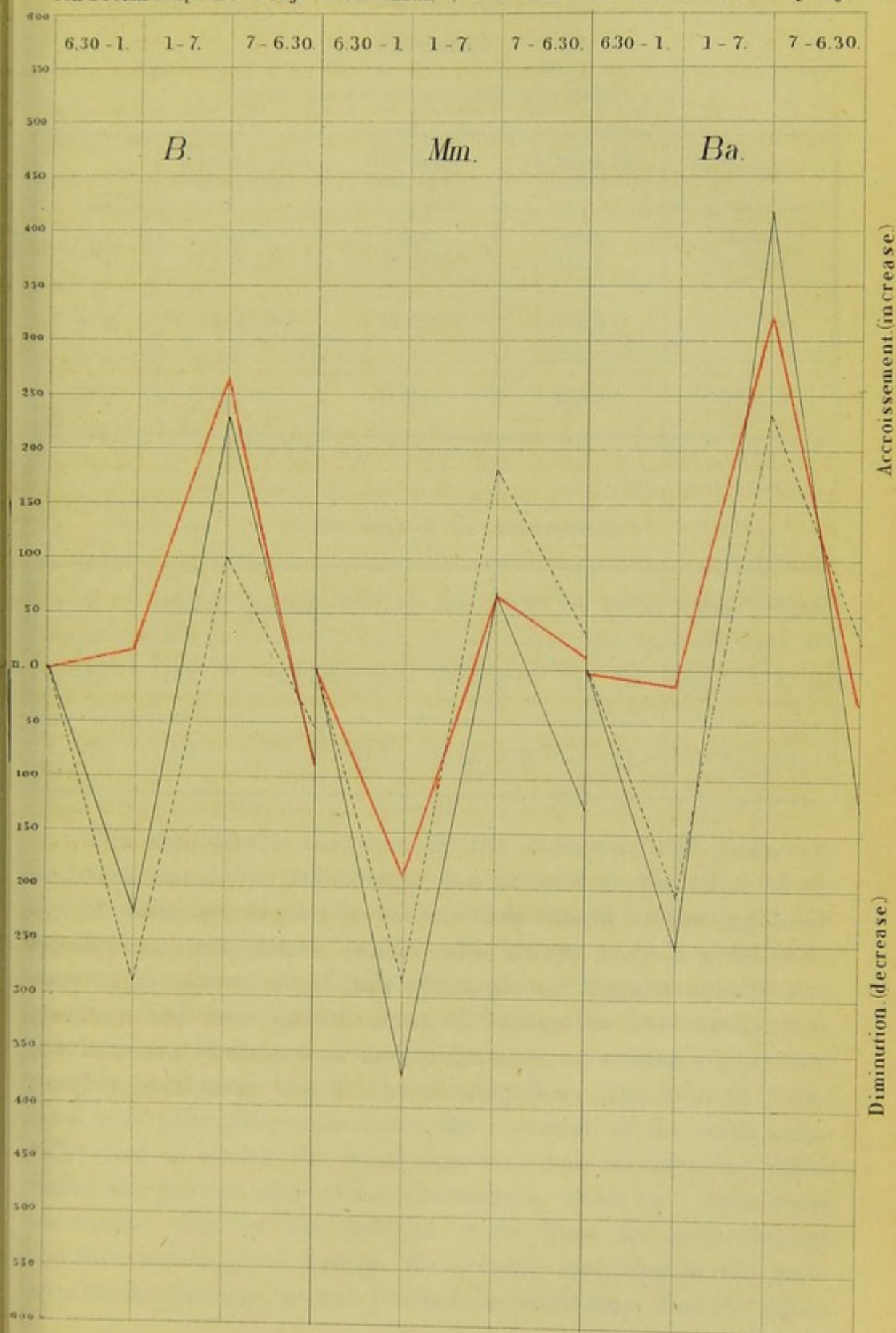
2) *The increase of excretions alluded to above, takes place through the kidneys, intestines, skin and lungs. But the diminution during the night is principally due to the retention of water. This alone is to be considered as the cause of the increased weight mentioned.*

The following table will elucidate this proposition.

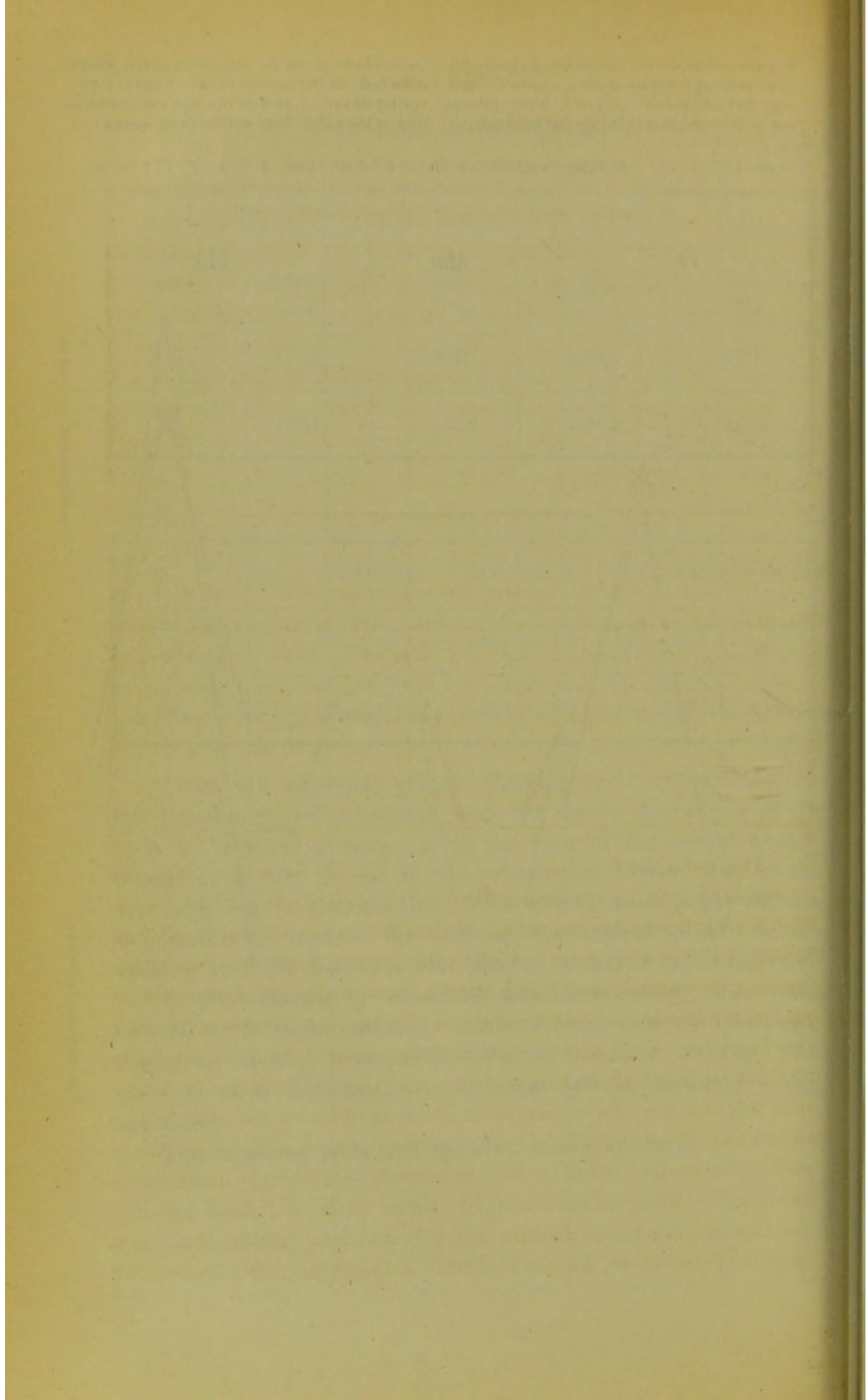


Lignes indiquant les variations du poids du corps pendant les jours ordin. (—), p.l.j. de l'usage du Curbrunnen (—), et p.l.j. de la combinaison du bain simple avec l'usage du Curbrunnen (---).

Curves indicating the variations of the weight of the body on the normal days (—), on the Cure-spring days (—), and on the days of combination of the saline bath and the Cure-spring (---).









*Excretions*

a) on the normal experimental days:

	through skin and lungs	through kidneys	through in- testines	Total
B.	Gmm. 1015,9	Gmm. 1812,7	Gmm. 153,6	Gmm. 2982,2
Mm.	1248,5	1717,6	146,5	3112,1
Ba.	1215,6	1830,4	165,3	3211,3

b) on the days of the cure-spring:

B.	1347,3 (+ 331,4)	1977,7 (+ 165,0)	318,8 (+ 165,2)	3643,4 (+ 661,6)
Mm.	1523,5 (+ 275,5)	1861,0 (+ 143,4)	225 (+ 78,5)	3609,5 (+ 497,4)
Ba.	1620,2 (+ 404,6)	1941,7 (+ 111,3)	192,5 (+ 27,2)	3754,4 (+ 543,1)

The considerable increase of the *cutaneous* and *pulmonary excretions* must be undoubtedly due in part to the effect of the Cur-brunnen, but in part it was certainly caused by the heightened atmospheric temperature, which will always have a great influence on the excretions. I thus admit, that if the atmospheric temperature had been greatly lowered during the cure-spring days, the increase of cutaneous and pulmonary excretions might have possibly been much less or absent altogether. The kidneys would then have principally undertaken the excretion of the watery particles and of course the renal function, not considerably raised under the present state of the atmosphere, would have been much increased. But as the imbibed water finds its issue through the skin and lungs or through the kidneys according to the atmospheric temperature, we are justified in concluding, *that the diluted*



*cure-spring* possesses no diuretic properties, but acts analogously in this respect to ordinary water, increasing according to circumstances either the excretions of the skin and lungs, or of the kidneys. Thus if in some diseases it is desired to increase the function of the skin after drinking the Cur-brunnen, a heightened temperature must be sought for. If in other diseases the action of the kidneys ought to be raised, higher temperature must be avoided. These hints are of importance in dealing with disorders of the skin, the bladder, the kidneys, or with rheumatism, &c.

As regards *intestinal excretions* they were increased with all three under the influence of the Cur-brunnen. But considerable individual differences are shown; with B. the increase amounted to more than double, with Ba. to scarcely  $\frac{1}{7}$ <sup>th</sup> of the usual quantity. We thus find the daily experience confirmed. But let us guard against considering the cure-spring as inefficient in cases, in which the intestinal functions have been only slightly increased. Our further investigations will show, that notwithstanding the very inconsiderable increase of intestinal secretion (as with Ba.) the spring exercises a great influence on the organism. Thus the expression "it does not act" (that is, it does not purge) is only justifiable in the mouths of lay people and ought not to be employed by physicians. Nor is it rational, to resort to the usual practice of immediately increasing the dose, or the quantity of salt, as soon as a purging effect does not appear. For experience shows often enough, that such an effect will not ensue even after increased doses, or if it does ensue, obstruction only becomes the more obstinate after the cure. Indeed if increased intestinal function is called for and does not follow after a dose of 600 cc. of diluted Cur-brunnen, I only consider it justified in rare cases to increase the irritation of the intestinal canal by larger doses or by the administration of a more concentrated water. We may probably conclude in such cases, that saline-water is not the appropriate agent for the realisation of the desired result, and a resort to small doses of drastic remedies will in all likelihood confirm the conclusion. I therefore never exceed a certain quantity of Cur-brunnen and it must be admitted, that it is an absurd idea, to assume that this or any other spring offered at the Spa, must in all instances induce an increase of the intestinal functions. The secre-



tory function and the muscular action of the intestinal canal are two distinct matters. Disproportion of either may produce tardiness of evacuations, and therapeutics will only then pursue the right course, when the real cause of disturbance is hit in each especial case.

It has frequently been stated, that the Cur-brunnen and other waters, with chloride of sodium as the chief ingredient, increase the biliary secretion and thus cause the intestinal evacuations to assume a darker color. But as much as eyes are enabled to judge, no increased *excretion* of bile took place. The thin pappy evacuations usually possessed a light brownish-yellowish color. Thus I must call in question an increase of biliary excretion at least on the part of the Cur-brunnen. But I may observe here, that in our third series of experiments, in which a saline-bath was used besides the Cur-brunnen, the urine of B. undoubtedly contained biliary coloring matter and likewise traces of bilic acid. Chance only called our attention to this circumstance, which unfortunately was not followed up in our cure-spring-days. Possibly it may stand in connexion with the simple increase of biliary secretion, which is said to take place in general after the imbibition of a great amount of water. But with M. and Ba. no change was observed in this respect.

The second part of the proposition is elucidated by the following table:

1841	1842	1843	1844	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	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a) on the normal experimental days:

	from 6,30 a. m. to 1 p. m.			from 1 to 7 p. m.			from 7 p. m. to 6,30 a. m.		
	through skin and lungs.	through the kidneys	through the intestines	through skin and lungs	through the kidneys	through the in- testines	through skin and lungs	through the kidneys	through the intestines
B.	Gmm. 334,0	Gmm. 399,1	Gmm. 0	Gmm. 307,6	Gmm. 616,9	Gmm. 0	Gmm. 373,6	Gmm. 797,4	Gmm. 153,6
Mm.	372,7	452,3	48,6	409,5	540,3	79,3	464,9	726,1	18,5
Ba.	307,7	481,7	0	378,3	462,3	0	526,5	888,9	165,3

b) on the cure-spring-days:

B.	411,1	528,8	164,1	456,9	659,6	28,1	478,4	789,9	126,5
Mm.	474,3	709,6	130	546,0	578,5	95	502,7	573,1	0
Ba.	429,3	653,2	76	632,2	455,4	93,1	557,4	835,5	23,3

Difference:

B.	+ 77,1	+ 129,7	+ 164,1	+ 149,3	+ 42,7	+ 28,1	+ 104,8	— 7,5	— 27,1
Mm.	+ 101,6	+ 257,3	+ 81,4	+ 136,5	+ 38,2	+ 15,7	+ 37,8	— 153,0	— 18,5
Ba.	+ 121,6	+ 171,5	+ 76	+ 253,9	— 6,9	+ 93,1	+ 30,9	— 53,4	— 142,5

This table requires no further comment, if we are only reminded of the increased cutaneous function being caused by heightened atmospheric temperature. It is shown, that the *Curbrunnen*, taken early in the morning, displays its principal effects in the morning hours. We find the principal increase in the intestinal and renal excretions; in a minor degree the excretions of the lungs and skin are promoted. A similar effect, but less intense, takes place



in the afternoons. By taking exercise at that period of the day, the high atmospheric temperature had especially its effect. But during night a diminution of waste takes place with the exception of an increased cutaneous function. Intestinal and renal excretions are diminished. As the cause of this can not be sought in diminished ingestion, as further the increased morning and afternoon waste is in a great measure repaired by an increased consumption of aliments, we can form no other conclusion but the following: that this decrease of excretions indicates really retarded organic metamorphosis *or* retention of certain substances. If atmospheric temperature had not been so high in day-time, this nightly decrease of excretions would most probably have been still more considerable, we should not then have found a plus in the space assigned for indicating the pulmonary and cutaneous excretions, but probably a minus.

3) Whilst taking the Curbrunnen, the organism is found during the whole day saturated with water in a higher degree than on normal days.

This proposition may be deduced from the last table (p 62). If we assume, that the cutaneous and pulmonary excretions contained 75 per cent of water on the normal experimental days and 80 per cent on the cure-spring days, if we further deduct from the renal excretion the known amount of solid ingredients, calculating the rest as water; if lastly we calculate, as regards the intestinal excretions 70 per cent of water on the normal days and 75 per cent on the cure-spring days, and assuming 40 per cent to be contained in the food taken morning and evening and 80 per cent in that taken for dinner, we obtain the following result with approximative exactitude:



a) for the normal experimental days:

	Ingestion of water			Excretion of water		
	6,30 a. m.— 1 p. m.	1 p. m.— 7 p. m.	7 p. m.— 6,30 a. m.	6,30 a. m.— 1 p. m.	1 p. m.— 7 a. m.	7 p. m.— 6,30 a. m.
B.	382 Gm.	1304 Gm.	882 Gm.	637 Gm.	830 Gm.	1176 Gm.
Mm.	383 "	1376 "	885 "	750 "	886 "	1069 "
Ba.	394 "	1406 "	899 "	698 "	730 "	1377 "

b) for the cure-spring days:

B.	985 Gm.	1303 Gm.	922 Gm.	982 Gm.	1027 Gm.	1259 Gm.
Mm.	987 "	1387 "	888 "	1179 "	1076 "	955 "
Ba.	998 "	1417 "	902 "	1042 "	1021 "	1276 "

Thus the amount of water in the organism is shown to be

a) on the normal days:

	1 p. m.	7 p. m.	6,30 a. m.
B.	— 255 Gmm.	+ 219 Gmm.	— 66 Gmm.
Mm.	— 367 "	+ 123 "	— 61 "
Ba.	— 304 "	+ 372 "	— 106 "



b) on the cure-spring days:

	1 p. m.	7 p. m.	6,30 a. m.
B.	+ 3 Gmm.	+ 379 Gmm.	+ 42 Gmm.
Mm.	— 192 "	+ 119 "	+ 52 "
Ba.	— 44 "	+ 352 "	— 22 "

Though these numbers can only be considered as approximately correct, they nevertheless give a decided and trust worthy answer to our question and correctly show the fluctuations of water in the organism with and without the use of the cure-spring. We learn, that while on the normal experimental days the organism exhibits a certain degree of inanition of water at dinner hour, normal saturation of water takes place at that hour in the cure-spring days or at all events a considerably greater amount of water than usual. The proportion varied accordingly till 7 p. m. If a normal degree of saturation was exhibited at 1 the proportion of water was greater at 7 p. m. than on the normal experimental days. If a slight deficiency of water was shown at 1, no excess of water over the normal days was found at 7 p. m., but about the same degree. During night the excretion of water is invariably diminished. If then, in the cure-spring days the excretion of solids is not proportionately increased an increase of bodily weight must result. This was actually the case with M. and Ba. We thus arrive at an observation, directly opposed to the generally accepted view on the effects of saline waters. But I can not doubt the correctness of the proposition: *that a moderate use of the cure-spring, not too strongly acting on the excretion of solids, induces, ceteris paribus, an increase of bodily weight and it occasions even then only a very slight diminution of bodily weight, when (as in the case of B.) the intestinal excretions are more than doubled, and the solid excretions of urine also very considerably increased. If the weight of the body should diminish*



*considerably under the use of the cure-spring, it shows injurious influences either local or general.*

Besides it must be considered as a fact, that whether we explain the higher degree of saturation with water during the cure-spring days at the dinner-hour by retention of the water taken in the morning, or by diminished excretion of the water ingested with the meals in the morning, that either the organism is more saturated with water till 7 p. m. during the cure-spring days, than during the normal days (with Mm. and Ba.), or that this saturation even lasts beyond 7 (as with B.). In other words, the water taken in the morning, does not leave the organism till 12 hours afterwards. But as besides, from causes as yet unknown, less excretion of water takes places during the nights following the cure-spring days, than during the normal nights, we may affirm the proposition: *that the imbibition of 600 cc. of diluted cure-spring in the early morning renders the organism more saturated with water during the whole day, than is the case without the use of the cure-spring.*

If we notice, that B. lost 5, 2 gm. more in weight during the cure-spring days, than during the normal experimental days, whilst M. and Ba. gained in weight by 134,3 and 88,4 g., we may learn from the above communication, how these results arose. B. daily gained 108 gm. of water during the cure-spring days. If nevertheless he daily lost 5 gm. more in bodily weight, than during the normal days, this could only proceed from a proportionately increased excretion of solid constituents (113 gm. per day) as it actually happened. M. and Ba. on the contrary daily gained 113 and 84 gm. of water respectively. Their proportionate increase of weight is thus explained in a great measure, and therefore we may assume, that retention of water was the chief cause of their increased weight. But with M. and Ba. increased excretion of solid constituents took place likewise under the use of the cure-spring, with certainty through the kidneys and intestines, and possibly also through the skin and lungs. If nevertheless increased weight of the body took place with them and if the quantity of retained water was scarcely sufficient, to account completely for the increase of weight, it follows, that the grater quantity of excretions must in this instance have been repaired by a proportion-



ately increased ingestion of solid food. These proportions can only be judged of in a general way without direct further investigations. But with the insight obtained into the relative variations of metamorphosis due to the influence of the cure-spring, we may perhaps arrive at the following conclusion :

The imbibition of 600 cc. of diluted cure-spring occasions, *ceteris paribus*, an increase of bodily weight, and at the same time an increased excretion of solid constituents through kidneys and intestines. This apparent contradiction is explained through the retention of water. But the proportionate increase of weight is greater or smaller individually according to a lower or higher increase of excreted solids and according to a more or less correspondingly repairing ingestion of food. If the solid excretions were much increased, the retained water principally serves to repair the weight and only a small rest (or possibly none) is left to increase the weight of the body. If the increase of solid excretions was less considerable, the whole of the water retained serves to increase the weight. In each instance an augmented proportion of water in the organism is the result.

4) *The cure-spring occasions a considerably increased excretion of urea and thus it accelerates the metamorphosis of nitrogenous particles. Excretion of sulphuric acid becomes likewise increased. But as regards the excreted quantities of uric and phosphoric acids the effects of the cure-spring vary and are on the whole very inconsiderable.*

5) *Notwithstanding this inconsiderable influence on the absolute quantity of phosphoric acid excreted, a relative increase of this acid ensues in the organism. In other words the relation in the organism between albuminates and phosphoric acid changes in favour of the latter.*

6) *The chlorides introduced with the cure-spring are completely removed from the organism during the first 6 days of their introduction. Nay apart from the increased ingestion and excretion of chlorides more chloride of sodium was excreted from the organism, than without the use of the cure-spring.*



The following table will show these facts:

*Excretions*

a) on the normal experimental days:

	Quantity of urine	Solid constituents (according to Trapp)	Urea	Uric acid	Phosphoric acid	Sulphuric acid	Chloride of sodium
B.	1767 G.	45,5 G.	31,59 G.	0,096 G.	2,30 G.	1,91 G.	11,26 G.
Mm.	1667 „	49,9 „	35,15 „	0,080 „	3,04 „	2,08 „	10,84 „
Ba.	1781 „	49,2 „	34,31 „	0,115 „	2,69 „	1,93 „	13,12 „

b) on the cure-spring days:

B.	1921 G.	56,4 G.	35,56 G.	0,140 G.	2,38 G.	2,12 G.	18,49 G.
Mm.	1802 „	58,7 „	39,68 „	0,054 „	2,97 „	2,26 „	18,79 „
Ba.	1882 „	59,6 „	39,37 „	0,206 „	2,88 „	2,17 „	19,21 „

The table demonstrates the absurdity of the expression alluded to above viz. "the spring does not act", because it does not purge. Though with Mm. and especially with Ba. alvine evacuations were not particularly increased, the above numbers show the "action" of the spring to be nevertheless manifest enough, albeit in an other direction.

Apart from the excretion of chloride of sodium, these numbers lead us to the conclusion, that 600 cc. of diluted cure-spring considerably increase the metamorphosis of nitrogenous particles of the economy. For it scarcely needs to be mentioned, that the increased excretion of 4; 4,5 and 5 gm. of urea can not be caused by the additional ingestion of 56,3; 31,8 and 30,9 gm. of solid food.



The same conclusion is justified by a proportionately increased excretion of sulphuric acid, which runs parallel with that of urea and could not have its cause in an increased introduction of sulphates into the organism. Uric and phosphoric acid, however, show no constancy in their relations. They are increased with B. and Ba., diminished with M. Their variation, however, was on the whole inconsiderable, so much so, that we may conclude, *the cure-spring to have very little influence on their excretions.*

If we now recur for a moment to the influence of the simple saline bath on the same substances and on their excretion, a considerable difference is shown. The metamorphosis of nitrogenous organic particles appears much more considerable under the influence of the cure-spring, than of the saline bath. Thus we arrive at the interesting result, that the organism *loses* much more nitrogenous materials by the former than by the latter, which causes indeed a very inconsiderable diminution of nitrogenous particles.

*Thus the organism gains water under the influence of the cure-spring and loses nitrogenous substances out of its tissues\*).*

A second essential difference is shown in the proportionate excretion of phosphoric acid. The saline bath causes a diminution of excretion and thus a positive gain of phosphoric acid for the organism. The reparative process must in my opinion become thereby promoted sooner or later, and with it a persisting increase of bodily weight will result. But under the use of the Cur-brunnen that excretion does not diminish and thus the organism does not gain in phosphoric acid. The increase of weight depends here hardly on formation of new tissues, but rather on retention of water, which possibly may not last much beyond the time of using the Cur-brunnen. A further consideration, however, teaches us, that though no positive gain of phosphoric acid takes place, the organism experiences a *relative* increase of phosphoric acid in

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\*) As regards the quantities of food taken during the series of investigation the reader must be referred to the German edition of Dr. Beneke's work. It may only be stated here, that the differences in the excretion of urea and sulphuric acid on the cure-spring days could by no means be due to a larger quantity of ingesta.



proportion to the *albuminates*. We can not but assume, that in the healthy organism all the integrating chemical constituents stand in a fixed proportion to each other. If then, under the influence of the cure-spring a considerably greater amount of nitrogenous materials become transformed than under the usual circumstances, whilst the excretion of phosphoric acid does not increase, nor experience any change, it follows, that an altered relation between albuminates and phosphoric acid must become established after any lengthy imbibition of the cure-spring.

The albuminates experience an absolute diminution, the phosphoric acid a relative increase. This can not be indifferent as regards organic nutrition. We may therefore assume, *that the cure-spring likewise possesses influences, which sooner or later support an increase of weight by the formation of new tissues after the termination of the course (through the relative increase of phosphoric acid).*

It would be of great interest, if the superficial experience of frequently increased bodily weight after the courses of saline-springs, were established by exact weighing. Much is still left for further investigation, and without a careful pursuit of exploration balneo-therapeutics will not make any material progress. Even the few hints here communicated will already suffice to demonstrate, how a somewhat minute examination may lead to results, which prove the incongruity of many a maxim, hitherto considered as unquestionably correct.

As regards chlorides we see from the above table, that under the use of 600 cc. of diluted cure-spring an increased quantity becomes excreted by respectively 7,23; 7,95 and 6,09 grm.

At the first glance one might be inclined, to attribute this increase to the account of an increased ingestion of chlorides. But an exact calculation shows that such a conclusion would be erroneous.

According to our former communication 7680 grains (= 468,3 grammes) of diluted cure-spring contain 65,853 grains (= 4,015 grammes) of chlorides. 600 grammes of the cure-spring diluted with equal parts of our drinking water in question thus contain 5,14 grm. of chlorides. Even if we assume, that all the chlorine



of the chlorides issues with the urine, we still find this quantity exceeded by a plus of excreted chloride of sodium of 2,09; 2,81 and 0,95 grammes respectively. We have every reason to suppose according to our investigation on the effects of the saline baths, that in the kitchen, which supplied our food, chloride of sodium was admixed very equably. The slight increase of solid food ingested during the cure-spring-days is likewise incapable of explaining the surplus of chloride of sodium found in the urine. We are therefore led to conclude, that with great probability, besides the excretion of all chlorides ingested with the cure-spring *the organism is deprived of a small quantity of chloride of sodium, under the use of the diluted Cur-brunnen*\*).

But I must add at once, that we only took Cur-brunnen during 6 days and our proposition thus can only refer to this short period.

In the further 6, 12, 18 and 24 days the proportions may be altered and if Vogel says in Virchow's Pathol. and Therap: "Plouviez found, after a two monthly use of chloride of sodium (how much? B) this salt increased in his blood, and albumen diminished and I myself (Vogel) observed the same effect with persons, who had been drinking the Nauheim cure-spring for 6 weeks", I can not consider these statements as opposed to our investigations, the less so, as the individuals subjected to examination by Vogel did certainly not drink the diluted but the natural cure-spring. Probably by the use of the concentrated cure-spring a retention of chloride of sodium in the organism is sooner induced than by the use of the diluted spring. Our own further investigations on the combined use of the cure-spring and saline bath make it probable, that already this combination, or the second series of 6 days of the cure-spring-course causes changes in the excretions of chloride

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\*) This experience agrees with Genth's and Mosler's investigation on the influence of water-drinking. The increased imbibition of 1000—4000 c. c. of water causes an increased excretion of chlorides. If we, however, assume, that with the considerably increased cutaneous excretion during the cure-spring days more chloride of sodium must have escaped through the skin, than on the normal experimental days, our proposition becomes the more confirmed.



of sodium. It is to be regretted, that J. Vogel did not state, whether the patients examined by him, used baths besides the cure-spring, as it is almost invariably the case at Nauheim.

If we now attempt to explain the effects of the cure-spring alluded to we have at first to notice the temperature of the water (10—12° R.) which must occasion an abstraction of heat and may induce an acceleration of organic metamorphosis. According, however, to the first experiments made in this respect by Dr. Mosler, it is not probable, that cold water exercises a greater influence on the increase of organic metamorphosis than warm water; thus we can not by any means attribute a principal portion of the effects observed to the withdrawal of heat. This being allowed, only three suppositions remain. The results must be due to the water, or to the saline constituents of the cure-spring, or to their combined action. These possibilities might have been cleared up with certainty, if *ceteris paribus* we had taken during 6 days 300 cc. of distilled water and 300 cc. of our diluting water, and if during 6 other days we had consumed the solid constituents contained in 300 cc. of the cure-spring in 300 cc. of the diluent water, at the same time investigating the proportions of metamorphosis.

Though a sufficient quantity of cure-spring was evaporated for this purpose, unfortunately we had not the time to carry it out. But we learn through many researches latterly made, that the imbibition of unusual quantities of water accelerates metamorphosis and especially increases the excretion of urea and chloride of sodium (Genth, Mosler, Böcker). We further know, that the ingestion of chloride of sodium promotes the metamorphoses of the nitrogenous materials of the body (Bischoff, Kaupp). But as we observed a more increased excretion of urea, than took place by imbibition of 600 cc. of common water on the part of the gentlemen in question, it becomes more than probable, *that both, the water and the saline constituents of the cure-spring contributed to the effects obtained.* This becomes more confirmed, if we find from the communications, to be made below, that the chlorides introduced early in the morning remained in the organism not only till noon, but partially till late at night and thus



they were enabled to display their influence for a long series of hours.

7) *The curves of the quantities of urine and of its solid constituents excreted hourly experience considerable change under the influence of the Cur-brunnen. The former exhibit ceteris paribus an increase during the day and a decrease during the night, the latter, however, are excreted in increased quantities at all periods of the day.*

That the Cur-brunnen, taken in the morning, causes an increased flow of urine, is put beyond doubt by the graphic drawing. This increase either commences during the imbibition (as with M. and Ba.) or soon after breakfast. The stimulus requisite with certain individuals to unfold the activity of the nervous system, is here furnished by the first meal. During the *afternoon hours* the quantities of urine are rather lower, than on the normal days. The function of the skin being so considerably raised through the high atmospheric temperature, this circumstance is easily accounted for. Without that high temperature there is every reason to believe, that the quantities of urine would have been likewise increased in the afternoon. *During the night* the quantity of urine diminished with each of us, for which result I am unable to assign a cause. The invariable increase of the *solid constituents* of urine allows us to conclude, that with great probability the Cur-brunnen exercises a persistingly accelerating influence on the metamorphosis of solid organic constituents, and from the numbers, which serve to elucidate this increase, we also obtain an insight into the *relations of the excretion of the chlorides, ingested during the morning with the cure-spring.*

1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5	26.5	27.5	28.5	29.5	30.5	31.5	32.5	33.5	34.5	35.5	36.5	37.5	38.5	39.5	40.5	41.5	42.5	43.5	44.5	45.5	46.5	47.5	48.5	49.5	50.5	51.5	52.5	53.5	54.5	55.5	56.5	57.5	58.5	59.5	60.5	61.5	62.5	63.5	64.5	65.5	66.5	67.5	68.5	69.5	70.5	71.5	72.5	73.5	74.5	75.5	76.5	77.5	78.5	79.5	80.5	81.5	82.5	83.5	84.5	85.5	86.5	87.5	88.5	89.5	90.5	91.5	92.5	93.5	94.5	95.5	96.5	97.5	98.5	99.5	100.5	101.5	102.5	103.5	104.5	105.5	106.5	107.5	108.5	109.5	110.5	111.5	112.5	113.5	114.5	115.5	116.5	117.5	118.5	119.5	120.5	121.5	122.5	123.5	124.5	125.5	126.5	127.5	128.5	129.5	130.5	131.5	132.5	133.5	134.5	135.5	136.5	137.5	138.5	139.5	140.5	141.5	142.5	143.5	144.5	145.5	146.5	147.5	148.5	149.5	150.5	151.5	152.5	153.5	154.5	155.5	156.5	157.5	158.5	159.5	160.5	161.5	162.5	163.5	164.5	165.5	166.5	167.5	168.5	169.5	170.5	171.5	172.5	173.5	174.5	175.5	176.5	177.5	178.5	179.5	180.5	181.5	182.5	183.5	184.5	185.5	186.5	187.5	188.5	189.5	190.5	191.5	192.5	193.5	194.5	195.5	196.5	197.5	198.5	199.5	200.5	201.5	202.5	203.5	204.5	205.5	206.5	207.5	208.5	209.5	210.5	211.5	212.5	213.5	214.5	215.5	216.5	217.5	218.5	219.5	220.5	221.5	222.5	223.5	224.5	225.5	226.5	227.5	228.5	229.5	230.5	231.5	232.5	233.5	234.5	235.5	236.5	237.5	238.5	239.5	240.5	241.5	242.5	243.5	244.5	245.5	246.5	247.5	248.5	249.5	250.5	251.5	252.5	253.5	254.5	255.5	256.5	257.5	258.5	259.5	260.5	261.5	262.5	263.5	264.5	265.5	266.5	267.5	268.5	269.5	270.5	271.5	272.5	273.5	274.5	275.5	276.5	277.5	278.5	279.5	280.5	281.5	282.5	283.5	284.5	285.5	286.5	287.5	288.5	289.5	290.5	291.5	292.5	293.5	294.5	295.5	296.5	297.5	298.5	299.5	300.5	301.5	302.5	303.5	304.5	305.5	306.5	307.5	308.5	309.5	310.5	311.5	312.5	313.5	314.5	315.5	316.5	317.5	318.5	319.5	320.5	321.5	322.5	323.5	324.5	325.5	326.5	327.5	328.5	329.5	330.5	331.5	332.5	333.5	334.5	335.5	336.5	337.5	338.5	339.5	340.5	341.5	342.5	343.5	344.5	345.5	346.5	347.5	348.5	349.5	350.5	351.5	352.5	353.5	354.5	355.5	356.5	357.5	358.5	359.5	360.5	361.5	362.5	363.5	364.5	365.5	366.5	367.5	368.5	369.5	370.5	371.5	372.5	373.5	374.5	375.5	376.5	377.5	378.5	379.5	380.5	381.5	382.5	383.5	384.5	385.5	386.5	387.5	388.5	389.5	390.5	391.5	392.5	393.5	394.5	395.5	396.5	397.5	398.5	399.5	400.5	401.5	402.5	403.5	404.5	405.5	406.5	407.5	408.5	409.5	410.5	411.5	412.5	413.5	414.5	415.5	416.5	417.5	418.5	419.5	420.5	421.5	422.5	423.5	424.5	425.5	426.5	427.5	428.5	429.5	430.5	431.5	432.5	433.5	434.5	435.5	436.5	437.5	438.5	439.5	440.5	441.5	442.5	443.5	444.5	445.5	446.5	447.5	448.5	449.5	450.5	451.5	452.5	453.5	454.5	455.5	456.5	457.5	458.5	459.5	460.5	461.5	462.5	463.5	464.5	465.5	466.5	467.5	468.5	469.5	470.5	471.5	472.5	473.5	474.5	475.5	476.5	477.5	478.5	479.5	480.5	481.5	482.5	483.5	484.5	485.5	486.5	487.5	488.5	489.5	490.5	491.5	492.5	493.5	494.5	495.5	496.5	497.5	498.5	499.5	500.5	501.5	502.5	503.5	504.5	505.5	506.5	507.5	508.5	509.5	510.5	511.5	512.5	513.5	514.5	515.5	516.5	517.5	518.5	519.5	520.5	521.5	522.5	523.5	524.5	525.5	526.5	527.5	528.5	529.5	530.5	531.5	532.5	533.5	534.5	535.5	536.5	537.5	538.5	539.5	540.5	541.5	542.5	543.5	544.5	545.5	546.5	547.5	548.5	549.5	550.5	551.5	552.5	553.5	554.5	555.5	556.5	557.5	558.5	559.5	560.5	561.5	562.5	563.5	564.5	565.5	566.5	567.5	568.5	569.5	570.5	571.5	572.5	573.5	574.5	575.5	576.5	577.5	578.5	579.5	580.5	581.5	582.5	583.5	584.5	585.5	586.5	587.5	588.5	589.5	590.5	591.5	592.5	593.5	594.5	595.5	596.5	597.5	598.5	599.5	600.5	601.5	602.5	603.5	604.5	605.5	606.5	607.5	608.5	609.5	610.5	611.5	612.5	613.5	614.5	615.5	616.5	617.5	618.5	619.5	620.5	621.5	622.5	623.5	624.5	625.5	626.5	627.5	628.5	629.5	630.5	631.5	632.5	633.5	634.5	635.5	636.5	637.5	638.5	639.5	640.5	641.5	642.5	643.5	644.5	645.5	646.5	647.5	648.5	649.5	650.5	651.5	652.5	653.5	654.5	655.5	656.5	657.5	658.5	659.5	660.5	661.5	662.5	663.5	664.5	665.5	666.5	667.5	668.5	669.5	670.5	671.5	672.5	673.5	674.5	675.5	676.5	677.5	678.5	679.5	680.5	681.5	682.5	683.5	684.5	685.5	686.5	687.5	688.5	689.5	690.5	691.5	692.5	693.5	694.5	695.5	696.5	697.5	698.5	699.5	700.5	701.5	702.5	703.5	704.5	705.5	706.5	707.5	708.5	709.5	710.5	711.5	712.5	713.5	714.5	715.5	716.5	717.5	718.5	719.5	720.5	721.5	722.5	723.5	724.5	725.5	726.5	727.5	728.5	729.5	730.5	731.5	732.5	733.5	734.5	735.5	736.5	737.5	738.5	739.5	740.5	741.5	742.5	743.5	744.5	745.5	746.5	747.5	748.5	749.5	750.5	751.5	752.5	753.5	754.5	755.5	756.5	757.5	758.5	759.5	760.5	761.5	762.5	763.5	764.5	765.5	766.5	767.5	768.5	769.5	770.5	771.5	772.5	773.5	774.5	775.5	776.5	777.5	778.5	779.5	780.5	781.5	782.5	783.5	784.5	785.5	786.5	787.5	788.5	789.5	790.5	791.5	792.5	793.5	794.5	795.5	796.5	797.5	798.5	799.5	800.5	801.5	802.5	803.5	804.5	805.5	806.5	807.5	808.5	809.5	810.5	811.5	812.5	813.5	814.5	815.5	816.5	817.5	818.5	819.5	820.5	821.5	822.5	823.5	824.5	825.5	826.5	827.5	828.5	829.5	830.5	831.5	832.5	833.5	834.5	835.5	836.5	837.5	838.5	839.5	840.5	841.5	842.5	843.5	844.5	845.5	846.5	847.5	848.5	849.5	850.5	851.5	852.5	853.5	854.5	855.5	856.5	857.5	858.5	859.5	860.5	861.5	862.5	863.5	864.5	865.5	866.5	867.5	868.5	869.5	870.5	871.5	872.5	873.5	874.5	875.5	876.5	877.5	878.5	879.5	880.5	881.5	882.5	883.5	884.5	885.5	886.5	887.5	888.5	889.5	890.5	891.5	892.5	893.5	894.5	895.5	896.5	897.5	898.5	899.5	900.5	901.5	902.5	903.5	904.5	905.5	906.5	907.5	908.5	909.5	910.5	911.5	912.5	913.5	914.5	915.5	916.5	917.5	918.5	919.5	920.5	921.5	922.5	923.5	924.5	925.5	926.5	927.5	928.5	929.5	930.5	931.5	932.5	933.5	934.5	935.5	936.5	937.5	938.5	939.5	940.5	941.5	942.5	943.5	944.5	945.5	946.5	947.5	948.5	949.5	950.5	951.5	952.5	953.5	954.5	955.5	956.5	957.5	958.5	959.5	960.5	961.5	962.5	963.5	964.5	965.5	966.5	967.5	968.5	969.5	970.5	971.5	972.5	973.5	974.5	975.5	976.5	977.5	978.5	979.5	980.5	981.5	982.5	983.5	984.5	985.5	986.5	987.5	988.5	989.5	990.5	991.5	992.5	993.5	994.5	995.5	996.5	997.5	998.5	999.5	1000.5
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The daily excretions of urine were

a) on the normal experimental days:

	Quantity of urine			Solid constituents of urine		
	from 6,30 a. m. — 1 p. m.	from 1 — 7 p. m.	from 7 p. m. — 6,30 a. m.	from 6,30 a. m. — 1 p. m.	from 1 — 7 p. m.	from 7 p. m. — 6,30 a. m.
B.	CC. 387	CC. 600	CC. 780	Gmm. 11,6	Gmm. 17,1	Gmm. 17,6
Mm.	437	523	707	15,3	16,9	18,5
Ba.	467	446	867	14,1	16,0	21,6

b) on the cure-spring days:

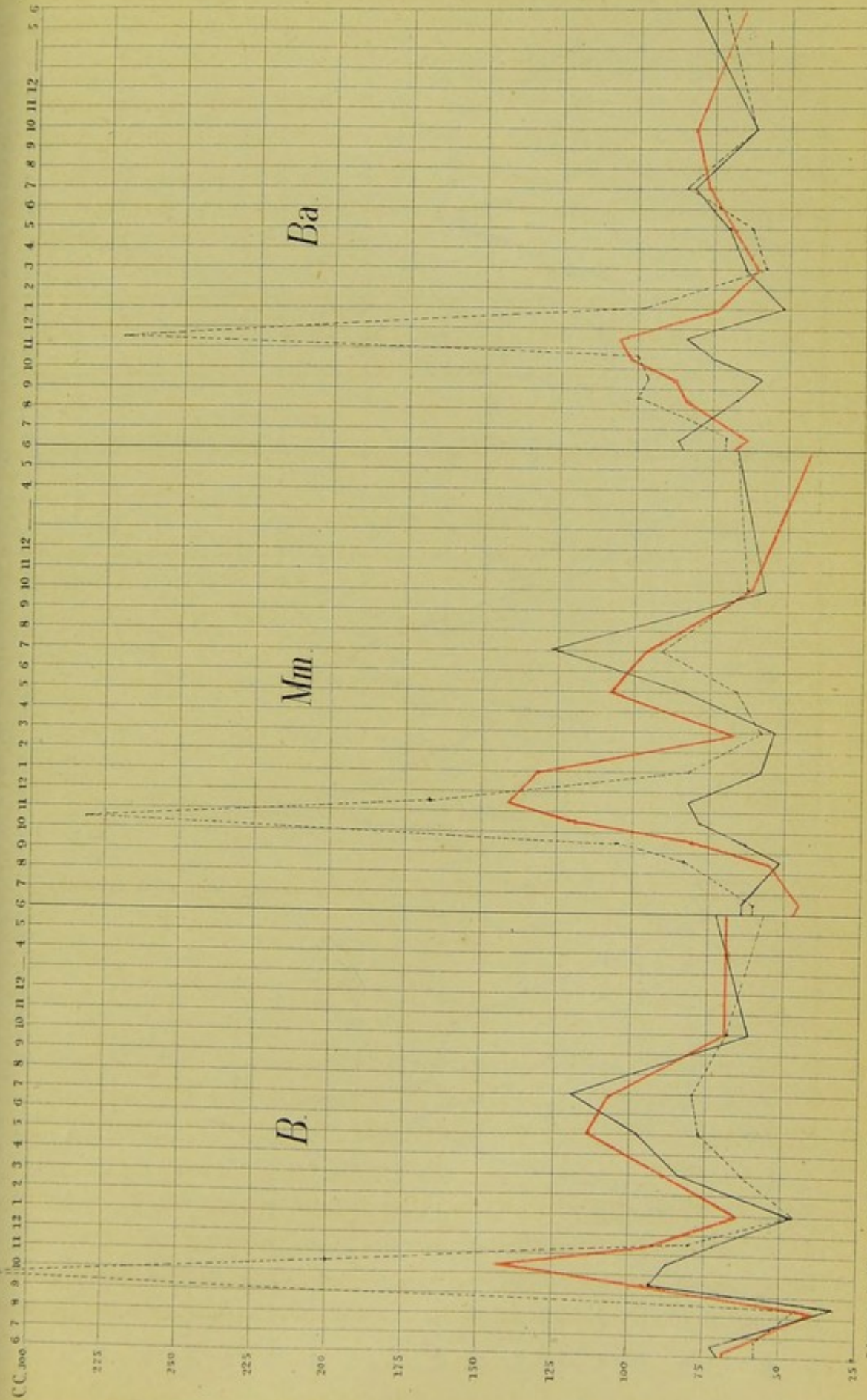
B.	514	638	769	14,7	21,5	20,9
Mm.	690	559	553	19,9	19,4	19,6
Ba.	635	436	810	18,4	18,9	24,7

Difference:

B.	+ 127	+ 38	— 11	+ 3,1	+ 4,4	+ 3,3
Mm.	+ 253	+ 36	— 154	+ 4,6	+ 2,5	+ 1,1
Ba.	+ 168	— 10	— 57	+ 4,3	+ 2,9	+ 3,1

We learn from this table, that if 5,14 grmm. of chlorides have been introduced into the system in the morning, these can not have left the organism already at dinner-time, even if we should assume the whole plus of solid constituents of urine excreted to

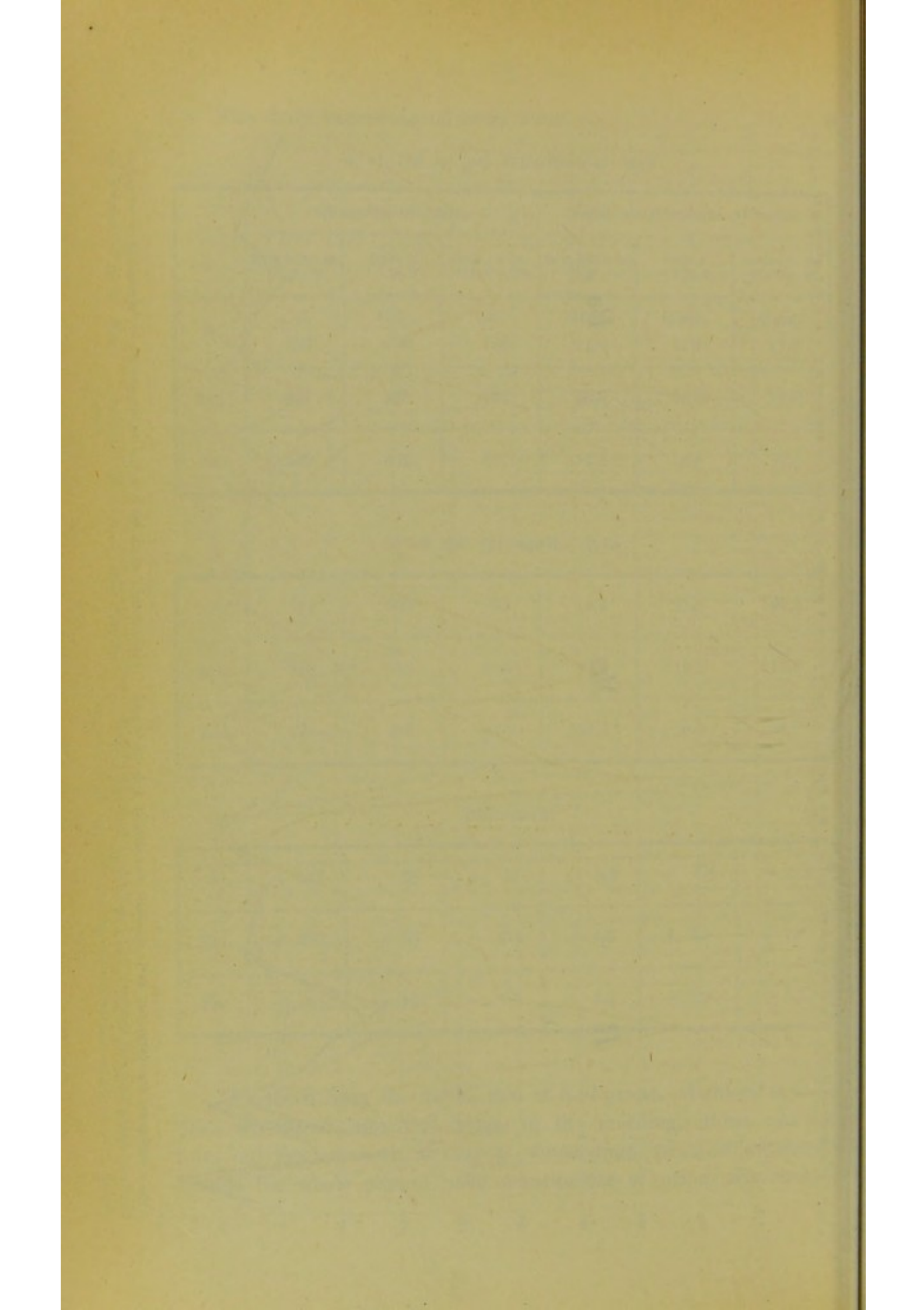




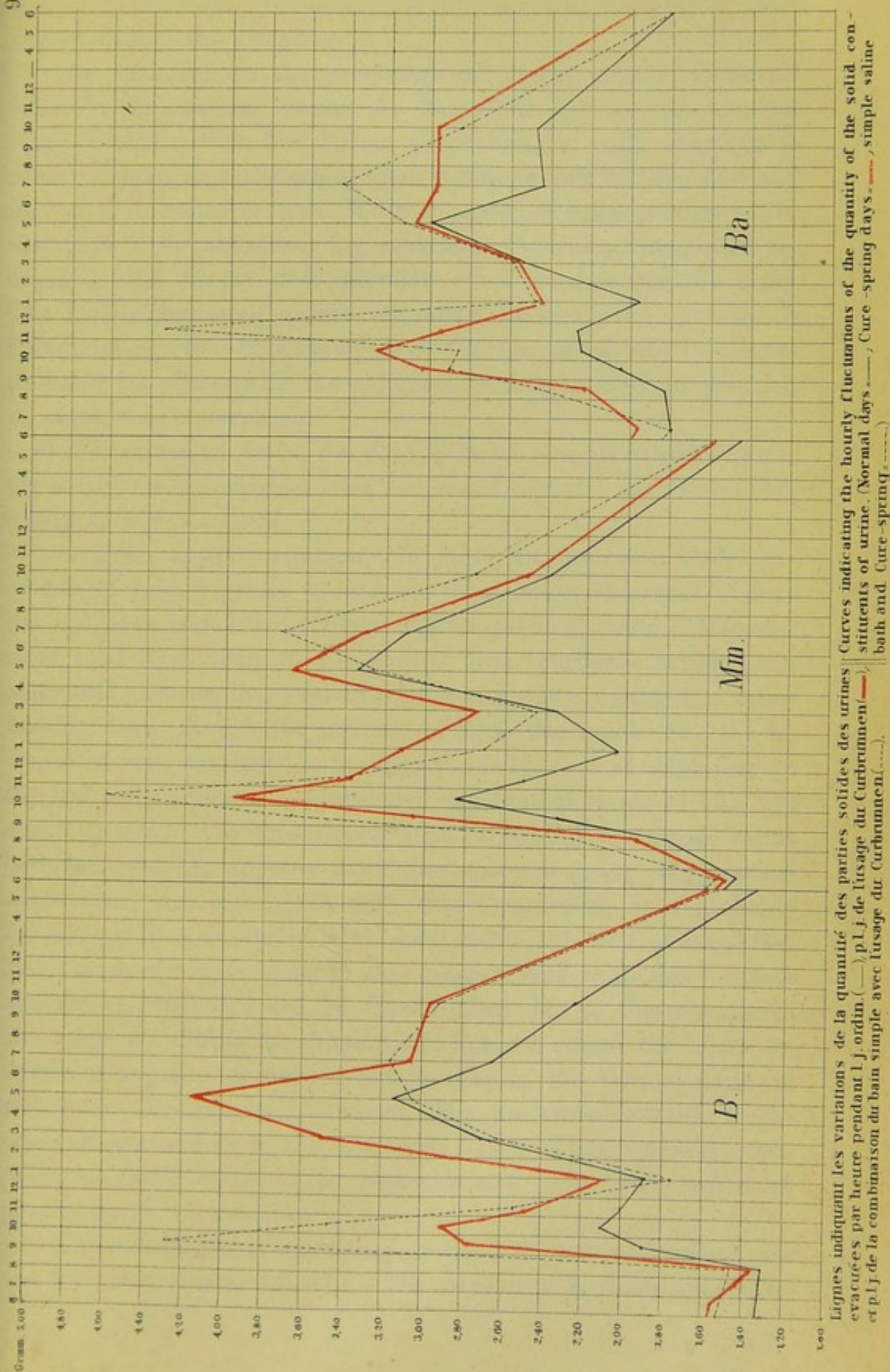
Lignes indiquant les variations de la quantité des urines évacuées par heure pendant les jours ordinaires (—), de l'usage du Curbrunnen (---), et de la combinaison du bain simple avec l'usage du Curbrunnen (.....)

Curves indicating the hourly fluctuations of the quantity of urine. (Normal days: —, Cure-spring days: ---, simple saline bath and Cure-spring: .....)





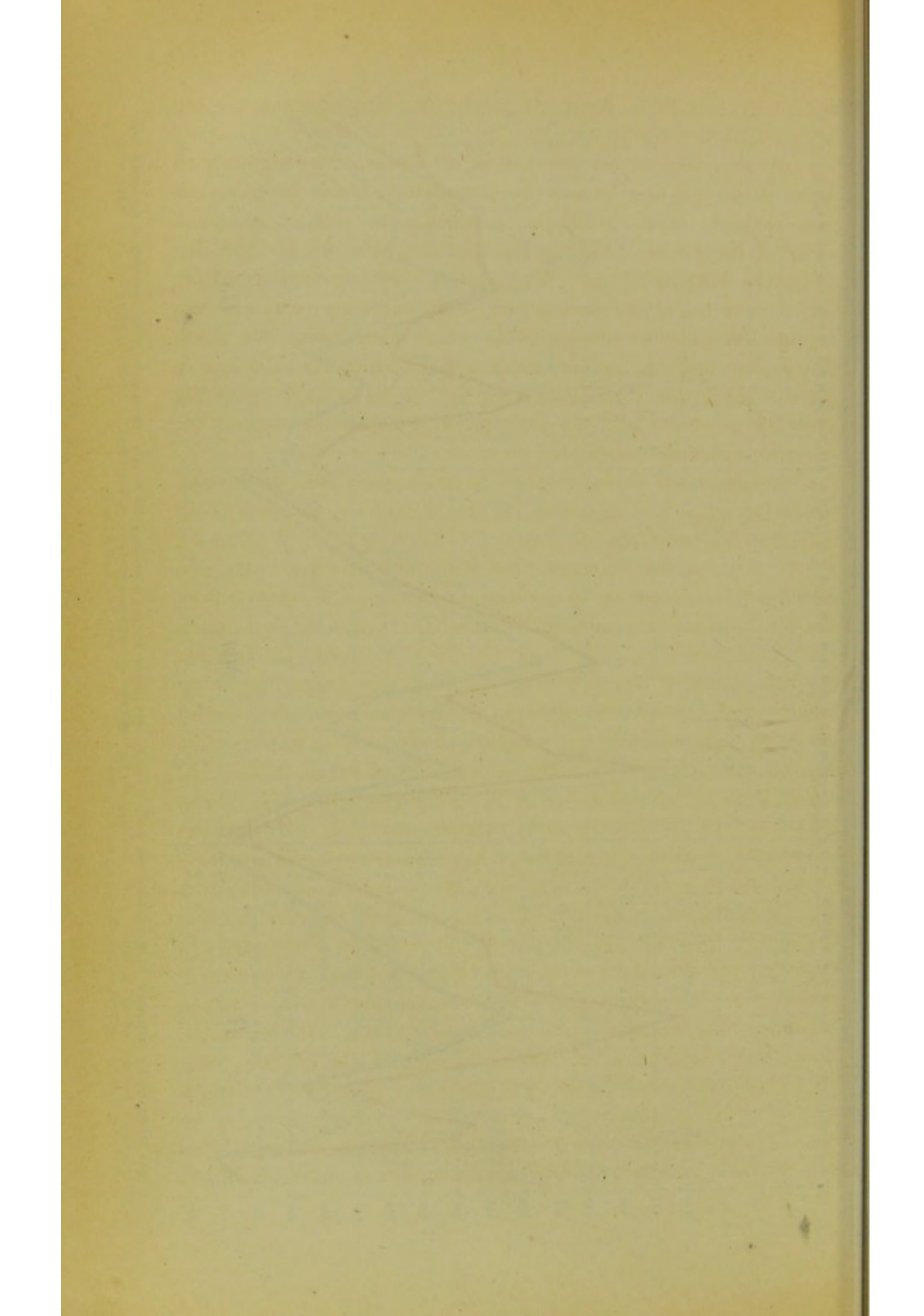




Lignes indiquant les variations de la quantité des parties solides des urines évacuées par heure pendant 1 j. ordin. (—) pl. j. de l'usage du Curbrumen (—) et pl. j. de la combinaison du bain simple avec l'usage du Curbrumen (---).

Curves indicating the hourly fluctuations of the quantity of the solid constituents of urine. (Normal days —, Cure-spring days ---, simple saline bath and Cure-spring —)







consist of chlorides. Thus the influence of these compounds must persist during the afternoon.

As according to the researches of Mosler, the imbibition of water in the morning causes an immediate increase of urea, we may conclude, that the higher proportion of solid constituents observed both in the morning and afternoon was at least partially due to an increase of urea. We may therefore consider it probable, that part of the chlorides, ingested in the morning, remain in the organism and display their peculiar effect even during the night. The higher degree of watery saturation, in which the organism is found during the cure-spring-days (as shown above) combines probably its effects with the chlorides in the observed acceleration of organic metamorphosis.

8) *The increased desire for food is much less considerable during the use of the cure-spring, than one would expect a priori and than it is generally supposed.*

It must appear strange, that with an increased daily excretion of 4—5½ grmm. of urea on an average, the want of food has not been raised to a higher degree (56,3; 31,8 and 30,9 grmm. more solid food, than on the normal days, perfectly satisfied our appetites). Indeed the want of food was greater during the saline bathing days, though the increase of urea was much less (the increase of urea amounted to 1—2 grmm. daily, that of solid food to 47, 103 and 54 grmm. respectively, and that of water to 125, 142 and 90 grmm.). It is thus shown, that in general the simple saline bath increases the appetite more than the cure-spring. If "practical experience" will not agree with this observation, it is probably on account of a decidedly heightened relish for food at breakfast. But this meal stands alone in this respect. And even this increase can not be attributed to the Cur-brunnen but to the exercise in the open air during its imbibition. For we found the same increase of appetite at our breakfasts during the normal days, in which no Cur-brunnen was taken, but the same exercise in the open air pursued as in the cure-spring-days. Thus we may state, that *the desire for food is proportionately very little raised in general by the cure-spring.*

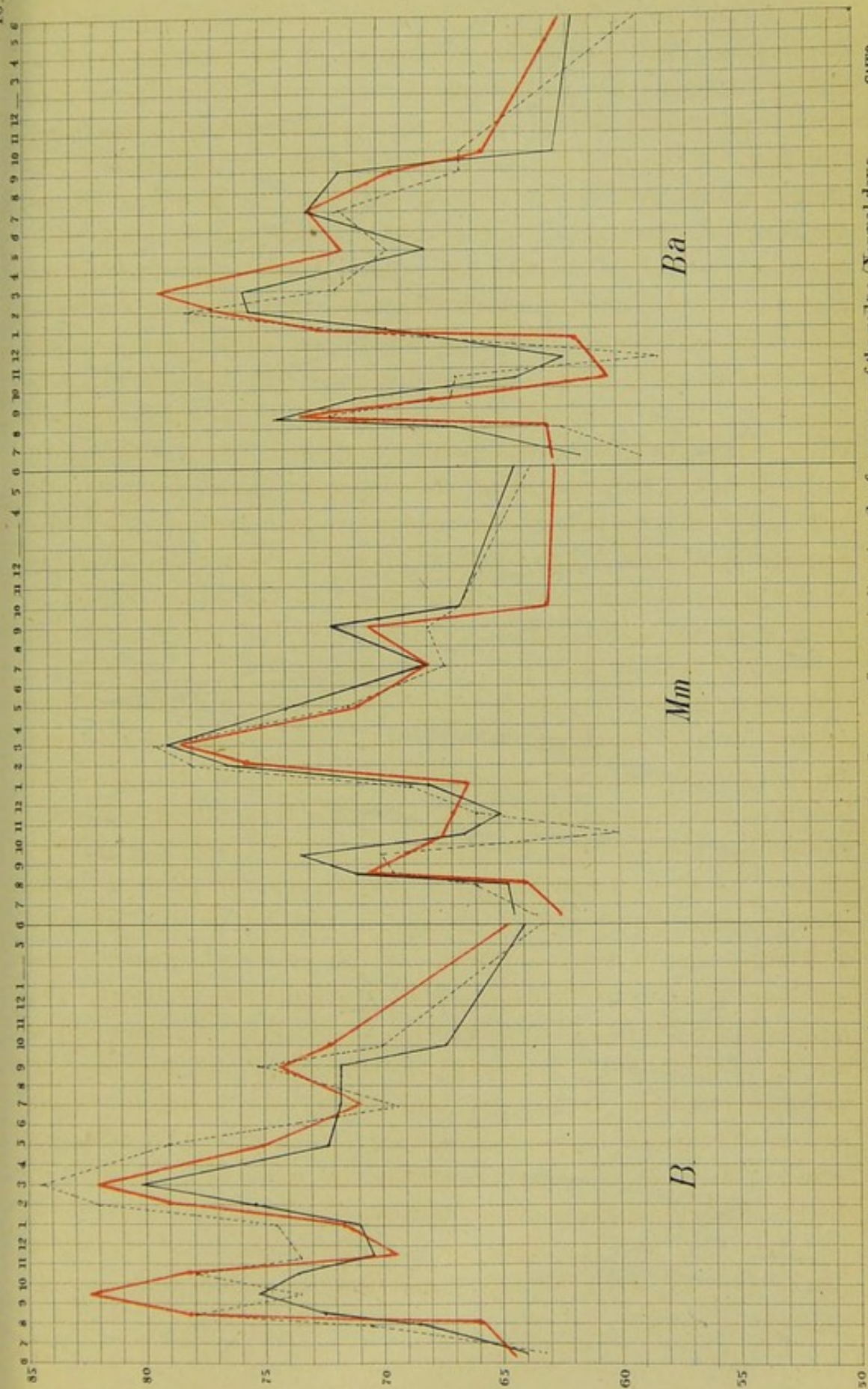
This conclusion is not unimportant. For it demonstrates, that the increased waste, to which the organism is liable under the



use of the cure-spring, tends to the flesh and blood of the organism itself as it were, and the more justifies the view of the accelerating influence of the cure-spring on the metamorphosis of tissues. And in this respect the Cur-brunnen differs from other agents promoting metamorphosis (sea-baths, sea-air, bodily exercise &c.). With these a considerable increase of ingestion is requisite, whilst with the cure-spring this happens in a less degree, an increased excretion of nitrogenous materials taking place without a corresponding increase of supply. I can only find an explanation of this interesting circumstance in the higher degree of saturation with water (under the use of the Cur-brunnen) causing the want of solid food to be less intensely felt, than it would be otherwise. It is true, the increase of appetite in water-cure-establishments is a generally admitted experience; but it still requires to be decided, how much of this increase has to be put to the account of altered diet, bodily exercise &c. and how much to the imbibition of water; besides we don't know, whether the saturation of the economy with water takes place in the same degree by using common water, as is the case with the water containing chloride of sodium.

This consideration leads me, by the bye to an other reflection. It was already mentioned above, that 600 cc. of diluted cure-spring exercise a more accelerating influence on the metamorphosis of the organic nitrogenous materials than the same quantity of ordinary water. The investigations of Dr. Genth for instance show, that through an increased consumption of 2000 cc. of ordinary water the excretion of urea is raised from 40,2 gmm. to 46,6 gmm. in 24 hours. 600 cc. of diluted Cur-brunnen caused with us already an increase of  $4-5\frac{1}{2}$  gmm. in 24 hours. This circumstance contains a therapeutic indication of some importance. If from some individual considerations the use of water in large quantities is thought undesirable, the requisite acceleration of organic metamorphosis may be obtained by adding a few grammes of chloride of sodium to a smaller quantity of water. Herein the great difference seems to lie between the effects of water-cure and a course of the cure-spring, that analogous effects are displayed by the latter from a considerably smaller quantity of water.

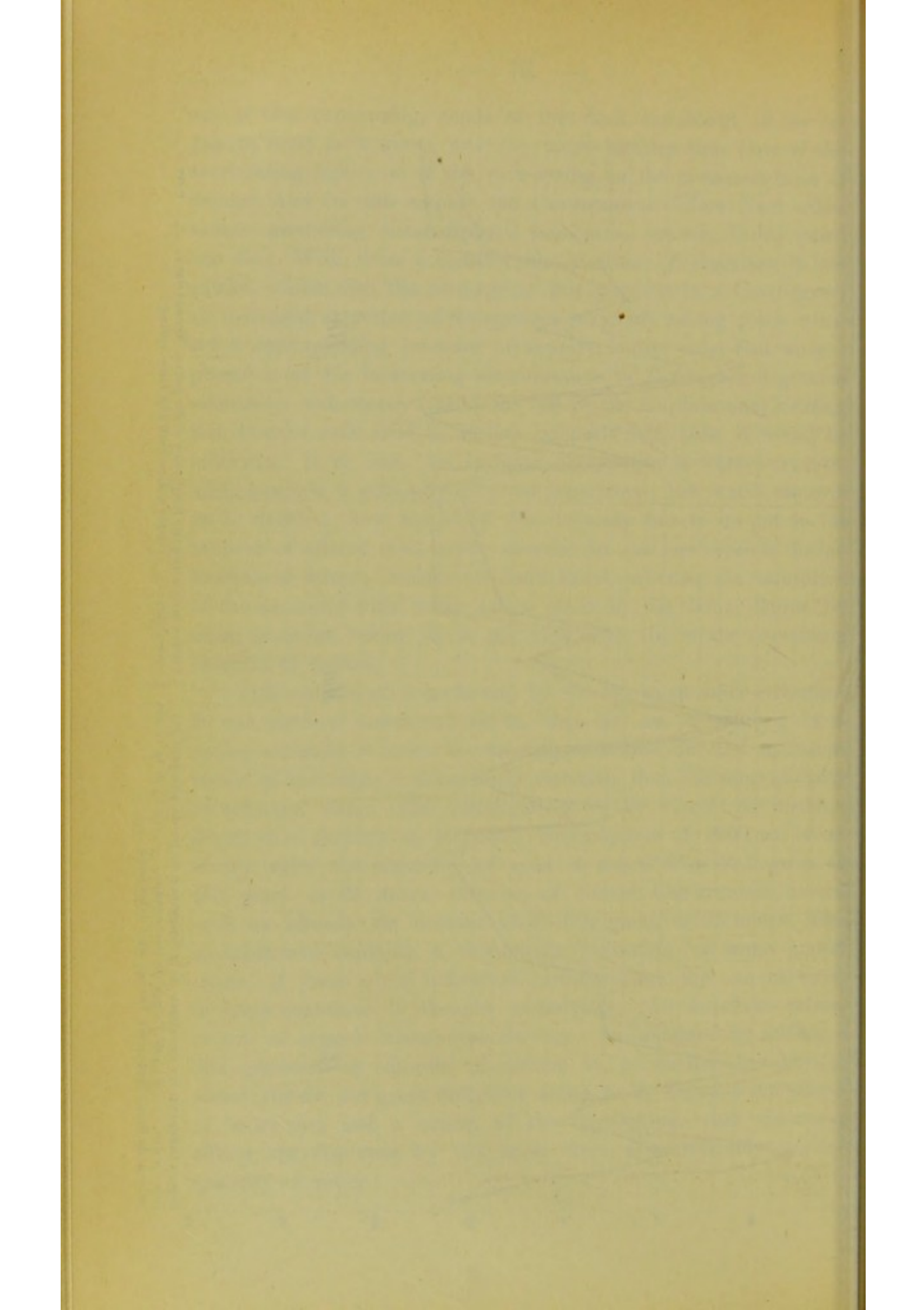




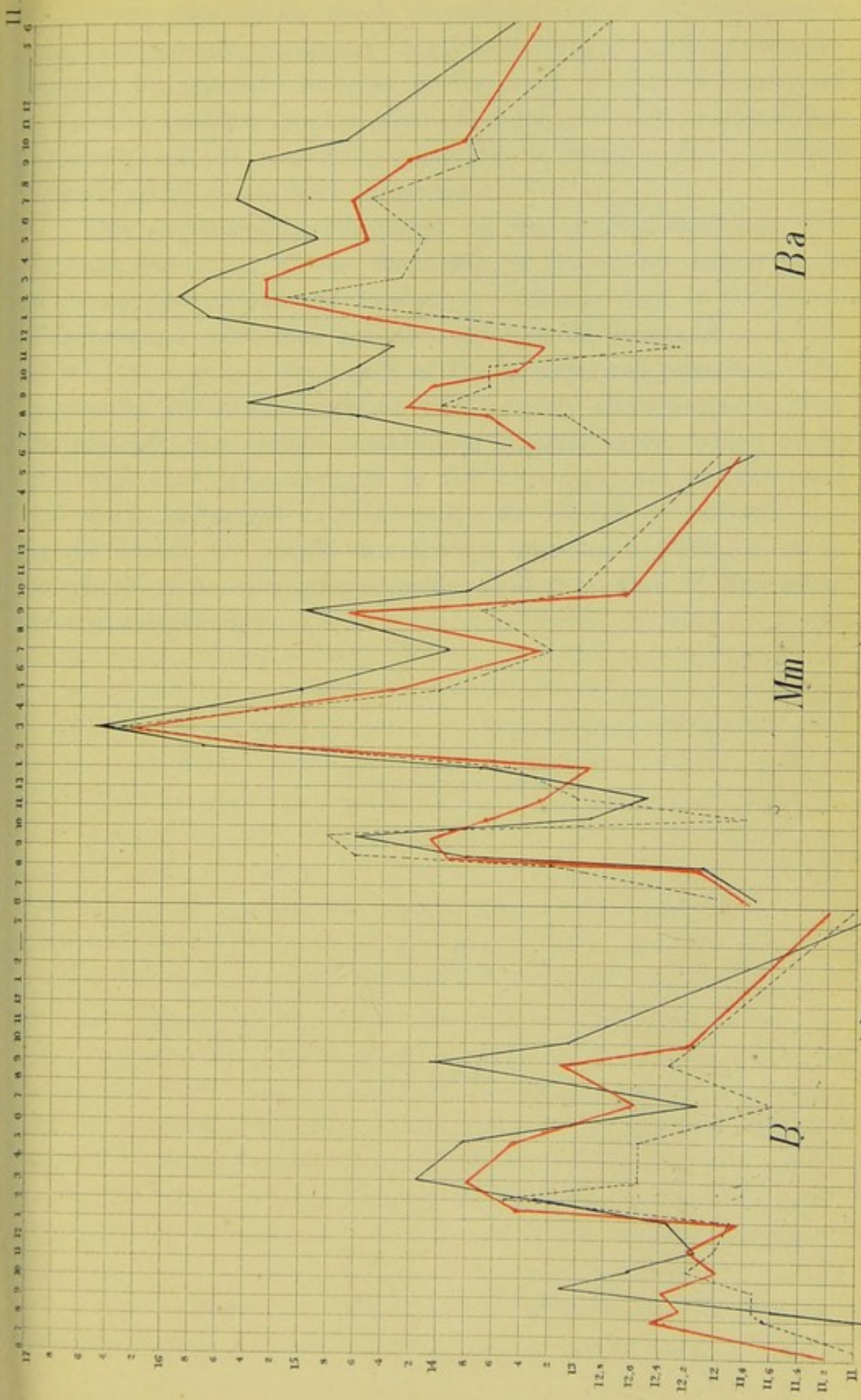
Liens indiquant les variations de la fréquence du pouls pendant les jours ordin. (—), p. l. j. de l'usage du Curbrunnen (—), et p. l. j. de la combinaison du bain simple avec l'usage du Curbrunnen (---).

Curves indicating the frequency of the pulse. (Normal days —; cure —; spring days —; simple saline bath and cure-spring ---).



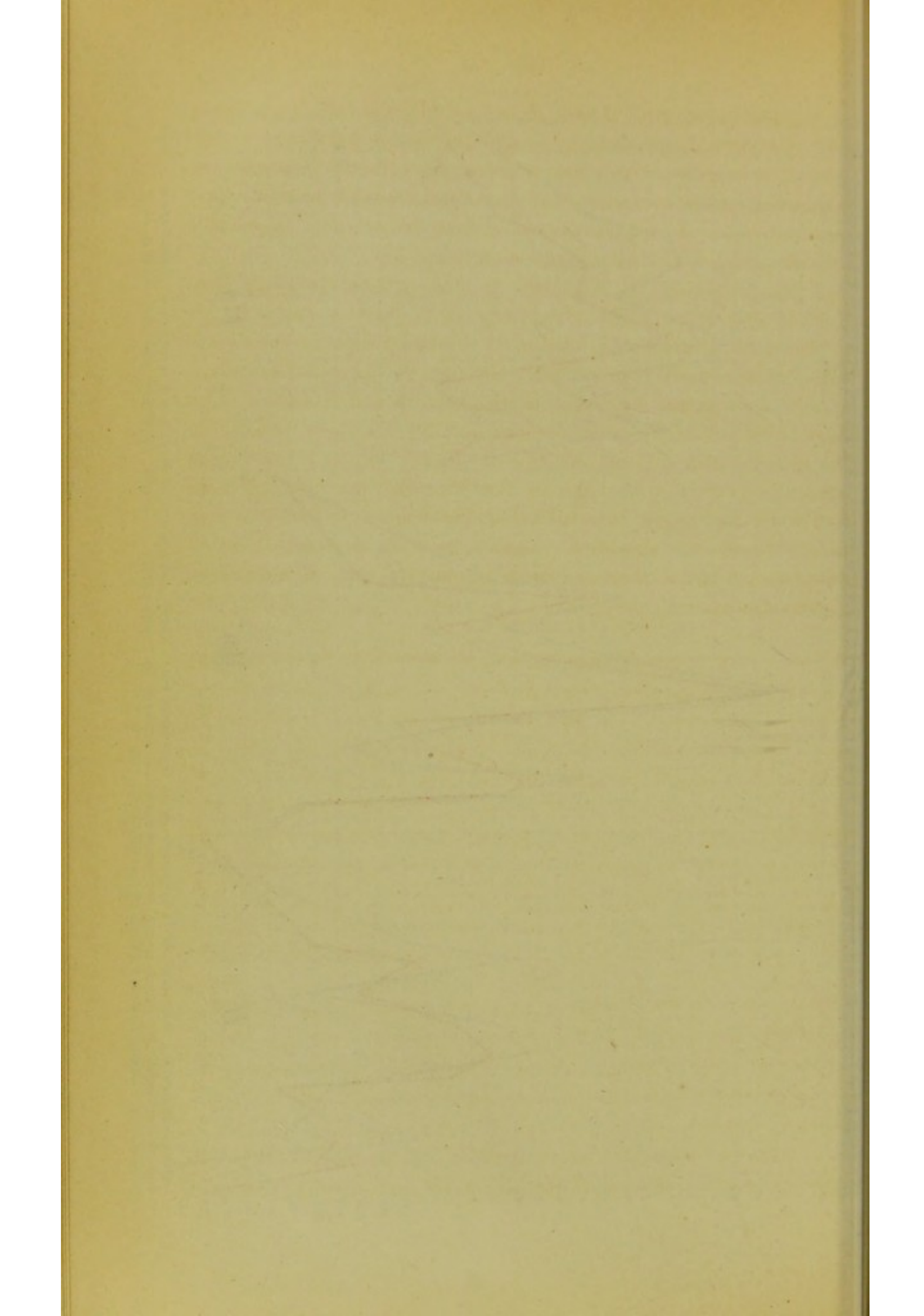






Lignes indiquant les variations de la fréquence de la respiration pendant les jours ordinaires (—), p.l.j. de l'usage du Curbrunnen (—), et p.l.j. de la combinaison du bain simple avec l'usage du Curbrunnen (----). Curves indicating the frequency of respiration. (Normal days —, Cure-spring —, simple saline bath and Cure-spring ----)







9) *The curve of the hourly frequency of pulse only experiences very inconsiderable deviations, though the morning-walk ordinarily induced a momentary increase of frequency. But the frequency of respiration suffers a regular diminution, and probably an accelerated metamorphosis of non-nitrogenous organic compounds (especially organic acids) comes here in question.*

This proposition is elucidated by the graphic drawings. The constant diminution of the frequency of respiration seems to be produced by a diminished tension of carbonic acid in the blood. This becomes more than probable through the increased excretion of solid constituents by means of the kidneys and intestines. The augmented cutaneous excretion may possibly also have assisted in the removal of a certain quantity of organic acids, which might otherwise have been changed in the organism into carbonic acid and water and might have increased the tension of carbonic acid in the blood. Or should we assume here an accelerated metamorphosis of non-nitrogenous acids similar to that of the nitrogenous compounds?



#### 4. On the effects of the combined use of the cure-spring and simple saline bath.

To combine the drinking of a saline water with a saline bath is such a usual custom not only at Nauheim, but at other analogous Spas, that one is compelled to believe, that experience must have shown the effects of the one agent to be increased or at least supported by the other. But according to many an observation it seemed to be more a customary usage, than based on any therapeutic investigation. It seemed part of a certain medical practice to act "mixtis compositis", and it was therefore the more requisite, to subject this question to an experimental inquiry. Its results are instructive enough. They tend to show in general, that the effects of the saline bath partially neutralise those of the saline drink and that even, where their combined use is indicated as a very salutary curative proceeding, it must be undertaken in different manner from that dictated by the usual routine.

The investigations lasted again 6 days and followed as before after a day's pause. All relations of life remained unchanged. We drank the Cur-brunnen between 6,30 and 8 a. m. The bath lasted half an hour and had a temperature of 25—26° R. (88—90° F.). During the first three days B. took it between 8,30 and 9,30 a. m. Mm. between 9,30 and 10,30 a. m. Ba. between 10,30 and 11,30 a. m. In the last three days, however, B. took it between 10,30 and 11,30; Mm. between 8,30 and 9,30 a. m., and Ba. between 9,30 and 10,30 a. m. By thus changing the bathing hours, we wished to demonstrate, in as striking a manner as possible, the



influence of the bath on the urinary secretion and on the frequency of the pulse, and in this we perfectly succeeded.

In this series of experiments the atmospheric temperature was again much higher, than on the normal days. Otherwise no disturbing influences interfered with the experiments. If thus the proportions of the renal excretions varied considerably several times with B. and Ba. no other cause can be found, than the effects of the Brunnen and bath.

Both agents must be considered as highly conducive to increase the renal secretion in particular days, whilst on the succeeding days a corresponding saving or retention took place. These relations appear often enough in such investigations and render the proposal lately made by a mathematician quite unjustified, viz. that those days, in which the secretions had been abnormally increased, should be unhesitatingly struck out, on the assumption that unknown and unusual influences must have taken place.

The essential results of our investigations may be comprised in the following propositions.

1) *If in the morning 600 cc. of diluted Cur-brunnen are imbibed and a simple saline bath taken, the effect of this combination does not equal in general the sum of the effects of each single agent.* On the contrary the effect of the Brunnen is partially destroyed by that of the bath and this the more, the sooner the bath is made to follow the drinking of the Brunnen. This is especially owing to the strong diuretic effect exercised by the bath, as is shown in the graphic drawing. Thus the greatest part of the water drunk in the morning (but without the whole of the salt introduced with it) leaves the organism after the bath. In this way a principal effect of the morning draught is lost viz, the intense watery impregnation of the organism. On the other hand the bath produces a more increased desire for food at mid-day (in consequence of its accelerating influence on the metamorphosis) than in the case of the exclusive use of the Brunnen. Thus in the afternoon, instead of acceleration of metamorphosis (effect of the cure-spring), retardation ensues (effect of the bath). The numbers given below will further explain the above proposition.



2) Nevertheless even under the combined use of Brunnen and bath an increase of bodily weight may take place besides the more intense want of food. If this want is satisfied, the weight seems often to increase even more, than under the use of the Cur-brunnen alone.

3) The excretions of the organism in general are not always greater under the combined use of Brunnen and bath, than under the use of the Brunnen alone.

The proofs are furnished by the graphic sketch (see above), which shows, that in the "combination days" a relative increase of weight took place in comparison with the normal and cure-spring days. In Mm. the increase was even absolute. It needs scarcely to be remarked, that we consumed on this occasion also exactly that amount of food, which corresponded to our desires. The following table will illustrate the second proposition.

#### Excretions

a) in the normal experimental days:

	6,30 a. m. — 1 p. m.	1 — 7 p. m.	7 p. m. — 6,30 a. m.	sum total
B.	Gmm. 733,2	Gmm. 924,5	Gmm. 1324,5	Gmm. 2982,2
Mm.	873,5	1029,0	1209,4	3111,9
Ba.	789,4	840,6	1581,3	3211,3

b) in the cure-spring days:

B.	1104,0	1144,7	1394,8	3643,5
Mm.	1313,9	1219,5	1075,8	3609,2
Ba.	1158,5	1180,7	1416,2	3755,4



c) in the combination days :

B.	Gmm. 1377,3	Gmm. 1126,7	Gmm. 1179,9	Gmm. 3683,9
Mm.	1404,3	1131,9	1155,3	3691,5
Ba.	1365,9	1151,5	1284,1	3801,5

Difference between a—c:

B.	+ 644,1	+ 202,2	— 144,6	+ 701,7
Mm.	+ 530,8	+ 102,9	— 54,1	+ 579,6
Ba.	+ 576,5	+ 310,9	— 297,2	+ 590,2

Difference between b and c:

B.	+ 273,3	— 18,0	— 214,9	+ 40,4
Mm.	+ 90,4	— 87,6	+ 79,4	+ 82,3
Ba.	+ 207,4	— 92,2	— 132,1	+ 46,1

The excretions are shown to be considerably increased during the morning hours, then diminished in the afternoon in comparison with the cure-spring days. It might seem from the table, as if the sum total of excretions was always higher than on the cure-spring days. This, however, is not the case. With Mm. certainly the increase of excretions may be put to the account of the added bath; it exclusively took place by means of the kidneys. With B. and Ba. on the contrary the cutaneous excretion was also increased in proportion to the cure-spring days. But the cause of this must only be sought in the higher atmospheric temperature, to which



we may rather attribute the increased sum total of excretions, than to the addition of the bath. Hence it follows, that the *total increase of excretions* during the combined use of Brunnen and bath (in proportion to the days, in which the Brunnen has been used alone) is not a constant event. According to the individual effect of the bath the sum of excretions on the combination days is sometimes equal to and sometimes greater than on the days, in which the cure-spring is imbibed alone.

4) *Under the combined use of Brunnen and bath the excretions of the intestines, kidneys, skin and lungs are increased in general. But the increase is not always higher, than under the use of the cure-spring alone, and when it is higher, it seems especially due to the promoted renal excretion.*

The proof is found in the following table:

*Excretions*

a) on the normal experimental days.

	through skin and lungs	through kid- neys	through intestines	sum total
B.	Gmm. 1015,9	Gmm. 1811,4	Gmm. 153,6	Gmm. 2980,9
Mm.	1248,0	1717,6	146,5	3112,1
Ba.	1215,6	1830,4	165,3	3211,3

b) on the combination days:

B.	1524,9 (+ 509)	1925,4 (+ 114)	235 (+ 81,4)	3685,3 (+ 704,4)
Mm.	1525,7 (+ 277,7)	1966,2 (+ 248,6)	199,5 (+ 53,0)	3691,4 (+ 579,3)
Ba.	1708,0 (+ 492,4)	1811,4 (+ 19,0)	282 (+ 116,7)	3801,4 (+ 590,1)



An increase of all excretions is shown in this table with a single exception, insignificant though from special reasons. The increase of *cutaneous and pulmonary excretions* is very considerable, as it is proportionately greater, than on the simple cure-spring days. It might seem again, as if the combination of the cure-spring *with the bath* promotes cutaneous excretion (similarly to the use of the saline-bath alone s. p. 25). But we must refer to the observed diminution of this excretion during the mother-lye days and remember, that on the combination-days the air was sometimes warmer than on the cure-spring days. Thus this excretion was raised even to an unpleasant degree during the afternoons, (especially with B. and Ba.) I attribute therefore again the increase of cutaneous and pulmonary excretions to the higher atmospheric temperature and not to the saline bath. Future investigations, where the disturbing atmospheric influence may be avoided, must decide this point.

The *renal* excretions are increased in proportion to the normal experimental days with B. and Mm., diminished with Ba. — If the cutaneous functions had not again been raised so considerably, the renal excretion would have been more considerable still and no decrease would have taken place with Ba. — In proportion to the cure-spring days (s. p. 59) we find the renal excretions diminished on the combination days with B. and Ba., but increased with Mm. We observe thus anew the same individual difference of effect, as we observed in the investigation of the influence exercised by the simple saline bath. With Mm. the saline bath has again a specifically diuretic effect, notwithstanding the high atmospheric temperature. The decreases with B. and Ba. are readily explained from the superabundant cutaneous excretion.

5) *The increase of excretions under the combined use of bath and Brunnen takes place in day time, whilst a diminution is invariably observed at night, especially a diminished excretion of water.*

The proof is found in the following table:



### Excretions

a) on the normal experimental days:

	from 6,30 a. m. to 1 p. m.			from 1 to 7 p. m.			from 7 p. m. to 6,30 a. m.		
	through skin and lungs.	through the kidneys	through the intestines	through skin and lungs	through the kidneys	through the in- testines	through skin and lungs	through the kidneys	through the intestines
B.	Gmm. 334,0	Gmm. 399,1	Gmm. 0	Gmm. 307,6	Gmm. 616,9	Gmm. 0	Gmm. 373,6	Gmm. 797,4	Gmm. 153,6
Mm.	372,7	452,3	48,6	409,5	540,3	79,3	464,9	726,1	18,5
Ba.	307,7	481,7	0	378,3	462,3	0	526,5	888,9	165,8

b) on the combination days:

B.	354,8	855,5	167	607,4	500,0	19,3	559,0	571,9	49
Mm.	416,9	858,7	128,6	590,9	470,3	70,8	517,5	637,6	0
Ba.	409,4	731,3	225,2	703,2	417,5	30,8	593,9	664,1	26

Difference:

B.	+ 20,8	+ 456,4	+ 176	+ 299,8	- 116,9	+ 19,3	+ 185,4	- 225,5	- 104,6
Mm.	+ 44,2	+ 406,4	+ 80	+ 181,4	- 70	- 8,5	+ 52,6	- 88,5	- 18,5
Ba.	+ 101,7	+ 249,6	+ 225,2	+ 324,9	- 44,8	+ 30,8	+ 67,4	- 224,8	- 139,8

The urinary excretion is seen to be considerably increased in the morning hours of the combination days, both compared to the normal and to the cure-spring days. *Thus the diuretic effect of the saline bath is here again established beyond any doubt.* During the afternoon of the combination days a diminished excretion of urine



takes place, it is true. But we have to consider the corresponding increase of cutaneous function in consequence of the high temperature of the air, and thus the diminution is accounted for. During the night, however, an absolute decrease of renal excretion ensues. For though cutaneous and pulmonary excretions are heightened, the decrease in question is proportionately more considerable than this increase. Herein we recognise the peculiar effect of the cure-spring. In general I do not hesitate to affirm, that *ceteris paribus under the combined use of the Cur-brunnen and saline bath the excretion of the kidneys is especially promoted and next to it the intestinal excretion.*

Here again I have, however, to mention, that we fixed the pulmonary and cutaneous excretions only as a sum total, and though in general they do not experience an increase *in consequence of Bath and Brunnen*, nevertheless a relatively increased proportion of their carbonic acid is *possible*, an assumption which finds support in the diminished frequency of respiration.

As regards *intestinal evacuations*, we made the same observation as we did on the cure-spring days. They increase during the morning hours, that is soon after the imbibition of the cure-spring. In the afternoon a slight increase takes place likewise (with an insignificant exception as regards Mm.). During the night, however, a diminution takes place, which is only to be considered as a natural consequence of the previous increase.

6) *The increase of weight taking place under the combined use of Brunnen and baths is chiefly due to the retention of water in the organism.* But it may be, and no doubt is occasionally caused by the assimilation and formation of new bodily substance. Thus the combined use of brunnen and bath does not invariably cause a decrease of substance.

7) *Under the combined use of Brunnen and bath in the morning the organism does not remain during the whole day in that state of higher saturation with water, as under the sole use of the cure-spring. This saturation is only found in a portion of the morning hours and during night.*

The proof of this proposition lies in the following numbers, which are approximatively correct. If we calculate again the proportion of



water contained in the organism during the various periods of the day according to the percentage\*) mentioned (pag. 63), we arrive at the following results:

On the combination days:

	Water imbibed			Water excreted		
	6,30 a. m.— 1 p. m.	1 p. m.— 7 p. m.	7 p. m.— 6,30 a. m.	6,30 a. m.— 1 p. m.	1 p. m.— 7 a. m.	7 p. m.— 6,30 a. m.
B.	975 Gm.	1419 Gm.	893 Gm.	1271 Gm.	995 Gm.	1051 Gm.
Mm.	986 "	1495 "	885 "	1288 "	996 "	1041 "
Ba.	1001 "	1505 "	906 "	1239 "	1002 "	1149 "

The contents of water in the organism were

a) during the normal days (see pag. 64):

	1 p. m.	7 p. m.	6,30 a. m.
with B.	— 255 Gmm.	+ 219 Gmm.	— 66 Gmm.
" Mm.	— 367 "	+ 123 "	— 61 "
" Ba.	— 304 "	+ 372 "	— 106 "

\*) The cutaneous function having been higher on the combination days than on the cure-spring days, we calculate 82 percent of water for it instead of 80. All other proportions remain the same.



b) according to the above calculation it amounts on the combination days to:

	1 p. m.	7 p. m.	6,30 a. m.
with B.	— 296 Gmm.	+ 128 Gmm.	— 30 Gmm.
" Mm.	— 302 "	+ 197 "	+ 41 "
" Ba.	— 238 "	+ 265 "	+ 22 "

It is evident from these tables, that the effects of the cure-spring imbibed in the morning are partially neutralised through a saline bath taken in the same morning. From our knowledge of the diuretic effect of the saline bath we can not wonder at this result. Whilst the organism is found in a much less degree of inanition of water at one p. m. in the cure-spring days, than in the normal experimental days (no inanition at all taking place with B.), in the combination days the inanition of water is almost equal to that on the normal days, and with B. even greater than on these days. — At 7 p. m. the quantity of water in the organism is less with B. and Ba. on the combination days, than on the normal experimental days and also less than on the cure-spring days; with Mm., however, there is a rather more considerable quantity, than on those two kinds of days. The result with B. and Ba. is the more remarkable, as in the afternoons of the combination days 33,3 cc. more water and also more solid food (containing water) was taken, than on the normal and cure-spring days. But this loses in significance, if we remember the considerably increased cutaneous function. The result would also have appeared less different with Mm., if a greater quantity of water had not been imbibed. On the other hand the difference would have been greater, if the cutaneous function had not been so considerably raised. — At 6 in the morning the proportion of water is invariably more considerable, than on the normal days, but with B. and Mm. somewhat less, and with Ba. rather more than on the cure-spring days. With these dif-



ferences it is rather difficult, to deduce a general proposition from the last observations. However looking at all the various influences, I believe, the following opinion may be justified: *If besides the imbibition of 600 cc. of diluted cure-spring in the morning a simple saline bath be taken, the organism is found about midday in a similar degree of inanition of water to that observed during the ordinary mode of living; the same may be said of the evening period (ceteris paribus), viz. a certain excess of water existing in the organism, as is the case in the ordinary days; but in the early morning there is rather more abundance of water under those influences, than under usual circumstances.*

The difference of this result from that, found under the exclusive use of the cure-spring, is clear (see p. 65). Whilst there the organism persisted in a higher degree of watery saturation during the whole day; here the saturation is not greater in the middle and after-part of the day, than on the normal experimental days. Only at night it is somewhat greater on the combination days. The cause of this can only lie in the addition of the saline bath. As we sought to explain the effect of the cure-spring in a great measure from the persistent watery saturation, it evidently follows: that the addition of the bath, especially during the morning-hours must paralyse to some extent the effects of the cure-spring.

From the above we also arrive at an approximatively correct insight into the relation of the bodily weight in the combination days. B. experienced on an average a gain of about 36 grmm. in proportion to the normal days. Thus not only the increase of weight, but also part of the weight of the increased excretion of solids is covered by the retention of water. M. and Ba. on the contrary experienced a gain of resp.: 102 and 128 grmm. of water, whilst their respective increase of weights amounted to 159,5 and 150,3 grmm. This increase can only partially be explained through retention of water. The other part must be attributed to a gain of solid constituents and to a real new formation of bodily substance. I do not by any means conceal from myself the circumstance of the above calculation being only approximatively correct. But if the result here obtained fully harmonises with the numerous practical observations communicated above (p. 31), I feel the less inclined to doubt the justice of the general and important pro-







*Excretions*

a) on the normal experimental days:

	Quantity of urine	Solid con- stituents (according to Trapp)	Urea	Uric acid	Phos- phoric acid	Sulphu- ric acid	Chloride of sodium
by B.	1767 CC.	45,5 G.	31,59 G.	0,096 G.	2,30 G.	1,91 G.	11,26 G.
„ Mm.	1667 „	49,9 „	35,15 „	0,080 „	3,04 „	2,08 „	10,84 „
„ Ba.	1781 „	49,2 „	34,31 „	0,115 „	2,69 „	1,93 „	13,12 „

b) on the cure-spring days:

by B.	1921 CC.	56,4 G.	35,56 G.	0,140 G.	2,38 G.	2,12 G.	18,49 G.
„ Mm.	1802 „	58,7 „	39,68 „	0,054 „	2,97 „	2,26 „	18,79 „
„ Ba.	1882 „	59,6 „	39,37 „	0,206 „	2,88 „	2,17 „	19,21 „

c) on the combination days:

by B.	1870 CC.	55,4 G.	35,08 G.	0,048 G.	2,41 G.	2,20 „	16,26 G.
„ Mm.	1905 „	61,5 „	41,57 „	0,013 „	2,99 „	2,56 „	16,91 „
„ Ba.	1752 „	59,0 „	38,10 „	0,58 „	2,89 „	2,29 „	17,88 „

Difference of a and c:

with B.	+ 103 CC.	+ 9,9 G.	+ 3,49 G.	- 0,048 G.	+ 0,11 G.	+ 0,29 G.	+ 5,00 G.
„ Mm.	+ 238 „	+ 11,6 „	+ 6,42 „	- 0,067 „	- 0,05 „	+ 0,48 „	+ 6,07 „
„ B a.	- 29 „	+ 9,8 „	+ 3,79 „	+ 0,043 „	+ 0,20 „	+ 0,36 „	+ 4,76 „



Difference of b and c:

with B.	CC.	Gmm.	Gmm.	Gmm.	Gmm.	Gmm.	Gmm.
	— 51	+ 1,00	— 0,48	— 0,092	+ 0,03	+ 0,08	— 2,23
" Mm.	+ 103	+ 2,8	+ 1,89	— 0,041	+ 0,02	+ 0,30	— 1,88
" Ba.	— 130	— 0,6	— 1,27	— 0 048	+ 0,01	+ 0,12	— 1,33

These observations permit several important conclusions as regards the practice at the Spas. *The solid constituents of urine* are considerably increased on the whole, it is true, under the combined influence of Brunnen and bath. But if we compare this increase with that which takes place under the exclusive use of the cure-spring, we find it is only greater with Mm., but less with B. and Ba. Similar proportions are found as regards *urea*. There is an evident increase in proportion to the normal days. In proportion to the cure-spring days, however, a further increase takes place again only with Mm., and a decrease with B. and Ba. In examining the effects of the simple saline-bath we found an increase of urea of 0,8 and 2,2 grmm. with B. and Mm. within 24 hours. If then on the combined use of spring and bath the effect of each were simply added together, we should have to find on the combination days a plus of urea of 4,7 grmm. for B. and of 6,73 grmm. for Mm. But we find for B. only a plus of 3,49 and for Mm. a plus of 6,42, so that even with him, notwithstanding the increased excretion of urea, on the combination days a smaller quantity was excreted, than could have been expected.

It seems, that we may draw from this the conclusion : *that if a saline bath follows in the morning the imbibition of the diluted cure-spring, it partially destroys the accelerating effect, which is exercised by the latter on the metamorphosis of the nitrogenous materials of the body.* Thus we have to proceed to other, than our usual measures in our practice at the Spas, if we wish to obtain the full effect both of Brunnen and bath. This result of our observation is the more trustworthy and striking, as in the cure-spring days we only increased our solid food by 56,3; 31,8 and 30,9 grmm.; whilst in the combination days we increased it by



96,9 : 105,4 and 106,5 grmm. respectively. We ought to have had accordingly an increased excretion of urea in the combination days. But as the desire for food was only inconsiderably heightened during the cure-spring days and we had to draw the conclusion, that the observed increase of urea was exclusively due to a more intense metamorphosis of the real flesh and blood of the organism (s. p. 75), the quantity of urea found in the combination days loses still more in its significance than the numbers indicate by themselves. For the increased consumption of solid food in consequence of the greater desire for nutriment no doubt furnished here part of the material for the excretion of urea. It is thus the more evident, that under the influence of spring and bath the metamorphosis of nitrogenous materials becomes less accelerated, than under the influence of the cure-spring alone. We shall obtain by and by a satisfactory explanation of the cause of this interesting occurrence.

*The sulphuric acid of the urine* is again excreted in the combination days with the same proportionate increase in comparison to the normal days as the urea. With Mm. we find an increase in the combination days analogous to that of urea, with B. and Ba., however, not a diminution, as we might expect, but also a slight increase. The latter, however, is so inconsiderable, that it might be put to the account of the limits, within which the numbers may be faulty. Even if we should hesitate to admit this as regards Ba., the increase is so inconsiderable, that no further conclusion can be deduced from it.

*Uric acid* is diminished in proportion to the normal days with B. and Mm., but increased with Ba. In comparison with the cure-spring days, however, a decrease of uric acid took place in all three of us. This seems to be no accident, and the less so, as under the exclusive use of the saline-bath a slight diminution of uric acid took place with B. and Mm. I believe therefore to be justified, in forming the proposition, *that under the influence of the cure-spring and bath the excretion of uric acid is somewhat less, than under the influence of the cure-spring alone.*

*As regards the phosphoric acid of urine* the relations are quite similar under the use of Brunnen and bath to those taking place



under the use of the cure-spring alone : slight increase of excretion with B. and Ba.; slight decrease with Mm. Indeed the difference in both series of experiments is so small (0,03; 0,02 and 0,01 grmm.) that it deserves no notice. If then the exclusive use of the saline bath occasions a diminished excretion of phosphoric acid (that is a saving of this acid [s. p. 28]), it follows, that in this respect also the effects of the combination are not equal to the sum of the effects of the simple agents. We rather have to state, *that under the combined use of bath and Brunnen the checking influence exercised by the former on the excretion of phosphoric acid is in a very great measure destroyed by the Brunnen.* But by a further reflection the diminished effect of the bath through the spring appears less significant, than it would seem to be according to the numbers. I may in the first instance refer to the remarks made above, as regards the *relative* gain of phosphoric acid under the use of the cure-spring alone. But then the following circumstance is also to be taken into consideration. In the combination days 100 grmm. more of solid food was consumed on an average, than on the normal experimental days, and 40—70 grmm. more than on the cure-spring days. If we even assume that the increased ingestion of 30—60 grmm. of solid food, including an increased introduction of phosphoric acid causes the inconsiderable increase of the excretion of phosphoric acid in the cure-spring days and the pretty equal increase in the combination days (with B. and Ba.), so that this quantity of phosphoric acid was not reserved for the benefit of the organism (at least with B. and Ba.), at all events the greater proportion of phosphoric acid introduced into the organism in the combination days with the 40—70 grmm. of food was retained in the organism under the influence of Brunnen and bath. We thus arrive at the result, that notwithstanding the excretion of equal quantities of phosphoric acid to those on the normal days, a gain of phosphoric acid happens for the economy.

It thus perfectly harmonises with my views concerning the physiological importance of phosphoric acid, that many persons (s. p. 88) experience a gain of bodily weight (under the influence of bath and spring) which could scarcely be explained as a simple consequence of retained water. It is therefore wrong to assert, that bath and spring combined invariably produce a diminution



of bodily weight. This result may no doubt be obtained; it requires some dietetic measures to produce it, if it is thought desirable. But if the weight decreases without any change in the quality or quantity of alimentation, it is probable, as already mentioned above, that some injurious influence is in action, and great caution in the employment of bath and spring is to be enjoined. I beg especially to add, that the accelerated metamorphosis of nitrogenous compounds under the influence of the cure-spring is by no means opposed to the increase of weight. There are many circumstances, under which an excess of albuminates in the organism leads to emaciation, as I have shown elsewhere\*). In these very circumstances a withdrawal of a certain amount of albuminates tends to prevent further emaciation, provided always, that there is no absolute want of the other organic and inorganic compounds requisite for the new formation of tissue.

To resume briefly : *the simple bath alone* occasions a diminished excretion of phosphoric acid; the organism gaining a corresponding amount. The *cure-spring alone* causes a slight increase of this excretion, it is true, but in consequence of the considerably accelerated metamorphosis of nitrogenous compounds albuminates and phosphoric acid enter quite a different proportion after the cure than before, and this in such a manner that phosphoric acid experiences a relative increase. *Cure-spring and bath combined* act on the quantity of phosphoric acid in a similar manner to the cure-spring alone. But the eventual gain of phosphoric acid for the organism is somewhat more considerable, than under the exclusive use of the cure-spring, because the want of food is heightened and thus an increased ingestion of phosphoric acid takes place with the introduction of the other ingredients. The quantitative chemical differences may be extremely small between one day and another. But a course continued 4, 6 or 8 weeks must produce the most considerable changes in the proportions of the single integrating constituents of the body. On this change, beyond any doubt, the great importance of the course rests in a great measure. It is a very just demand of *Virchow's*: that the physician ought to accustom himself "to think mikro-

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\*) Cf. On the development of oxaluria by F. W. Beneke. Göttingen 1852.



scopically". But let us not forget the composition over the form and let us attribute an equal importance to the mikrochemical thinking.

To the elementary particles constituting the form of the organism nutritive material is supplied, the integrating constituents of which stand *in perfectly fixed proportions* to each other. Normal nutrition results from the immutability of these proportions. Their slightest derangement must produce alteration of the former. Without a careful attention to this neglected part of our physiology and pathology and especially without an exact study of the relations, in which the organic constituents stand to the inorganic, medical science will always remain very deficient and imperfect. But as according to all probabilities new supports are to be expected in this direction not only to pathology, but also to *Therapeutics*, the highest aim of the physician, more labor ought to be bestowed on this field. Though this would be more difficult, than the study of morphological objects, the results would reward labor in a corresponding manner.

Lastly we have to refer to the *chlorides*. Their quantity in the urine is greater on the combination days, than on the normal experimental days, but less by 2,23; 1,88 and 1,33 grmm. than on the corresponding cure-spring days. It is difficult, to ascertain the exact cause of this circumstance. The saline-bath alone and also the mother-lye bath scarcely (if at all) diminish the excretion of chlorides.

It is very improbable, that during the combination days much more of the chlorides should be excreted through the skin and intestines, than on the cure-spring days, especially as with Mm. no increase of excretion took place through skin and lungs, though the decrease of chlorides in the urine was found as well with him, as with B. and Ma. The ingestion of chlorides was, however, greater on the combination days, through the increased consumption of food and not less than on the cure-spring days. Thus we are compelled to assume, *that during the prolonged continuation of the cure-spring and just in consequence of this continuation, the excretion of chlorides becomes diminished*. We found above, that in the first 6 cure-spring days, not only the whole quantity of chlorine introduced with the spring, but even more chlorine was excreted



by the urine, than on the normal experimental days. For this latter excess no other source could exist but the organism itself. It may be presumed, that only a certain quantity of chloride of sodium (individually differing) is disposable for egestion out of the organism by an increased imbibition of water, and that, this quantity once exhausted, the increased introduction of water is unable according to the laws of diffusion to dissolve any more of the chloride of sodium of the organism. Thus it will be found, that in a second and third week of using the cure-spring the chlorine of the urine is diminished in proportion to the first week. But there is an other cause of the diminution of excretion of the chloride of sodium. *Plouviez* and *Vogel* (s. p. 71) maintain, having found, that by a continued use of chloride of sodium or of the cure-spring of Nauheim the blood gains in its proportion of chlorides and loses in that of albuminates. We have no reason to doubt the correctness of this observation. According to the laws of diffusion ascertained by C. Schmidt of Dorpat it even obtains a high degree of probability. Schmidt found, that for every quantity of albuminate withdrawn from the blood a diffusion equivalent of salt may be retained in it, or absorbed by it. — Now as the cure-spring causes a not inconsiderable increase of excretion of albuminates, it becomes probable, that a retention of chloride of sodium by the blood follows, and thus not more but rather less chlorine will find its issue, than that introduced with the cure-spring. Indeed it is possible, that this retention began to appear with B. and Ba. in the second week of the use of the cure-spring. For whilst 5,14 grmm. of chlorides were introduced daily with the cure-spring, only 5 and 4,76 grmm. respectively were excreted with the urine. But these fluctuations only allow conclusions as regards a possibility. The certain proof can only be furnished by further researches. Thus much, however, we may assert, that *by a continued use of cure-spring the proportion of the albuminates to the chloride of sodium is similarly modified in the organism as that of the albuminates to phosphoric acid*, and we may certainly see in this an important curative influence of saline water against certain morbid conditions.

11) *The curves of the quantities of urine and of its solid constituents excreted hourly experience considerable variations under*



the use of spring and bath. The powerfully diuretic effect of the bath becomes here most evident. The variations of both curves are only partially of the same kind.

It is clear, that the saline bath following the imbibition of the cure-spring in the early morning considerably increases the quantity of urine in the morning hours, whilst in the afternoon it is scarcely and in the night inconsiderably greater, than on the normal days. The corresponding increase of urinary excretion with all three of us in the morning hours can only be considered as the consequence of the bath.

To cause this effects to appear very distinctly, the bath was taken at other hours in the first three days of the combination period, than in the last 3 days. The increase of the urinary secretion appeared chiefly in the bathing hour itself, then continued from 1 to 2 hours afterwards, and ultimately ended in a diminution as compared with the normal days. The graphic drawings are executed according to the results of the first three days of the combination period. In these days B. bathed between  $8\frac{1}{2}$  and  $9\frac{1}{2}$  a. m., Mm. between  $9\frac{1}{2}$  and  $10\frac{1}{2}$  and Ba. between  $10\frac{1}{2}$  and  $11\frac{1}{2}$ .

*Evacuation of urine:*

	before $8\frac{1}{2}$ a.m.p.hour	$8\frac{1}{2}$ — $9\frac{1}{2}$	$9\frac{1}{2}$ — $10\frac{1}{2}$	$10\frac{1}{2}$ — $11\frac{1}{2}$	$11\frac{1}{2}$ —1	1—3
by B.	36 CC.	337 CC.	201 CC.	77 CC.	46 CC.	66 CC.
" Mm.	86 "	106 "	277 "	166 "	81 "	56 "
" Ba.	100 "	97 "	100 "	272 "	99 "	58 "

But when the bath was taken by Mm. between  $8\frac{1}{2}$  and  $9\frac{1}{2}$ , by Ba. between  $9\frac{1}{2}$  and  $10\frac{1}{2}$ , and by B. between  $10\frac{1}{2}$  and  $11\frac{1}{2}$ , the quantity of urine amounted in the same hour to



	before 8 <sup>1</sup> / <sub>2</sub> per hour	8 <sup>1</sup> / <sub>2</sub> —9 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>2</sub> —10 <sup>1</sup> / <sub>2</sub>	10 <sup>1</sup> / <sub>2</sub> —11 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub> —1	1—3
with B.	27 CC.	103 CC.	180 CC.	322 CC.	147 CC.	90 CC.
" Mm.	83 "	176 "	157 "	122 "	84 "	54 "
" Ba.	62 "	59 "	119 "	116 "	66 "	52 "

The diuretic effect could not be demonstrated more clearly, and if the increase of urinary excretion was less considerable with Mm. and Ba. in the bathing-hours of the second 3 days, than in those of the first, I have to observe, that the cause has to be exclusively sought in the greatly heightened cutaneous function during the morning hours of the second 3 days.

Their cutaneous and pulmonary excretion in the morning hours amounted to :

	on the first day	2d day	3d day	4th day	5th day	6th day
with Mm.	256 Gmm.	370 Gmm.	363 Gmm.	455 Gmm.	560 Gmm.	497 Gmm.
" Ba.	268 "	327 "	246 "	442 "	727 "	445 "

The proportions of *solid constituents of urine*, hourly excreted, were quite corresponding to the quantities of urine. They also experience a considerable increase in the morning hours, when the saline bath has been taken in addition. During the afternoon they are almost perfectly equal to the quantity excreted on the normal days, becoming more considerable again during the night. Here again it can be demonstrated with the greatest certainty, that it was the bath, which caused the increased excretion in the morning hours, for the greatest amount of solid ingredients is again found in the bathing hours. When B. bathed between 8<sup>1</sup>/<sub>2</sub> and 9<sup>1</sup>/<sub>2</sub>, Mm. between 9<sup>1</sup>/<sub>2</sub> and 10<sup>1</sup>/<sub>2</sub>, Ba. between 10<sup>1</sup>/<sub>2</sub> and 11<sup>1</sup>/<sub>2</sub>, the following amount of solid ingredients was excreted :



	before 8 <sup>1</sup> / <sub>2</sub> a. m. pr. hour	8 <sup>1</sup> / <sub>2</sub> to 9 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>2</sub> —10 <sup>1</sup> / <sub>2</sub>	10 <sup>1</sup> / <sub>2</sub> —11 <sup>1</sup> / <sub>2</sub>	11 <sup>1</sup> / <sub>2</sub> —1	1—3
with B.	Gmm. 1,45	Gmm. <b>4,24</b>	Gmm. 3,44	Gmm. 2,54	Gmm. 1,76	Gmm. 2,67
" M.	2,28	3,68	<b>4,59</b>	3,37	2,72	2,42
" Ba.	2,44	2,90	2,86	<b>4,31</b>	2,47	2,56

But when Mm. bathed between 8<sup>1</sup>/<sub>2</sub> and 9<sup>1</sup>/<sub>2</sub>, Ba. between 9<sup>1</sup>/<sub>2</sub> and 10<sup>1</sup>/<sub>2</sub> and B. between 10<sup>1</sup>/<sub>2</sub> and 11<sup>1</sup>/<sub>2</sub>, the excretion of solid constituents amounted in the same hours to:

with B.	Gmm. 1,42	Gmm. 3,13	Gmm. 3,64	Gmm. <b>3,86</b>	Gmm. 2,93	Gmm. 3,34
" Mm.	2,25	<b>4,23</b>	4,03	3,75	2,83	2,32
" Ba.	2,13	2,32	<b>3,31</b>	3,26	2,38	2,39

These proportions very readily explain, how on the combination days the desire for food was greater at dinner-time, than on the normal and cure-spring days. But an other conclusion of great importance may be deduced from the sums of the quantities of urine and of its solid constituents excreted in the single periods:

a) on the normal experimental days:

	Quantity of urine			Solid constituents of urine		
	fr. 6 <sup>1</sup> / <sub>2</sub> to 1	fr. 1 to 7	fr. 7 to 6 <sup>1</sup> / <sub>2</sub>	fr. 6 <sup>1</sup> / <sub>2</sub> to 1	fr. 1 to 7	fr. 7 to 6 <sup>1</sup> / <sub>2</sub>
B.	CC. 387,5	CC. 599,8	CC. 779,8	Gmm. 11,63	Gmm. 17,11	Gmm. 17,59
Mm.	437	523,3	707,5	15,28	16,98	18,56
Ba.	467,6	446,3	867,3	14,09	16,02	21,65



b) on the cure-spring days:

B.	514,1	638,1	769	14,69	21,51	20,93
Mm.	689,7	559,1	553,5	19,92	19,45	19,66
Ba.	634,8	436,5	810,8	18,49	18,91	24,74

c) on the combination days:

B.	838	480,6	551,1	17,53	19,42	20,82
Mm.	837	451	617	21,67	19,28	20,66
Ba.	712,5	399,5	640,3	18,84	17,96	23,88

.Difference of a and c:

B.	+ 450,5	— 119,2	— 228,7	+ 5,90	+ 2,31	+ 3,23
Mm.	+ 400	— 72,3	— 90,5	+ 6,39	+ 2,30	+ 2,10
Ba.	+ 244	— 46,8	— 227,0	+ 4,75	+ 1,94	+ 2,23

Difference of b and c:

B.	+ 323,9	— 157,5	— 217,9	+ 2,84	— 2,09	— 0,11
Mm.	+ 147,3	— 108,1	+ 63,5	+ 1,75	— 0,17	+ 1,00
Ba.	+ 77,7	— 37,0	— 170,5	+ 0,44	— 0,95	— 0,86



This table clearly indicates the increase of urinary secretion in the morning hours of the combination days compared with the cure-spring and normal days. We now learn the reason, why we found the saturation of the organism with water much less at noon of the combination days, than on the cure-spring days and about as great, as in the normal experimental days.

If the imbibition of 600 cc. of diluted cure-spring is soon followed by a simple saline-bath, the urinary excretion becomes considerably increased, and thus the effect of the imbibition, which consists in keeping the organism in a higher degree of saturation with water, is more or less lost towards the middle of the day.

As we ascribed the most material effect of the cure-spring to this saturation with water, diminished saturation must produce diminished effect. And thus we found against our expectation, the sum of solid constituents of urine not greater with B. and Ba. under the use of the bath & spring, than under the exclusive of the cure-spring, but on the contrary rather smaller. The increase, which took place with Mm., did not reach that proportion, which might have been looked for after the investigations of the effects of the saline bath.

We ought to expect a priori a similar relation to that, found concerning the supply of water under the use of spring and bath, if chlorides are introduced early in the morning.

The notion lies very near, that, the quantity of urine being considerably increased in the morning hours of the combination days, the organism should lose not only the water, but also the greatest part of the chlorides ingested in the morning. But this does not appear to be the case. Though our determination of the quantity of the solid urinary constituents be only approximatively correct, it shows, that in the morning hours of the combination days about 5,9; 6,4 and 4,7 grmm. more of solid urinary constituents have been excreted, than on the normal days. But as we found (p. 36), that under the exclusive use of the saline bath in the morning about 2 or 3 grmm. more of solid urinary constituents were excreted, than under ordinary mode of living, and as there is no reason to assume, this effect of the saline bath to fail in the combination days: it is clear, that if 5,13 grmm. of chlorides have



been introduced into the organism in the morning, these could not yet have been excreted towards midday. It is true, we find the solid urinary constituents increased in the morning of the combination days, as compared, with the cure-spring days by 2,8; 1,7 and 0,4 grmm. But we may unquestionably attribute this increase to the augmented excretion of urea, and can only wonder, that it is not generally at least as considerable, as it was with B. Further researches are necessary to investigate the excretion of urea and chlorides in the different periods of the day under the employment of the above agents. But it seems, that under the combined use of bath and spring not more, but rather less chlorine (and thus also less chloride of sodium) becomes excreted, than under the exclusive use of the spring. This view gains much probability from the law of diffusion between the albuminates and chloride of sodium mentioned above.

I feel disposed to assume with certainty, that the excretion of urea, furnished by the albuminates, is more increased in the mornings of the combination days, than of the cure-spring days. But an equivalent of salt, corresponding to this loss of albuminates is retained instead. Thus we arrive at the conclusion, that the bath does paralyse the effect of the water introduced with the cure-spring, but by no means that of the chlorides ingested along with it.

Might not the marked retention of water in the organism, during the nights of the cure-spring and combination days stand in connexion with the presence of greater quantities of chloride of sodium and with their probable gradual absolute increase?

12) *The curve of the frequency of the pulse suffers similar changes under the use of bath and spring to those observed under the use of the saline bath alone. The curve of respiratory frequency, however, experiences an almost constant diminution, caused to all probability by an accelerated metamorphosis of the nonnitrogenous compounds of the blood.*

In the curves of the *pulse* (see above) the known influence of the bath appears distinctly. Its frequency diminishes immediately after the bath. But after dinner the increase is more considerable, than on the normal experimental days.



We find the same result as under the exclusive use of the bath (p. 39) and no other explanation need be sought for, than that given above. The small sinking in frequency during the night forms a deviation, for under the exclusive use of the bath a small increase takes place. But the variations are so insignificant, that I should not dare to base any conclusion on them.

We endeavoured, however, to elucidate another point, viz. the decreased frequency of the pulse after the bath; we wished to find out, whether this would differ according to the greater or smaller distance of the bath from the last meal.

In order to receive an answer to this question, we bathed in the first three days of the combination period at another hour after breakfast, than in the last three days. The result of our observations was : that if

B. bathed 1 hour after breakfast, the frequency of the pulse diminished by 4,7 beats									
B.	3	„	„	„	„	„	„	„	11 „
Mm.	1	„	„	„	„	„	„	„	6,7 „
Mm.	2	„	„	„	„	„	„	„	10 „
Ba.	2	„	„	„	„	„	„	„	7,7 „
Ba.	3	„	„	„	„	„	„	„	8,3 „

From this it becomes probable, *that the diminished frequency of the pulse, invariably produced by the saline bath, is the more considerable, the longer the bath was distant from the last meal.*

This point, of course, is of therapeutic importance, but it is readily explained, if we consider, that the ingestion of a meal always increases the frequency of the pulse, and thus serves as an opposition to the diminished frequency resulting from the bath.

As regards the *respiratory frequency*, a glance at the curves suffices to show, that it stands somewhat lower on the combination days, than on the cure-spring days and also lower, than on the normal experimental days. For an explanation of this phenomenon we have again to recur, as it seems to me, to the diminished tension of carbonic acid in the blood (p. 41). Under the *special* circumstances I, however, call particular attention to the absolute or relative retardation of respiration at the end of the bathing hour. This appears from the curves, and is manifestly



due to the effect of the saline bath. Here also it is found analogous to the frequency of the pulse, *that the more the bath is distant from the last meal, the more considerable is the retardation of respiratory frequency.*

When B. bathed 1 h. after breakf., respir. was diminished by 0 breath in the min.

" B.	"	3	"	"	"	"	"	"	1,2	"	"	"	"
" Mm.	"	1	"	"	"	"	"	"	2	"	"	"	"
" Mm.	"	2	"	"	"	"	"	"	3	"	"	"	"
" Ba.	"	2	"	"	"	"	"	"	1	"	"	"	"
" Ba.	"	3	"	"	"	"	"	"	1	"	"	"	"

It is therefore certainly not indifferent, whether the bath is taken sooner or later after a meal. Not the slightest attention has hitherto been paid to these points in practice. It is true, it was forbidden to bathe "with a full stomach". But the possible disturbance of digestion and the nonestablished "exciting effects" of the bath were more held in view, than the real physiological consequences of such a proceeding.

For the cure-spring and combination days I have likewise made a calculation of the average daily proportions, as regards the frequency of pulse and respiration. It led to the following results :

The proportion of the respiratory frequency to the frequency of the pulse was :

	with B.	with Mm.	with Ba.
1. In the normal exper. days	= 1 : 5,6	1 : 5,02	1 : 4,57
2. " " cure-spring days	= 1 : 5,88	1 : 4,98	1 : 4,85
3. " " combination days	= 1 : 6,33	1 : 4,99	1 : 4,93

In the normal experimental days there were on an average per minute:

with B.	71,75 pulsations	and	12,63 respirations.
" Mm.	69,93	"	13,93
" Ba.	68,94	"	15,08

In the cure-spring days:

with B.	74,23 pulsations	and	12,61 respirations.
" Mm.	68,7	"	13,77
" Ba.	69,02	"	14,21



In the combination days:

with B.	75,34	pulsations	and	11,90	respirations.
„ Mm.	69,30	„	„	13,88	„
„ Ba.	67,96	„	„	13,78	„

Thus with Mm. and Ba. the change of the normal proportion materially depended on a decrease of respiratory frequency, whilst the frequency of the pulse only exhibited very slight deviations in all three series of investigations. With B. alone, however, a small increase in the frequency of the pulse altered the normal proportion in the cure-spring days, whilst in the combination days a more considerable alteration was produced by the coëtaneous decrease of respiratory frequency, taking place besides this increased frequency of the pulse.



## 5. Reflexions and conclusions.

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THE investigations communicated above have led to such variegated results, that it will be useful to sum up briefly the material facts, and especially those, which open new practical views. Some of these harmonise so strikingly and persistently in three different individuals, that we may consider them as expressions of truth, and deduce from them certain practical rules.

I proceed from the view, that in every course of drinking or bathing at a Spa it is desired to produce certain changes in transformation or nutrition; whether we wish to deprive the organism of certain ingredients, abnormally excessive, or to provide it with an addition of this or that ingredient, *at any rate we intend to modify the proportions of the integral chemical constituents of the organism.* But the agents employed for this purpose influence the body in the *most different ways*; it is therefore of the utmost consequence, to examine these ways in as careful a manner, as possible. Even as regards metamorphosis itself, it is by no means indifferent, whether we endeavour to approach it chemically or dynamically. If we consider, that in any course of mineral waters we make the most claims on that organ, through which the efficacy is to be produced and hereby influence its future power, this difference becomes all the more important. Indeed I believe, that on this circumstance alone depends the varying result of drinking or bathing, of warm or cold baths, of cold and moist or moist and hot air &c. For as far as we know, the modifications of metamorphosis often resemble each other more or less, and the ultimately different result can only be based on the different points



selected for attack, and on the different ways, through which the single agents exercise their action.

But if the physician has to select his remedy in each case according to the development of the disease, the happy result of his treatment will depend, as well on his pathogenetic knowledge, as on his right appreciation of the mode of acting of his remedies.

Our warm saline bath of 25° to 26° Réaum. (88° to 91° F.) undoubtedly exercises its chief effect through the cutaneous nervous system. The irritation produced on the cutaneous nerves is forthwith manifested by a diminished action of the heart and an increased diuresis. All further general effects may be readily deduced from this primary action.

Is it probable, that this daily irritation continued for some time, produces a *lasting* effect on the nervous system or in other words, is the ultimate result of the bath based on a direct change in the condition of the nervous system? Further, in case of the answer being affirmative, may we consider this change as beneficial and connected with greater energy of the system in question?

The investigations detailed above, and my observations made in regard to patients, have shown with certainty, that if the organism is endowed with a somewhat strong nervous system, a slight chill is produced on entering the bath and soon followed by a pleasant sensation of warmth. After the bath a feeling of freshness and general ease appears, and during the whole day neither fatigue nor overexcitement is felt. With such individuals no languor appears at the end of the course. On the contrary the feeling of general ease and energy is greater than before.

But it is otherwise with individuals complaining of that congenital or acquired "general nervous weakness", which, whatever be its cause, does not depend upon certain organic lesions of the nervous system or on certain derangements of metamorphosis. For there sometimes the irritation, caused even by the simple bath, is too strong. The chill produced in entering the bath, will occasionally continue for a long time and not cease during the whole period of bathing. Instead of the sensation of freshness, languor is felt afterwards. The diminished frequency of the pulse



which is now regularly observed, soon gives way to a considerable increase, which in a high degree of nervous debility may even amount to a feverish height. We meet then the symptoms of overexcitement, as exhibited by constantly increased frequency of pulse, by weakness, want of sleep, of appetite. In other cases perhaps 12 to 14 baths are taken without any appearance of overexcitement, but more or less suddenly the symptoms of overexcitement ensue even here, and the regular continuation of the bath must consequently be interrupted.

The same phenomena sometimes occur with individuals of proportionately stronger nervous system, if mother-lye be added to the bath; and here, as well as with weak persons, the symptoms of overexcitement don't cease with the cessation of bathing, but on the contrary, they usually continue for some time afterwards. — What shall we conclude from these observations?

The fact, that the bath often increases the existing weakness of nervous and debilitated persons, teaches us in my opinion with certainty, that our bath does not belong to the class of tonics or strengthening remedies. On the contrary, if employed as an exciting agent by those individuals, it must only be used in a diluted state or with regular intermissions. But the opposite fact, that it is borne without any injury by individuals of some strength, permits the further conclusion, that its direct attack on the nervous system is perfectly harmless to them, and that, if they feel greater freshness and energy afterwards, they must not attribute this improvement to a *direct* acquisition of strength on the part of the nervous system; but rather to an indirect favourable change, brought about through the altered conditions of organic transformation.

Our experiments confirmed, it is true, the result obtained by *Lehmann* from the examination of the saline thermal spring of Oeynhausen (Rehme), viz. that the power of accelerating the metamorphosis of *nitrogenous* compounds is only exercised by the bath in an inconsiderable degree. But we have ascertained on the other hand with certainty, that the saline bath causes material changes of the temporary fluctuations of metamorphosis, and on these changes not a small part of its *general*



action seems to be based, in my opinion. The irritation directed towards the skin is forthwith followed by a considerable increase of renal excretion, and *without loss of power* an increased waste is forced on the organism for a fixed time.

The next result is an increased want of food at the time of the succeeding meal. In the period following this meal no further acceleration, but diminution of metamorphosis takes place. The former loss becomes more or less repaired. In this relation we recognise the possibility of a highly salutary action on the materials of alimentation and on the nutrition of the organism.

It is manifest, that the quality of the repairing material, that is of diet, must be of the greatest importance.

The opportunity is afforded to us, of supplying for the loss of a certain quantity of organic materials perhaps an equal quantity, but of a very different quality. Only with an exact determination of diet, adapted to each particular case, this opportunity may be profitably seized. — But I repeat it, without the most exact dietetic measures successful cures must be rare. It lies now in our hands, to promote assimilation or retrogression in the organism, and according as the one or the other is materially required, the diet must be either of a more animal, or of a more vegetable kind, either more or less nitrogenous &c. — If increased retrogression is desirable, as it sometimes happens, we possess a remedy in the bath and especially in the mother-lye bath, which attacks the nervous system and secures the required curative results. Circumstances may arise, which require the nervous system to be irritated and even weakened, in order to impede the process of assimilation. Men, who describe themselves as inexhaustible, but have attained to a troublesome degree of obesity in leading too easy a life, or suffering with eczema, rheumatism &c., belong to this category, as well as robust women, with whom it is perhaps desirable to retard the development of fibroid tumors of the womb, of ovarian enlargement &c. In such cases the energetic use of the bath is indicated.

But these cases are not the most numerous, and even in them the too bold use of mother-lye and stream baths can not often be resorted to with impunity.



But apart from these important variations of metamorphosis we have further found, that the simple saline-bath procures *a gain of phosphoric acid* for the economy, if it does not produce an over-excitement of the nervous system. According to our knowledge of the physiological significance of phosphates it is put beyond doubt, that this gain can only promote the process of assimilation and I have not the least doubt, that the benefit, which is derived from the bathing at Nauheim, especially by children suffering from a scrofulous constitution, an atrophic state &c. &c. is principally due to this gain of phosphoric acid (phospate of lime).

Besides I proceed to refer again to the *constantly observed decrease of respiratory frequency* under the use of the simple saline bath. We considered this as the consequence of diminished tension of carbonic acid in the blood, and in all probability we have to recognise in it the accelerated metamorphosis of the nonnitrogenous compounds of the blood and especially that of the organic nonnitrogenous acids (s. p. 42). The decision could only be attained by direct measurment of the carbonic acid exhaled from the lungs and skin, which is unfortunately most difficult to accomplish. But if this question be answered in the affirmative, as I do not doubt, if the oxydation of nonnitrogenous compounds is decidedly accelerated, and the excretion of carbonic acid temporarily increased, in a greater proportion from the skin (at the expense perhaps of the pulmonary excretion), a very important view of the general effect of the saline-bath is opened to us. It is true, we scarcely know the effect of the pathological increase of organic acids in the blood. I hinted above, that this is sometimes shown by foetor of breath, and that the normal formation of red coloured blood corpuscles seems to be retarded in consequence of this anomaly. Moreover it is not improbable, that it may stand in connexion with the production of cutaneous disorders (as ecthyma, impetigo, acne &c.) and indeed we may consider these as partly caused by the "irritation of the elements of tissues" which is so forcibly urged by Virchow. But, however this may be, the diminution of those acids in the blood, or rather their reduction to the normal amount, cannot be without salutary effects, and we may expect very important information from further investigations of this



point\*), which is a real necessity for pathology and therapeutics.

The practical hints, based on these communications are easily deduced from them.

I commence with repeating, that individuals with weak nervous systems must take the saline-bath with caution, and abstain altogether from the mother-lye bath. Such patients are only allowed to bathe every third day at first, and for a short time merely or in diluted saline water, and if even then signs of overexcitement appear : the saline-bath must be considered as totally unfit for them. This warning cannot be urged with too great earnestness, for experience has taught me, that mother-lye and stream baths are frequently recommended without the knowledge of their easily ensuing injurious consequences. On the other hand patients often use the baths on their own accord and only discover too late their mistaken notion, as regards the effects they expected.

We further deduce, that the best time for bathing is the forenoon, for only then we are enabled to support our curative measures by the chief meal of the day. But the bath must not follow breakfast too soon. Apart from the disturbance of digestion, which could result from this, our observations (p. 103) show, that its effects on circulation and respiration and eventually on the processes of metamorphosis may be partially obstructed through the influence of the previous meal. Therefore at least two hours ought to intervene between breakfast and bath.

Under circumstances, and where retrogressive rather than progressive transformation is required, it seems advisable, to bathe fasting. But this is only to be permitted to strong individuals, as the attack on the nervous system is more powerful in that condition, than after a previous breakfast. But should the bath have been taken thus early, the breakfast must *not* follow immediately afterwards, as is usually done, but about an hour ought to elapse first. It is also to be considered, that under these circumstances a

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\*) The experiments of Richardson on the effects of the injection of lactic acid into the blood are here called to mind. But it might be left undecided, whether they more indicate altered relations of endosmosis and exosmosis, than irritation of the elements of tissues.



marked increase of the frequency of the pulse appears after breakfast and this is not always desirable. — If the bath is taken after the first breakfast, it seems unadvisable, to take a second breakfast, because that effect of the bath, which accelerates the transformation of organic particles of the body, would be thereby frustrated. But when the decrease of pulse after the bath is soon followed by a considerably increased frequency and accompanied with a feeling of languor, I recommend some broth or wine after the bath, to prevent the above unpleasantness. With regard to diet itself and especially to the hour of dining, no general rules can be laid down, as individual considerations must decide in each separate case.

We learned, that the afternoon was the period in which the reparative process is especially active. It follows, that every great exertion has to be forbidden at that time, if that process is to be kept in view, whilst patients, with whom a retrogressive metamorphosis is more desirable, are to be recommended to take long walks in the afternoon. But I call to mind the increase of frequency of pulse appearing in all cases after dinner. If such an increase is undesirable a very quiet conduct is doubly necessary, and thus the first hours of the afternoon ought indeed always to be spent in comfortable ease and quietness.

These short hints may suffice. Modifications will always be demanded by a careful examination of each individual case. Though our investigations refer only to the *general effects* of the bath, I have to mention, that certain *local effects* especially on the skin and female sexual organs are not of less importance. But into these considerations I will only enter after communicating further practical observations and facts.

As to the second part of the curative resources of Nauheim, we have to refer to its "*drinking springs*". The organ first invaded by them is the stomach and intestines. Though little is generally spoken of this first invasion, it is nevertheless of considerable importance, so that temperature, quality and quantity of its constituents, as well as the quantity to be imbibed, are all of the utmost consequence. As regards our cure-spring, its natural temperature, as well as that of the diluted cure-spring, of 17° and 10—12° R. (74° and about 55—59° F.) cannot be considered as



the cause of any special effects. Both, however, may possess some advantage in certain cases over similar colder ones, as for example the Kissingen springs. But the saline contents of our cure-spring are too strong for most patients, and therefore I generally administer it in a diluted form. We know through the experiments of *Bidder* and *Schmidt*, that chloride of sodium stimulates the stomach and increases the secretion of gastric juice. This can scarcely take place without an increased flow of blood to that organ. Continued daily for some time, it is manifest, that by the introduction of saline water into the empty stomach, whilst the gastric nerves become perhaps at the same period over-excited, hyperaemia or catarrh of the stomach must ensue.

That this really takes place, is shown by many of the patients complaining of gastric oppression, want of appetite, alienated taste, furred tongue &c. after taking the undiluted cure-spring. But these symptoms will not occur after the imbibition of the diluted cure-spring nor any other injurious effect on the stomach, as far as I can learn.

But do this and similar springs confer direct benefit on the stomach? We must leave this question unanswered. For though undoubtedly they frequently exercise a beneficial action on chronic disorders of the digestive organs, this may be considered as an *indirect* benefit, and if metamorphosis is unquestionably increased in the glands and coats of the stomach and its nerves are stimulated, I can not acknowledge this as a direct salutary result.

But our investigations scarcely admit a doubt of the powerful secondary influence of the cure-spring on the process of transformation. On this and the production of slight derivatory hyperaemic conditions in the digestive canal the total effect of our spring may probably be reduced. The considerably increased excretion of urea appears as a specially significant sign of a heightened metamorphosis of albuminates under the influence of the cure-spring. The water itself, as well as its saline contents, take part in this effect.

Not all urinary constituents are excreted in an increased ratio. The excretion of phosphoric acid scarcely exceeds the normal amount, and that of chlorine is even left behind the normal proportion, after some part of the course has elapsed. Through this



a considerable change is caused in the proportions between albuminates and phosphoric acid and chloride of sodium in the organism, moreover, according to all probability, between albuminates and water. Nobody can deny, that such changes may be considered as the solution of a curative problem, and that at any rate they must produce material alterations in the vegetative vital process. In the second place we have to refer to the diminished frequency of respiration, produced by the internal use of the cure-spring and probably based on a diminished tension of carbonic acid in the blood, and this I might bring again in connexion with an accelerated metamorphosis of non-nitrogenous compounds (organic acids). I lay a considerable stress on this, for I can state as a fact, that under the use of the spring, the accumulation of certain organic acids in the blood often diminishes.

This general effect, it is evident, can be materially assisted by an appropriate diet, and it requires scarcely to be mentioned, that it may be completely annihilated by an irrational mode of living.

Hitherto the view was entertained, that the saline purgative waters act generally by promoting the transformation of the organic particles of the frame and by producing some degree of emaciation. We see, that the first part of this view, as regards the albuminates (and the non-nitrogenous compounds) is correct, the more so, as our proposition is mainly based on the increase of nitrogenous excretions through the kidneys and the diminution of respiratory frequency, increased excretions of organic compounds through the intestines probably taking place likewise. But the second part of the above view we must designate as erroneous. For, if the cure does not disturb the general well-being (and only thus we have to consider it as salutary), no decrease of weight takes place, according to our experiments, but rather an increase, probably due in most cases to a retention of water in the organism, and occasionally, notwithstanding increased metamorphosis of albuminates, to the reparative assimilation of new tissues. The relative gain, by the organism, of phosphoric acid, chloride of sodium and water is certainly of importance in this respect. It deserves particular notice, that the desire for food is only very inconsiderably increased under the *exclusive* use of the cure-spring. The percep-



tible increase of appetite at breakfast and after the ingestion of the cure-spring must be rather considered as a consequence of the morning walk. If then the quality of the diet be rationally adapted to the individual requirements, nature will be a sufficient guide as regards the quantity.

Great stress has hitherto been laid on the purgative effects, said to be produced by the saline waters, and their principal curative action was considered to depend materially on this result. I willingly admit, that the so called "derivation on the intestinal canal" produces benefit in several cases, but I can not conceal from myself, that the material proof of such derivatory hyperaemia is wanting, whilst a heightened process of diffusion may exist without it. But the derivation admitted, I have nevertheless shown, that the general influence of the spring on metamorphosis appears in an equally high degree, if the purgative effect has only been very slightly exhibited. To say then, that in these cases the course was inefficacious, would be highly unjustifiable. For, besides the general effects mentioned, whether purgation ensues or fails, we have unquestionably to expect promoted biliary secretion, as a known consequence of the increased imbibition of water, besides a more abundant secretion of gastric juice at meals following the ingestion of a greater quantity of water, as proved by Bidder and Schmidt.

It is therefore my opinion, that so much importance ought not to be attributed to this purgative effect. As regards the great number of chronic constipations said to be cured by the saline springs, I feel more and more convinced, that the greatest number of these ailments is more baised on faulty innervation and muscular function, than on disturbed secretion of the intestinal mucous membrane, so that slight doses of aloes, rhubarb &c. would more readily obviate them, than our purgation waters.

A much more lasting improvement takes place, when the purgative effect of the spring has been displayed very slowly, than where it appeared with violence, or was enforced through large doses. In these latter cases the patient may attain his purpose at the Spa. But a few days after his return home, the old complaint returns at an increased rate with an additional weakness of innervation in consequence of the preceding overexcitement. These considerations induce me, to shun the too violent use of the saline



waters and rather to direct attention to the salutary invisible effects, than to those highly praised visible ones.

To sum up: I seek the beneficial result of the cure-spring in the invariably increased metamorphosis of nitrogenous and non-nitrogenous compounds, and in a relative gain of phosphoric acid, chloride of sodium and water. The retarded metamorphosis of albuminates, so injurious to the organism, is thus stopped, and whilst this is accomplished through the increase of chloride of sodium, the gain of phosphoric acid may under certain circumstances lay the foundation for further formation of new tissues. Excess of albuminates (either relative or absolute) is but too often the source of a long series of disorders, and especially of general atrophy (s. p. 29). To diminish this excess is therefore often the most essential therapeutic requirement for a prosperous condition of the organism, and it is on this account, that moderate doses of the diluted cure-spring are often taken with such great benefit by emaciated persons. It is on this account likewise that those persons find such marked improvement, who discover diminution of nervous energy in the course of active employment and who notwithstanding a generous diet, offer all symptoms of retarded metamorphosis, frequently accompanied by emaciation.

As to the period of drinking the spring, the morning hour is to be selected, and bodily exercise in the open air has to be enjoined in the morning. But it must not be overlooked, that for many a weakly individual even a short walk in a fasting condition is fatiguing, and as such fatigue in most cases counteracts the curative result, patients of this class are ordered to take their draughts at an other period of the day (about two hours before dinner or an hour and a half before supper), or they are recommended to drink a cup of tea or coffee before going out. In other cases a longer bodily exercise may be altogether omitted and the water either taken under a quiet sojourn in the open air, or in certain cases in the house.

As regards the practical rules to be deduced from our investigations, when the cure-spring is used exclusively, they must depend on the peculiarity of each individual case.

But when *spring* and *bath* are used in combination, the following remarks ought to be well weighed.



In the first place, as regards the combination itself, there can be no doubt, that from physiological and practical considerations, it is perfectly misplaced in numerous instances, in which it has hitherto been recommended without further reflection or knowledge of the action of the separate agents. Apart from the special effects of the saline-bath, it produces in general a slight acceleration of the metamorphosis of albuminates, a gain of phosphoric acid by the organism and probably an accelerated metamorphosis of the non-nitrogenous compounds (organic acids &c.). The cure-spring on the contrary materially accelerates the metamorphosis of the albuminates (and probably also of the non-nitrogenous compounds), and causes not only a relative gain of phosphoric acid but also an addition of chloride of sodium and water. The combination of both these general effects may form the therapeutic requirements under certain circumstances. But let us remember, that the saline-bath induces, immediately after its employment in the morning hours, a considerable increase of renal excretion (of solid constituents, as well as of water), that the want of food is not considerably increased at dinner, that during the afternoon on the contrary transformation becomes retarded. Let us further recall to our mind, that the diluted cure-spring causes the whole day an increased elimination of solid constituents of urine, probably in consequence of a higher degree of saturation of the organism with water and also through the persistent effect of chloride of sodium; and likewise, that its exclusive use increases only slightly the appetite at dinner. Thus differences are shown of great importance for practice. If the saline bath follows as usual 1, 2 and 3 hours after the imbibition of the cure-spring, the whole of the ingested water will be eliminated through the diuretic effect of the baths forthwith or at all events before dinner. Thus the important watery impregnation of the organism becomes frustrated. A similar effect happens as regards the chloride of sodium, though it will not be quite as completely expelled as the water. Moreover the appetite, which was otherwise only slightly increased at dinner, is now raised considerably, and the acceleration of metamorphosis during the afternoon hours yields to that retardation, which is brought on by the morning bath. The consequence of these relations is this, that the metamorphosis of albuminates is



not at all or only very slightly higher in consequence of the bath and spring, than in consequence of the spring alone. Besides we are exposed to the danger of paralysing the material effect of the spring by yielding to the heightened desire for food at dinner. New organic formation may thus become promoted in the afternoon, whilst we should have perhaps desired the acceleration of metamorphosis. We also learned, that the bath alone procures an absolute gain of phosphoric acid for the organism, whilst the cure-spring only induces a relative gain of that acid. If bath and spring act together, that effect of the bath becomes lost altogether, and we gain less phosphoric acid, than we might have expected *a priori*. Thus the advantage, which should result from the bath, is pretty nearly lost by the at random combination, usually and unthinkingly adopted in practice. Absolute gain of phosphoric acid fails to take place, and the diminished influence of the spring on the transformation of albuminates has the same significance as the loss of the effect of the bath alone on this transformation. Nothing is therefore left from the general effects of the bathing-course, but increased desire for food at dinner and retarded metamorphosis in the afternoon; for the increased metamorphosis of non-nitrogenous compounds is probably also caused by the exclusive use of the cure-spring.

How are these contradictions to be reconciled in practice? — Indeed no general rule can be fixed, but in each separate case we have to consider the individual indications.

If it is required to diminish the quantity of the albuminates only in a very slight degree (but rather more the non-nitrogenous compounds), whilst at the same time we desire to procure an addition of phosphoric acid for the organism (as in the case of delicate scrophulous individuals, amenorrhoea with slight degrees of chlorosis), the exclusive use of the bath is sufficient and the spring is contra-indicated. Reparative assimilation will be directly promoted and local disorders removed, provided always that the bath does not exercise a weakening effect on the nervous system. — If on the other hand it is requisite to diminish the albuminates (and non-nitrogenous compounds), but to procure for the organism a relative gain of phosphoric acid and of chloride of sodium, the bath is superfluous and the spring alone is sufficient (as in catarrhs of the



respiratory organs, hyperaemia of the liver, the consequence of a sedentary mode of living, and generally in retarded organic metamorphosis). Here again reparative formation will be promoted if not during the course, at least afterwards; for the pathological increase of albuminates, whether in an absolute or relative proportion, is a frequent cause of emaciation, as I have shown elsewhere (l. c. page 28) I wish to add, that a relative increase of albuminates is especially frequent, when abundant quantities of aluminous substances are consumed by weakly nervous individuals. For we must not disregard the fact, that the relations between the strength of the individual and the requisite nutritive material are as distinct and marked, as between the single constituents of the food itself.

If it is required to accelerate as much as possible the metamorphosis of the albuminates (and non-nitrogenous compounds), whilst addition of phosphoric acid is not called for, but rather an increase of chloride of sodium and water (the indication of our predecessors to dilute the blood), as in rheumatism, gout &c., strong individuals have to take the bath fasting, to breakfast from half an hour to an hour afterwards and to take the cure-spring about 2 hours before dinner (at 11 or 12). People, who are less robust, ought to take some coffee and bread before the bath, and a second light breakfast between bath and cure-spring. Increase of new formation may also take place here under certain circumstances. But if this is decidedly uncalled for, but on the contrary its decrease demanded, mother-lye is to be added to the bath, a less nitrogenous diet to be taken and besides long walks are to be recommended in the afternoon.

If it is requisite, to produce a higher degree of metamorphosis of albuminates (and non-nitrogenous compounds), than can be accomplished by the bath alone, and at the same time to change advantageously the proportion of phosphoric acid, the spring ought to be drunk early and combined with moderate bodily exercise. An early and moderate dinner ought to follow. A bath is then to be taken from 4 to 5 hours after dinner and a rather more abundant supper is to follow in the evening; or the valetudinarian may drink half the destined quantity of the spring in the morning, bathe one or two hours before dinner, abstain from any fatiguing



exercise in the afternoon, and take the second half of the requisite quantity of the spring about 5 hours after dinner. The principal tendency can only be in this case: increased new formation, as it can merely happen, if a certain abundance of phosphates exists without an excessive quantity of albuminates; a principal desideratum in scrophulous individuals. The use of mother-lye baths is contraindicated here, and if even the simple bath produces symptoms of fatigue, it is only admissible in a diluted form, or with certain intermissions.

I am not unaware, that I propound here theories opposed to the ordinary routine of practice, and requiring confirmation and extension by many of certain determined facts. However, if balneo-therapeutics is to be pursued with any degree of rationality and if the usual at random proceeding is to be given up, we must accustom ourselves to found our precepts on physiological bases. However difficult it may be at first to enter fully into all the physiological and physiologico-chemical relations, they form the bases of rational treatment on the part of the Spa-physician. Even when only a so called local ailment is before us, the general relations are to be weighed and considering, that these local disorders are mostly engendered by some general derangement, it stands to reason, that the right mode of their removal can not be pursued without a thorough appreciation of the distant cause. I therefore hope than, an indulgent reception may be given to my remarks. My purpose is attained, if by proving certain shortcomings of ordinary practice I gave a stimulus to further thought, but especially to further careful and trustworthy investigations.



### III. PATHOLOGICAL AND THERAPEUTICAL REMARKS.

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IN the years 1857 and 1858 I have treated on the whole 323 patients at Nauheim — of these

80 suffered with scrophulosis;	1 with struma;
1 „ „ rhachitis;	3 with disease of the brain
63 with general debility and the	without further specification
different morbid phenomena	of diagnosis;
resulting from it;	10 with spinal disease;
15 with haemorrhoids;	1 with paralysis in consequence
6 with organic disease of the	of apoplexy;
heart;	5 with hypochondriasis;
2 with atheroma of arteries;	10 with different derangements
5 with varicose veins;	of the nervous system
1 with chronic gastric catarrh;	(hemicrania, hyperaesthesia);
15 with gout and rheumatism;	1 with progressive muscular
2 with syphilis;	atrophy;
1 with mercurial cachexia and	1 with melancholia;
fatty liver;	13 with pulmonary tuberculosis;
3 with cancer and sarcoma;	4 with chronic catarrh of larynx
1 with morbus maculosus	and bronchi;
Werlhof.;	1 with organic disease of the
1 with furunculosis;	heart;
1 with chlorosis;	2 with gallstones;



249 carried forward	295 carried forward
4 with chronic constipation;	8 with other chronic cutaneous diseases;
1 with abscess. peritonaei;	7 with chronic inflammation of various joints and their consequences;
1 with omental fibroid;	10 with difficulty of hearing;
1 with morbus Brightii;	1 with induration of the sub-cutaneous cellular tissue;
19 with diseases of the womb;	1 with deaf-dumbness;
4 with disturbance of menstruation (without general weakness);	1 with conjunctivitis granulosa;
16 with eczema chronicum;	
295	323

The statistical enumeration of clinical facts always offers great difficulties. One circumstance is especially obstructive, viz. that we are rarely able to designate an ailment fully by a single name. A rheumatism for example is often only the most prominent symptom of a general derangement, which is perhaps based on nervous debility as the most material pathogenetic principle. If the name is to be chosen from the most prominent phenomenon (a potiori nominatio) the potius in this case would rather be the nervous debility, than the rheumatism. I have endeavoured, to examine the single forms of disease as carefully, as possible in this respect, and to give them their appropriate place in the above table.

But still greater difficulties are found in the way of a Spa-physician, who seeks to elaborate pathologico-therapeutical materials. The accumulation of so many agents acting on the valedudinarian deprives the observer of the accurate judgment he might otherwise form on the efficacy of the single remedies, so that individual views and hypotheses often assume the place of critical judgment. The difficulty becomes greater still, when we consider, that it is comparatively rare for the Spa-physician to be informed of the ultimate results of the course. Indeed, how many of the so-called facts and observations, contained in the usual Spapamphlets, would stand a severe critical examination? Only a long series of years, *a regular correspondence with the ordinary medical*



*attendants of the patients*, and a mature deliberation as regards the patients and his mode of living at the Spa itself, may possibly lead to somewhat trustworthy results. In order to attain the utmost in this respect, I latterly request the patients themselves, to mark down daily in a form, handed to them, the remedies, they are using. They willingly undertake this task, which the physician alone could not carry out, and which affords great assistance in the reports of cases worked out by the latter. I recommend a similar proceeding to my colleagues.

It must be chiefly due to the difficulties mentioned above and to the faulty views and conclusions engendered therefrom, that we meet a whole series of very similar diseases in the most different Spas. I was formerly physician to the whey-establishment at Rehburg in Hannover, then for three years I visited regularly a sea-bathing establishment, and lastly the two past summers I was at a saline bath. Apart from the great number of consumptive patients sent to the first establishment, and of scrophulous sufferers sent to the two latter places, I found in all three a similar quodlibet of diseased persons. I feel inclined to seek the cause of this confused state rather in the uncertain indications of our various sanitary resorts, than in a deficient diagnostic judgment of the attending physicians.

To obviate this evil, is the most urgent task of the Spa-physicians. I have therefore taken the utmost pains, to trace the indications for Nauheim as sharply as possible in the following communications. The results are deduced from only a short period of observation, it is true, and I am therefore far from considering them as final and irremovable. But the indications, which I mark down, I hope to designate as safe, and if they are strictly adhered to — and the patients assist by their exactly obeying orders — a beneficial result will not fail.

There is one circumstance I have especially to mention. We are not often in the happy position, to be able, to remove diseases with a single remedy, and it is therefore a wrong view to imagine, that particular Spas will as safely cure certain ailments, as quinine cures intermittent fever. Very frequently it happens on the contrary, that a Spa acts very efficaciously against one important side of a



diseased state, whilst it has less or no influence on the other sides. If for instance a girl with chlorotic complexion suffers from a scrophulous eczema and fluor albus, a saline bath may be indicated. But while the scrophulous cutaneous disorder and partially also the fluor albus may be perhaps materially improved, the chlorotic phenomena will certainly only experience little alteration. Such cases occur in hundreds with the most different variations. Cases of this kind render it necessary for the Spa-physician to have different remedies at his command, to *assist* him besides his chief natural remedy. If the majority of physicians have hitherto found themselves justified, to combine spring and bath in many instances, I do not see, why other combinations should not be permitted as well under other circumstances.

And even against the employment of powerful remedies, as for instance Decoct. Zittmanni (s. p. 5) no valid objection can perhaps be raised per se. It remains however the important task of the physician, that he should not deceive himself and others by ascribing to his chief remedy more effect, than it has actually exercised. Truth can only be advanced by the most exact observation, frankness towards one self and in public communications, and above all by the conviction, that bath and springs possess like all other remedies a certain sphere of action according to distinctly delineated physiological laws, but that they are no panaceae against all evils, nor capable of performing miracles. I have availed myself at Nauheim of the most different adjuvants, of which I shall give an exact account. It was at the same time my utmost endeavour, to avoid every deception in regard to the curative result and to the agents, which brought it about. But *healing* I have always considered to be my chief task; and even with the risk of not ascertaining the exact effect of spring or bath, I have made use of all our curative appliances in appropriate cases, wherever help appeared to offer itself.

After these short remarks I proceed to the single forms of disease, alluded to above, and I shall describe as concisely as possible, the experience, I have obtained.

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## 1. Scrophulosis.

The 80 patients mentioned above, offered the most different forms of general scrophulous derangement.

In 25 cases no *locality* was especially affected;

- " 16 " the *osseous system* was particularly ailing;
- " 9 " the *eyes* were chiefly affected;
- " 9 " the *cervical glands* " ;
- " 8 " a more or less extended eczema was the chief complaint;
- " 4 " *Anginae* of an intense degree were present;
- " 2 " *Ozoena* was the chief complaint;
- " 2 " *Favus*;
- " 1 " *general tumor* of the face was the chief complaint;
- " 1 " cutaneous ulcers was the chief complaint.

It did not seem to me, that the bath alone, or bath and spring combined had exercised a more favourable influence on one form, than on another. Only the scrophulous eczema seemed to make an exception; for *visible* improvement appeared in this form of disease much quicker, than in any other, which is doubtlessly to be ascribed to the local influence of the bath on the skin.

But as different as the local manifestations of the general disorder were the *constitutional peculiarities* of the patients, and according to these very different effects of the baths could be observed.

I must permit myself, to make a little digression here. *Virchow* in his, "Cellular Pathology" lays particular stress on the view, so important for practical medicine, viz. that every durable change existing in the condition of the circulating liquids must be derived from certain points of the body and depend on single organs or tissues. As in scrophulosis hitherto, "durable changes of the fluids" were justly considered to prevail, that sentence must apply to our subject. But, however willingly I admit this theory for *certain* changes of the blood, referred to by *Virchow*, it does not seem



to be applicable to the majority of those morbid conditions, which we are accustomed to ascribe to general, "dyscrasia", and among these scrophulosis must be reckoned.

Blood consists of a number of simple or compound chemical combinations and of certain formed elements. The composition of these compounds and elements is subject to constant changes from hour to hour. But we have to consider, that for the quantitative and qualitative proportions of the elements a normal measure must exist, which can not be exceeded, and especially, that the single chemical constituents must stand in a fixed relation to each other, if health is to be maintained. But a "dyscrasia", in the true sense of the word, consists in the removal of one or more integral constituents out of its or their normal proportions; or in the admixture of a heterogenous substance to the blood. Such an anomaly may be brought about by all those circumstances, which influence the composition of the blood, as by food, inspired air, altered state of the digestive organs or of their appendages, and — what is of an especial importance — by disturbances of the nervous system, which would then be unable to exercise its normal influence on the functions of single organs and on metamorphosis. Dyscrasia may thus be developed in most different ways, it may be acquired, it may be congenital.

But it is equally clear, that the dyscrasia must become very different, according as one or more of the integrating ingredients of the blood have been pushed out of their normal proportion. These differences sometimes render it impossible, to draw an exact limit between one dyscrasia and another (for instance between the rheumatic and scrophulous). Only single prominent symptoms permit a decided separation. But some of these symptoms are still so little fixed, that the experienced physician is but too often justified in his doubt, to what class he should put this or that dyscrasia.

If we apply these remarks to *scrophulosis*, I do not consider it in the least doubtful, that we have to deal with a genuine dyscrasia, predominating in the greatest number of cases over this or that local ailment, and arising either through a faulty composition or quantity of aliments, or in consequence of an hereditary



or acquired faulty condition of the nervous system, or lastly (and most rarely) in consequence of some local organic disease. But in whatever manner the dyscrasia may have originated, its material character consists in retarded metamorphosis, and I dare to pronounce it as a positive proposition, that the organic compounds of the blood, both nitrogenous and non-nitrogenous, are pathologically increased, while the phosphates become pathologically diminished.

I seek the proof of this statement, in cases of hereditary dyscrasia, in the generally weakly or slowly developed osseous system in instances of acquired scrophula, in the considerable excretions of earthy phosphates by the urine at certain periods of the development of the disease, and in both cases in the frequent and often persisting appearance of urates as urinary sediments, in the fetid smell of pulmonary and cutaneous exhalations, in the great tendency to hyperplasiae (not capable of development) especially of the lymphatic glands.

To this general basis of scrophulous ailments the most different further faulty compositions may be added, producing a great variety of disorders. At one time we meet with a chlorotic, at another with a blooming complexion, according as the red blood-corpuscles are diminished in number, or normal. At another time we find an intense disposition to the so called "formation of acidity in the primae viae", a phenomenon, which I attribute in the greatest number of cases to a pathological increase of alkaline bases. For in the first instance it may be generated by a long use of carbonate of soda, and secondly it yields to no remedy as safely and duringly, as it does to mineral acids. At another time digestion offers no particular anomaly. Again the excretion of earthy phosphates and the eventual poverty in these compounds sometimes reaches a very high degree (I have seen children excrete from 2 to 3 grammes of earthy phosphates daily, whilst the normal excretion should only amount to 0,1—0,3 grammes). At another time the excretion is less. Sometimes the exhalation of organic acid through the lungs is manifested by an almost insupportable smell, at another time this exhalation only takes place temporarily and slightly &c. &c.



According then to these different relations the general aspect of the patient and his "constitutional peculiarity" becomes extremely different and the possibility of the manifold variations, as offered by practice, is thus afforded.

But, to return to our Nauheim springs, I am enabled, to give the following data from my observation of *their effects on scrophulous individuals* :

1) If the scrophulous phenomena are combined with "general nervous debility" to a considerable degree, the danger of overstimulation lies too near for using the Nauheim bath without due consideration. In these cases sea-air is perhaps mostly to be preferred. But if the saline bath is to be used, it must only be employed in a diluted form.

2) If a high degree of chlorosis was associated with scrophulosis, I have seen no decided success from the use of the baths. In lower degrees of chlorosis, which so often accompany scrophulosis, good results were obtained under the simultaneous use of mineral acids or bitter tinctures and iron.

3) If the nervous system possessed but a moderate degree of power, the complexion not being very chlorotic, I have witnessed excellent results from the bath in the most various forms of the complaint, whether the weight of the body was reduced or not. In many instances the coëtaneous use of the diluted cure-spring was recommended in moderate doses with great advantage.

4) In prevailing tendency to acidity in the primae viae I have advantageously employed small doses of mineral acids (besides the bath or the cure-spring).

5) To diminish local complaints (glandular or articular swellings, slight degrees of anchylosis), I have found nightly applications of saline water or mother-lye to the affected parts highly useful.

6) In cases, where the nervous system had to be „strengthened" I have found it very advantageous, to order a light cold rain-bath immediately after the warm saline bath.

7) As with other patients, it happened also with the scrophulous, viz. that frequently the success of the course only appeared long time after its termination, without any other remedies being used



in the mean time, though previously scarcely any appropriate remedy had been left untried. Whilst formerly such assertions appeared to me often doubtful, I am now convinced by facts of the *after, effects* following bath and spring courses.

The physiological explanation and foundation of these remarks seem to me possible according to the above communications on the general effects of bath and spring, provided that my views on scrophulous derangement be admitted. We have seen, that by bath and spring the relation between albuminates and phosphates undergo a material alteration, the former diminishing whilst the latter increase, moreover, that under the use of the spring by the increase of chloride of sodium in the blood probably the retardation of metamorphosis of albuminates is checked for some time afterwards.

By these relations we counteract the very essential base of scrophulosis, and therefore the *modus operandi* of the Nauheim springs appears to me very intelligible.

One might object, that such changes in the proportions of the integrating constituents of the blood might be obtained in a much easier way by a judicious modification of diet and by administering such remedies, as are apt to repair the deficient materials. To this we may answer, that it is not in our power, and least of all in a proportionately short time, to alter the proportions of diffusion by means of diet alone. These proportions, once given, regulate the assimilation and waste of newly added materials — a law, preserving no doubt in part the species in the vegetable kingdom.

To attain our purpose, we must therefore resort to special means, and among these springs and baths occupy perhaps the first place.

With reference to the “absorbing or resolvent” effects of the saline springs, so much extolled of old, the disappearance of scrophulous swellings of glands or joints is certainly often effected under the exclusive use of spring or bath. But the explanation of this curative action does not seem to depend on specific peculiarities of spring or bath. We must on the contrary rather recur to the diminution of albuminates (and of non-nitrogenous organic compounds) as well as to the change in the temporary fluctuations



of metamorphosis. Fibrin being increased in the blood after venae-section and during inanition, the proportions of individual organic diffusion seem to have a self-preserving tendency; thus if the blood be deprived of one part of its albuminates, an equivalent portion of albuminates seems to leave the tissues to supply the sanguineous loss, whilst afterwards a portion of chloride of sodium is received as an other equivalent of diffusion. Besides the so called *derivatory* effects of bath and spring play likewise an important part, whether they are exclusively directed to intestines and kidneys, or to the skin, whether they result in abundant secretions or only in transitory hyperaemiae. In a third place the regulation of the whole process of nutrition must be taken into account, a process, which does not admit in a normal state the hyperplastic tendency of particular organs. To arrest such an abnormal organic enlargement is the first step of its retrogressive march towards a normal condition.

But the curative action of the bath on scrophulous eczema, as well as the effect of the saline and mother-lye applications, douches &c. in articular swellings, osseous enlargements &c. I consider more owing to a local hyperaemia and to a locally accelerated metamorphosis.

In the latter instance the hyperaemia becomes very clearly manifested (s. p. 7), in the former, where irritation of the whole sensitive cutaneous nervous system prevails, I can not doubt, that a more or less durable hyperaemia and eventual acceleration of metamorphosis is produced by the bath on the skin.

I consider eczema, in whatever form it may appear, as the result of a locally disturbed nutrition with an atonic dilatation of the vessels and consequently retarded local metamorphosis, as the immediate consequence of which hyperplasia of cellular elements arises and either rapidly appears in a purulent form, or in the shape of a mere epidermic pseudo-formation. The general hyperaemia, the circulation which is accelerated at certain periods of the day, and the increased energy of transformation counteract at first probably the vascular atony, and thus a more favourable turn of the local derangement may be instituted.

However weak these attempts at explanation may appear in the present state of pathological physiology, the endeavour, to



penetrate the origin of pathological phenomena, and to give a rational account of the therapeutical results, is at all events more useful, than a thoughtless acceptance of success with a probable feeling of satisfaction. The former stimulates to further thought and research, whilst the latter prevents the clear recognition of our scientific deficiencies.

The following brief notes may find a place here and serve to confirm the propositions enunciated above.

1. Miss — 20 years old — ophthalmia serophulosa. — Chronic conjunctivitis with opacity of the cornea. Blepharadenitis. Complexion very pale. Father and elder sister alive and "healthy"; mother died 17 years ago from "pneumonia". The patient was brought up by hand—says she has suffered in childhood with "inflammation of the brain", but never with any signs of serophula. Menstruation only commenced a year ago, but is now regular and copious. Frequent ophthalmiae before its appearance; and since 3 months the disease has attained a very high degree. Tongue slightly furred. Appetite pretty good and regular, evacuation retarded — Personal appearance: emaciated. She feels herself less strong than formerly. Little objection can be made to her mode of living. Pulse of average strength, 79 beats per min. at 8<sup>3</sup>/<sub>4</sub> a. m.

She was ordered to take a simple saline bath daily and to drink 1–2 glasses of undiluted cure-spring. From 10th to 15th June the eyes slightly improved.

But towards the 20th a new conjunctivitis makes its appearance. Baths are omitted. A grain of calomel is given three times a day. At the same time calomel is springled into the eye. Considerable improvement follows. July 2d recommencement of the baths; from the 9th: additions of mother-lye (2, 3, and 4 quarters). Satisfactory state of health till the 15th. Tongue especially is cleaner, one *loose* stool is daily produced by the cure-spring. On the 18th conjunctivitis appears again and is more intense, than on the 20th of June. Complexion does not improve. The patient loses flesh. The baths are intirely omitted. Cure-spring is continued for a few days longer. Then Tinct. ferr. sesquichloridi is administered. Empl. canth. perpet. behind the ears. Sprinkling with calomel; eyes and complexion considerably improve under this treatment. On the 11th of August she is discharged

Here was an exquisite case of serophulosis in a chlorotic individual with a weakly nervous system. Neither the bath alone, nor the addition of mother-lye produced any improvement, whilst such a rapidly favorable result ensued from the treatment by colomel &c., that I can not ascribe it to the after-effects of the baths. For such cases sea-air and a moderate use of sea-baths, and in some instances perhaps Pyrmont or Schwalbach, are more appropriate.



2. Miss — 23 years old, apparently strong, complexion ruddy, dark fair; figure terse; but on closer acquaintance great nervous irritability and want of energy is observed. Had suffered with "chlorosis" in her 16th and 17th year. Menstruates now regularly, tongue chapped and furred, sedes retarded, Slight Blepharadenitis. Since 15 months a hardish tumor exists in the fossa supraclavicularis sinistra, which is recognised as a lymphatico-glandular swelling. Without seeking medical advice, she drinks for 8 days 4 glasses of undiluted Cur-brunnen and takes besides a warm saline bath daily (26° R) for half an hour. General "excitement" appeared, want of sleep and of appetite; no inclination for any durable occupation. The baths are now taken, by my advice, only every third day, for 15 minutes; and from the Cur-brunnen only 9 ounces are allowed daily, diluted with an equal quantity of water. Tinct. Valerian in the evening. Symptoms improve and with a pretty satisfactory state of health; bath and Brunnen are continued. Cataplasms of mother-lye are applied to the supraclavicular swelling.

The tumor diminishes. At last a trial is made with mother-lye baths (addition of 2—4—6 quarters). But very soon the described phenomena of excitement, that is of over-stimulation, appeared in so striking a manner, that it was necessary to leave of the baths altogether. I saw the patient again after 6 months. The tumor is considerably diminished, the blepharadenitis has not quite disappeared.

I have adduced this case to show what injury may result from an excessive employment of the Nauheim springs and especially of the mother-lye baths, and how this may be avoided by a careful use. The caution must be the greater, as the state of the nervous system can very often only be found out after nearer acquaintance, and indeed I should have expected nothing less in the blooming patient before me than the pretty considerable degree of nervous weakness, which was actually met with. I beg to observe at the same time, that the large doses of Cur-brunnen taken at first produced violent, diarrhoea-like exhausting evacuations, whilst the subsequent use of the diluted Brunnen in smaller doses had the desired effect.

3. A girl of 4 years (whose father suffered with scrophulosis from his youth) was affected with impetigo capitis soon after birth, and with short interruptions has laboured under impetigo ever since. It is now spread over the face, arms, hands, back &c. The smallest irritation of the skin (as a sting of a gnat for instance) induces formation of pustules. Complexion slightly chlorotic; catarrhus ventriculi with retarded evacuations; laxity of muscles. The child had learned to walk pretty early, but the teeth made their appearance very slowly and under great troubles. The little patient took on the whole, with regular interruptions, 30 simple saline baths each of 20 minutes duration, and drank besides 3—6—9 ounces of Cur-brunnen, likewise



with interruptions. From the commencement of the second week of the course some phosphate and carbonate of lime (in equal parts) were added to the meals. The result was brilliant. The skin became perfectly clean, the complexion clearer, the muscular structure firmer, the appetite more regular. The weight of the body increased by 50 grammes, and the cure is durable according to the report of the parents. As the child had constantly lived in the country and in the best circumstances, the change of air or frequent sojourn out of doors could not have produced the good effect. Several similar cases lie before me and for them the saline bath seems peculiarly indicated.

4 Miss — 20 years old, born by a scrophulous mother, apparently "healthy" up to her fifteenth year. Then with the appearance of the menses, which are regular, but weak, swelling of the lips, of alae nasi and afterwards conjunctivitis eczematosa appeared. From these ailments she suffers still. Complexion slightly chlorotic. Frame pretty strong — no complaint about nervous weakness. Tongue covered with a yellowish fur. Appetite moderate. Sedes retarded. During the first part of the course under the daily use of a simple saline bath and of 18 ounces of diluted cure-spring the health visibly improves (from August 1st to 13th) In the midst of August a new conjunctivitis arises, and till the end of the course new eczema continues forming on the conjunctiva and only yields at last to calomel-sprinkling. On the whole 28 baths were taken, with some addition of mother-lye to the latter ones. Though she felt herself perfectly well and free from any languor under the course, the chlorotic tint became more prominent than before and induced me to give her 1 grain of Sulph. Ferr. three times a day. The patient departed without my being satisfied with the result. After 6 months, however, I received the news, that the improvement gradually progressed without further treatment, and that she was now completely cured. This may serve as an example of a favourable after-effect of the course.

## 2. General Debility.

Under this head I comprise a number of diseases, the most prominent symptom of which consists in a state of general weakness. Most of the patients belonged to the female sex. With 25 of them no local manifestation of disease was present. They were either children, overfondly brought up, with pale complexion; young girls, who had lived too luxuriously and led a life of



idleness, or patients borne down by hard fate, or weakened through excessive mental labor, night watching &c. Wit 15 patients a persisting fluor albus prevailed besides the general debility.

With 7 general irritability was present besides chronic catarrh of the digestive organs; irregular alvine evacuations, light rheumatic pains, irregular menses &c., all signs, which so often foretell the development of pulmonary tuberculosis.

With 3 haemorrhoids were present besides fluor albus.

With 2 chronic *uterine hyperaemia* (once with ulceration of os uteri) besides fluor albus.

With 2 *amenorrhoea* of several years' duration and sterility.

With 2 *chronic eczema* frequently vanishing and then reappearing.

With 2 *metrorrhagiae* (*Menses nimiae*).

With 1 *prurigo pudendorum*.

With two men : *impotency*.

With *one female* obscure ovarian disease and sterility.

With *one female* patient a considerable nervous irritability associated with frequently occurring rheumatism and catarrh of the stomach.

It does not unfrequently happen, that female patients exhibit an excellent complexion, considerable stoutness and such great mental vivacity in describing their ailments, that a state of debility would be the last thing anticipated. But a few days' acquaintance suffices to convince the observer of the deficient mental calmness and of the small bodily power. The smallest joy raises them to the skies, and the most insignificant suffering is to them a misery only alleviated by a flood of tears. In other cases the diagnosis is less difficult and may be formed from the first report of the symptoms, which at the same time often makes it clear, how the causes of the disorder were overlooked for the local ailment, and why "many remedies" afforded only "little relief". After the preceding observations it is scarcely necessary to state, that for such patients a regular course of saline baths is not adapted and whenever I have observed instances of over-stimulation, it was invariably in cases of this description.

In one instance a girl of sixteen bathed for three successive days, she always felt a sensation of chill in the bath. Afterwards



an unnaturally deep sleep ensued and on the third day such a considerable frequency of the pulse appeared, that it was necessary, to discontinue the baths. An attempt renewed at a later period led to the same result again.

In another instance of an unmarried lady of 24 years of age the general strength seemed to be quite satisfactory according to all appearances. Desirous of losing a troublesome obesity she took 14 baths. But suddenly after the 15th hysteric spasms appeared, of which she had never suffered before, and recovery took place only very slowly. Many cases of this kind might be adduced.

Sometimes patients are sent to Nauheim suffering with amenorrhoea and sterility, without being chlorotic. It is a fixed experience, that the bath induces congestion to the womb, and under its use ladies, who formerly menstruated regularly, will see their menses appear from 2 to 8 days too early. These congestions did not fail, to occur with the patients in question, and may certainly prove salutary under certain circumstances. Nauheim has even obtained a certain celebrity through its beneficial influence on sterile women. But in two cases observed by me, the menses were not restored, violent lumbar pains and uterine colic ensued besides general excitement and different indications of reflex-suffering. Moreover the foundation of her disorder, general debility, was not removed through the bath, but rather increased. In such cases Nauheim is positively inappropriate.

The more observations of this kind I have collected, the more cautious I have become in the employment of the baths whenever a state of weakness existed. However, with the auxiliary remedies at our disposal I have very often obtained highly satisfactory results, even when the baths were not applicable.

In general I beg leave to offer the following observations, deduced from my experience:

- 1) In conditions of debility, whether associated with a local complaint or not, the mother-lye bath is not to be permitted under any circumstances.

- 2) Even the regular daily use of a simple saline bath is inappropriate under such circumstances. A diluted bath, or its employment every third day is beneficial under certain circumstances (as general atony, hemorrhoids, fluor albus, eczema &c.).



3) I have very advantageously combined cold irrigations and rainbaths in such cases with the use of the warm saline bath, and in fluor albus the simultaneous employment of the cold uterine douche and rain-sitting-baths proved exceedingly salutary.

4) The undiluted cure-spring generally exercised under such conditions a very irregular and unpleasant effect on the intestinal canal. Gastric catarrh, want of appetite &c. did not unfrequently appear. But the diluted spring was often very successfully employed in doses, which sufficed to exercise a gentle effect on the bowels.

5) The deranged digestion, as well as other symptoms connected with the disturbance of the nervous system have induced me to employ occasionally : Inf. Valer, mineral acids, Tr. Chin. compos., Tr. Rhei. compos. and mild preparations of iron By means of these remedies, together with cold irrigations and douches and an appropriate diet besides a careful use of the saline bath, many patients have been permanently cured, who had suffered from general debility, irregular menstruation, chronic fluor albus and chronic gastric catarrh. But I do not believe, that the bath has *materially* contributed to this result.

A few cases may again be mentioned as illustrations of the above remarks.

5. Mrs. — 32 years old, married since 5 years, had many troubles before marriage, had suffered from profuse metrorrhagia, spasms of the bladder and general hysteric fits. Two years after marriage she was delivered of her first child, 16 months afterwards of her second. The latter child is suckled by the mother herself. This induces such intense weakness, that she faints several times in the course of the day. Since that time she feels the pressure of a knot in the epigastric region, which after the employment of exutoria, yields to a feeling of pressure along the whole sternum. Last summer she used Wiesbaden. But the pressure remains; a high degree of fluor albus exists; hemorrhoidal swellings are developping themselves, appetite irregular, and vomiting is produced by mental emotions. Acid eructations and taste are rarely absent—sedes regular, not loose. Menses regular, strong. Portio vaginalis soft, swollen; slight antroversio uteri. High degree of mental restlessness, anxiety, want of sleep &c. — The patient had already taken 10 saline baths in 10 consecutive days, when I saw her. The baths had rather increased than diminished the state of excitement. They were now only continued with interruptions. Besides cold irrigations were employed and the cold uterine douche. Internally mineral acids. Latterly goat-whey, wine and broth daily and animal diet in moderate



quantity. To avoid much society, to sojourn frequently in the open air, to sleep as much as possible; to take for some time after the termination of the course: Tinct. ferr. sesquichlor.

Under this treatment the patient visibly improved. Fluor albus disappeared completely, also the acid taste. The mind became calm and cheerful. After 6 months I received news of her complete recovery.

6. Mrs. — 52 years of age, whose grand parents were very gouty, suffers with rheumatic pains of the knee joint. Menses ceased two years ago. Complexion pale. Mind depressed (unhappy family circumstances). Deficient mental energy. Slight catarrh ventriculi. Constant tendency to diarrhoea; hemorrhoidal swellings — fluor albus — Organs of the chest healthy. For a long time she had not followed any systematic course of treatment. I ordered: simple saline baths with regular intermissions every third day. Internally 3 times a day a grain of sulphate of iron. On the whole she took 18 baths. Her health is materially improved, and her principal complaints are removed.

7. Mrs — 26 years old. In consequence of seven deliveries rapidly following each other she is highly irritable and incapable of undergoing any exertion whilst she had enjoyed excellent health previously. The long profuse menses compel her invariably to keep the bed for 8 days. Fluor albus in a considerable degree — gastric catarrh, want of appetite, irregular evacuations. Complexion very pale. The patient had already taken 12 saline baths, and used Schwalbach water internally when I saw her first. No change of her symptoms had then taken place. In lieu of the warm saline baths cold rain baths are now ordered, light at first and gradually stronger; at the same time cold uterine douche twice daily. Internally occasionally mineral acids and bitter tinctures. Very soon a favourable turn takes place. — Fluor albus almost disappears completely.

For the future menstrual periods the use of sulphate of iron is recommended. During winter I received the news of durable improvement and considerable diminution of the metrorrhagiae.

However inappropriate the saline bath was in this and similar instances, our different curative auxiliaries proved the more useful. The patient was the mother of two scrophulous children, who were to use Nauheim under her care. In order to afford her likewise some advantage, the same baths were thoughtlessly recommended to herself. Such cases clearly show, how desirable it must prove, to possess various remedial agents in the Spas.



### 3. Hemorrhoidal complaints.

The varicose state of the veins permeating the rectum and neck of the bladder with the attendant changes of their lining mucous membrane, is rarely an isolated phenomenon. These disorders are either due to a certain general disturbance of circulation (liver- or heart-disease), which is less frequent, or they are the expression of a general derangement, which in my opinion possesses rather a nervous than a humoral origin. Vascular atony in consequence of deficient innervation seems to me invariably part of the complaint, whilst the other symptoms of the evil appear in the most different forms, either principally affecting the digestive apparatus or the nervous system. That the origin is frequently constitutional, is shown by the hereditary character of the disease, as well as by its whole development. That its production is sometimes favoured by local impediments to circulation is proved by clinical observation, which shows, that the hereditary tendency frequently finds development only under such circumstances, as are apt to produce hepatic hyperaemiae &c. (as excess in diet, hot climate &c.). Its connexion with the nervous system, and especially when in a state of debility, is proved by the observation, that hemorrhoidal tumors are often developed in the last days of consumptive patients, and that they rarely appear in strong, but frequently in weak females (especially after deliveries), being besides associated with other phenomena pointing to a deficiency of nervous power.

Led by these general reflexions, I prefer as a rule the tonic treatment in hemorrhoidal complaints. However, the symptoms of retarded metamorphosis and of local derangements of the digestive apparatus (catarrh, flatulence, retarded evacuation, hepatic hyperaemia &c.) are often so prominent, and their removal is such an essential condition for a further successful treatment, that they claim the first attention. In this respect we possess excellent remedies in the careful employment of the baths and diluted cure-



spring of Nauheim. With the baths I frequently combine cold irrigations, cold sitting or rainbaths, the cold ascending douche. The cure-spring I prescribe in pretty abundant quantities, but without enforcing intestinal evacuations by concentration or by too high doses.

In single instances I have attained my purpose with Nauheim's remedies, notwithstanding the difficulties I had to contend with at first through the fickleness of the patients themselves, and this the easier, the less the ailment was based on a constitutional cause. With people, who had acquired hemorrhoids through a sedentary mode of living and intense mental labour besides luxurious living, a course of 5 or 6 weeks at Nauheim often sufficed, to produce a lasting cure. In other cases, however, in which nervous symptoms prevailed, whilst the digestive and other disturbances could only be considered as dependent on them, I was not so satisfied with the result and was obliged, to order a moderate use of the sea-bath to complete the cure, as far as possible. At all events hemorrhoidal patients may expect to derive benefit from one or other of Nauheim's sanitary resources, if cautiously employed.

8. Mr. — 37 years old. The patient lives in the country under very good circumstances, looks ruddy, enjoys good appetite and regularity of sedes, but suffers from hemorrhoidal swellings, which sometimes bleed and now invariably come out during stools. Temper irritable, nervous system languid. Neuralgiae of the face often appeared latterly. No other morbid phenomena.

The patient is ordered, to take simple saline baths with subsequent rain-douche every other day, and at first 2—3 times internally 6 ounces of non-diluted cure-spring. The baths agree perfectly, but the Brunnen molests the stomach, causes oppression, and produces an undesirable drastic effect. He especially complains of feeling "so excited" after its use. Schwalheimer mineral water is substituted for the Brunnen, and after a few days, small quantities of the Brunnen are added to it. All the symptoms gradually improve after this in a satisfactory manner. The hemorrhoidal swellings become smaller and do not more protrude during the evacuations. After 3 weeks the patient leaves Nauheim "very satisfied" with the result of the cure, in order to use sea-baths for some time at my advice.

9. Mr. — 45 years old, a lover of good cheer, has suffered for several years with catarrh of the stomach and considerable hemorrhoidal swellings frequently bleeding. — The volume of the liver is enlarged, apparently in



consequence of simple hyperaemia. In the omentum a moveable fibroid tumor can be felt of the size of a swan-egg. Complexion and conjunctiva yellowish. Thoracic organs perfectly healthy. Temper very cheerful; absence of any sign of weakness. He daily drinks two or three times 5 ounces of cure-spring and takes a simple saline-bath every afternoon between 5 and 6. This course is continued uninterruptedly for 4 weeks. The result is perfectly satisfactory. Gastric catarrh, as well as hemorrhoidal symptoms are materially improved.

These two cases clearly demonstrate the different phases of hemorrhoidal complaints. In the first general weakness and irritability were clearly prevailing, whilst in the second disturbed abdominal circulation was the only demonstrable point, that could have produced the hemorrhoidal development. The difference of the therapeutic indications is therefore selfevident and their proper fulfilment was rewarded with a good result in both cases.

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#### 4. Gout and rheumatism.

In gout and rheumatism the saline-springs have long occupied a prominent rank, and the few observations I have to make in this respect, only serve as a confirmation of older experiences. The existence of a general dyscrasia will be as little denied here, as in the scrophulous diseases. For those cases of light and frequent neuralgiae of cutaneous (and muscular?) nerves, produced by the most trivial causes, may be considered as in general improperly put down for rheumatism. But the development and external form of the real rheumatism offer again a great variety. According to the observations, hitherto made by me, retarded metamorphosis of nitrogenous compounds is here likewise greatly prevailing. The abundant urinary sediments and the deposits of urates &c. in the joints prove this sufficiently. Moreover the pathological increase of non-nitrogenous organic acids, shown by the strong acid reaction of the perspiration (in corpses by the acid reaction of the pericardial serum) may only be considered as a



further consequence of the originally nitrogenous compounds being checked in their process of metamorphosis. But this great difference seems to exist between scrophulous and rheumatic tendencies, that in the former a diminution of inorganic phosphates invariably prevails, whilst in the latter such a diminution appears at least only as a rare phenomenon, and in such cases both morbid forms melt so much into each other, that it is difficult to mark the limits of either. I here allude to the acute articular rheumatism not unfrequently occurring in so called scrophulous individuals and generally offering most resistance to a successful course of treatment. But how very different are again the features of disease we meet in the various sufferers from rheumatism and gout! Here a chlorotic condition is associated with the original rheumatic complaint, there a great richness in coloured blood-corpuscles is present. Here gastric derangements are the constant companions, there chronic pulmonary catarrh is the secondary ailment. Here renal, there hepatic disease is complained of &c. &c. It scarcely requires to be mentioned, that according to the different morbid phenomena therapeutics vary. But in whatever form the disease may appear, Nauheim will have a salutary effect, in one or other direction, and even if its springs should not be able to produce a complete cure in many a case, their combination with appropriate remedies will seldom remain without result.

I again subjoin here briefly the results of my experience :

1) In rheumatic and gouty patients with a strong nervous system and a good complexion the full use of Nauheim's drinking and bathing springs exercises a salutary effect. But the single course must not be allowed to extend too far, to prevent injury of the nervous system.

2) In chronic local rheumatisms, the residua of acute or chronic inflammatory processes, the cautious use of the douche is sometimes very efficacious. I have also observed striking results in such cases from the employment of the carbonic acid gas bath.

3) With individuals of a weakly nervous system the bath is first to be given in a diluted form, or pure for a short time, or every third day only; a too extended course being positively contra-indicated.



4) To individuals who complain of prominent digestive derangements, it is advisable to recommend the cure-spring exclusively, till they feel visibly improved, and then only combination with the bath may be commenced.

5) For individuals of chlorotic complexion the simultaneous use of tonics, bitter tinctures, iron &c., under certain circumstances an acidulous chalybeate are indicated. For several of these cases the Schwalheim spring is to be recommended as a common beverage, but then the carbonic acid ought first to be allowed to escape partially.

6) If any renal affection is present and verified by careful examination of the urine, and especially if symptoms of parenchymatous nephritis are exhibited, bath and Brunnen are to be desisted from. After the use of the former I have witnessed in a case of this kind the excretion of albumen considerably increased.

7) If with more or less weakly individuals local remnants of former inflammations are the subjects of treatment, as articular swellings, periosteal enlargements &c., douches must not be used without great caution, as a local overstimulation of the affected localities is apt to produce new exsudations or inflammations.

8) The organic cardiac diseases, resulting from previous rheumatism or endocarditis, do not by any means contra-indicate the saline bath. The four cases of organic disease of the heart mentioned above confirm this statement. Not a single phenomenon appeared, which could have rendered the regular continuation of the baths unadvisable. I have on the contrary convinced myself, that the saline bath is sometimes able, if not to improve the organic lesion, at least to prevent deterioration and relapse.

As this assertion may perhaps be opposed to preconceived opinions, I have to observe, that I subjected the patients in question to a very careful contrroll, and to one of them I ordered a course of Nauheim in two consecutive years. In no instance either subjective or objective derangements appeared, which might have justified the opinion, that the exciting saline bath is contra-indicated in cardiac diseases. Of course, the development and history of the disease, the individuality and the degree of the lesion are all to



be taken into account, and I should therefore be unwilling to state it as a rule without exception.

But I should not hesitate an instant, to recommend the baths to patients affected with cardiac disease in consequence of rheumatism, as long as no secondary diseases have been developed (especially no renal affection), and I believe the bath to be of some use.

10. Mrs. — 32 years old. Married 15 years. Two children, one of 10 and the other of 12 years. Was slightly scrophulous in childhood. Affected with fluor albus since 12 years. In consequence of getting wet through 4 years ago, violent pains arose in her left arm, affecting at first the fingers and afterwards the shoulder, then spreading to the mamma, exacerbating during the menses and occasionally rendering the movements of the arm impossible. The left mamma sometimes swells. The treatment was hitherto exclusively directed to the sexual organs. A swelling of the uterus was supposed to be present, and therefore uterine douches and cauterisation were employed without any improvement of the fluor albus. The patient has a well proportioned frame, a slightly yellowish complexion, and is regularly menstruated; slight degree of hemorrhoids and of gastric catarrh. The nervous system is in a state of "irritable weakness".

A careful use of the cure-spring and of simple saline-baths (at first every other day and subsequently daily), the employment of mild cold stream douches to the left shoulder, and afterwards nightly applications of mother-lye to the same joint had the most desired effect. Within 6 weeks she was freed from all pains, the fluor albus reduced, the gastric catarrh improved. Her state of health was perfectly satisfactory in the following winter.

Beyond doubt an affection of the plexus brachialis was here in existence (with a general rheumatic dispositon), exacerbating from time to time and especially during the menses. Should I have to designate the local ailment more exactly, I should point it out as an intermittent hyperaemia with slight exsudative processes of the plexus brachialis, the region of the plexus having been increased by pressure, particularly during menstruation. In other respects the local ailments showed an unmistakable connexion with the generative organs (hyperaemia, fluor albus) whilst the general rheumatic disposition seemed to form the basis for both ailments.

This occurrence of hyperaemia and catarrh as well as neuralgia of the womb in general rheumatic disposition seems to be very frequent, and many uterine complaints removed through our Spa, belong to this category. J. Begbie directed the attention of the



profession lately to this circumstance by an excellent treatise in the "Edinburg medical journal" May 1858, p. 983. He says: "So intimate is the relation and so frequent the concurrence of rheumatism with an unhealthy condition of the uterus, that Dr. Todd has seriously proposed the question: "Whether under certain circumstances the uterus may not be regarded as a source of rheumatic or arthritic matter" and has devoted one of his interesting croonian lectures to the illustration of the subject. — — I incline much more to the view, that the uterus is affected in its function and structure through the rheumatic blood. We know that it suffers through gout, and that the affections thus engendered, are relieved or overcome through colchicum and such other means, as favor the elimination of gouty matter. I cannot doubt, that it is similarly affected through the rheumatic element, hence the relief obtained in so many of its disorders through arsenic and other remedies, which are known to influence that particular constitution. I have seen cases of peritonitis in intimate relation with rheumatism and do not doubt the accurate observation of those who have diagnosed rheumatic inflammation of the womb. — — — The connection of rheumatism and dysmenorrhoea has long been recognised. — — Dr. Rigby writes to Dr. Todd: "I have been for several years aware, that many common derangements of the uterine organs are frequently connected with a state of the system analogous to what, when it attacks the limbs, is known by the name of rheumatic gout, arthritis &c. *This is more especially the case with certain forms of dysmenorrhoea, inflammation of the os and cervix uteri, with albuminous discharge and the early stage of scirrhus uteri*". — These experiences and views are to my knowledge as yet little noticed in Germany, but they are decidedly based on a very just and careful observation. Besides the anatomical and physiological relations of the uterus render the intimate connexion of some of its disorders with a general rheumatic disposition very conceivable.

11. Mrs. — 52 years old. The following is her medical report: "Mrs — has suffered for 10 years with rheumatico-arthritic complaints. Since three years the patient can not move freely, her gait is unsteady and lottering, and the power of sensation in the arms and legs is likewise affected. The suspicion of spinal suffering occurs, caused by rheumatico-arthritic deposits, especially in the medulla oblongata. Menses omitted the last year. For



three consecutive years she has sought relief in Wiesbaden, but without apparent result. In conclusion it is necessary to state, that she also suffers from stasis abdominalis and hemorrhoidal complaint, which may probably necessitate an internal resolvent course of treatment with the use of the Nauheim baths". — In former years she had suffered from orgasm of the blood and haemoptysis, probably owing to a state of debility produced by protracted lactation. The weakness of the extremities appeared *suddenly*, after the preceding rheumatism of the joints. Change of weather invariably influences her state of health. By continuing to walk pains appear in the back. Tongue covered to a great extent with a white fur. Sedes irregular, retarded. — Appetite on the whole good. Slight arterial rigidity. The first sound of the heart not quite pure. Father had been suffering from gout.

The patient took 21 saline baths with regular intermissions, and with additions of mother-lye. Besides she took daily 18 ounces of diluted cure-spring. In the last 8 days mineral acids were employed on account of her gastric catarrh. The result was perfectly satisfactory. Walking became freer and steadier and the patient praised, after every bath, of feeling fresher and stronger. In the last 3—4 baths she felt a kind of anxiety as she expressed it, and resolved to terminate the course. It does not seem to me improbable, that the addition of mother-lye was the cause of this condition, so that I shall restrict these additions more and more in future even in those morbid states, in which they have hitherto been urgently recommended.

The remarks made above with reference to cardiac diseases may find some elucidation in the following case :

12. Mr. — 65 years old, was formerly healthy. Two years ago he experienced an inability to find words; this was removed by different derivative remedies. A year ago apoplexia ensued with paralysis of both left extremities. After some time (employment of saline baths and Ragoczy) this likewise disappeared completely. At present the patient complains principally of incontinentia urinae, which occasionally gives way to a spasmodic closure of the bladder, so that he can only pass his water in great intervals. The quantity of urine very small. Rheumatic pains occasionally in the left extremities.

Appetite bad notwithstanding regular alvine evacuations. Tongue pretty clean. The patient can walk for hours without fatigue. Sometimes palpitation of the heart appears, but lasts only a short time. Physical examination shwos considerable *insufficiency of the mitral valve and a slight degree of cardiac hypertrophy*. On July 28th he begins to take daily 8 ounces of undiluted cure-spring, and every other day a simple saline bath. On Aug. 4th appetite and sleep still wanting, but the baths agree very well. He feels some chilliness on entering the bath, but it soon gives way to a pleasant sensation of warmth. The pulse sinks in the bath from 70—74 to 62—68 beats in the minute. The Brunnen promotes alvine evacuation in a moderate degree.



On Aug. 11th the patient reports his appetite and rest to be improved. No symptoms of sanguineous orgasm are present. Micturition more normal. On Aug. 15th the course terminated, the patient being quite satisfied with his state of health.

Let this case only serve as a proof, that cases of cardiac disease bear a careful employment of the saline bath exceedingly well under certain circumstances. The three other cases observed by me had similar results. In no instance have I witnessed the much dreaded orgasm and congestion of blood; nay whenever a rheumatic disorder is still existing, I most decidedly consider myself justified in recommending Nauheim, provided the patients are not weakly or anaemic.

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## 5. Diseases of the central parts of the nervous system and of their coverings.

In consequence of some striking cures of paralysis of the extremities having been observed in acidulous saline baths and especially in the excellent Spa of Rheme, the number of patients suffering with cerebral and spinal diseases has considerably increased in those places. An obscure idea of the "stimulating" or "reviving" influence of carbonic acid seems to have partially assisted in this choice, at least I must come to this conclusion from the perusal of some medical reports. But, if any where, it is especially necessary here, to recur to the anatomic conditions causing the ailment, and to consider well, that though the morbid phenomena may be similar, their terminations diverge widely from each other: For whilst for a certain series of this class of patients the baths unquestionably produce most salutary results, for others it is not only not curative, but in my opinion decidedly injurious.

It is true, our knowledge of these anatomic lesions of the nervous centres which cause neuralgiae, paralyses, convulsions, or simply faulty nutrition stands still on a very low degree of deve-



lopment. Nevertheless this much may be assumed as certain, that the diseases in question are due in certain instances to a morbid condition of the coverings of the nervous centres, and in others to an abnormal state of the nervous tissue itself. This difference of the original development of the disease is of great importance as regards therapeutics.

In the former instance we have generally to deal with inflammatory processes of the membranes and their appendages; in the latter with new formations proceeding from the cellular tissue of the nervous centres, or with atrophiae and degenerative processes of single nervous portions, either congenital or through excessive strain or exertion of some kind, or developed through some other pathological processes, as apoplexiae &c. The diagnosis of these conditions sometimes offers great difficulties. But the history of the development of the disease must offer pretty safe starting points. Moreover, it seems to me, that the diseases of the nervous substance itself are mostly associated with such striking derangements of nutrition, that the presence of these may be considered as a safe indication of their origin. It struck me as a peculiarity, that patients belonging to this category, suffer so frequently from cutaneous diseases, as ecthyma, acne, furuncles, eczema &c., without any fundamental evil, which could be considered as the cause of both series of disorders, thus the cutaneous diseases seemed to me decidedly to depend on the affection of the nervous centres. If it is asked, in what cases the Nauheim baths are indicated, I must confess, that I have witnessed no successful result in any undoubted affection of the nervous centres themselves, and therefore I cannot recommend Nauheim in such cases. Its effect on the nervous system indicated above offers at the same time a sufficient theoretical basis.

In real atrophy of nervous substance (atrophy of the brain in adults, tabes dorsalis &c.) I consider the Spa downright contraindicated.

As regards those complaints, however, due to inflammatory affections of the coverings of the nervous centres I expect a good result from the bath, if a general constitutional ailment, especially rheumatism, forms them or bid foundation. The improvement of the latter includes here generally that of the local ailment. Such



diseases belong to this category, as have been developed in consequence of inflammations of the vertebrae; especially in paralyses following serophulous inflammations of the vertebral column the baths offer a most appropriate remedy.

Besides the diseases of the nervous centres, based on certain local anatomical changes, a great series of maladies occurs, due to transitory alterations, hyperaemiae, exhaustion &c. and unfortunately often most difficult to diagnose. Many cases of cephalalgia, migraene, giddiness, hallucinations of the senses &c. may be mentioned as appertaining to this category. Nothing but trial of the remedy can often be decisive in such instances. If, however, for instance abdominal disorder, cardiac disease or hemorrhoids form the bases of the complaint, it will depend on the nature of the latter, whether success can be expected from the bath or from bath and Brunnen combined. The following notes may serve to illustrate the above remarks :

13. Mr. — 35 years old, formerly constantly healthy, unmarried, observed first about Christmas 1856 in dancing a weakness in the lower extremities. This slowly increases. The extremities hang down like weights from the body. The patient complains of pain in the back and great stiffness in the legs, especially the left.

In the latter he frequently feels as if it was made of wood and did not belong to his body. If he bends forward, he loses the equilibrium and falls. He can only put on his lower garments by leaning the upper part of the body towards a wall. In walking the legs are dragged forward. Intellectual powers undisturbed. Obesity of a moderate degree. Good complexion. The patient is not aware of any distinct cause of his ailment.

When I saw him first, he had already taken 14 saline baths and besides daily 4—5 glasses of undiluted cure-spring, which produced 5—6 stools. His condition remains unaltered. The dose of the spring was now reduced to half, the bath only allowed every other day, spirituous washings of the back were ordered. Animal diet and wine. Under this treatment and encouraging words his state of health improved at first. The gait became steadier the power of walking lasted longer, and with great joy the patient reported, that he could stand for a short time again on one leg. But at the 24th bath the symptoms of tabes reappeared in their old form; the weakness of the lower extremities became considerable. I advised the patient, to discontinue the course.

After a year I received the news, that his condition continued, to deteriorate and that a speedy end did not seem distant.

Similarly unsuccessful were bath and Brunnen in an analogous case of a man of 48 years of age who had been syphilitic formerly,



and who had passed through most extensive mercurial and hydro-pathic courses and who was afflicted these 8 years with paralytic symptoms of the lower extremities and of the bladder. He sought the cause of the first appearance of his complaint in a damp residence. Whether justly or not — ?

14. Mr. — 29 years old, had suffered for several years from prostatic induration in a considerable degree. It was said, to have owed its origin to a gonorrhoea. According to the medical report the induration and enlargement of the gland is so considerable, that urinary and alvine evacuation can only be performed with great difficulty. Incipient impotency and weakness of the lower extremities are considered to be in connection with the prostatic disease by his medical attendant; under the employment of iodine, leeches to the perinaeum, and afterwards extr. Nuc. vomic. the symptoms improve. But a sensation of great weakness in the lower extremities, especially in the left remains behind. In walking he feels a kind of rocking sensation; he can scarcely stand without support. — A high degree of emaciation; he weighs 88 pounds 320 grammes; complexion chlorotic. Tongue slightly furred; appetite and sedes regular and satisfactory. Mental faculty unimpaired.

I believe, that in this case also an incipient tabes dorsalis was in existence, and that the prostatic disease did not cause the morbid condition of the nervous system, but rather coincided with it. I mention the case, however, because the patients health materially improved under the careful use of the saline baths (every 3d bath omitted) during 3 weeks. The weight of the body increased by two pounds. Walking was considerably easier, the rocking sensation quite lost. But whether the improvement was lasting, is the question.

15. Mrs. — 49 years old. Formerly constantly healthy; had born two children and suffered three abortions. Since 9 months she labours under a kind of *mimic spasm* of the face. Latterly lacrymal flow and erosion of the lower eye-lids supervened. Menses ceased 4 years ago. Digestive organs inactive; stomach in a state of chronic catarrh. The patient bathes daily and drinks from 10—15 ounces of indiluted cure-spring. The effect of the latter is very regular. The baths are well borne. After the first week the spasmodic symptoms of the facial muscles diminished, and disappeared almost completely after three weeks. A further continuation of the baths was not thought necessary, as the last ones had caused a slight degree of languor and with it a momentary reappearance of the facial spasms.

The origin of her ailment was no doubt to be sought in the abdominal organs. Bath and Brunnen had an excellent effect. But we find here again, that the continuation of the bath beyond a certain point induces a kind of fatigue, and where nervous symptoms are present, as was the case here, the course is then



fortwith to be terminated. The comical idea, that a certain number of baths *must* be taken, is so fixed with many patients, that they are sometimes with great difficulty induced to be satisfied with a smaller number.

No doubt, the medical attendant sometimes commits the mistake of dictating to his patient the number of baths to be taken, hence the unwillingness to desist from the prescribed number. But do we in the ordinary treatment of diseases possess an exact estimate of the quantity and quality of medicaments requisite for a thorough cure?

## 6. Uterine diseases.

It was already mentioned above, that the saline bath induces almost without exception a premature appearance of menses with women, whose menstrual functions have hitherto been regularly performed.

However, easy it may be generally thought to explain this fact, to me it appears difficult. Have we to consider the regular periodical appearance of the menses as a phenomenon depending on the nervous system, or are we to assume, that in the female organism a certain excessive quantity of material is employed for the development of an ovulum with its follicle, and that with the separation of this ovulum a part of the material is expelled in the form of menstrual blood? In other words, does the periodic maturation of ova and the associated menstruation depend on general laws of metamorphosis, or is it based on a periodic action of the nervous system? A full discussion of this question would lead me too far in this place, but according to the axioms of comparative physiology as well, as according to the observation on the pathological and normal relations of menstruation it seems, that from



both sides certain conditions are offered for this periodical function.

If then the saline bath invariably induces a premature menstrual discharge, we might consider this effect due both to the altered relations of metamorphosis and to the reflex movements in the uro-genital nervous system. We must assume, that in the female organism every quantity of elaborated material furnishes a certain small portion for the functions of the sexual organs. If then a larger quantity of this material is elaborated, a greater portion will be allotted to the sexual organs, and consequently that point will be reached the sooner, by which the evolution of the periodic sexual function ensues. We therefore find the menses appear earlier than usual with many women after exposure to great bodily exertion, in travelling &c. Moreover the daily reflex action of the urogenital nervous system most probably exercises its influence on the heightened activity of the organs in question, and from different reasons I am inclined, to attribute a higher influence to the latter, than to the former cause. The local processes happening during menstruation materially consist, apart from the ovarian function, in a tumefaction and hyperaemia of the uterine mucous membrane besides contemporary rapid development of its glands. It is not improbable, that the bath is invariably followed by a temporary hyperaemia of the uterine mucous membrane, nay of the uterus itself, analogous to the considerable increase of renal function.

In this daily returning hyperaemia we might seek the cause of the curative action, which the bath is by manifold experiences proved to exercise on certain uterine diseases.

In general there are cases, in which retarded development of the genital system exists. The womb is shown by the examination with the sound to be small, the menses appear rarely or are quite absent; the individuals in question are sterile. There are other cases of deficient uterine involution after pregnancy, or infarcta in consequence of unfruitful connexion. Other uterine diseases are undoubtedly based on rheumatism, and this latter ailment may perhaps sometimes be considered as the link, through which new formations in the uterine muscular substance are developed. Furthermore there are states of uterine hyperaemia in which periodical



increase and decrease takes place with apparently healthy individuals, though no menses ensue. These hyperaemiae are betrayed by leucorrhoeae, besides other phenomena associated with the function of the nervous system. In all those cases, in which success may be expected a priori from an appropriate stimulation and an increased local metamorphosis of the genital nervous system, the use of the saline baths seems almost invariably to prove salutary. Very frequently, however, chronic leucorrhoeae, slight persisting uterine hemorrhage, erosions of the portio vaginalis &c. are also due to an atonic condition of the womb, and to more or less considerable vascular enlargements with their consequences. Frequent pregnancies, unfruitful marriages, general debility or the hemorrhoidal process may lay the foundation to such disorders. In these latter instances I could not convince myself of a salutary effect produced by the bath, whilst I frequently obtained successful results by the cold uterine douche, cold rain sitting baths, or simple cold sitting baths. Latterly the saline baths have acquired a special reputation for the cure of chronic uterine swellings (fibroids &c.) and ovarian diseases (cystoids, fibroids &c.); and particularly the springs of Kreuznach are praised highly in this respect. I have no direct experience on the subject. But if I reflect on the anatomical relations of these tumors, I must confess, that it seems to me at least highly improbable, that a real fibroid, whether existing in the uterus or connected with the ovary, should ever be absorbed. If such a thing should be asserted, it must be based on a diagnostic error. Has ever an external fibroid been in the least reduced by the Kreuznach bath or mother-lye or even by local applications of mother-lye? The uterine therapeutics offer a patient chapter; though the examining finger feels, and a report is made verbally and on paper, the eye rarely sees the abnormal state and thus the control fails. But I will not by any means deny, that the saline baths in general, and perhaps Kreuznach in particular, may arrest the further development of the tumors in question and thus a great gain is already obtained. Thus much is certain, that I have not yet witnessed in Nauheim either a fibroid or a hydroarian tumor diminish in circumference.

We latterly employ in Nauheim uterine douches of carbonic acid. The communications of *Broca*, *Follin*, *Simpson* and *Bernard*



on their anaesthetic and resolvent effects are not unknown to me. But the experience hitherto furnished seems to me to be too little established, for the deduction of distinct indications.

The observations made by me at Nauheim have not led to any reliable result. Experiments which I made with a stream of carbonic acid directed to the swimming membrane of a frog under the microscope, to the conjunctiva of a human eye, and to a naked arm placed it beyond doubt, that the action of the stream is followed by a slight expansion of the capillaries and accumulation of blood corpuscles. The skin feels at the time a tickling sensation; the lacrymal secretion of the eye is increased. An excitation of the sentient nerves and consequent paralytic dilatation of the vessels seems to me to be undoubtedly the primary effect. But whether a secondary anaesthetic effect is subsequently produced, I could not say.

According to observations lately made at Würzburg, and according to those of Bernard, the uterine douches of carbonic acid seem to require a great deal of care. I am willing to believe with Bernard, that an absorption of carbonic acid by the vaginal mucous membrane takes place, and that general derangement as head-ache, giddiness, feeling of weakness, nausea, disturbed vision, languor &c. may be the consequence of this absorption.

16. Mrs. — 30 years of age, married these six years; without children. Has suffered for ten years with hemorrhoidal swellings which bleed occasionally. From year to year a higher degree of irritable weakness is developing itself. The patient is easily put out; exhausted after every slight exertion, and extremely anxious as regards her health. Thus she thinks herself unable to drink the Brunnen in the open air, as she would be sure to catch cold (Temperature being  $16^{\circ} \text{R} = 68^{\circ} \text{F.}$  in the shade) Fluor albus since several years. Menses very regular and abundant. Sensation of heaviness and tension in the abdomen. Appetite variable. Sedes retarded. Sleep disturbed.

Against this manifest uterine hyperaemia the daily imbibition of Cur-brunnen was ordered besides simple saline baths with regular intermissions. The bath was followed by a light cold rain-bath. In the evening Infus. Valerianae. The morbid symptoms rapidly diminished beyond expectation. Fluor albus disappeared within 4 weeks, the whole state of health appeared more vigorous, the appetite became regular and good. The effect of the Cur-brunnen was very salutary and unquestionably contributed much to the removal of the uterine hyperaemia.

17. Mrs. — 29 years old. Married five years, had one child a year after her marriage. Was scrophulous in childhood, never chlorotic. After the first



lying-in violent pains, regularly appeared every evening. They resembled labour pains, deprived her of all appetite and even produced vomiting. These pains return now and then to the present moment. No conception after her first delivery. Menses regular and abundant. Considerable fluor albus.

Examination discovers a marked tumor of the portio vaginalis uteri, with a kind of spongy puffiness of the uterine tissue. Last winter she suffered from swelling and abscess of the cervical glands. Frequent diarrhoeae, especially after bodily exertion or mental excitement. The treatment was hitherto antiphlogistic, as an inflammatory affection of the vertebral column was suspected. But by the leeches &c. the patient was only weakened the more. She then bathed at Nauheim for 14 days, three quarters of an hour daily, without any medical advice. The morbid symptoms thereby became but more considerable, the general languor increased. The baths were forthwith omitted; but a cold uterine douche was ordered morning and evening. After 8 days the baths are resumed, but for 20 minutes only and regularly continued besides the douche.

Her health shows marked improvement. Fluor albus abates. The dorsal pains only appear rarely now. The ulcerated spots on the neck begin to cicatrise. After 3 weeks continuation of the course the tumor of the portio vaginalis is considerably reduced; general state of health satisfactory. The course is terminated, after she had taken 32 baths on the whole.

Several cases of this kind have been observed by me, and I do not doubt therefore, that the careful use of the Nauheim baths will continue to prove salutary against such complaints. Amongst patients of this class must also be reckoned a woman of ruddy complexion and formerly perfectly healthy, who had undergone all possible modes of treatment on account of her supposed sterility. The most different diagnoses were propounded. Probably in consequence of cauterisations of the portio vaginalis, of injections, application of leeches &c. &c. a not inconsiderable hyperaemia and puffiness of the portio vaginalis had been developed, sometimes associated with oedema of lab. pudend. and with an obstinate fluor albus. A careful verbal examination has shown, that with the greatest probability, nay almost with certainty, the cause of sterility lay on the side of the husband, in whose family several unfruitful marriages happened in the male line. For three years she was almost constantly under treatment in various places, till her patience became exhausted. I ordered cold uterine douches, some cold sitting baths, alternately with a few saline baths. Her state of health was satisfactory. But as the most essential advice for



her further guidance I have strongly recommended to her, not to visit again next winter any institution for the cure of female diseases!

### 7. Chronic eczema.

A few cases of eczema were mentioned above (p. 134), in which the cutaneous disease was connected with a general morbid condition of the nervous system. Apart from scrophulous patients, eczema is frequently developed with individuals who are far from exhibiting any character of debility, who possess on the contrary an excellent complexion, a stout frame, and who are free from any local disturbance.

At the utmost slight gastric disturbances or hemorrhoidal or rheumatic symptoms are occasionally observed with them, besides urinary sediments of urates, high coloured urine &c. indicative of a somewhat retarded metamorphosis.

In all cases of this class (16) I have witnessed the best results from the use of the Nauheim springs, both internally and externally, and if any where, I was able to convince myself here of the actual so called *after-effects* of the course.

I could never hear formerly of such after-effects, especially in *manifest* visible maladies, like eczema, without feeling grave doubts. But my eczema patients have completely removed this doubt. For whilst some of them left the Spa without any material improvement, they reported to me, about 8 or 10 weeks afterwards, their perfect recovery without any other remedy having been taken subsequently to the course. But this after-effect ought not to surprise us so much, if we carefully weigh the investigations detailed above.



If (as is really the case) after the use of Bath and Brunnen the proportions of the single integrating constituents of the blood and nutrient liquid are altered, these altered proportions do not only exist momentarily, but according to the laws of diffusion, they are as certainly maintained as, beforehand, the pathological proportions. If chronic cutaneous diseases are based on such abnormal proportions, as it is perfectly manifest in numerous cases, a complete removal of the cause must precede the retrogression of the local abnormality and require a certain length of time for its accomplishment.

An after-effect of bath and Brunnen, I should say, must necessarily ensue, because the alteration of the integrating nutrient elements, as regards their proportions, being instituted, the physiological effect must require some time for its development. As long as the effects of the morbid proportions exist to any extent, the full action of the Spa can not appear in its perfect purity.

With other patients a very salutary effect appears during the course itself, especially with children, in whom general scrophulosis was more or less developed. The local ailment sometimes improved so rapidly in such cases, that I felt compelled to explain the improvement rather from the local action of the bath, than from the general effects of bath and Brunnen. I refer to the remarks made above as regards increased metamorphosis of the skin in consequence of the bath. If we cannot but ascribe the origin of these diseases to slight local obstructions of metamorphosis or inflammatory process, we must seek the curative principles in the stimulation of the cutaneous nerves, in the changes of the capillaries of the skin and in the eventually altered nutrition of the morbid epidermic layer.

It remains a question, how far or what alteration may be ascribed to the reception of water into the epidermic layer itself. Such an alteration is not improbable, though the constituents of the Spa, received by the epidermis need not necessarily enter the circulation of the blood. The softness of the surface of the skin after a lengthy use of the baths, nay the frequent disappearance of slight degrees of pachydermia, as observed by me, tend to confirm this probability.



It will be needless, to illustrate these remarks by reports of cases, which do not offer any particular interest. The proofs, I could furnish, may be found in the statements made above.

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### 8. Difficulty of hearing.

However imperfect the pathology of the auditory organ may be, we know with certainty, that very different relations may furnish causes of difficult hearing. How far a purely nervous deafness may be admissible, must remain questionable, as we are unfortunately unable, to clearly diagnose the disturbances of the internal ear. But thus much may be considered as certain, that apart from the incurable organic lesions of the middle ear, deafness is in a great many instances produced by pathological changes of the mucous membrane of the internal, as well as of the external auditory meatus; and that especially chronic catarrhs of the tuba Eustachii and of the middle ear furnish a frequent source of deafness.

This catarrh is rarely an isolated phenomenon. It rather appears in general as a part of rheumatic-catarrhal disease, in chronic hyperaemia and deficient intestinal function, and above all in scrophulous individuals, in whom a swelling of the tonsils and of the mucous membrane of the fauces opposes besides a mechanical impediment to the entrance of the air into the Eustachian tube.

In so far as these general ailments experience an improvement through Nauheim's baths and springs, under certain circumstances a salutary effect will be exercised on the catarrh of the middle ear associated with them. As a rule, however this catarrh, or the hyperaemia and swelling of the mucous membrane, on which it is based, offer very considerable obstinacy. Out of the ten cases of



difficulty of hearing observed by me, I only recollect one, which was cured through the general employment of bath and spring.

Apparently in consequence of similar experiences aural surgeons direct a special attention to the local treatment, and amongst the remedies employed the carbonic acid douche enjoys a special reputation.

No better opportunity for administering these douches can be afforded, than by the thermal Spa of Nauheim, which is so rich in carbonic acid gas. A small gashouse even exists, as above mentioned, for administering douches to the eyes and ears. But these douches, employed with such admirable perseverance by many a deaf patient, are only calculated as an apt remedy for the external auditory canal. Though I will not deny their salutary effect in certain pathological conditions, unfortunately in the majority of those patients seeking aid against this malady, disappointment will be the probable result. If deafness is due to catarrh, accumulation of mucus in the middle ear takes place; the stream of carbonic acid must hit the mucous membrane of the middle ear, if it is to be of any use, which can only be attained by applying it through a catheter. Through the impossibility of being constantly present, I have not been often able, hitherto to employ the catheter, and hence I cannot speak of my experience on the effects of the carbonic acid douche, employed in this manner. But I shall make arrangements, for applying the catheter to patients as often as requisite, and shall not hesitate, to communicate the result after a certain number of observations.

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## 9. On various other morbid conditions.

As regards most of those diseases mentioned above (p. 121) so few observations are at my command, that I do not permit myself to judge on the influence, which Nauheim's sanitary ap-



pliances may exercise on them. As regards chronic *diseases of the heart* I have already pronounced my opinion (p. 145); also as regards chronic obstipations (p. 60); with respect to these I can only add, that the more moderate doses of the cure-spring I administered, the better was the result, so that latterly I have employed the spring invariably in a diluted form. After the details communicated on the general effects of bath and Brunnen it will be easy to decide, in what cases a salutary result may be expected, so that I consider myself dispensed from offering further pathologico-therapeutic considerations, without fearing the reproach of superficiality.

The morbid states especially adapted to Nauheim are defined above. Whether this or that single case, not belonging to any of the categories mentioned, may undergo a course at Nauheim with good chance of success, must be left to the consideration of the medical attendant.

On two forms of diseases, however, I beg leave to offer a few remarks, viz. *on chronic inflammation of joints* and their consequences, and *on pulmonary tuberculosis*.

As regards the former, I have met with seven cases, where either a carious process had commenced, or where only inflammatory exsudations existed in the joints. In the former states, if they were of long standing, whilst the general health was good, purulent or sero-purulent secretion inconsiderable, the soft parts closed with the exception of small canals, the carious surfaces of the bones being felt more or less distinctly with the sound: I have perceived either no or very little change of the local disease. But on the other hand, if articular inflammations and their results were of recent date, the simple saline baths and the nightly applications of brine or mother-lye have really rendered excellent services, especially whenever the local complaint had been kept up by a general scrophulous or rheumatic cachexia. No one can expect, that so deepseated a disease, as articular suppuration with an external opening, should disappear in the short space of 4 to 8 weeks; or that thickenings of articular ligaments and of synovial membranes with exsudations or enlargements of the osseous terminations should be removed. But I have several times witnessed such undoubted improvement in the mobility, sensitiveness and



swelling of the joints, that I unhesitatingly recommend Nauheim's baths in such cases, provided always, that the constitution of those patients offers no contra-indications.

The following cases may serve as illustrations :

16) Anna — 4 years old. The child being formerly quite well, commenced in the beginning of April 1857, to lose her former cheerfulness and complained of pain in the left hip. Shortly afterwards she dragged the left leg a little. In the beginning of May she could only step on the toes of the left foot. Against the disease, which manifested itself as femoral coxalgia the campaign was opened by the application of a fontanel. Since 8 weeks quiet supine posture has been enjoined. But all this did not prevent the formation of a slight ankylosis of the hip joint, and pelvic displacement. At the end of July the child was brought to Nauheim.

It possesses a slightly scrophulous habit; complexion pale, tongue slightly furred. She cannot walk even if supported. The lower part of the femur is lightly flexed through muscular contraction. A sister of hers labours under Kyphosis Pottii.

On August 2d the daily use of simple saline baths is commenced. Applications of brine are made to the hip at night, and afterwards of mother-lye. An eczema arises on the hip in consequence. Since August 3d a slight douche is directed to the hip. Under this treatment the contraction of muscles is the first to disappear. On August 23d the child commences to walk with a stool, setting down nearly the whole sole of the left foot. The joint is no more painful. On Sept. 6th the child can walk alone and without any support. The ankylosis is not removed, also a slight dislocation of the pelvis is still present. But the morbid process in the hip-joint is completely arrested.

19. Mr. — 31 years old, had suffered in his 8th year from inflammation of the right hip-joint, probably in consequence of a fall; for many years he could only walk with crutches. Besides pelvic displacement ankylosis was present and a constant painful sensation of the joint with occasional exacerbations. It was only in his 19th year that the walking became easier, so that the crutches could be removed. In his 24th year the patient could even dance for any length of time without inconvenience. Two years ago fresh pain arose in the joint, increased by pressure. Exutoria are employed extensively, but without success. Cold water cure proved equally unsuccessful. The patient is able to walk with the stick now, it is true, but pain is constantly produced by pressing on the thickened trochanter, and the movement of the thigh is somewhat impeded.

In other respects the patient finds himself well, with an excellent complexion and powerful muscular development.

Ordered to take daily 18 ounces of diluted Cur-brunnen besides a simple saline bath. At first the saline baths are used plain, subsequently 4 baths are given with additions of mother-lye (from 2 to 4 measures). In opposition to distinct orders the sufferer in his impatience increases the dose of the mother-lye to 10 measures. The consequence was general lassitude,



and such an increase of pain (hyperaemia) in the morbid joint, that he was obliged to lay up; — a new confirmation of our proposition so frequently insisted upon, and the more instructive as the patient had appeared so robust and ruddy.

The inclination for mother-lye was now radically removed. Ten more simple baths were taken, with the continuation of the Cur-brunnen and the course terminated after 23 baths had been taken on the whole.

The momentary result was not satisfactory, as free movement of the morbid extremity had not yet returned. But in the following spring I saw the patient and I learned from him, that he was perfectly satisfied with the after-effects of the bath. He walked without a stick and found himself as well as he was in the middle of his twentieth year.

As regards *pulmonary tuberculosis*, I need scarcely mention, after the preceding remarks, that I consider Nauheim in general perfectly inappropriate in this disease. A state of weakness being mostly present to contraindicate the use of the Spa, no remedy can offer a more salutary result, than sea air. Nevertheless a few cases occurred to me, in which the baths, employed with great caution, met with strikingly favourable results. I mention them, to show, that the careful employment of the Spa may even be permitted to weakly individuals without being followed by such "excitement", as is usually predicted.

The patients in question were, however, only in the incipient stages of tuberculosis and were not sent to Nauheim on account of this disease, but in order to seek aid against, "chronic rheumatism" or scrophulous swellings of glands. I subjoin a brief report:

20. Miss — 29 years old had frequently suffered from scrophulous ophthalmiae in childhood. Menses appeared in her 14th year. They ceased in her 15th whilst she suffered from symptoms of chlorosis. But the menstrual discharge appeared and remained constantly regular. Frame delicate, strength never very great. Since 4 years she has to complain of „nervous rheumatism" in the shoulders, hip, back. After the useless employment of Wildbad she resorted in the year 1857 to Nauheim on account of these ailments. The tongue is intensely red; the papillae highly developed. Appetite and sedes however regular. Nervous system very irritable; mental disposition changeable; sleep restless. Thoracic organs without any derangement.

In this condition the patient used the simple Nauheim baths for 5 weeks in 1857 and drank Schwalheim water besides. During the course several times symptoms of lassitude appeared, and the patient left Nauheim rather dissatisfied. But in the winter of 1857/58 her health was considerably better.



## Appendix.

### FIRST NOTICE

*as regards the artificially diluted cure-spring of Nauheim.*

On p. 11, 57 and 113 I have already entered into the above subject. With reference to the effect of the diluted cure-spring on the healthy organism, a careful report will be found in pp. 57 and foll. With patients I have only witnessed the difference of effects between the natural and diluted Cur-brunnen on the intestinal canal. The great importance of the subject induces me to offer a few brief remarks and to refer specially to some cases in point.

1) It is a fact, that the taste of the undiluted cure-spring is unpleasant to some patients in consequence of the concentrated state of its ingredients. The diluted cure-spring on the contrary has not been found unpleasant by any patient, nay it seems to be drunk by them with pleasure.

2) The taste of the diluted cure-spring almost completely resembles that of Ragoczy (of Kissingen). A patient, 62 years of age, who had drunk Ragoczy for some time at Nauheim, made a trial at my advice, of the diluted cure-spring. His own words were : "The Brunnen tastes and acts exactly like the Ragoczy." He did not return to the use of Ragoczy subsequently.

3) The undiluted cure-spring induced with several patients an unpleasant gastric oppression and loss of appetite. A gentleman, 48 years of age, expresses himself thus : "the Brunnen lies like a stone in my stomach." The same sensation appeared with every new trial. It was therefore necessary, to desist from its use. The



Ragoczy of Kissingen was then substituted and had the desired effect. If this case would have happened in the second year of my sojourn at Nauheim, I should simply have ordered him the diluted cure-spring. But I should wish to add, that such an intense disagreement of the Cur-brunnen was rare on the whole. It had been imbibed for years, and I have myself witnessed good results from its use without any untoward symptom.

But all valetudinarians at Nauheim agree, that the diluted "Cur-brunnen" has a "much more pleasant taste in drinking" than the natural one, whilst its "effect" does not differ much from that of the latter.

4) I have observed several times, that the natural cure-spring already exercises a very drastic effect in the dose of 10—15 ounces. Soon after its imbibition, a watery, exhausting evacuation appears and the effect is terminated. This was the case with a gentleman, 40 years of age, who laboured under a peculiar cutaneous disease. The substitution of the diluted Brunnen had in these cases the best results. It acts "much more pleasantly" and produces 2—3 pappy evacuations, instead of one violent watery stool.

5) Single cases occurred, in which the undiluted cure-spring and even the stronger "Salz-brunnen" displayed no purgative effect whatever. By diluting the springs, purgation was *gradually* developed to the desired degree. This seemed to me always to lead to the most favourable result.

6) On the other hand the diluted cure-spring sometimes remains at first without effect on the intestinal function, whilst the natural one induces this action forthwith and with readiness.

According to circumstances the latter was then retained, or ultimately given in a diluted form. But if the desired effect was not produced by the administration of 12 to 18 ounces of the natural cure-spring, I did not go on increasing the dose, as I was convinced myself, that more injury than benefit would result from it. It is better to assist the failing alvine function in these cases by pil. aloës c. rheo or similar pharmaceutical remedies.

May these few remarks suffice, to convince the distant physicians, that besides its excellent baths, Nauheim possesses also



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drinking springs, through the employment of which either in a natural or diluted form those results may be obtained, which are in general expected from the internal use of saline springs.

## SECOND NOTICE

*as regards Schwalheim's acidulous spring.*

The ferrugineous acidulous spring of Schwalheim contains, according to the above analysis, only a very small quantity of solid ingredients; among these principally chloride of sodium and an inconsiderable portion of carbonate of iron. I have already mentioned its being frequently employed as an article of diet and especially liked on account of its richness in carbonic acid. It forms indeed a most refreshing beverage similar to Selters water, whether it be taken with or without the addition of sugar and wine. But for many years the water has also been employed for curative purposes.

I have also administered it with benefit especially in some chlorotic individuals.

It is known, that the abundant imbibition of common water alone exercises a beneficial effect on many chlorotic individuals. But this will sometimes disagree, occasionally causing oppression in the stomach and a feeling of fulness. In such cases the acidulous water is decidedly preferable; and especially from this reason (to obtain the *effect of water-drinking*) I availed myself of it. Without causing any complaint the water may be taken fasting to 800 c. c., and a similar quantity in the afternoon. But with a quantity of 1600 c. c. of the Schwalheim water the economy receives at the same time 40 grains of chloride of sodium, 4 gr. of chloride of magnesium; 15 gr. of carbonate of lime and 0,30 gr. of carbonate of iron. These substances are certainly not without effect, and with delicate, chlorotic and slightly scrophulous individuals this



composition may be recommendable a priori. But I should not like to attribute too much weight to these ingredients; the effect of the water itself seems to me to be the most material. For many an individual the amount of carbonic acid contained in the Schwalheim water is too considerable. In these cases the glass has only to be left uncovered for a short time after being filled. It is advisable, to do this at any rate, when large quantities (600—800 c. c.) are to be taken.

A further insight into the effects of the spring is only to be expected from a continuation and extension of chemico-physiological researches.

THE END.











