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THE SALT-WATERS

OF

Tracts 155

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KREUZNACH.

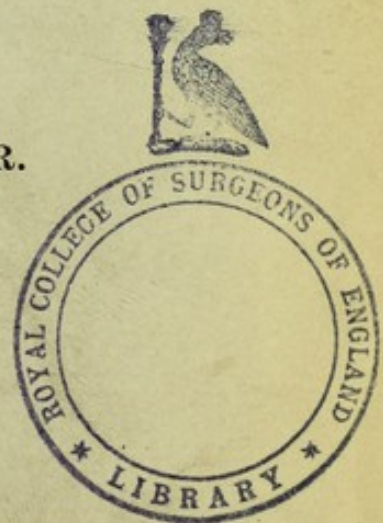
A PHYSIOLOGICAL AND CHEMICAL ESSAY

BY

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TRANSLATED BY THE AUTHOR.



KREUZNACH 1878.

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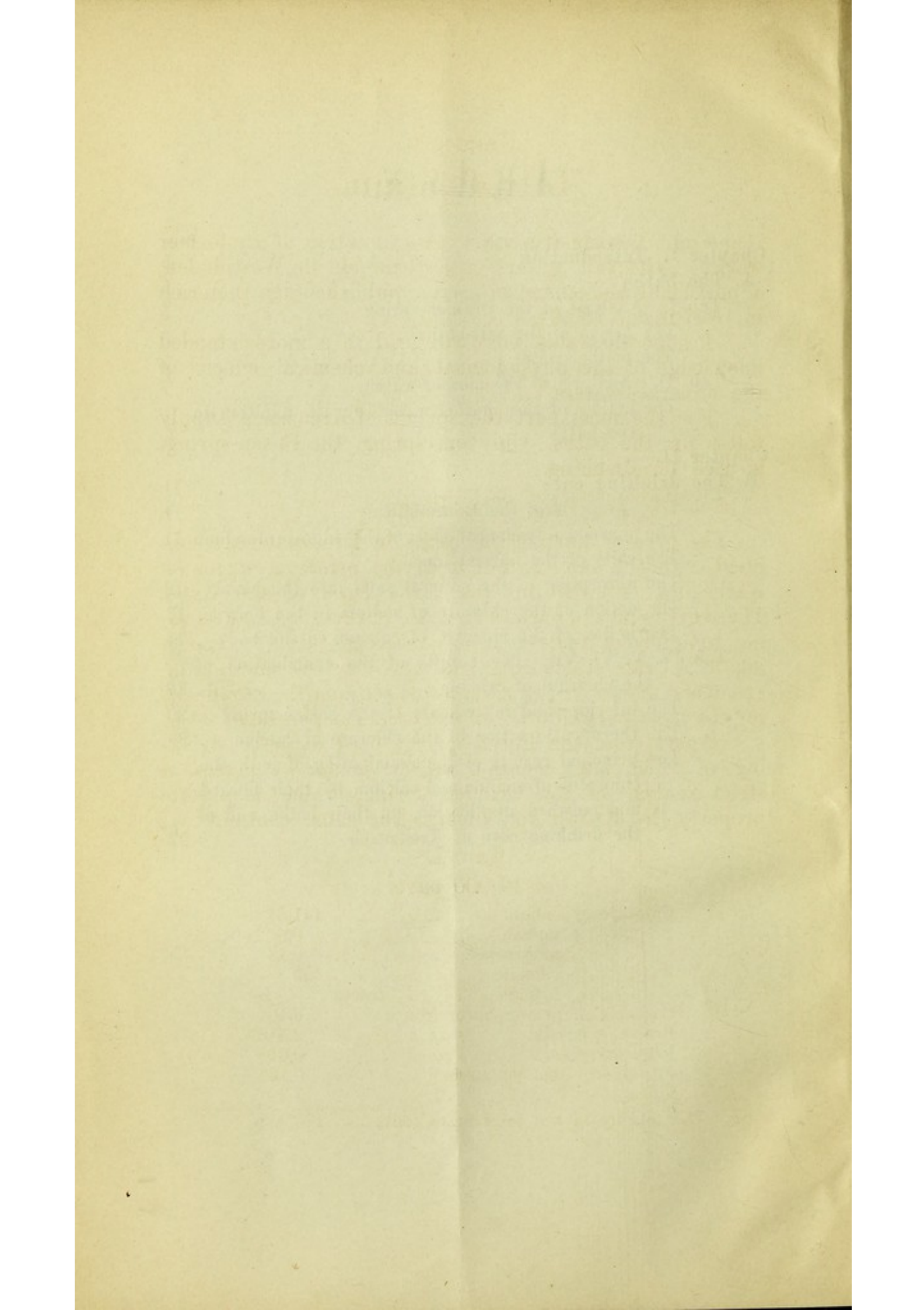
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I n d e x.

| | Page |
|---|------|
| Chapter I. Introduction | 5 |
| A. The baths | 5 |
| Tab. I. Analysis of the Oranien-spring | 5 |
| The action of the salt-baths | 6 |
| The mother-water | 7 |
| Tab. II. Analysis of the mother-water | 7 |
| The action of the mother-water by its addition to the baths | 8 |
| Chapter II. | |
| B. The drinking cure | 11 |
| Tab. III. Analysis of the Elisen-spring | 11 |
| The pharmaco-dynamical effect of the chlorate of sodium | 11 |
| The salts of the normal blood | 11 |
| The absorption of the mineral salts into the blood . | 12 |
| The action of the chlorate of sodium in the body . | 12 |
| The action of the chlorate of calcium in the body . | 14 |
| Tab. IV. V. VI. VII. The results of the examination of the chlorate of calcium | 17 |
| The inferior solid ingredients of the Elisen-spring . | 25 |
| The therapeutic action of the chlorate of calcium . | 26 |
| The principal results of the examination of both the chlorates of sodium and calcium by their inward and outward application, of their baths and of the drinking cure at Kreuznach | 27 |





Chapter I.

Introduction.

The following treatise is a continuation of my former work: „The salt-waters of Rothenfelde in Westphalen, a medicinal and chemical essay, published by Dieterich in Goettingen 1859.“

I hope that this work will lead to a more extended knowledge of the physiological and chemical effects of the mineral-waters.

For the most part the springs of Kreuznach supply water for the baths. Only one spring, the Elisen-spring, is used for drinking.

A. The Baths.

The greater part of the baths in Kreuznach are supplied with the salt-waters from the principal spring of Karlshalle, situated on the right bank of the Nahe. There exists no new careful analysis of this spring. According to a former analysis it is said to contain 98, according to a later still incomplete analysis 135 mineral ingredients, of which 118 chlorate of sodium, the remainder for the most part chlorate of calcium. Temperature: 24°C.

Apart from the Elisen-spring, used only for drinking, of which later mention will be made, we possess a strict analysis of the Oranien-spring, which is private property, by Knapp and Liebig. The same contains:

Tab. I.

in 10,000 parts:

| | |
|---|--------|
| Chlorate of sodium | 141,54 |
| „ „ potash | 0,6 |
| „ „ magnesia | 0,19 |
| „ „ calcium | 29,4 |
| „ „ lithium | traces |
| Carbonic of protoxyde of iron | 0,464 |
| Brome-magnesia | 2,318 |
| Iodine-magnesia | 0,016 |
| Phosphoric acid magnesia | 0,124 |
| Silica | 1,3 |

The totality of the solid ingredients . . 175,952.

The proximity of the springs of Karls- and Theodors-Halle on the one side and of the Elisen- and Nahe-spring on the other side — the waters of the latter spring are used for the baths in the public bathing-house —, and the same soil from which all the springs take their source, make it highly probable that the mineral ingredients of all the springs are the same.

With one and a third ($1\frac{1}{3}$) percent of mineral ingredients, the Karlshaller salt-waters offer to our present knowledge of the physical effects of the baths, in comparison with other salt-waters of Germany with three, four, five and more percent mineral ingredients, only a weak salt-water.

Already twenty years ago, it has been proved by Beneke, Lehmann, and others, as also by me, that in a tepid bath of four to five percent mineral ingredients, and of half an hour's duration, not even a trace of chlorate of sodium penetrates through the skin into the blood; that consequently the effects of the salt-baths are not produced by the imbibing of chlorate of sodium, but by the stimulative effects which they exercise upon the skin, and by means of their proceeding in the nerves to the „medulla oblongata“ and by reflection from this upon the rest of the body, causing thereby an acceleration of the oxydation and of the absorption and an increased assimilation.

These results have been repeatedly affirmed by other authors, so that there can be no doubt that the greater or lesser quantity of the mineral ingredients of the salt-waters, although their effects are not produced by absorption in the baths, is proportionate to the estimate of the salt-waters with regard to the extent of their effects, and indeed by the intensity of the irritation, which the greater or lesser quantity of mineral ingredients exercises upon the skin.

A second not less important consideration in the estimate of the mineral waters is the irritability of the skin and of the whole body of the patient to whom salt-water-baths have been ordered. Whilst one observes in cases of high irritability of the skin and of the whole body, i. e. in certain forms of skin-diseases by a tender, sensitive skin and by great universal irritability,

in the irritable cases of scrofula, particularly with the feminine sex, by the continued use of our simple salt-water-baths, the skin too intensely irritated and the general irritability increased to such a degree as to lead to sleeplessness and to a general exhaustion, we see on the contrary effects only by torpid and phlegmatic constitutions, by lengthened diseases of the skin, by torpid scrofulous subjects with swollen body, with tumours of the glands, when the salt-ingredients are increased by the addition of *mother-water*.

These means at our command of increasing the quantity of mineral ingredients in our baths according to the irritability of the skin and of the whole body, and even by the most torpid natures producing an effect suitable to the condition of the disease, are not to be lost sight of in comparing the baths of Kreuznach with other salt-waters richer in chlorate of sodium.

The mother-water of the neighbouring Theodors-halle is for the most part used for the baths of this place. It contains according to the latest analysis by the chemist Dr. Aschoff in Kreuznach, as the following table II shows:

Tab. II.

in 10,000 parts :

| | |
|-------------------------------|----------|
| Chlorate of calcium | 2567,75 |
| " " strontian | 0,85 |
| " " magnesia | 219,12 |
| " " potash | 297,10 |
| " " sodium | 211,53 |
| " " lithium | 0,48 |
| " " caesium | } traces |
| " " rubidium | |
| Brome-magnesia | 0,76 |
| Iodine-magnesia | 0,0009 |

The totality of the solid ingredients . 3297,59.

The mineral ingredients of the mother-water consist of about

- | | | | | | |
|-----|-------|---------|-----------------|----|-----------|
| 1) | 75 | percent | chlorate | of | calcium, |
| 2) | 9 | " | " | " | potash, |
| 3) | 8 | " | " | " | sodium, |
| 4) | 7 | " | " | " | magnesia, |
| | <hr/> | | | | |
| | 99 | " | chlorates, | | |
| and | 1 | " | Brome-magnesia. | | |

Iodine, which was formerly used as a charlatanical recommendation of the baths of Kreuznach, is only found in the very small quantity of 0,0009 in 10,000 parts of mother-water.

This quantity of Iodine and Brome cannot be taken into consideration according to our present knowledge in comparison with the 99 percent chlorates.

The baths can contain 250—300 litres of water. Without the addition of mother-water, the same bath of the salt-water of Karlshalle may contain 3—3,5 Kilo of mineral ingredients.

One litre of mother-water contains about 500 Grammen = $\frac{1}{2}$ Kilo of mineral ingredients. After the addition of one litre of mother-water in the bath, the mineral ingredients increase to half a Kilo; therefore after the addition of ten litres to five Kilo, so that the same bath contains eight to eight and a half ($8-8\frac{1}{2}$) Kilo of mineral ingredients.

By the addition of mother-water the chlorate of sodium contained in the salt-water is only a very little increased, more especially however the *chlorate of calcium*, of which the mother-water contains 75 percent, whilst of chlorate of sodium only 8 percent. The five Kilo of mineral ingredients added to the bath in ten litres of mother-water, consist therefore of three and three fourths ($3\frac{3}{4}$) Kilo chlorate of calcium and about one and five eighths ($1\frac{5}{8}$) chlorates of sodium, potash, and magnesia. Thereby not only the chemical, but also the physical nature of the bathing-water is changed. In place of the chlorate of sodium the chlorate of calcium has become prevalent.

An experiment by solutions of chlorate of sodium and of chlorate of calcium decidedly proves this.

If one prepares a five percent solution of chlorate of sodium and a solution of the same percent of chlorate of calcium in spring-water, warms both to a temperature of 27° R., and puts in the former the right arm, in the latter the left arm up to the elbow, one feels after five minutes a slight pricking in the left arm, and the colour of the skin begins to redden in places. After ten minutes the redness and the pricking have spread themselves over the whole of the forepart of the left arm.

On the right arm the skin begins only at the end of twenty minutes to redden in places and only a slight pricking to be felt.

After twenty-five minutes the pricking in the left arm has increased to a slightly burning feeling, whilst in the right arm only a slight pricking continues.

After taking them out of the water, the colour of the left arm shows itself considerably redder than that of the right arm. The redness on the left arm disappears much more slowly than on the right arm.

Half an hour later, the skin of the right arm shows its normal colour; the left arm on the contrary still red spots. Only at the end of another thirty minutes has the redness quite disappeared.

This experiment, which I have several times repeated with the same results, shows, that with the same quantity percent of both solutions, that of the chlorate of calcium produces a far quicker and more intense effect upon the skin, than that of the chlorate of sodium, that therefore not only the chemical nature, but also the physical nature of both solutions is essentially different,

Thus much may be concluded from this intense irritation of the skin by observing, that on the application of the mother-water in the form of compresses, even by a three or four-fold dilution of the mother-water in spring-water, the skin soon reddens, the epidermis softens and rises in blisters, if one does not discontinue the farther application.

The chlorate of calcium is therefore for the skin a far more intense stimulating remedy than the chlorate of sodium, and as the mineral ingredients of the mother-water consist of 75 percent chlorate of calcium, undoubtedly the chlorate of calcium is that ingredient of the mother-water which makes this such a powerful stimulating remedy for the skin, therefore the most important ingredient of the mother-water.

That the chlorate of calcium is supported in this effect by the other chlorates of the mother-water, the chlorates of potash, of magnesia, and of sodium, which form altogether 24 percent of the ingredients of the mother-water, is undoubted according to the chemical and physical nature of the same.

On the contrary the iodine (0,0009) and brome of magnesia (1 percent) exist amongst the mineral ingredients of the mother-water in such a small quantity that one cannot ascribe to them an irritating effect upon the skin, which supports the effect of the chlorates.

By the gradual addition of mother-water to the baths, one is able to excite to such a degree the irritation of the skin in the most torpid cases that in spite of the torpor it may be brought into a suitable state of irritation, and the process of oxydation, with respect to the absorption of the organs and products of the diseases, may be conducted, by the continuation of the stimulative by means of the sensitive nerves to the central (medulla oblongata), and from this by reflex action upon the whole body.

All the baths of chlorate of sodium produce a similar effect. Those with chlorate of calcium have the decided preference on account of the more intense irritation which they produce upon the skin in torpid cases.

The chlorates, which are contained in the mother-water, particularly the chlorate of calcium, can in time chemically dissolve the epidermis, when they are brought for some time into contact with the skin. However to extend the duration of a bath of the above-mentioned chlorates, or the local application of the mother-water by compresses etc. for so long a time, or to add to the same those chlorates in so large a quantity, until, or in order that the chemical solution begins, would be to exceed the given indications, and be said to miss the mark.

Apart from the fact that the most torpid skin and the greatest torpor of the whole body do not allow of an effect, sufficient to dissolve chemically the epidermis without producing the greatest exhaustion, would be to miss the object which one has in view, of exercising an active and lasting effect upon the oxydation of the organism through repeated application of the baths or compresses.

In order to obtain the irritative effect of the chlorates upon the nerves of the skin, it is sufficient that the epidermis imbibe a solution of the same of a duration and concentration which leads at most to a moderate softening, to accelerated peeling off of the skin, and to a quicker regeneration, but not to a chemical dissolving of the epidermis.

Chapter II.

B. The Drinking Cure.

The Elisen-spring, situated at the southern limits of the „Kurpark“ and on the right bank of the Nahe, offers a farther remedy in Kreuznach. It is only used for drinking and contains according to the analysis of Bauer :

Tab. III.

in 10,000 parts:

| | |
|---|--------|
| Chlorate of sodium | 95,18 |
| „ „ potash | 1,265 |
| „ „ magnesia | 2,128 |
| „ „ calcium | 14,966 |
| „ „ lithium | 0,098 |
| Carbonic of protoxyde of iron | 0,26 |
| „ „ „ mangan | 0,012 |
| „ acid calx | 2,064 |
| „ „ baryte | 0,39 |
| Phosphoric acid magnesia | 0,28 |
| Iodine-magnesia | 0,0009 |
| Brome-magnesia | 0,359 |
| Silica | 0,409 |

the totality of the solid ingredients 117,41.

The chlorates of sodium and of calcium are in the Elisen-spring-water the principal ingredients with regard to quantity. The remaining mineral ingredients are contained by it in so small a quantity that they come far behind the above-mentioned chlorates with regard to the effect which they produce.

The pharmaco-dynamical effect of the chlorate of sodium has been, like the chlorate of calcium, very imperfectly explained by physiological and clinical experiments. Experiments on animals have given the greatest knowledge of the effects of the chlorate of sodium on the body. —

Nearly all our organs and fluids contain chlorate of sodium. It, of all the salts, exists in the greatest quantity in our blood, and indeed from three fourths to one ($\frac{3}{4}$ —1) percent.

Chlorate of potash and the neutral salts: carbonic acid and phosphoric acid sodium, sulphuric acid kalium, and phosphoric acid calx, exist in much smaller quantities in the blood.

According to Richardson, Nasse, Moleschott, Scherer, one reckons in 1000 parts of normal human blood: 5—10,3, medium: 8,26; in 1000 parts of serum: 6,5—11,6, medium: 9,45 of soluble salts.

For the absorption of the mineral-salts, the quantity of the soluble salts in the blood, and the relation of the soluble salts to the quantity of water in the whole mass of the blood, and particularly in the serum, have the greatest influence.

In our veins circulates a mineral water which contains in 1000 parts medium: 8,26; in serum: 9,45 per mille soluble salts. The water of the Elisen-spring contains in 1,000 parts: 11,8 soluble salts, and is therefore 1,7—2,8 per mille richer in salts, and denser. Of two different dense fluids which make an interchange through an inanimate membrane, the thinner gives principally water to the denser, but the latter principally salts to the former. It is highly probable that the chlorate of sodium of the Elisen-spring in the stomach and in the intestines by means of the capillary blood-vessels enters into the blood, which is 1,7—2,8 per mille richer, although in this case the two fluids are not separated by an inanimate, but by an animate membrane. This probability becomes a certainty by examinations of the urine, in which within the space of the following twenty four hours we find again the most part of the chlorate of sodium which we have taken with the water of the Elisen-spring. Besides the reins, the other organs of secretion, the skin, the mucous membranes etc. may also secrete more chlorate of sodium.

This agrees with the results obtained by many experiments on animals, that the salts usually contained in the blood, if these are introduced into the stomach, and from this into the blood, are also secreted by the organs of secretion in an unusual quantity, and these secretions last as long as they exist in abundance in the blood.

An adult can drink 700—800 Grm. spring-water quickly one after the other, without feeling the least discomfort at the time or afterwards. If as much chlorate of sodium is added as the blood contains ($\frac{3}{4}$ —1 percent), it is scarcely possible to drink that quantity in quick succession. After drinking the second third, there follows

a feeling of fulness, of pressure and heaviness in the stomach, sickness etc., and if we persevere in drinking the third, this feeling increases, and is usually followed by a purgative effect. This effect proves that the spring-water, which contains an equal quantity of chlorate of sodium, requires a much longer time for penetrating into the blood-vessels than the ordinary spring-water. However if one drinks the 700—800 Grm. spring-water mixed with salt in three or four intervals of twenty or thirty minutes, these feelings and effects either do not follow at all or only in a much less degree, a proof that the chlorate of sodium during the intervals has penetrated for the most part into the blood-vessels.

The greater the quantity of chlorate of sodium in the water, in comparison with that in the blood, the stronger are the above-mentioned indications of indigestion, terminating in the purgative effect. The chlorate of sodium is not absorbed.

The blood as the less dense fluid must by contact with the denser solution of chlorate of sodium give water to the latter. But the exosmotic action of the chlorate of sodium is very small; it attracts only a little water through an inanimate animal membrane, if it penetrates through the same in a contrary direction, and it may be concluded therefore that the chlorate of sodium does not attract so much water from the blood, as sulphuric acid sodium, and therefore does not exercise so easily a purgative effect as the latter. The purgative effect of the chlorate of sodium by solutions with a greater quantity of chlorate of sodium than the blood or the serum of the same, is a consequence of the delayed reception of the chlorate of sodium by the blood-vessels, and of the irritation of the lower part of the intestines by the non-absorption of the chlorate of sodium.

The results of many experiments show that the digestion is essentially aided by the chlorate of sodium, when it enters the stomach in a moderately increased quantity. It increases the secretion of the muriatic acid and that of the sodium necessary to the bile. If however the muriatic acid is not absolutely necessary for the digestion of the albumen and the fibrine — the

peptic and phosphoric acid can replace it — it has however been proved as an excellent means for the digestion.

Farther the chlorate of sodium produces, as an irritative means of the mucous membranes, of the whole intestines, beginning from the mouth, and indirectly all the organs of secretion connected with them, a larger secretion, increases with it the whole digestion and the need for food.

The experiments of *Barral* have decidedly proved that the increased supply of chlorate of sodium increases the secretion of the urine, that it not only increases absolutely the water of the urine, but also relatively in regard to the quantity of the water which has been drunk; however not to so great an amount, as to denote the chlorate of sodium as a strong diuretical means.

It is shown by *Bischoff's* experiments (L. W. Bischoff, *Harnstoff als Maass des Stoffwechsels* 1853) that by the increased supply of chlorate of sodium the oxydation, especially the absorption of the organs, is accelerated. As has been observed by the feeding of animals with chlorate of sodium, the absorption can be replaced by a larger supply of food in consequence of the greater need of food, which is caused by the chlorate of sodium.

The observation made by *Lehmann*, that the exsudates which incline to suppuration, contain always a great quantity of chlorate of sodium besides phosphates and salts of potash, whilst the plastic exsudates only contain a small quantity of chlorate of sodium; farther the simplest form of the fluid, which contains vesicles the milk rich in chlorates, suppose an intimate relation to the vesicle-formation.

If we do not take into consideration the effect of chlorate of sodium by large local application upon the organic substance which is not covered by epidermis, it results from the foregoing facts that:

An increased introduction of chlorate of sodium increases for the time the quantity of chlorate of sodium in the blood and in the secretions, accelerates the oxydation, particularly however the absorption in the organs, and increases the need of food.

After the chlorate of sodium the chlorate of calcium is found in the greatest quantity in the *Elisen-spring* (0,14 percent).

Its physiological action is quite unknown. We know nothing of its reception by the blood nor of its secretion. It is supposed that it produces, on account of decomposition and formation of chlorate of sodium, a similar effect as the latter upon the stomach. It is said to hinder the digestion, to lessen the appetite, to produce sickness, pressure in the stomach and diarrhea. 10—15 Grm. are said to produce by adults diarrhea, and larger doses vomiting, exhaustion, dizziness, a feeble pulse.

In therapeutics the chlorate of calcium has nearly fallen into disuse. Formerly it was renowned as anti-scrofulosum by Fourcroy, James Wood, Hufeland, and others; in cases of swellings and indurations of lymph-glands in the inguinal region by Sommerveil, and as diureticum by others.

Because of our defective knowledge of the physiological action of the chlorate of calcium the task of elucidation forces itself upon us by personal experiments.

I made these experiments first in October 1876 in a period of three weeks. In the first seven days I determined the quantity of the oxydation of my body; I determined therefore daily the weight of my body, farther the weight of the solids and fluids which I partook of, and the weight of the giving out, of the urine, of the dejecture, and by the skin and the lungs; the latter by comparative calculation of the giving out of urine and of dejecture with that of the body.

Twice a day, in the morning at eight o' clock and in the evening at six o' clock, the quantity and quality, the reaction and the specific weight of the urine were determined and analysed after the wellknown methods of „Titrirung“ of Neubauer and Vogel into the contents of urea, uric acid, sulphuric acid, phosphoric acid, and chlorine with the utmost carefulness and with the observance of all precautionary measures.

The temperature, the state of the barometer, the direction of the wind, weather, the state of the health, and the functions of the skin were at the same time carefully observed.

In the period of seven days following that of the preliminary examination, I took daily 0,5 Grm., and in the seven days following the second period, 1,0 Grm.

chlorate of calcium, dissolved in a glass of spring-water, and I continued the daily determination of the weight of my body, of the reception, and of the giving out, as well as the analysis of my urine, and observed as much as possible the same relations with regard to the movements of the body and to the food as during the preliminary examination.

Only the determination of solid food was too difficult, and as my mode of living for many years has been the same daily with regard to the quantity of vegetables, bread, sugar etc., I only weighed my daily portion of meat, because meat essentially influences the secretion of urea and uric acid.

The results of the three-weeks-series of examination were so abundantly convincing that a second series would not have been necessary. However I preferred making a second one of a longer duration, to guard against the imputation of a premature judgment. The execution of the same was not possible until April 1877.

I found no reason to deviate from the method followed in the first series of examination, and preceded it also by a preliminary examination of seven days. In the first four days I determined the weight of solids and fluids; only later the daily quantity of the meat and the fluids. I separated the latter from the fat, and took it partly raw, chopped, partly slightly cooked. A change was made of the different kinds of meat, beef, pork and veal. For the first breakfast I took tea and white bread without butter; for the second: bread and butter; for dinner: meat-soup, vegetables, and raw or cooked meat with only a few potatoes; in the afternoon a cup of coffee, and in the evening tea with bread, butter, and meat.

I give in the following the results of the second four-weeks-examination, made in April 1877 in calculated average amounts, because the statement of the daily results of examination would take too large a space, and the average amounts are fully sufficient for judging the matter.

I only add that the results of the second series of examinations are fully identical in regard to the essential points with those obtained by the first series of examinations, and that I am 57 years of age.

Tab. IV.

I. PERIOD. (The preliminary examination.) 3—10. APRIL 1877.

The average state of the barometer : 758 Mm. The average temperature of the air : 9,5° C.

| The supply | | T H E G I V I N G O U T | | | | Weight of the body (average): | | |
|------------|--------|-------------------------|-----------------|-------------------------|--|-------------------------------------|------------------------|------------------------------------|
| solids | fluids | quantity | specific weight | 1. of urine reaction | particular ingredients | | 2. of the dejection | 3. by the skin and the lungs |
| 1102 | 1582 | 1528 | 1021,5 | sour | urea 34,25 uric acid 1,146 sulphuric acid 2,25 phosphoric acid 3,18 Chlorine 11,560 <u>totality : 52,386 Grm.</u> | 171 | 965 Grm. | 90,5 Kilo. |

Totality :
2684 Grm.

Totality of the giving out :
2664 Grm.

Tab. V.

II. PERIOD. (0,5 Grm. chlorate of calcium) 10—17. APRIL 1877.

The average state of the barometer: 758 Mm. The average temperature of the air: 9° C.

| The supply | | T H E G I V I N G O U T | | | | | Weight of the body | |
|------------|--------|-------------------------|-----------------|----------|---|------------------------|-----------------------|---|
| solids | fluids | quantity | specific weight | reaction | 1. of urine particular ingredients | 2. of the dejecture | | 3. by the skin and the lungs |
| 1102 | 1582 | 1536 | 1022 | sour | urea 36,65 uric acid 0,925 sulphuric acid 2,85 phosphoric acid 3,32 Chlorine 12,45 totality: 56,195 Grm. | 173 | 958 Grm. | 90,200 Grm. less for seven days: 300 Grm. less for one day: 43 Grm. |

Totally:
2684 Grm.

Totally of the giving out:
2727 Grm.

Tab. VI.

III. PERIOD. (1,0 Grm. chlorate of calcium) 17—24. APRIL 1877.

The average state of the barometer: 763 Mm. The average temperature of the air: 10,5° C.

| The supply | | T H E G I V I N G O U T | | | | | Weight of the body | |
|------------|--------|-------------------------|-----------------|----------|--|------------------------|-----------------------|---|
| solids | fluids | quantity | specific weight | reaction | 1. of urine particular ingredients | 2. of the dejection | | 3. by the skin and the lungs |
| 1102 | 1582 | 1625 | 1022,5 | sour | urea 38,57 uric acid 0,775 sulphuric acid 3,256 phosphoric acid 3,442 Chlorine 13,155 <u>totality: 59,198 Grm</u> | 180 | 955 Grm. | 89,668 Grm. less for seven days: 532 Grm. less for one day: 76 Grm. |

Totally:
2684 Grm.

Totally of the giving out:
2760 Grm.

Tab. VII.

IV. PERIOD. (1,5 Grm. chlorate of calcium) 24. APRIL—1. MAI 1877.

The average state of the barometer: 765 Mm. The average temperature of the air: 10,8° C.

| The supply | | T H E G I V I N G O U T | | | | | Weight of the body | |
|------------------------|--------|--|-----------------|-------------------------|---|------------------------|-----------------------|---|
| solids | fluids | quantity | specific weight | 1. of urine reaction | particular ingredients | 2. of the dejecture | | 3. by the skin and the lungs |
| 1102 | 1657 | 1685 | 1023,2 | sour | urea 39,675 uric acid 0,442 sulphuric acid 3,945 phosphoric acid 3,972 Chlorine 13,82 <u>totality: 61,854 Grm.</u> | 194 | 1005 Grm. | 88,793 less for seven days: 875 Grm. less for one day: 125 Grm. |
| Totality: 2759 Grm. | | Totality of the giving out: 2884 Grm. | | | | | | |

The taste of chlorate of calcium is salt and disagreeably bitter. It caused no burning and particularly no disagreeable feeling in the stomach and in the intestines during the whole examination.

The appetite was not increased, but also not lessened. The tongue showed no change as also the heart and pulse no difference from their normal state.

Only the feeling of thirst began to increase in the middle of the third period of examination, and it was necessary to allay it by drinking more water (75 Grm. per diem). For the rest, the supply of solid food remained the same; it produced also no need for more food, but rather an indifference for it.

The chlorate of calcium has an diuretic affect, as the tables show. Already in the second period (0,5 Grm. chlorate of calcium per diem) the secretion of the urine increased daily to the amount of 68 Grm. This effect began first on the fourth day of the II. period, and increased in the following days. In the III. period it increased daily to the amount of 29 Grm., and in the IV. period, however by daily increased supply of 75 Grm. water, to 60 Grm.

The dejecture not changed as well in regard to the compactness; in the III. period the same increased daily to the amount of 6 Grm., and in the IV. period of 19 Grm. in comparison with the I. period of the preliminary examination. The consistence was in the IV. period instead of the preceding solid more pappy.

The discharge through the skin and by the lungs had in the II. period hardly changed at all; in the III. on an average daily diminished to the amount of 13 Grm.; however in the IV. period increased daily to 40 Grm. This increase is probably to be attributed to the higher temperature in this period; the activity of the skin was greater during this period with regard to the secretion of perspiration.

Notwithstanding the diuretic affect, the chlorate of calcium increased also the solid parts in the urine. The specific weight of the same increased regularly from 1021,5 in the period of the preliminary examination to 1023,2 in the IV. period.

The quantity of all the solid ingredients of the urine, with the exception of the uric acid, was increased.

The *urea* regularly increased in the course of the third period and was finally secerned in the IV. period to an average daily amount of 5,42 Grm. more than in the I. period of the preliminary examination.

On the contrary, the *uric acid* was regularly less secerned — upon an average daily of 1,146 Grm. in the I., and 0,442 Grm. in the IV. period, therefore less 0,704 Grm. per diem.

Sulphuric acid and *chlorine* offer an almost equal progressive increase; the former

| | |
|--------------------------|-----------|
| in the I. period . . . | 2,25 Grm. |
| in the IV. period . . . | 3,94 „ |
| therefore increase . . . | 1,69 Grm. |

the latter

| | |
|--------------------------|------------|
| in the I. period . . . | 11,56 Grm. |
| in the IV. period . . . | 13,82 „ |
| therefore increase . . . | 2,26 Grm. |

The *phosphoric acid* was only a little increased in the II. and III. period; however in the IV on an average daily of 0,79 Grm. in comparison with the results in the I. period of the preliminary examination.

The azotic constituents leave the body for the most part in the form of the urea. The urea and the sulphuric acid — the latter as well as the urea a produce of the azotic constituents by the oxydation of the sulphur in the above, which afterwards as sulphuric acid drives out of the alkaline salts — increase or diminish according to the greater or less quantity of the azotic food, with regard to the nourishment according to the greater or less extent of the oxydation.

The increased secretion of urea and of sulphuric acid, and the diminished secretion of uric acid by equal food prove in this case that the chlorate of calcium notwithstanding the moderate dose has essentially increased.

The uric acid is a less degree of the oxydation of the urea; by increased oxydation it diminishes, because the increased oxydation produces more the higher degree of oxydation. The increased secretion of uric acid justifies

therefore the conclusion contrary to the urea of a diminished, the diminished secretion of an increased oxydation in the body.

Also the phosphoric acid is similar to the uric acid; an increased oxydation diminishes, a less oxydation increases them. In this case it would be found, if only in a less degree, to be regularly increased, so that this more in the IV. period, in comparison with the secretion of the same in the I. period of the preliminary examination amounted to an average daily of 0,79 Grm.

This increase of the phosphoric acid and of the chlorine — the latter to an average amount daily of 2,62 Grm. more in the IV. period than in the I. period of the preliminary examination by continual equal food — render it highly probable that the chlorate of calcium is decomposed in the body, that chlorate of sodium and phosphoric calx have been formed and secreted with the urine the for the blood unusual quantity of the above, a process which always takes place, when too great a quantity of salts is introduced into the blood, and the chlorate of sodium, which has been formed by the decomposition of the chlorate of calcium, has been the essential agent of the increased oxydation.

The regular decrease of the weight of the body corresponds with the increased oxydation. In the I. period, it remained nearly the same; in the II. period it decreased to 43 Grm.; in the III. period to 76 Grm.; in the IV. period to 125 Grm. on an average daily; so that the body had lost during three weeks 1700 Grm. (1,7 Kilo).

Also the state of health had changed towards the middle of the fourth week. The feeling of exhaustion and weakness and disinclination to work began to be felt. Although a part of these feelings may be attributed to the spring-air, the steady decrease of the weight of the body and the falling of subcutaneous cellular texture (*panculus adiposus*) were too evident facts, which indicated that the essential cause of these feelings must lie in the increased oxydation with continually the same quantity of food.

Although it had been my intention to continue the examination for the fifth week, these feelings hindered me.

That by such an increased oxydation the need of food did not correspondingly increase, is a result of which the cause lay most probably in the quantity of chlorate of calcium and in the form in which I took it.

The process of oxydation was much increased in the second period (0,5 Grm. chlorate of calcium) and in the III. period (1,0 Grm. chlorate of calcium), and nevertheless the need of food was not increased; however the oxydation in the IV. period increased to such an extent (daily average decrease of the weight of the body: 125 Grm.) that one might have expected in consequence an increased need of food.

Instead of this a certain indifference for food was felt. Probably the daily dose of 1,5 Grm. of chlorate of calcium, dissolved in a glass of spring-water, taken at one time, was too large, which slackened, if it did not hinder, my digestion. Taken at different times and dissolved in a larger quantity of water, the aforesaid dose would probably have produced an increased need of food, correspondingly to the increased oxydation.

The Elisen-spring contains in a thousand parts 1,499 chlorate of calcium, thus the same quantity which I took daily at one time, dissolved in about 150 Grm. spring-water. When adults drink daily 1000 Grm. of Elisen-spring-water at two different times, morning and evening, each time in intermissions, such a prescribed quantity is exceptionally large, although the same quantity is taken in much greater solution than I took it. It is highly probable that by the more concentrated dissolution and by taking it in one dose, it occupied the digestion for a longer time, and thereby hindered that the need of food took place.

A dose of 0,5 Grm. chlorate of calcium, taken four times a day by adults, and of 0,03—0,06 Grm. by children, will not hinder in the least the digestion.

In any case the chlorate of calcium is already a much lighter digestive, on account of its much easier solubility, than the sulphuric acid calx, which is very frequently found in salt-waters.

If we sum up the results of the examination of the chlorate of calcium, the same give:

The chlorate of calcium, taken in proportionately little, but continued doses, promotes decidedly:

- 1) the oxydation, particularly the absorption in the body;
- 2) the diuresis; and
- 3) taken in larger and more concentrated dose slackens the digestion. —

Besides the chlorates of sodium and calcium,

| | |
|--------------------------------|-------|
| the chlorate of magnesia . . . | 0,21 |
| „ „ „ potash . . . | 0,12 |
| „ „ „ lithium . . . | 0,008 |

are to be found in 1000 parts of Elisen-spring-water.

Of the chlorates the *chlorate of potash*, besides the chlorate of sodium, is found in the blood, although in a much less quantity than the latter; whilst, according to Liebig and Hennefeld, the quantity of chlorate of potash is much greater in the muscles than that of chlorate of sodium.

Therapeutically the chlorate of potash is now used almost solely in croup and diphtheria.

Chlorate of magnesia is not found as such in the body, but phosphoric acid and carbonic acid magnesia in the bones and in the teeth. It is very deliquescent, and is not used therapeutically.

The *chlorate of lithium* is found only in a very inferior quantity in many mineral-waters.

Of the alkaline-earths the *carbonic-acid calx* is found in the greatest quantity (0,220) in the Elisen-spring.

Calx is found in the blood only in combination with phosphoric acid as basal-phosphoric-acid calx. Carbonic acid calx is contained in the bones at 11 percent; farther in the teeth. On account of its difficult solubility, it is probably held in solution in the blood by means of the albumen, it is therefore difficult to be found in the blood, and as such is transmitted to the bones and teeth.

The Elisen-spring contains the same quantity of carbonic of protoxyde of iron as the spring: „Weinbrunnen“ of Schwalbach.

Including the iron and lithion, the remaining solid ingredients: baryte, brome-magnesia, iodine-magnesia, phosphoric-acid-magnesia, and silica, are only to be found in very inferior quantities.

Iron, magnesia, and silica are normal parts of the body, which are introduced into it in so small a quantity that one cannot ascribe to them a particular effect in consideration of the effects of the chlorates of sodium and of calcium.

Little account can be made of the effect of the *iodine* (0,0009 iodine-magnesia in 10,000 parts), if one will not deny altogether the action of iodine.

One might the rather ascribe to the *brome* in the Elisen-spring (0,359 brome-magnesia in 10,000 parts), an effect upon the body, but with the above-mentioned quantity, such an effect as to increase the oxydation or absorption, which it was thought formerly to have, must be denied until this action of the brome has been certainly proved. —

The results of the examinations, made by me in October 1876 and in April 1877, have induced me occasionally to use therapeutically chlorate of calcium, and namely in four cases of „struma parenchymatosa“ (follicularis Virchow); in two cases of swelling and induration of the glands in the inguinal region, remainders of syphilis; one case of swelling and induration of the right testicle, as well as a remainder of syphilis, and in one case of ascites, caused by the insufficiency of the mitral valve.

These cases of „struma“ were of three young ladies of 26—34 years and of a young man of 19 years; the swelling of the testicle of a young man of 27 years, and the swelling of the glands in the inguinal region young men of 21 and 25 years.

In all these cases iodine had been employed in all known preparations outwardly and inwardly in the preceding winter for five or six months without perceptible results.

I ordered in all these cases 1,0 Grm. chlorate of calcium, dissolved in 120 Grm. spring-water, in four portions, and compresses of a solution of chlorate of calcium (1:25) from two to three hours daily. The results were so exceedingly favorable that they induced me to repeat them.

Also in the case of „ascites“, chlorate of calcium, given in the same solution and dose, increased the diuresis

in such a degree that the water of the ascites much diminished, and the patient was much relieved.

Chlorate of calcium has nearly fallen into disuse since the discovery of iodine, whilst it was formerly highly recommended by the greatest physicians of the day, as Fourcroy, James Wood, Störck, Heinecken, Hufeland, and others, especially in cases of Scrofulose, of scrofulose swellings of the glands, of rheumatic, arthritic, serous and inflammatory exsudations.

In any case its therapeutic use deserves a repeated examination, and this I would particularly recommend to my colleagues, especially in clinical hospitals. —

We believe to have shown in the foregoing that

I. Chlorates of sodium and of calcium, both in the form of baths and by inward application, decidedly promote the oxydation and especially the absorption in the body.

II. That the use of the baths of Kreuznach, with or without mother-water, is essentially aided in this effect by drinking the water of the Elisen-spring.

III. That the chlorate of calcium used in the form of baths is a far more intense stimulating remedy than the chlorate of sodium; and therefore by the addition of mother-water to the baths a much more intense stimulant can be exercised upon the skin, than by the simple salt-water-baths.

The quantity of the mother-water must be regulated according to the individual irritability of the skin and of the whole body.

IV. That the baths of Kreuznach do not owe at all their well-known effects in torpid cases of skin-diseases (sporiasis, lichen, eczema, acne etc.) of Scrofulose, of swellings of the glands, of parenchymatous and exsudations of scrofulous, rheumatic, arthritic origin, or remains of acute or chronic inflammation (metritis, perimetritis, parametritis) to the traces of iodine or to the small quantity of brome; but essentially to the chlorate of calcium as the most quantitative ingredient of the mother-water, which exercises by its addition to the baths a much greater stimulant upon the skin than the other chlorates.

The End.

In such a disease that the water of the acetate is
 diminished, and the patient was much relieved.
 Chlorate of potash has nearly fallen into
 since the discovery of iodine, which it was formerly
 highly recommended by the greatest physicians of the
 day as a remedy. James H. and Frank H. recommend this
 and others, especially in cases of Scrophulous
 scrophulous swellings of the glands of the throat, and
 scrophulous and tuberculous excrescences.

In any case the therapist has better a recourse
 examination, and this I would particularly recommend to
 my colleagues, especially in clinical hospitals.

The doctor to have shown in the foregoing that
 the Chlorate of potash and of sodium, both in the
 form of salts and in various medicinal doses, has
 and the potassium and especially the sodium in the
 11. That the use of the Chlorate of Potash is
 without other water, is extremely useful in all
 kinds of cases of the Chlorate.

12. That the Chlorate of potash used in the form of
 salts is a far more useful and valuable remedy than the
 Chlorate of potash; and further, by the addition of water
 to the salts a much more useful stimulus is
 afforded than the Chlorate of potash, and the
 The quantity of the salts may vary from
 according to the individual sensibility of the
 the saline body.

13. That the salts of the Chlorate of potash
 have a different effect on the system of Chlorate of
 potash, than the Chlorate of potash, and especially
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 potassium in the form of Chlorate of potash, and
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