The report made to the National Institute of France, in the month of December, 1799, by citizens Portal, Pelletan, Fourcroy, Chaptal, and Vauquelin, respecting the artificial mineral waters prepared at Paris by Nicholas Paul, & Co. : with extracts from the reports of the Society of Physicians of Paris, and the Faculty of Geneva; and other testimonies in favour of the same waters : to which are added, some notes and observations, by N. Paul.

THE REPORT

MADE TO THE

NATIONAL INSTITUTE OF FRANCE,

IN THE

MONTH OF DECEMBER, 1799,

BY

CITIZENS PORTAL, PELLETAN, FOURCROY, CHAPTAL, AND VAUQUELIN,

RESPECTING THE

ARTIFICIAL MINERAL WATERS

PREPARED AT PARIS

By NICHOLAS PAUL, & Co.

WITH

EXTRACTS FROM THE REPORTS OF THE SOCIETY OF PHYSICIANS OF PARIS,

AND

THE FACULTY OF GENEVA;

AND

OTHER TESTIMONIES IN FAVOUR OF THE SAME WATERS:

TO WHICH ARE ADDED,

SOME NOTES AND OBSERVATIONS,

By N. PAUL.

TRANSLATED FROM THE FRENCH.

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1802.

TO

BENJAMIN COUNT OF RUMFORD.

To diminiſh the wants, and increaſe the comforts of Mankind, is ſurely one of the nobleſt purpoſes of Philoſophy. This, Sir, has ever been the object of your labours. You have deſcended from the ſublimeſt inveſtigations of Phyſical Science, to the humble taſk of bringing your diſcoveries to the level of vulgar comprehenſion; and (ſtill more to inſure their benefit to Society) you have condeſcended to inſtruct the Artiſt and the Workman in thoſe particulars, which are neceſſary to their practical application.

Confident of the intereſt you take in every thing that relates to the benefit of Mankind, I venture to claim your Patronage to an undertaking which has for its

object

object a concern equally important and univerſal, the Preſervation of Health, and the Relief of Diſeaſe. It is to no fanciful untried ſcheme, Sir, that I ſolicit your attention, but to an extenſive and uſeful improvement of Chemical Diſcoveries, which had their riſe in England, and which by unceaſing efforts, and by the liberal ſupport of enlightened men, I have happily ſucceeded in bringing to a greater degree of maturity in a foreign country.

Many years have elapſed, ſince I firſt engaged in a manufacture of Artificial Mineral Waters at Geneva. The diſtinguiſhed approbation which that undertaking met with from the Phyſicians of that Place, and from the public at large, induced me to form another, and ſtill more extenſive one, of the ſame kind, at Paris. This, Sir, you have, not long ago, been pleaſed to viſit; and the annexed Reports reſpecting it, which are drawn up by Committees ſelected from amongſt the ableſt Chemiſts and Phyſicians in France, will concur with your teſtimony to ſhow that its claims to encouragement are not founded upon myſterious ſecrecy or ſpecious pretence, but

reſt upon the firm baſis of ſcientific examination and approved uſe.

The characteriſtic liberality of the Britiſh Nation, entitles it, in an eminent degree, to ſhare in the advantages of whatever is calculated for the good of Society; but it has a peculiar claim to benefits derived from the application of diſcoveries which originated from itſelf. Under your auſpices, then, I chearfully ſubmit the matter to the teſt of public trial; and cannot doubt but the reſult will correſpond with that countenance and favour, which you have been pleaſed to beſtow upon the labours of,

SIR,

Your moſt obedient, and
very humble Servant,

Ns. PAUL.

N° 7 Villier's Street, Strand
10th of April, 1802.

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CONTENTS.

PREFACE.

HAVING been ſtrongly encouraged, by ſome friends in this country, to eſtabliſh in London a laboratory, or manufacture of artificial mineral waters, upon the new plan, and with the ſeveral improvements which I have introduced abroad into that department of practical chemiſtry, I have lately repaired to England for that purpoſe. And although not quite a ſtranger in this City, where I reſided for about fifteen months at a former period, I thought my firſt care ought to be to convey to the public an idea of my object, and of what I conſider as my claims to its ſupport. In this view I have been induced to publiſh the annexed REPORT made to the NATIONAL INSTITUTE of France by a ſelect committee of eminent medical men and chemiſts, reſpecting the manufacture of mineral waters and the bathing eſtabliſhment, which, within theſe two years, I have ſet on foot at Paris. This Re-

port, I have reaſon to ſuppoſe, will attract the public attention more effectually than any account or commentary of my own. It will ſhow that not only phyſicians and men of ſcience abroad have thought it worthy of their attention to inquire minutely into this eſtabliſhment, but that it has, in ſome degree, become in France an object of public concern.

To this Report I have only ſubjoined, in the form of an Appendix, a few Notes, the principal of which contain teſtimonies from the Faculty of Paris, and from the Phyſicians of Geneva. To the latter eſpecially, who have never ceaſed to give me all poſſible encouragement and aſſiſtance, I feel great pleaſure in expreſſing upon this, as upon every occaſion, my gratitude and regard.

Being myſelf a native of Geneva, and inſtructed early in life in ſome practical branches of mechanics, I often enjoyed the invaluable advantage of exerciſing my induſtry under the eyes and immediate direction of the late celebrated Profeſſor de Sauſſure, and of his worthy ſucceſſor, the preſent Profeſſor Pictet, who has never ceaſed to honour me with his friendſhip, and to aſſiſt me with his advice in all my undertakings. It is not

ſurpriſing

ſurpriſing, if, under ſuch circumſtances, I felt a ſtrong deſire to become acquainted with the elements of Chemiſtry and Natural Philoſophy, and endeavoured to apply to ſome uſeful practical purpoſe, the gradual progreſs which I made in the ſtudy of thoſe ſciences. Amongſt my firſt attempts of this kind, the imitation of mineral waters occupied the greateſt portion of my time and attention. In conjunction with two other gentlemen of Geneva, and with the aſſiſtance and enlightened ſupport of the Phyſicians of that Town, I ſoon met with very encouraging ſucceſs; and although my attention has at no time been excluſively confined to this particular purſuit, yet I have ever ſince been endeavouring to bring theſe firſt attempts to a greater degree of utility and perfection.

My intention, at preſent, is to confine myſelf to the preparation of all ſuch kinds of mineral waters as are either taken medicinally, or drank as a luxury, and as a ſalubrious article of diet, laying aſide the bathing eſtabliſhment, and all that relates to the *external* uſe of mineral waters. But the apparatus and laboratory are equally calculated to prepare any kind, or any quantities of

mineral waters, that may be required for any purpoſe whatever.

The public will now be conſtantly and regularly ſupplied with any of the mineral waters that are mentioned in the annexed Reports, and with ſuch other kinds, or ſuch new modifications of thoſe waters, as Phyſicians may think proper to ſuggeſt.

The mineral waters that will be kept immediately in readineſs are:

1. The STRONG SELTZER WATER.
2. The MILD SELTZER WATER *.
3. The STRONG SPA WATER.
4. The WEAK SPA WATER
5. The GASEOUS ALKALINE WATER (commonly called *mephitic)* either with carbonate of ſoda or carbonate of pot-aſh.
6. The SEIDLITZ WATER.
7. The OXYGENATED WATER.
8. The HYDRO-CARBONATED WATER.
9. The HYDRO-SULPHURATED OR HEPATIC WATER.

Theſe

* The epithets STRONG and MILD, or STRONG and WEAK, which have been arbitrarily uſed in the Report, for want of more appropriate

Theſe waters, in general, will be prepared according to the analyſis mentioned in the annexed Report. But whenever it ſhall appear proper to make any changes or additions to the *formulæ* now employed, ſuch alterations will be made known to the public. It is impoſſible, indeed, to have any fixed and conſtant ſtandard in the application of medicinal powers, the effects of which muſt always be influenced by the differences of climate, of conſtitution, and, above all, by the vaſt variety of diſeaſes to which they are applied. Although I am far from claiming any pretenſions to medical knowledge, and make a point on the contrary to ſubmit, upon every occaſion, my opinions to the experience of medical men, I can eaſily conceive that this claſs of medicines may be varied almoſt indefinitely. It may be found, for inſtance, that the Spa and Seidlitz water, mixed together, make an uſeful tonic purgative; or, that the Spa water

appropriate names, to contraſt theſe two varieties of Seltzer Waters, cannot be conſidered as ſtrictly applicable to their real nature, ſince the difference between them lies in the QUALITY rather than in the QUANTITY of the gas which they contain. This important difference will be found pointed out, and explained, in ſeveral parts of the Report. See pages 23 and 32.

may

may with advantage be mixed with the hydro-ſulphurated water. Perhaps, alſo, the Seltzer water, blended with Seidlitz water, may be found preferable to that of Cheltenham; and, in ſhort, innumerous combinations can be obtained, by artificial means, that may be more effectual in particular caſes than thoſe which Nature affords.

With regard to the *names* that are uſed to diſtinguiſh the different kinds of mineral waters, it muſt be confeſſed, that a degree of confuſion cannot fail to ariſe from the deficiency of language in that reſpect. A variety of names have been arbitrarily introduced in the nomenclature of artificial mineral waters, which by no means always convey an idea of their compoſition. I ſhall not ſcruple, therefore, to adopt, for thoſe that are altogether artificial compounds, ſuch names as may appear more analogous to their real nature; but, in the imitation of natural waters, I wiſh to preſerve, as much as poſſible, the names of the natural ſprings which it is intended to imitate. It is ſcarcely neceſſary to add, that I ſhall have no kind of objection, whenever it may be thought proper, to ſubſtitute occaſionally, for the foreign artificial chalybeate, purgative, or hepatic waters,

thoſe of Tunbridge, Cheltenham, Briſtol, Bath, or Harrowgate, with their full proportion of gaſeous contents, according to the moſt accurate analyſis which we have of theſe waters, and which Dr. Saunders, in his late treatiſe on mineral waters, has collected with great care and perſpicuity.

With regard to the commercial part of this eſtabliſhment, and all that relates to the ſale of the waters, I beg leave to decline entering at preſent into any particulars on this ſubject. Notice of theſe particulars will be given to the public, from time to time, with an account of the different kinds of waters that will be kept in readineſs, and of the alterations which may occaſionally take place. I ſhall only obſerve, with reſpect to the œconomical part of this buſineſs, that a long experience, and careful compariſon of reſults, have induced me to prefer glaſs bottles, notwithſtanding their higher price, to the earthen ones commonly uſed for that purpoſe. My reaſon for this preference is, that the earthen bottles, from their porous texture, are apt to let a quantity of gas eſcape. I have experienced, on the contrary, that mineral waters could, with proper precautions, be tranſported in glaſs bottles to the diſtance of

three

three or four hundred miles by land, and could bear a voyage to the Eaſt and Weſt Indies, or indeed any voyage whatever, without being in the leaſt injured. And beſides, the tranſparency of glaſs has the additional advantage of affording an eaſy and certain means of aſcertaining their perfect cleanlineſs. In compliance, however, with the received cuſtom, both kinds of bottles will be uſed, and the public will have its choice of either.

I do not know how far the uſe of mineral waters has been introduced into the hoſpitals of this country; but I conceive that they may, in ſome inſtances, ſuperſede the uſe of wine or other expenſive articles. I ſhall be happy, if this ſhould be found to be the caſe, to ſupply public charitable Inſtitutions, on any terms that their general welfare may be thought to require.

REPORT,

&c. &c.

SECTION I.

Object of the Report:—Short account of the attempts hitherto made for the preparation of Artificial Mineral Waters.

IN the year 1755, M. Venel of Montpellier, preſented to the Royal Academy of Sciences, an account of his ſucceſs in imitating Seltzer water, by paſſing through pure water the gas ariſing from effervеſcing ſubſtances. Chemiſts then, for the firſt time, began to conceive the hope of producing, by artificial means, mineral waters, exactly reſembling thoſe of Nature; and the prejudice before entertained, of its being impoſſible to communicate to ſimple water the ſame principles and the ſame virtues, that are found in natural mineral waters, gradually diſappeared. M. Venel, indeed, conſidered this gas as nothing more than common condenſable air; but, notwithſtanding

his error reſpecting the nature of ſuch waters, ſtill his proceſs was the firſt deciſive ſtep towards their ſucceſsful imitation. Soon after this, however, Dr. Black's diſcovery reſpecting fixed air, or (as it is now termed) carbonic acid, and the ſucceſſive diſcoveries of Dr Prieſtley, the Duke de Chaulnes, and M. Ruelle, on the ſolution of this new aëriform acid in water, brought to light the true compoſition of ſpirituous or acidulous waters, and afforded the means of imitating them perfectly. The knowledge which was at the ſame time accumulated from all hands, reſpecting the various ſalts diſſolved in water; the manner of detecting them with certainty, and extracting them without alteration; the ſolubility of iron by the aſſiſtance of the carbonic acid; and that of the fetid or hepatic gas (ſulphurated hydrogen) in water, furniſhed the means of compoſing from their reſpective ingredients, artificial waters, in the ſeveral claſſes of acidulous, alkaline, bitter ſaline, ſimple and acidulous chalybeate waters, and likewiſe ſulphureous waters; of all which, ſcience had already ſhewn the important diſtinctions. Bergman was the firſt, who, in his valuable diſſertations, publiſhed in 1774, 1775, and 1778, on the preparation of cold waters, on the aërial acid, and on the analyſis of waters in general, gave eaſy proceſſes of imitating, from their ſcrupulous examination, the waters of Scidchutz, Seltzer, Spa, and Pyrmont; and alſo the hot and cold hepatic, or ſulphureous waters. He

ſhewed

ſhewed that no mineral water could be conſidered as exactly analyſed, unleſs it could be imitated in all its properties, by diſſolving in ſimple water the ſame principles that had been obtained from the compounded one; and he proved, that there was no exception to this general rule. Laſtly, after having pointed out the advantages which Sweden, in particular, might derive from the artificial preparation of the above mentioned waters, as well with reſpect to its commerce, as to its indigent ſick, and alſo to the advancement of the healing art, he gives ſome obſervations on the good effects of theſe factitious waters, which he had often found even ſuperior to the natural ones in hæmorrhoidal affections, in arthritic pains, and in obſtinate intermitting fevers. Thus did the illuſtrious Swediſh profeſſor leave far behind him all the imperfect eſſays which had been given before that period, and the vague or conjectural theories that had been offered reſpecting the analyſis of waters.

In the year 1779, M. Duchanoy publiſhed a treatiſe on the art of preparing artificial mineral waters, in which the modes of imitating them were detailed at greater length, but with very little information that was new, or different from what had been given before by Bergman. In this treatiſe, however, the author offered the firſt entire and ſyſtematic view of the artificial preparation of moſt of the mineral waters in uſe, according to the

principles of an art, which, not twenty years before, had been deemed impoſſible.

Thus was the imitation of mineral waters not only invented, but almoſt immediately carried to perfection, in the interval between the middle of the century and the year 1780; that glorious æra of chemical labours and diſcoveries, in which the ſcience underwent a complete change in France, and was built as it were upon a new foundation.

From that time, (1780) the art of imitating mineral waters has been continually improving; all the ſyſtematic works in Chemiſtry, as well as the numerous treatiſes on this ſubject in particular, preſenting facts and reſults, which have carried this part of the ſcience to a degree of perfection that leaves us ſcarcely any thing more to wiſh for.

It may therefore be ſaid, that the art of imitating mineral waters is now carried to its utmoſt limits; and that Chemiſts well acquainted with the reſources of their art, and ſkilful in their operations, will no longer find any difficulty in the preparation of them. Accordingly, for theſe twenty years paſt, the Chemiſts engaged in this department of their buſineſs, have ſatisfied the wiſhes of all phyſicians, who were ſufficiently acquainted with chemical ſcience, to put due truſt in it, and to be convinced, that it has at laſt diſcovered the proceſs of nature. In ſeveral well conducted laboratories of this kind, the waters of

Seltzer, Seidlitz, Spa, Balarue, and Barege, are now prepared; they are alſo made either ſtronger or weaker than thoſe which nature affords, and their mildneſs or ſtrength thus regulated to the degree which the views of the phyſician require.

But, beſides that, either from local circumſtances, or from the inadequate capital of thoſe engaged, the buſineſs could not be carried on every where with the ſame facility and perfection, ſuch an undertaking could never have attained that extent in the variety or magnitude of its operations, that enables it to ſupercede the uſe of the natural mineral waters, and to ſupply the demands of a large and populous city, if men equally converſant with the chemical and mechanical ſcience neceſſary to enſure ſucceſs, had not conceived and executed the plan of eſtabliſhing genuine manufactures of artificial mineral waters upon an extenſive ſcale. Among the eſtabliſhments of this kind lately begun in France, that which Meſſrs. Paul and Co. have juſt ſet on foot, in the ſtreet of Mont-Martre, in Paris, deſerves to be particularly diſtinguiſhed *.

M. Paul, who, being at firſt connected with Mr. Goſſe, an ingenious apothecary of Geneva, has for ten years paſt prepared mineral waters with great ſucceſs at that place, and ſold annually up-

* This eſtabliſhment has ſince been removed to the ſtreet of Lazarre, near Tivoli.

wards

wards of forty thouſand bottles of artificial Seltzer water, preſented to the National Inſtitute, at its ſitting of the 16th November, a paper on the preparation of mineral waters, the ſubſtance of which the Reporters will now proceed to ſtate; they will afterwards deſcribe the ingenious proceſſes which they have ſeen employed in his laboratory, and give an account of the artificial waters themſelves; they will then add ſome obſervations on their nature and comparative properties, and ſuggeſt certain improvements of which they appear to be ſtill ſuſceptible. Laſtly, the Report will terminate with a ſtatement of the reſults which the preceding facts have afforded, and of the concluſions which the Committee wiſh to lay before the Inſtitute for its conſideration.

SECTION II.

Abſtract of the Memoir of Meſſrs. Paul and Co.

The firſt part of this paper contains an account of the advantages which Geneva has, for ten years paſt, derived from the manufacture of artificial mineral waters*. The ſimple imitation of thoſe waters, to which M. Paul firſt confined himſelf, has been followed by certain modifications ſuggeſted to him

* See Appendix, Note A.

by

by the phyſicians of that place; and eſpecially by the preparation of gaſeous waters, more highly impregnated than thoſe of Nature. The eſtabliſhment then, may be conſidered, both from its magnitude, and from the variety of mineral waters produced at it, as a real pneumatic laboratory. There are ſcarcely any mineral waters now imported into Geneva, whilſt thoſe of his manufacture are exported to the amount of forty or fifty thouſand bottles annually. The ſucceſs of this firſt attempt, has induced him to form a ſimilar eſtabliſhment at Paris. In this, are prepared nine kinds of artificial waters. The ſummary remarks that have hitherto been made upon each of theſe waters, are contained under the following heads:

1. The Seltzer Waters have been uſed with advantage in catarrhs, rheumatiſm, aſthma, and in bilious and putrid diſorders;—they prove diuretic and antiſeptic, even when externally employed;—they are ſerviceable in ſpaſmodic affections of the ſtomach; and they promote digeſtion. They may be taken mixed with milk, with wine, or with ſyrup of capillaire. M. Paul prepares them in two different ways: in the one, the carbonic acid (or fixed air) is diſengaged from chalk by ſulphuric (vitriolic) acid; in the other, it is ſeparated from the ſame ſubſtance by heat alone. The water prepared in the former mode has ſomewhat of a ſharp taſte and irritating quality, owing to a ſmall portion of the ſulphuric acid carried over with

with the carbonic gas; but when prepared in the other, it is quite free from ſuch impregnation, and therefore better adapted to thoſe complaints in which irritation is to be avoided. With the carbonic acid gas, obtained in either of theſe modes, he likewiſe manufactures Seltzer water, either ſtrong or weak, according to the proportion of gas introduced.

2. The waters of Spa, which like thoſe of Seltz, are charged with a large proportion of carbonic acid, are, however, diſtinguiſhed from the latter by containing iron. To the properties of the Seltzer water, therefore, they unite the tonic and ſtomachic qualities which this metal is known to poſſeſs.

3. The gaſeous alkaline water, ſo highly commended in England, in caſes of gravel and ſtone, certainly affords very great relief to the pain which accompanies theſe complaints; and, according to the authors of the Memoir under conſideration, this effect muſt be attributed to the ſolvent power which this water imparts to the urine: they, therefore, think it proper to be imployed inſtead of the cauſtic alcali, and Stephens's medicine. Patients ſhould drink, every morning, two or three tumblers of this water, mixed with milk *.

4. The Seidlitz waters are the moſt eaſily imitated of any; and the artificial ones have exactly he

* Vide Dr. Saunder's Letter to Dr. Percival, in his Philoſophical, Medical, and Experimental Eſſays, vol. 3d, 1776.

the ſame cooling and purgative qualities, which are obſerved in thoſe that are produced by Nature.

5 The oxygenated waters, which contain nearly half their bulk of oxygen gas, and were firſt prepared by M. Paul, on the ſuggeſtion of the Phyſicians of Geneva, have perfectly anſwered the expectations formed of them, and deſerve the greateſt attention from medical men. Although poſſeſſed of no particular taſte or ſmell, they reſtore appetite and ſtrength, promote urine, reſtore the menſtrual diſcharge, and relieve ſpaſms of the ſtomach, and hyſterical complaints. The *Bibliothéque Britannique* contains a ſeries of intereſting obſervations on their ſalutary effects.*

6. The hydrogenated waters contain about one-third their bulk of hydrogen gas (inflammable air). They are uſeful in fevers with inflammatory ſymptoms, in which they diminiſh the frequency of the pulſe: they likewiſe allay pains in the urinary paſſages, promote ſleep, and give relief in ſome nervous complaints.

7. The hydrocarbonated waters (thoſe impregnated with a mixture of inflammable and fixed air) do not differ materially from the preceding.

8. The hydroſulphureous waters, prepared with hydrogen gas, mixed with a ſmall proportion of hepatic or hydroſulphureous gas, have the taſte and ſmell of rotten eggs, and reſemble the natural

* See the Appendix, note B.

ſulphureous waters. They are diaphoretic and diſcutient; very uſeful in obſtructions, in jaundice, and in affections of the meſentery. They admit of many varieties, according to the proportions in which the two gaſes are employed; and their external application is equally worthy of attention. From the great quantity of ſulphurated hydrogen gas with which they are charged, they become valuable as a lotion or bath in various foulneſſes of the ſkin; and when applied in a ſtream *(douche)* upon the part, they have proved ſucceſsful in curing ill-conditioned ulcers. They very advantageouſly ſupply the place of the natural ſulphureous waters, to thoſe patients whoſe circumſtances will not permit their undertaking expenſive journies for that purpoſe.

The author of the Memoir in queſtion, concludes it with two obſervations, equally important. The firſt is œconomical, and has for its object, the advantage of not only keeping at home the money which uſed to be ſent out of France, for the purchaſe of theſe waters; but of producing an influx of money for the ſame purpoſe from other countries. The other relates to the benefits which ſcience will probably derive from the proceſſes employed in this eſtabliſhment for the preparation of mineral waters. Such is the ſubſtance of the Memoir preſented by M. Paul to the Inſtitute; and the whole is written with that ſimplicity and preciſion which correſpond with the nature of the ſubject.

SECTION

SECTION III.

Proceſſes uſed by Meſſrs. Paul and Co. in preparing the Artificial Waters;—Deſcription of the Place in which the Buſineſs is carried on;—Proportions of the ſeveral Ingredients employed.

The Committee, on the invitation of Meſſrs. Paul and Co. went to the laboratory, where the waters are prepared. They were immediately ſtruck with the ſimplicity of the apparatus; with the order that prevailed in their reſpective arrangement; the ingenious means employed for procuring water, and for filtrating it between the firſt reſervoir and that from which it is taken when about to be mineralized. They were not leſs gratified with the perfection of the machines for obtaining the gaſes, and particularly that for obtaining the carbonic acid from carbonate of lime (chalk), either by heat, or by the addition of ſulphuric (vitriolic) acid; but they admired, above all, the rapid mechaniſm by means of which the gaſes are compreſſed, and condenſed in the water that is to receive them. Throughout the whole the Committee have ſeen the moſt ingenious mechanical contrivances united to the greateſt chemical accuracy. They were every where ſtruck

with the difference between operations of this kind, when conducted on this large ſcale, and the little, not to ſay inſignificant mode, in which they are uſually carried on. The apparatus, which the Committee will now proceed to deſcribe, is ſo diſpoſed in this laboratory as to prepare at once ſeveral hundred pints of mineral waters, and to impregnate them in the ſtrongeſt and moſt uniform manner.

The inventor of theſe proceſſes is ſo perfectly acquainted with all the apparatus employed in the French laboratories for inveſtigating the nature and uſe of elaſtic fluids; and has exerted ſo much ingenuity and preciſion in conſtructing his machines, that they might be conſidered as intended for chemical experiments of the moſt accurate kind. As the inventor, however, wiſhes to reſerve to himſelf, and his partners, the complete knowledge of his apparatus, and eſpecially of that employed to compreſs the gaſes (with which even the Committee were not made acquainted), it is not intended to enter into a minute deſcription of it. The Committee, however, think it their duty to give at leaſt a general notion of the proceſſes employed, that the Inſtitute may be enabled to appreciate the careful and enlightened management which preſides over this important eſtabliſhment. Enough will be ſaid to convey an idea of the merits and advantages of this manufacture, but not to furniſh the means of imitating it; and the Committee will thus have fulfilled the taſk

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aſſigned to them reſpecting the reſults of theſe proceſſes, without infringing the rights of the inventor with regard to the machinery by which they are performed.

Two ſorts of apparatus, equally ſimple and ingenious, and carried to a degree of perfection which may render them very uſeful, even in accurate experiments, are employed, the one for diſengaging the gaſes by heat, the other by efferveſcence. The firſt is a metallic cylinder, which paſſes through a furnace, and is provided at each extremity with contrivances that enable the operator to ſee what is going on within it at any time, during the proceſs; and alſo to collect, transfer, meaſure, and purify the gaſes thus ſeparated. In ſhort, this apparatus exhibits an aſſemblage of all the moſt exact and uſeful contrivances furniſhed by modern chemiſtry, for obtaining and examining elaſtic fluids.

From the extremity of this apparatus, (which is divided by a partition, and has on one ſide the furnace and cylinder, on the other, the receivers, and whatever elſe is neceſſary to the collecting, meaſuring, and purifying gaſes), there ariſe moveable tubes that can be lengthened, ſhortened, and directed at pleaſure, ſo as to convey the gaſes into a pump, by which they are forced into ſtrong cloſe caſks, where they meet with the filtered water, as it iſſues from a contiguous apparatus, and are diſſolved in it by the joint aſſiſtance of agitation and

preſſure. This apparatus is applied to the condenſation of the carbonic acid, and likewiſe to that of the oxygen and hydrogen gaſes.

The ſecond kind of apparatus is appropriated to the obtaining elaſtic fluids by efferveſcence, and is ſtill more ſimple than the former. Although it reſembles thoſe uſed in our laboratories, and conſiſts of a receiver furniſhed with tubes, and ſtop-cocks, yet M. Paul has brought it to a degree of perfection, ſimplicity, and convenience, which renders the operation more eaſy, expeditious and certain, than before. Its performance is ſo exact, that nothing whatever is waſted: it collects the whole of the gas; and is ſo contrived, that the efferveſcing materials can never ſwell ſo much as to reach the firſt water through which the gas paſſes: in ſhort, every thing relating to it, whether reſpecting time or ſpace, is turned to the greateſt advantage. The mechaniſm, which produces theſe effects, is at the ſame time of wonderful ſimplicity; and ſuch as denotes in the inventor the moſt perfect experience in the ſeveral operations, as well as a complete acquaintance with the acknowledged inconveniencies attending the machines in common uſe, and with the means of obviating them. The gas furniſhed by this proceſs, is drawn out by the ſame pump, and conveyed into the ſame caſks as that which is expelled by heat.

With regard to the compreſſing machine, (the ſtructure of which was not explained to the Committee,

mittee, as the inventor wiſhes to keep it ſecret) it is ſufficient for us to ſay, that it anſwers the purpoſe in the moſt effectual manner; as the various gaſeous waters, ſpecimens of which were prepared before the Committee, contain a larger proportion of elaſtic fluids (eſpecially of thoſe that are known not to be ſoluble in water, except by the aſſiſtance of preſſure) than any that have been made hitherto. The Committee ſaw him prepare in leſs than two hours, two ſmall caſks of Seltzer water, as well with the carbonic acid expelled by heat, as with the ſame gas diſengaged by means of the ſulphuric acid. This proceſs is ſo ſimple in all its parts, as to be attended with no difficulty, irregularity, or loſs of time: the greateſt neatneſs prevails throughout the whole of the operation. The ſaline and other fixed matters that enter into the compoſition of ſome of theſe waters, and eſpecially thoſe of Seltz, Seidlitz, Spa, &c. are put in their due quantities, well mixed and powdered, into each bottle, before it is filled with the gaſeous water, which is drawn immediately from the caſk where it receives the impregnation. Even the mode of drawing off the gaſeous water from theſe caſks is brought to the higheſt degree of improvement. The hiſſing noiſe, and the burſting of the bottles occaſionally, at the moment they are corked, convinces the ſpectator, that the water is ſuper-ſaturated with gas; and, that, notwithſtanding a ſmall quantity eſcapes, the liquid ſtill retains much

much more of it than any artificial water hitherto prepared.

To this ſketch of the new proceſſes which M. Paul employs for the ſolution of gaſes in water, the Committee think it proper to add a ſhort account of the various ingredients which enter into the ſeveral mineral waters prepared by him; in order that phyſicians may thereby be enabled to direct their uſe according to the principles contained in them, or to ſuggeſt ſuch modifications, in their preparation, as they may think deſirable*. The following are the proportions, which, according to the written ſtatement of M. Paul, to the Committee, are contained in each bottle of twenty ounces meaſure.

1ſt, The STRONG SELTZER WATER contains, in each bottle of 20 ounces,

Carbonic acid obtained by effervescence, 5 times the bulk of the water employed.
Carbonate of Lime, ... 4 grains
Magneſia, ... 2 grs.
Carbonate of Soda, ... 4 grs.
Muriate of Soda, ... 22 grs.

2dly, The MILD SELTZER WATER contains
Carbonic acid evolved by means of heat, and mixed with a little hydrogen gas, 4 times its bulk.

* See the Appendix, Note C.

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The 4 ſalts in the ſame proportions as in the *ſtrong* Seltzer water.

3dly, The SPA WATER contains, in each bottle of 20 ounces:

Carbonic acid obtained by efferveſcence, 5 times its volume.

Carbonate of Lime, ...	2 grains
Magneſia, ...	4 grs.
Carbonate of Soda, ...	2 grs.
Muriate of Soda, ...	⅓ gr.
Carbonate of Iron, ...	½ gr.

4thly, The STRONG SPA WATER contains:

The ſame as the preceding, but with a double proportion of iron.

5thly, The GASEOUS ALKALINE WATER contains:

Carbonic acid by efferveſcence, 6 times its volume.

Carbonate of Pot-aſh, . .	144 grains

6thly, The SEIDLITZ WATER contains:

Carbonic acid by efferveſcence, 5 times its volume.

Sulphate of Magneſia, . .	144 grains

7thly, The OXYGENATED WATER contains:

Oxygen gas half its volume.

8thly, HYDROGENATED WATER contains:
Hydrogen gas, one third of its volume.

9thly, HYDRO-CARBONATED WATER contains:
Carbonated hydrogen gas, two-thirds of its volume.

10thly, The WEAK HYDRO-SULPHURATED WATER contains:
Half its volume of hydrogen gas, mixed with one-thirtieth part of ſulphurated hydrogen gas.

11thly, The STRONG HYDRO-SULPHURATED WATER contains:
Half its volume of hydrogen gas, mixed with one-fourth of ſulphurated hydrogen gas.

SECTION IV.

Examination of the Waters prepared in the Eſtabliſhment of Meſſrs. Paul and Co.

THE Committee did not confine its enquiry to the inſpection of the laboratory of mineral waters, and the proceſſes of fabrication; they thought it proper to bring the reſults themſelves under examination. For that purpoſe, a few bottles of each of the waters, prepared by the above mentioned proceſſes, were carried, carefully corked

and ſealed up, from the laboratory of Meſſrs. Paul and Co. to that of one of the members of the Committee, where they were examined, not with all the accuracy required in the analyſis of an unknown mineral water, (as ſuch a preciſion would have been ſuperfluous), but with ſufficient care and attention, to give perfect ſatisfaction as to the nature of their contents. The following circumſtances were obſerved by the Committee, three days after the bottles had been in their poſſeſſion, during which time they were kept in a cool and ſhaded place.

The bottles containing Seltzer water, eſpecially that which M. Paul calls *Strong Seltzer water*, produced at the moment they were uncorked, a conſiderable efferveſcence, accompanied with a remarkable hiſſing noiſe. The cork was ſeveral times blown out with a loud report, and abundance of bubbles continued to eſcape from the fluid for ſeveral hours. In decompoſing this water accurately by lime water, the precipitate obtained indicated a little more than three times its volume of carbonic acid. The reagents indicated the preſence of the different ſalts that had been diſſolved in the water.

The ſame circumſtances took place with the weak Seltzer water; this however yielded a little leſs gas than the former; yet it produced a ſimilar hiſſing and efferveſcence, and one of the corks was blown out.

The ſtrong Spa water had blackened its cork. Some light yellowiſh clouds were ſeen floating in it; it was briſk and ſparkling, and had a diſtinct ferruginous taſte; it reddened on the addition of nut-galls.

The weak Spa water was briſker and more acidulous than the former; it had leſs of the metallic taſte, and was not ſo much blackened by the addition of gallic acid. Some light yellowiſh clouds were alſo perceived in it.

The gaſeous alkaline water which was much leſs effervescent than any of the former, and had a ſweetiſh taſte, contained twice and half its volume of carbonic acid. The preſence of the alkali was made conſpicuous by every poſſible reagent; and its power in weakening the acidity, was abundantly well marked, eſpecially when compared to the Seltzer and Spa waters.

The Seidlitz water, beſides the properties of a gaſeous water, exhibited thoſe of a ſolution of ſulphate of magneſia, or Epſom ſalt.

The oxygenated, hydrogenated, and hydrocarbonated waters, differed but little either in taſte or properties from common water. They produced neither hiſſing noiſe, on being uncorked, nor any very ſenſible effervescence, on coming in contact with air; and, in general, they did not offer any obvious analogy with gaſeous waters. They ſcarcely emitted a few bubbles of oxygen, or hydrogen gas; and they did not produce

upon any reagent, effects ſufficiently marked to indicate clearly the preſence of the gaſes with which they had been impregnated by preſſure; yet the ſmall portion that they did yield, had undergone no alteration, but retained the characters, the one of oxygen, and the other of hydrogen gas, in a ſtate of tolerable purity.

Finally, the hydro-ſulphurated waters, without producing any agitation, or efferveſcence, appeared a little turbid, and emitted a ſlightly fœtid ſmell. The nitrous acid, and acetite of lead, clearly indicated the preſence of ſulphur. The precipitate produced by the firſt of theſe reagents, was more diſtinctly marked in the ſtrong, than in the weak ſort.

All the phenomena and characters that have juſt been enumerated and deſcribed, were equally diſcovered in the principal kinds of the ſame mineral waters, ſome months after they had been ſent from Geneva to Paris, where they had been kept in cellars; there was this difference however, that the quantity of carbonic acid in the firſt kind, was ſenſibly diminiſhed, although not ſo much as might have been expected, ſince the ſtronger ſort ſtill contained twice and half its volume of carbonic acid.

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SECTION V.

Obſervations on the Modes of Preparation, and on the Nature of the Waters.

The general ſurvey of the eſtabliſhment, the inſpection of the apparatus, the communication made by M. Paul himſelf, of his receipts for the factitious waters, and the examination of theſe waters, both freſh and old, as prepared by him at Geneva, and at Paris, led the Committee to ſome obſervations, which it may be uſeful to communicate to the Inſtitute: they relate both to the general proceſſes uſed by the inventor, and to the ſpecial nature of each of the mineral waters in particular. The principal object of theſe obſervations is to ſuggeſt ſome modifications or improvements of which theſe artificial liquids appear ſuſceptible, and which may have ſome influence on their ſucceſs in the cure of diſeaſes.

1ſt, Although there can be no doubt, that the machines and proceſſes of M. Paul, enable him to impregnate water with a greater quantity of gas than any of the proceſſes hitherto employed, theſe waters have conſtantly appeared, on examination, to contain leſs gas than the author ſtated. It ſhould not be inferred from this circumſtance, that

that M. Paul does not actually poſſeſs the means of condenſing in the water, by his compreſſing machine, as much as 6 times its volume of carbonic acid, and of aſcertaining with certainty, the reality of this condenſation; but it is certain, that theſe waters ſuffer conſtant and ſucceſſive loſſes, either at the moment the cork is applied and ſealed in the bottle, or in keeping, or uncorking it; as the rapidity and noiſe with which the cork is drawn, ſufficiently denotes. It muſt be obſerved, however, that more elaſtic fluid is obtained from theſe waters, by the pump and other ingenious mechaniſm that the author has conſtructed for that purpoſe, than by the proceſſes uſed by the Committee; but there is reaſon to believe, that notwithſtanding his ingenious contrivance for diſengaging the gaſes from the water, and aſcertaining their quantity, ſtill there may be ſome ſource of error; ſince ſolutions of lime and barytes, uniformly indicate a ſmaller quantity of theſe gaſes *. This obſervation, however, (the only one the Committee will have to make on the general ſcheme of M. Paul,) ought rather to convey a more favourable idea of his eſtabliſhment, as will appear from the following remarks on each kind of artificial water in particular.

2dly, The ſtrong Seltzer water, although appearing to contain, when chemically examined,

* See the Appendix, Note D.

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leſs carbonic acid than it was made to abſorb in the proceſs of preparation, is ſtill found to be loaded with a greater quantity of this gas than any of the artificial waters hitherto made. Bergmann, and all the authors that have followed him, mention only a volume of gas, either equal, or a little ſuperior to that of the fluid; whilſt M. Paul's waters conſtantly yielded upwards of *three times* their volume of gas. But this great proportion of carbonic acid, which gives to the ſuperabundant gas ſuch a conſtant tendency to eſcape, and to the water ſuch a remarkable effervescent quality, may be regarded as ſuperfluous as to the medicinal properties of the water. Twice its volume of gas would be ſufficient to render it ſuperior to any of thoſe that nature affords. Patients do not take in any thing like the quantity of gas contained in M. Paul's factitious water; a great deal of it being diſengaged in uncorking the bottles, and a great deal again in pouring out the water and ſwallowing it. But it muſt be acknowledged that the briſk and ſparkling quality is generally agreeable, and particularly well adapted to ſome domeſtic purpoſes; ſo that, although it is not indiſpenſable in the medicinal adminiſtration of theſe waters, the author nevertheleſs, deſerves credit for this additional merit. The Committee, however, does not entertain the ſame opinion with reſpect to the addition of carbonate of lime and magneſia, in the artificial Seltzer water. They believe

believe with Bergmann, that theſe earthy ſalts, without being ſo noxious as the illuſtrious profeſſor thought, and without occaſioning the obſtructions which he apprehended might reſult from them, cannot at leaſt add any uſeful quality to this water, and may, perhaps, diminiſh thoſe which it derives from its other principles *.

3dly, The preparation of the weak Seltzer water, with carbonic acid extracted by heat, was a very happy invention. It is certain that this water has not the ſame ſharpneſs, and does not occaſion the ſame irritation as is obſerved in that which is prepared with carbonic acid obtained by efferveſcence. The two obſervations on the ſuperabundance of acid, and on the preſence of the earthy ſalts, apply to this kind as well as to the former. It may moreover be obſerved, that it would, perhaps, be deſirable that this water ſhould not contain the hydrogen gas which M. Paul ſtates to exiſt in it; and as the origin of this gas is well known, he might eaſily avoid it by ſubſtituting in place of his iron cylinder, an earthen one, and for the chalk which he employs, ſome powdered marble or calcareous ſpar. The water which he pours into the cylinder, and which he finds ſo efficacious in facilitating and haſtening the diſengagement of the carbonic acid, would then no longer give birth to the hydrogen gas above mentioned. But it muſt be acknow-

* See the Appendix, note E.

ledged, that this remark, although tending to carry a little farther the degree of perfection which this preparation is ſuſceptible of, ought to be conſidered as of little importance, with reſpect to the nature and ſalubrious effects of this kind of mineral water*.

4thly, In both kinds of M. Paul's factitious Spa waters, there always appears a cloudy precipitate of carbonate of iron, notwithſtanding the ſuperabundance of carbonic acid, which is contained in theſe waters, and the exact and careful method by which the iron is added. M. Paul puts into the bottle, previous to the introduction of the ſalts, and of the gaſeous liquid, a quantity of ſolution of iron in acidulous water, the proportion of which he varies according as he wiſhes to prepare weak or ſtrong Seltzer water. The precipitation of the iron muſt, therefore, be owing to the previous preparation of this ſolution; and it would be very eaſily prevented either by preparing the ferruginous ſolution later, or by leaving out the two earthy ſalts, which are added to no uſeful purpoſe. However, notwithſtanding this partial precipitation of iron, there remains enough of it to give to the water the metalic taſte, the property of blackening on addition of gallic acid, and the medicinal qualities that are known to belong to this claſs of waters.

* See the Appendix, note F.

5thly,

5thly, The gaſeous alkaline water is prepared with carbonate of pot-aſh, evidently for the ſole purpoſe of giving it exactly the ſame quality as that known under the name of alkaline mephitic water, ſo much uſed in England, and ſo ſtrongly recommended by Dr. Jugenhoutz, in caſes of calculus. Yet the natural gaſeous alkaline waters are all ſolutions of carbonate of ſoda, with exceſs of carbonic acid. The waters of Vichy, of Bard, and ſeveral waters of Puy de Dome and Montd'or, are of that kind. If Phyſicians ſhould wiſh to have waters prepared exactly ſimilar to thoſe which we have juſt mentioned, it would be very eaſy to M. Paul to introduce that ſlight modification in his proceſs, by ſubſtituting the carbonate of ſoda to the carbonate of pot-aſh. He might, at the ſame time, continue to prepare the alkaline gaſeous water with pot-aſh, if it ſhould continue to be found uſeful in ſome urinary complaints; but it does not appear at all probable, in the preſent ſtate of animal analyſis, that an alkaline carbonate ſhould poſſeſs a ſolvent power over calculi formed of uric acid or phoſphate of lime; and theſe two kinds of concretions are known to be the moſt frequent of all.

6thly, Although the Seidelitz water, with which we are acquainted at Paris, does not, by any means, contain a portion of gaſs approaching to that which is introduced into the waters which M. Paul prepares; this addition, probably recommended

by medical men, cannot be attended with any inconvenience: it would be eaſy, however, in caſe it ſhould be found adviſeable, to diminiſh at pleaſure the proportion of gas, as alſo to vary and increaſe the proportion of ſulphate of magneſia, in order to render this water more active and more purgative. Perhaps, alſo, it will be found proper that M. Paul ſhould add to his factitious Seidelitz water, the ſmall proportion of muriate of magneſia, which has been found in the natural Seidelitz water, and which, conſidering its ſharp and ſtrong taſte, ſeems to deſerve being ranked amongſt its active principles.

7thly, The preparation of oxygenated water, and the ſolution of oxygen gas, in twice its volume of water, by means of a ſtrong preſſure, is a real and important diſcovery, both in philoſophy and medicine. There is every reaſon to believe, that it will become uſeful in ſeveral arts; and it may alſo account for ſome natural phenomena, hitherto but little underſtood. This water, however, does not appear to be a true ſolution of oxygen gas; the gas ſeems merely to be condenſed and retained in it by preſſure, ſo as to eſcape from it eaſily, whenever the preſſure is either diminiſhed or removed; and it is for that reaſon, no doubt, that we could not extract from the water even one-third of the quantity which the author ſtates. Although the taſte, and other properties of the water thus oxygenated, ſeem not

to differ from thoſe of common water, it would not be reaſonable to raiſe any doubts on the effects which the phyſicians of Geneva have obtained from it; which effects they have carefully deſcribed in ſeveral numbers of the *Bibliothéque Britannique*, while treating of the modern pneumatic chemiſtry. From the reſearches which one of the members of this Committee had already made on that part of medicinal chemiſtry (ſeveral years before Meſſrs. Rollo and Cruckſhanck, who ſeem either to have forgotten or to have been ignorant of his previous ſpeculations on the ſubject), the Committee is perſuaded, that water impregnated with oxygen gas, may become one of the moſt powerful remedies, and moſt uſeful reſources in the healing art. It will, perhaps, in many inſtances, ſupply the place of the acids, the oxyds, and metallic ſalts, with regard to their oxygenating operation, or, at leaſt, aſſiſt and ſupport them in promoting that effect. But this is quite a new field of inveſtigation, where much remains to be done before it is poſſible to draw any poſitive concluſions.

8thly, As to the hydrogenated and hydro-carbonated waters, notwithſtanding the hopes which the Phyſicians of Geneva had, with ſome foundation, conceived of theſe waters, when they induced M. Paul to attempt their preparation; the trifling effects that have been obtained from them are ſuch as might have been expected from the

ſmall

ſmall quantity of hydrogen gas which they contain, and the extreme weakneſs with which it adheres to the liquid; this however by no means appears to be a ſufficient reaſon for laying aſide theſe two kinds of artificial waters. Time alone can ſhow what may be expected from their uſe; and the theory of elaſtic fluids, in ſhowing, that hydrogen and oxygen are contraſted in their virtues, indicates that their utility ſhould not be deſpaired of, until their true properties have been carefully aſcertained.

9thly, Finally, the ſulphurated waters appeared to the Committee to be not ſufficiently impregnated with ſulphurated hydrogen gas. This gas is united, in this inſtance, with ſome pure hydrogen gas, forming only one thirty-ſecond part (in volume) of the weak ſort of theſe waters, and one-fourth of thoſe of the ſtronger kind. There does not appear to be any advantage in introducing into the water *pure* hydrogen along with the *ſulphurated* hydrogen gas; the former, as it is well known, diſſolves in water, but very ſparingly, and only by means of a conſiderable preſſure, and therefore can but ſerve to diminiſh the ſolubility of the latter, which, of itſelf, is tolerably ſoluble. Bergmann propoſed to imitate the ſulphureous waters by the ſimple addition of ſulphurated hydrogen gas; and no chemiſt, after him, had ever propoſed to aſſociate this with the pure hydrogen gas. At any rate, the proportion of ſulphurated hydrogen gas might

be varied according to circumſtances, and it could be carried much beyond the limits indicated by M. Paul, whoſe means however are more than ſufficient to fulfil every indication *.

RECAPITULATION AND CONCLUSION.

FAR from wiſhing to offer the foregoing obſervations, as objections to the eſtabliſhment juſt deſcribed, they have only been intended to place in a more meritorious and conſpicuous light, the great extent and utility of which it appears ſuſceptible. Thoſe obſervations ought to prove, at the ſame time, the high value which the authors of this inquiry ſet upon the undertaking, and the eſteem which they have conceived for the inventor. But that there may remain no doubt in that reſpect, they will terminate this report by a ſummary account of the advantages which may be expected from this new manufacture of mineral waters, and of the motives that led them to the concluſions they have drawn.

1ſt, Since chemiſtry has determined the nature and proportion of principles (particularly of the gaſes), diſſolved in mineral waters, art poſſeſſes all the means of imitating them. The proceſſes of M. Paul ſhow, that he is completely poſſeſſed of

* See the Appendix, note G.

thoſe

thoſe means, and has a perfect knowledge of all the reſources that art can afford.

2dly, The new eſtabliſhment deſcribed in this Report, offers a laboratory much ſuperior to any hitherto known; here are no longer ſeen the narrow means commonly uſed in chemical laboratories, nor is the operation any longer confined and reſtrained by the complication of a thouſand other experiments, going on at the ſame time. It is a true PNEUMATIC LABORATORY, a real manufacture, in which the ſame courſe of operations, performed with great care and upon a large ſcale, conſtantly lead to uniform reſults.

3dly, To the common, but inadequate proceſſes of ordinary laboratories, M. Paul has ſubſtituted a compreſſing machine, which introduces into the water, not only a quantity of carbonic acid gas three times as great as could be done before, but other elaſtic fluids alſo, which had been hitherto conſidered as totally inſoluble.

4thly, The Seltzer and Spa waters prepared in this eſtabliſhment, are made much ſtronger, and much ſuperior to thoſe which were formerly prepared in ſhops and laboratories, and this entirely by means of the new proceſs of compreſſion which Mr. Paul employs for ſaturating the water with carbonic acid gas. The weak Seltzer water, prepared with carbonic acid evolved by heat, has certainly the advantage of being much leſs irritating, and therefore much better adapted

to

to certain caſes, than that prepared with the ſame acid diſengaged by effervescence, which, in ſuch caſes, might be attended with prejudicial effects.

5thly, The oxygenated and hydrogenated waters are acquiſitions of conſiderable importance in the healing art. In Phyſics and Chemiſtry, they will afford new means of inveſtigation; and in agriculture, and in the arts, they may perhaps become new inſtruments equally uſeful and valuable.

6thly, The Seidlitz waters, and the ſulphureous artificial waters, are entirely ſimilar to the natural ſprings which they are intended to imitate.

7thly, The preparation of the various kinds of medicinal mineral waters, by the methods of M. Paul, is ſuſceptible of modifications and improvements, readily to be obtained. It would be eaſy, by means of ſome ſlight changes in the quantities of the different ingredients, and the management of the proceſſes, to increaſe, diminiſh, and otherwiſe modify their effects.

8thly, The new eſtabliſhment, conſidered in a general point of view, offers to the healing art a ſeries of medicinal preparations, that may fulfil in practice a variety of indications of cure; and, with the aſſiſtance of a very few other means, prove adequate to the treatment and relief of a great number of diſeaſes.

9thly, The preparation of mineral waters having thus become eaſy, and being carried on upon a large ſcale, the indigent ſick, and the hoſpitals of every deſcription, will find, in the products of this pharmaceutical eſtabliſhment, curative means that they could much leſs eaſily have obtained from their natural ſource, on account of the expence of travelling, or that which neceſſarily attends the importation of thoſe waters from diſtant countries.

10thly, Finally, this preparation of artificial mineral waters, carried on upon ſuch an extenſive ſcale, as to ſupply conſtantly a great number of individuals, is calculated to create in France a new branch of induſtry, not only important to the healing art, but alſo to commerce and national proſperity, by preventing the exportation of conſiderable ſums of money, which, on the contrary, will now be imported for the ſame object from neighbouring countries.

The Committee, therefore, is of opinion, that the Inſtitute ſhould give the moſt diſtinguiſhed approbation to the proceſſes of Meſſ. Paul and Co. for the preparation of artificial mineral waters, and declare, that they have perfectly fulfilled their intended object of ſupplying medicine with artificial remedies, that are in many inſtances EVEN SUPERIOR to thoſe which nature affords*.

NATIONAL

* See the Appendix, Note H.

NATIONAL INSTITUTE 21ſt Frimaire, the 8th Year, (December 1800.)

(Signed) VAUQUELIN.
CHAPTAL.
PELLETAN.
FOURCROY.
PORTAL.

The Inſtitute approves the Report, and adopts its concluſions.

26th Frimaire, the 8th Year.

(Signed) CUVIER.

APPENDIX.

NOTES OF THE EDITOR.

NOTE A.—Page 6:

I BEG leave to tranſcribe here the following declarations of the *Phyſicians of Geneva*, and of the *Society for the Encouragement of the Arts*, in which thoſe learned and reſpectable bodies were pleaſed to expreſs publicly, ſeveral years ago, their approbation of my firſt attempts in the imitation of mineral waters.

DECLARATION OF THE FACULTY OF GENEVA.

" We underſigned, Phyſicians of the Faculty " of Geneva, declare, that having ſubmitted to " our examination the factitious mineral waters " prepared by M. Paul, and particularly thoſe of " Seltzer and Spa; and having communicated to " him our obſervations on this ſubject, with a " view to aſſiſt him in the ſucceſs and improve- " ment of his undertaking: we have ſeen, with

" ſingular

" ſingular pleaſure, that the means invented and
" employed for this purpoſe, by the ſaid M. Paul,
" ſurpaſs all the attempts that have been made
" hitherto in the imitation of theſe waters; that
" Science, united to induſtry, has produced in
" his hands the happieſt effects, ſince he can
" now, with perfect eaſe, furniſh the public with
" a conſtant ſupply of artificial mineral waters,
" ſtronger and more energetic than the ſame
" waters, when iſſuing from the laboratories of
" Nature; ſo that we can poſitively aſſert, that
" M. Paul, by his laudable efforts, has ſuc-
" ceeded in rendering himſelf equally intereſting
" to Phyſicians, and uſeful to humanity, in the
" cure of diſeaſes."

Geneva, 26th Auguſt, 1796.

(Signed) SOLOMIAC, M. D.
and Senior of the Faculty.
VIEUSSEUX, M. D.
ODIER, M. D.
VIGNIER, M. D.
DUNANT, M. D.
MANGET, M. D.
MIROGLIO, M. D.
BUTINI, Jun. M. D.
VEILLARD, M. D.

DECLARATION OF THE SOCIETY FOR THE ENCOURAGEMENT OF THE ARTS:—COMMITTEE OF MECHANICS.

" We underſigned declare, that having, at M. " Paul's requeſt, attended at his houſe, in order " to witneſs the proceſs, by means of which he " impregnates his factitious mineral waters with " carbonic acid gas; and having examined his " ſeveral apparatus minutely: we have found " them conſtructed upon excellent principles, " and capable of condenſing in water, quantities " of this elaſtic fluid, ſuperior to thoſe that are " contained in natural mineral waters, however " carefully preſerved. The energy of thoſe appa- " ratus can be varied at pleaſure; and their " action is ſuch as to impregnate rapidly a very " conſiderable quantity of water. They are alſo, " from their nature, equally applicable to the " condenſation of any other elaſtic fluid with " which water can be impregnated, thus ſupply- " ing the art of healing with new means of cure, " and opening to Phyſicians and Chemiſts a " new and intereſting field of obſervation.

" M. Paul has ſhewn himſelf, in the conſtruction " of theſe apparatus, deeply converſant with me- " chanics, and natural philoſophy; and we have " obſerved, with great ſatisfaction, that this diſ- " tinguiſhed artiſt has had chiefly in view, for a " long time paſt, in his ſucceſſive labours, and in

" the

" the gradual developement of his talents and
" induſtry, the relief of ſuffering humanity; and
" we ſeize with pleaſure this opportunity of ex-
" preſſing to him our diſtinguiſhed approbation."

Geneva, 27th Auguſt, 1796.

(Signed) M. A. PICTET, Profeſſor of Natural Philoſophy, and Preſident of the Committee of Mechanics, of the Society for the Encouragement of the Arts.

ODIER, M. D. Member of the ſame Society.

BUTINI, Jun. M. D.

NOTE B.—Page 9.

The obſervations here alluded to, were publiſhed by Dr. Odier, Profeſſor of Medicine at Geneva, in the 8th and 10th volumes of the *Bibliothéque Britannique*, annexed to an account of Dr. Rollo's late publication on the treatment of Diabetes and Syphilis, and to that of Mr. Cavallo's work on Factitious Airs. The name of Dr. Odier, and the moſt juſtly deſerved reputation of the publication in which theſe obſervations are recorded, induced me to tranſlate them here verbatim.

" To the methods of oxygenation and de-oxygenation, mentioned by Dr. Rollo, (ſays Dr. Odier,

Odier, *Bibliothéque Britannique, Sciences & Arts*, vol. viii.) we muſt add another, a very ſimple one, which we have employed for ſome time paſt at Geneva with ſucceſs. I mean the gaſeous waters prepared by M. Paul. I have already mentioned them in this journal, (vol. vii.) and promiſed to ſpeak of their effects as ſoon as they ſhould be ſufficiently aſcertained by experience. I haſten to keep my word, in order to facilitate the obſervations that other practitioners may make on this ſubject.

" The oxygenated waters, which contain about half their volume of oxygen gas, are perfectly pure in every other reſpect. This gas is not incorporated in the water, by means of any baſis, but merely by powerful compreſſion. It is therefore neceſſary, when the waters are uſed, that they ſhould be conſtantly kept in bottles well corked, the bottle being reverſed upon the cork, in a pot of water; and it ſhould be opened only at the moment of uſing it, when they ſhould be drank off as rapidly as poſſible, one glaſs at a time, carefully corking the bottle between each glaſs. With theſe precautions, I have found that this remedy, (which is far from diſagreeable, the waters being without any taſte whatever), reſtores the appetite and ſtrength, promotes the ſecretion of urine, allays ſpaſms of the ſtomach, particularly when they are accompanied with hyſterical

ſymptoms; and prevents their return, eſpecially if the fits are periodical.

"I attended ſome time ago, the mother of a family, 40 years of age, ſubject for many years paſt to hyſterical fits, which had lately returned with increaſed violence, in conſequence of great mental emotion. They began with a cramp in the ſtomach, accompanied with a tightneſs in the throat, ſuffocation and contraction of her limbs. This ſtate, which was totally exempt from fever, laſted with all its violence about an hour, after which the ſymptoms gradually abated, and left the patient with no other ſenſations than a ſort of general uneaſineſs, which remained for ſome hours. The next day ſhe was perfectly well; but the following day, exactly 46 hours after the commencement of the preceding attack, it returned with the ſame violence, the ſame ſymptoms, and in the ſame manner.

"She was in her third fit, when I was called in; I at firſt gave her the bark in large doſes, 4 days ſucceſſively, without effect. I afterwards tried the CARDAMINE PRATENSIS a remedy firſt recommended by Sir George Baker, and from which I have ſeen very good effects in nervous diſorders. It failed in this caſe, though the doſe adminiſtered was an ounce a-day. At length I uſed the oxygenated waters, in doſes of a glaſs every two hours, and from the firſt bottles the remedy ſucceeded

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the fits returned no more, and the patient has been in good health ſince.

" Another mother of a family of the ſame age, and nearly the ſame conſtitution, was attacked lately by a bilious fever, during the courſe of which ſhe had ſeveral fits of hyſterics, which manifeſted themſelves by ſpaſms in the ſtomach, tightneſs of the throat, complete extinction of voice, with a ſenſation of ſuffocation, great anxiety, involuntary tears, &c. Theſe fits at firſt recurred at irregular periods. I preſcribed the oxygenated waters, but they produced ſome ſymptoms of dyſuria, which obliged me to ſuſpend the uſe of them. A few days afterwards, this effect having ceaſed, and the fits having become periodical, returning regularly every 18 hours, and having reſiſted very powerful anti-ſpaſmodics, I had again recourſe to the oxygenated waters, which now ſucceeded perfectly, and prevented any return of the paroxyſms. The dyſuria, which theſe waters are apt to occaſion, again returned, but not till after the patient was cured; and as ſhe then only took the waters by way of precaution, the uſe of them was diſcontinued without inconvenience.

" I ſhall not enter at preſent into any further detail of caſes. I have ſeen ſeveral analogous inſtances in which the oxygenated waters have done great ſervice. It appears to me, upon the whole, that they may be ranked amongſt the number of good antiſpaſmodic tonics. I have ſeen them

ſucceed extremely well in the caſe of a return of melancholy, which had before been cured by the black oxyd of manganeſe, which remedy had afterwards failed. I have known alſo a dropſical caſe, in which they were attended with aſtoniſhing diuretic effects. But they ſometimes irritate the urinary paſſages, and even the inteſtinum rectum, ſo much as to produce accidents of dyſuria, teneſmus, ſanguinolent ſtools, &c. I have witneſſed a ſingular effect from theſe waters, that I conſider as being of the ſame nature. I was called in conſultation, the 21ſt of laſt March, in the caſe of a girl of eleven years of age, who after the ſmall-pox had a jaundice, which was ſucceeded by hyſterical affections, which returned frequently, and manifeſted themſelves by violent cramps in the ſtomach, accompanied by ſuffocation, &c. Several antiſpaſmodics had been tried without effect. I adviſed the oxygenated waters. They had a complete ſucceſs, and prevented at once the return of the paroxyſm; but during the firſt three days, the young patient complained of a ſenſation of extreme cold in making water, as if her urine was frozen. When I was informed of this ſingular effect, I was deſirous of examining the temperature of the urine by the thermometer, but it was too late; the ſymptoms had ceaſed, and from that time the patient has enjoyed good health. It is probable, that this ſenſation of coldneſs was nothing more than a ſlight irritation, ſimilar to

that

that which occaſioned the dyſuria. Theſe accidents, however, are not laſting; and I only mention them to put others in the way of juſtly appreciating the manner in which theſe waters act.

" I do not know whether I am miſtaken; but it appears to me, that theſe oxygenated waters might be uſed in bleaching linens, with much more eaſe and advantage, than the oxygenated muriatic acid, from which ſo much uſe has been derived for the ſame object. It would not be difficult to the talents of the ingenious artiſt, who has diſcovered the method of preparing them on a ſmall ſcale, to give a greater extenſion to his proceſſes, and to make theſe waters flow as a river, which watering our fields, would powerfully aſſiſt our manufactures of printed linens, and revive amongſt us a branch of induſtry of conſiderable importance.

" The hydrogenated waters, which contain about one-third of their volume of hydrogen gas, have no particular taſte, and require, in being uſed, the ſame precautions as the oxygenated waters. They have not hitherto appeared to me to have any very deciſive effects. I have employed them, with tolerable ſucceſs, in caſes of fever, proceeding from, or accompanied by, inflammatory irritation. They have almoſt always, in theſe caſes, evidently diminiſhed the frequency of the pulſe; but this effect, which would be very important if it was durable, never laſted long. They have

alſo

alſo ſucceeded in abating, for ſome little time, the pains of dyſuria, and thereby facilitating the evacuation of urine. They have alſo ſometimes procured ſleep; but, upon the whole, I have not ſeen yet any cure performed by their means, and the good effects which patients experience from the firſt bottles, are little or not at all ſenſible after a few days. I have heard, however, that they had effectually removed ſpaſmodic diſorders, which had reſiſted other remedies.

" I may ſay as much of the hydro-carbonated waters, which do not appear to me to differ eſſentially from the hydrogenated waters, or to be ſuperior to them in efficacy. It is ſingular, that the hydro-carbonate is not diſcoverable in the water by any taſte, provided they are carefully prepared, ſo as to prevent a taſte of empyreuma, which they eaſily contract.

" The hydro-ſulphurated waters, which are prepared by impregnating water with hydrogen gas, mixed with one ſixty-fourth part of hepatic gas, have a ſmell and taſte of rotten eggs, which makes them reſemble the ſulphureous thermal waters. I have employed them, with more decided ſucceſs than the ſimple hydrogenated or hydro-carbonated waters, in catarrhal fevers, in conſumptions, in old and inveterate coughs. But I have not yet had the good fortune to derive permanent effects from them, whether it is becauſe the remedy being diſagreeable, it is difficult to

continue

continue it long enough to obtain any conſiderable advantage; or whether, becauſe it is naturally leſs efficacious than would at firſt have been imagined; or, in ſhort, whether it may not be, that the waters are too weakly impregnated with the principal gas which diſtinguiſhes them from the other mephitic waters. They might perhaps be employed to advantage, either internally, as diaphoretics and ſolvents, that is to ſay, as favourable to the abſorption of the ſolid parts, (I have ſeen, in this reſpect, ſome good effects from them, though temporary); or externally, in the form of lotions, in herpetic diſorders of the pſoric kind.

" I have not yet employed them in this manner; but I preſume, that to render them uſeful, by external application, it is neceſſary that they ſhould be much ſtronger, which might be very eaſily effected."

In the other article above mentioned, (Bibliothéque Britannique, Sciences & Arts, vol. x.) Dr. Odier expreſſes himſelf as follows:

" I beg leave to take this opportunity of recommending to the attention of Phyſicians, a mode of oxygenation, much more convenient than that which is obtained by the pneumatic method. I mean the oxygenated waters, which we continue to uſe in a very extenſive and ſucceſsful manner.

1ſt, " We

" 1ſt, We every day witneſs their good effects, in caſes of ſpaſms in the ſtomach and inteſtines, and eſpecially thoſe that attend hyſterical affections, and proceed from debility, rather than from plethora, or any irritating cauſe. I cured, by means of theſe waters, a Spaniſh lady, from 25 to 30 years of age, who had been for a length of time daily attacked with violent ſpaſms, which were originally brought on by ſtrong emotions of mind, and afterwards conſiderably increaſed by fatigue, and continual vomitings, which ſhe had ſuffered in a ſea voyage. All the known antiſpaſmodics had been uſed without ſucceſs; at length the oxygenated waters were tried, which ſoon produced a complete cure.

" 2dly, Theſe waters have been found uſeful in affections of the cheſt, of an aſthmatic, rather than of a conſumptive nature. I ſaw a woman of 55 years of age, who had been ſubject for many years paſt to difficult reſpiration, attended with occaſional fits of coughing and ſuffocation, take theſe waters, and derive a relief from them, which no other remedy had been able to afford. I knew likewiſe a gentleman about 50, rather of a weakly conſtitution, who, in conſequence of a catarrhal fever, had ſuffered for a long time, from a weakneſs in the cheſt, ſo that the leaſt effort of voice fatigued him extremely, an inconvenience he felt the more ſeverely, being profeſſionally

obliged to give leſſons, when he could neither ſpeak nor read aloud, without extreme fatigue. He had a conſtant ſenſation of cold, numbneſs, and weakneſs in the legs and thighs. After having unſucceſsfully tried ſeveral other remedies, I at length uſed the oxygenated waters, which anſwered perfectly well, and procured him very conſiderable relief.

3dly, "The oxygenated waters have alſo appeared to me very uſeful in caſes of weakneſs and lingering convaleſcence, after febrile diſeaſes; and when the patient, without having any local complaint, found it difficult to regain his ſtrength, his appetite, and ordinary ſpirits. I have taken them myſelf after an ague, which had weakened me conſiderably, and I derived very good effects from them.

4thly, "They have ſucceeded extremely well as diuretics, in caſes of anaſarca, accompanied with oppreſſion and livid countenance. One of my colleagues attended a patient, labouring under a diſorder of this nature, who had taken ſeveral remedies without effect, and whom the oxygenated waters cured as it were by enchantment, by producing an abundant evacuation of urine. This cure, which was effected ſeveral months ago, has proved permanent.

"When I began to uſe the oxygenated waters, I obſerved that, with ſome patients, it brought on diſtinct ſymptoms of dyſuria. I have ſince found,

however, that this remedy ſeldom produces ſuch an effect; and, on the other hand, I have ſometimes ſucceſsfully uſed the hydrogenated waters to allay this ſymptom.

" However, neither the hydrogenated waters, nor the carbonated, nor even the hydro-ſulphureous, have hitherto appeared to me efficacious remedies in thoſe caſes, in which they have been uſed. The oxygenated waters alone have completely anſwered the hopes we had conceived of them, and that to ſuch a degree, that M. Paul has already diſpoſed of a conſiderable quantity of theſe waters. They are contained in bottles of the capacity of about one pint, which, by the means of compreſſion, invented by this ingenious mechanic, are impregnated with half their volume of pure oxygen gas. Patients take one or two of theſe bottles in the day. I conſider this remedy as a valuable acquiſition, that will, no doubt, prove permanent in practice. I am far however from thinking, that we have yet any clear notion of the manner in which it operates. Does the oxygen actually paſs into the chyle, and from hence into the blood? Or does it act merely on the ſtomach, and the inteſtines? Its effects appear ſo quick, that I ſhould be rather inclined to adopt the latter opinion. In this point of view, there would be but a very diſtant connection between this mode of adminiſtering oxygen, and the oxygenation of the blood by the lungs. But ſuch is

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the origin of moſt diſcoveries. We ſeek for one thing, and find another."

NOTE C.—Page 16.

In the month of July, 1800, the ſame year in which this Report was read before the Inſtitute, another Report on the ſame ſubject was preſented to the SOCIETY OF MEDICINE OF PARIS, the ſubſtance of which perfectly coincided with the former. But from the account this Report gives of the formulæ, employed in the fabrication of the waters, it will be ſeen that ſome ſlight changes had already been effected in the formulæ, in conſequence of the hints ſuggeſted in the Report to the Inſtitute. In the Seltzer and Spa waters, the carbonate of lime had been ſuppreſſed; and, on the other hand, the following new varieties of waters had been added, either to be drank, or uſed as baths:

Water of Vichy.

Carbonic acid by effervescence, twice its volume.
Carbonate of Lime, ... 2 grains
Carbonate of Magneſia, . . ½ gr.
Carbonate of Iron, ... 1/16 gr.

Carbonate of Soda, ... 24 grs.
Sulphate of Soda, ... 6 grs.
Muriate of Soda, ... 4 grs.

Water of Buſſang.

Carbonic acid by efferveſcence, 3 times its volume.
Carbonate of Soda, ... 6 grains
Carbonate of Iron, ... $\frac{1}{8}$ gr.

Water of Vals.

Carbonic acid by efferveſcence, 3 times its volume.
Muriate of Soda, ... 13 grains
Sulphate of Iron, ... $\frac{1}{2}$ gr.
Sulphate of Alumine, . . . $\frac{1}{2}$ gr.
Carbonate of Iron, ... $\frac{3}{4}$ gr.

Water of Contreaeville.

Carbonic acid by efferveſcence, one-twelfth part of its volume.
Sulphate of Lime, ... 6 grains
Carbonate of Lime, . . . 4 grs.

Water of Balaruc.

Carbonic acid by efferveſcence, twice its volume.

Calcareous

Calcareous Earth	4 grains.
Muriate of Soda	12 grs.
Carbonate of Pot-aſh . . .	4 grs.

Water of Plombiéres.

Carbonic acid by efferveſcence, one-twentieth part of its volume.	
Sulphate of Lime	3 grains
Carbonate of Lime	2 grs.
Sulphate of Magneſia . . .	1 gr.

Water of Barége.

This water contains in each bottle 10 or 12 drops of the following preparation:

Common water	8 ounces
Sulphate of Soda	½ dram
Carbonate of Soda	2 ounces
Muriate of Soda	2 drams
Oil of Petroleum	12 drops.

The Report of the Society of Medicine, from which the foregoing ſtatement is extracted, concludes as follows:

" From the report you have juſt heard, we pro-
" poſe to the Society to give to the eſtabliſhment
" of Meſſrs. Paul and Co. for the preparation of
" artificial mineral waters, the moſt authentic ap-
" probation, acknowledging the excellence of
" their methods, the perfection of their products,

" and

" and the utility which both national intereſt and " the health of Citizens may derive from their " enterprize."

(This Report is ſigned) PELLETIER,
FOURCROY,
P. JOSSE,
DELUNEL,
LAFISSE.

NOTE D.—Page 23.

The quantity of gas condenſed in the water, in the firſt inſtance, is exactly indicated during the operation by the nature of the proceſs itſelf. As for the deficiency of gas obſerved by the reporters, on examining the contents of the bottles, they have partly accounted for it themſelves. I have only to remark, that in order to extract all the gas from the water in which it has been condenſed, I have found that the combined aſſiſtance of a boiling heat, and of the pneumatic pump, were abſolutely required; and the apparatus alluded to in the report, is adapted to this double purpoſe. But even with the aſſiſtance of this apparatus, I have reaſon to believe that a portion of gas always remains intimately united with the water, in which it is detained, partly by the earthy ingredients, partly, perhaps, by the water itself.

NOTE

NOTE E.—Page 25.

I have occaſionally tried to ſuppreſs the earthy carbonates, in conſequence of the objection ſuggeſted, in the Report on the ſuppoſed inutility or noxious effect of theſe ſalts. But ſeveral medical men having had reaſon to ſuſpect that the waters were not always ſo effectual after this ſuppreſſion, I ſhall continue to add theſe ſalts whenever phyſicians ſhall not think proper to order their ſuppreſſion.

NOTE F.—Page 26.

The reaſon why an earthen cylinder has not, in this operation, been preferred to an iron one, is, that the former, from it's porous texture, particularly when expoſed to a ſtrong heat, cannot anſwer the purpoſe near ſo well as one made of caſt iron. But care is taken that the cylinder be previouſly ſo oxydated as to be very unfit for decompoſing water, and the very ſmall portion of hydrogen that may ſtill be diſengaged, has never been found to alter in the ſmalleſt degree the good qualities of the water. Perhaps, upon further examination, this ſuppoſed portion of hydrocarbonate may be found to conſiſt partly of the gaſeous oxyd of carbone, which has lately attracted the attention of Chemiſts. This, however, is but a

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mere conjecture, which I ſhall take the earlieſt opportunity of verifying by experiment.

NOTE G.—Page 31.

Some ſulphureous or hepatic waters are found in Italy, which appear to be conſiderably ſtronger than any of thoſe that are found in other parts of Europe. In the month of Auguſt, 1801, the Medical Society of Paris gave, in their journals, an account of a work of conſiderable length, ſoon to be publiſhed, on the mineral waters of Naples or its environs. The author of this Treatiſe (which I underſtand is now printing) is ATTUMONELLI, Profeſſor of Phyſiology, and Phyſician to the chief hoſpital of Naples. It appears from his account, that Nature has brought together, in that particular ſpot, all the ſtrongeſt remedies of this ſort that ſhe has ever been known to produce; the ſulphureous waters containing (according to the analyſis given in the extract of the work juſt quoted) no leſs than *once and three quarters* its own bulk of ſulphurated hydrogen, with *once and a half* its bulk of carbonic acid gas. The chalybeate waters of Naples ſeem alſo to contain a much larger proportion of iron and carbonic acid gas, than any of the mineral waters hitherto analyſed.

The Medical Society gave, in the report juſt quoted, a very favourable account of Profeſſor Attumonelli's Work.

NOTE H.—Page 34.

As it may be intereſting to the Reader to have an opportunity of comparing the opinion delivered in this Report, by the French philoſophers, on the imitation of mineral waters, with that of the lateſt Engliſh medical authors on the ſame ſubject, I ſhall tranſcribe here the following paſſage from Dr. SAUNDERS's valuable work on the MEDICINAL EFFECTS OF MINERAL WATERS, in which he has pointed out in the fulleſt manner, both the advantages that may reſult from the artificial imitation of thoſe waters, and the difficulties, which, in ſome inſtances, we may ſtill encounter in attempting it.

" The compoſition of the moſt celebrated mineral waters having been known by accurate analyſis, ſeveral ingenious men have endeavoured to confirm their experiments by ſyntheſis; and to produce, by artificial means, a compound, in all reſpects ſimilar to the natural preparation. To

this too was added the additional motive of being able to ſupply the want of the natural waters, in places, and at times when theſe could not be procured. The illuſtrious Bergman, in his excellent treatiſe on mineral waters, has given very good ideas on the method of preparing them artificially; but ſome of the proceſſes which he propoſes, are imperfect, and liable to objections. Where the water to be imitated is only a ſolution of ſome neutral ſalts, ſuch, for inſtance, as the Epſom, Sedlitz, or Sea water, all that it is neceſſary to know, is the proportion in which they are contained in the natural ſpring; but the proceſſes of nature are not always imitated with ſo much eaſe. A greater difficulty lay in the way, which was, that of impregnating water with gaſeous ſubſtances to as complete a ſaturation, as is found in ſome of the moſt powerful mineral ſprings. This every chemiſt knows to be a very difficult object to attain, and impracticable with any of the more common apparatus now in uſe for ſuch purpoſes; but, under particular management, it has been attained, and ſome of the ſpecimens of artificially carbonated water that are to be ſeen, appear fully to equal in this reſpect the natural waters of Pyrmont or Seltzer. The ſaline and chalybeate principles may alſo be eaſily added, and the imitation will be complete for all medical purpoſes.

" Theſe artificial compoſitions have defects as well as advantages. With regard to the former,

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we may obſerve, that it is always difficult to hit the ſame point of ſaturation with gas, and with the ſubſtances which the gas is to diſſolve; and this is particularly the caſe with every degree of ſaturation below the higheſt. Thus then, theſe medicines will not be ſo conſtantly the ſame as the natural ſprings; for uniformity of compoſition is a very conſpicuous feature in almoſt every one of theſe. However, as it is generally the *defect* of the natural waters to be too weak in theſe active ſubſtances, and as no material inconvenience appears often to ariſe from an exceſs of theſe gaſes, it is probable that with tolerable caution, theſe ſubſtitutes might be generally adopted, if requiſite.

"There are ſome kinds of chemical mixture, however, which art has not been able to imitate: the ſuſpenſion of ſiliceous earth in water, a curious and wonderful phenomenon in the hiſtory of many of the thermal ſprings, is a ſtriking example of this. If ſiliceous earth, apparently ſo inert and inactive on the body from its great difficulty of ſolution, ſhould ever be found to poſſeſs any medicinal properties, this will form a marked difference between the natural and artificial medicated waters. Perhaps the ſuper-ſulphurated waters of Aix, combined as they are with ſoda and with a high degree of heat, would exerciſe all the powers of the beſt chemiſt to imitate with ſucceſs. Several other combinations might be pointed out, in which,

if *perfect* accuracy of reſemblance were required, we ſhould ſtill find the imperfection of art. Again, there is another caſe in which the natural water has a great advantage over the artificial; and this is, in ſome of the very compound thermal ſprings that are uſed for bathing as well as for a drink. It muſt be more difficult at all times to prepare a hot than a cold artificial water; and for the purpoſes of the bath, much advantage is gained by having a large body of water, as at Bath, Aix, and the like, where the patient can move his limbs about freely when immerſed, and is ſurrounded with an atmoſphere of ſteam, mixed with the volatile gaſeous contents of the water, and where the heat is kept up much more permanently and uniformly.

"On the other hand, ſome peculiar advantages may be gained by the artificial preparation of medicated waters. Several of the moſt valuable natural ſprings contain ſubſtances which are either uſeleſs or poſitively detrimental. Pyrmont water, for inſtance, contains thirteen grains in the pint of calcareous ſalts, which render it very hard; and hence it may certainly prove inconvenient to ſome conſtitutions. Other neutral waters contain ſo little of their moſt active ingredient, as to require often an inconvenient bulk of liquid to produce the deſired effect; as for example, where Scarborough or Epſom water are uſed as purgatives. All theſe defects may be remedied in the artificial preparation,

preparation, by leaving out the uſeleſs and noxious matter, and encreaſing that in which the proper medicinal virtue reſides. Art likewiſe can prepare out of the ſame materials, new compounds, which would be conſidered as valuable natural treaſures, were ſuch found. Of this kind, I ſhould reckon a moderately dilute ſolution of a neutral ſalt, (vitriolated magneſia for inſtance) fully ſaturated with carbonic acid. This makes a very valuable addition to its powers as a medicine, from the known operation of this gaſeous acid in quieting irritation of the ſtomach, and rendering the ſurface of the body more cool and perſpirable; and beſides, it powerfully corrects the nauſeous taſte, which is in many inſtances a material objection to the neutral ſalts, eſpecially to a daily uſe of them as a gentle evacuant and alterative.

" One more advantage I would mention, which the artificial preparation of theſe medicines would promiſe, and this is, that of introducing much more ſimplicity in their compoſition than nature employs, and by this means we may be materially aſſiſted in forming preciſe ideas of the operation of every part of theſe important claſs of remedies, which the reader will readily ſee is a great object to be deſired by the philoſophical enquirer into the powers of medicine. Every one who examines into this ſubject, muſt be ſtruck with the great inaccuracy and confuſion of ideas that pre-

vail in the deſcription of the operation of mineral waters, and the great ſimilarity of effect aſcribed to very different ſpecies of this large and heterogeneous claſs of bodies. It has been my object in the preceding pages, to attempt in ſome degree to introduce more preciſion in inveſtigating the powers of theſe bodies; but the ſubject can never be fully canvaſſed, till we are in poſſeſſion of a greater number of facts founded on experiment; and to promote this deſirable end, the aſſiſtance of art in imitating the proceſſes of nature, may be called in with every proſpect of advantage. In this view, therefore, the ſtudy of the method of preparing mineral waters may be recommended to the medical enquirer as an intereſting object of inveſtigation.

" For the practitioner, who entertains a decided preference for the medicated waters which nature preſents, we may ſuggeſt the convenience of occaſionally mixing different kinds of the ſimple waters, in order to obtain the effects of ſome of the more compound, which may not be at all times procured. Thus a Spa or Pyrmont water, mixed with that of the Sea or Epſom, will make a good imitation of the Cheltenham or Scarborough ſpring, according to the proportion uſed; as the one furniſhes in abundance the carbonic acid and the iron, and the other, the neutral purgative ſalt; and each of theſe contain ſo much of their active ingredients as to bear dilution, and yet to retain

conſiderable

conſiderable efficacy. The ſynoptical table, which is added to the chapter on the particular waters, will, it is hoped, afford ſome aſſiſtance in this object.

" There is nothing more gratifying to the phyſician, who conſiders the healing art in its true light, that of an experimental ſcience, than to be able to add to the general ſtock of profeſſional knowledge, information which is to be afforded by the aſſiſtance of a collateral ſcience. Of theſe, none is more intimately connected with medicine, by a community in many of the objects, than chemiſtry; and the aids which this ſcience furniſhes, are conſtantly encreaſing, on account of the rapid accumulation of experimental knowledge. An enquiry into the nature and right application of mineral waters, is certainly not one of the leaſt important objects of phyſic; ſince theſe are remedies that have been at all times peculiarly favourites with the public, and have deſerved, from their real efficacy, much of the eſteem in which they have been held. The ſubſtances concerned in the compoſition of theſe waters, are ſuch as come particularly under the accurate and diſtinguiſhing eye of modern chemiſty, and admirably illuſtrate ſome of its moſt beautiful diſcoveries. They have engaged the attention of the ableſt chemiſts for many years in various countries, and the importance attached to theſe enquiries, has

abundantly

abundantly repaid the labour and difficulty of the reſearch.

" Impreſſed with the idea, that the ſcience of of chemiſtry has done more to illuſtrate this, than almoſt any other claſs of natural ſubſtances that are uſed medicinally, it has been my wiſh in the foregoing pages to lay before the public a general view of our preſent ſtate of knowledge on this ſubject; in order to aſcertain, with ſome preciſion, the practical advantage to be derived from theſe facts. Viewing, with ſome regret, the apparent ſlight which has been thrown upon theſe enquiries by ſome, whoſe profeſſional knowledge attaches much weight to their opinions, I have endeavoured to clear away ſome cauſes of error, ariſing from too partial and confined a view of the ſubject; in order that the leading features of medical chemiſtry, attached to theſe enquiries, may be rendered more conſpicuous; and my object in undertaking this work will be anſwered, if theſe pages will at all contribute to the advancement of the healing art."

THE END.

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