CXVI. *An Account of a Treatiſe, in* Latin, *preſented and dedicated to the* Royal Society, *intituled,* "Gottlob Caroli Springsfeld, "M. D. &c. &c. commentatio de pre- "rogativa Thermarum Carolinarum in "diſſolvendo calculo veſicæ præ aqua cal- "cis vivæ," *by* William Watſon, *Member of the Royal Academy of Phyſicians at* Madrid, *and F. R. S.*

Read Dec. 23, 1756.

DR. Springsfeld's Treatiſe, which he lately communicated to the Royal Society, contains a ſeries of experiments and obſervations upon the Carlſbad waters in Bohemia, as a ſolvent for the ſtone in the bladder; from whence it appears, that theſe waters have that property in a much higher degree than even lime-water. The Carlſbad waters have been long celebrated for their excellent effects in removing, or at leaſt relieving, many of the diſorders to which mankind is ſubject. How high they ſtood in the opinion of the great Hoffman almoſt every part of his writings bears teſtimony; and if to their other before-known properties they ſhould prove a ſafe, eaſy, and effectual ſolvent for the ſtone in the kidneys and bladder, it certainly would greatly enhance their value.

Our author has very attentively conſidered the writings of Doctors Jurin, Hales, Hartley, Whytt, and others, concerning ſolvents for the ſtone. He has adminiſtred to ſeveral patients, with little or no

ſucceſs, the late Mrs. Stephens's medicine, with the ſtricteſt obſervance of all the cautions, ſaid to be neceſſary in courſes of that medicine. And, though he allows every thing to be true that has been laid down by Dr. Whytt and others in relation to oyſter-ſhell lime-water, he does not ſcruple to aſſert, that the Carlſbad waters, which, as will hereafter appear, have great analogy to calcarious waters, are a far more excellent ſolvent for the ſtone in the kidneys and bladder than any lime-water. Of this truth he is ſatisfied by various experiments, ſeveral of which were made by himſelf alone, and others in conjunction with our learned and ingenious brother Dr. Lieberkuhn, whoſe exactneſs as well as fidelity in making experiments of this kind no one will queſtion.

Dr. Springsfeld, in a treatiſe upon the Carlſbad waters, publiſhed by him in the year 1749, has ſhewn by undoubted experiments, that theſe waters partake always of an alcaline principle; for every pint of them, beſides the neutral purging ſalt, contains three grains of alcaline ſalt, and ten grains of calcarious earth; for which reaſon they ferment with every ſpecies of acids. I before mentioned, that theſe waters have great analogy with lime-water; and if they continue in the baths for any conſiderable time, they not only turn milky, like lime-water, but have a pellicle upon them as that water is obſerved to have. They have likewiſe a gently conſtringing taſte; that was it not for their ſaline taſte they could not eaſily be diſtinguiſhed from lime-water.

It muſt here be premiſed, that all hard bodies, viz. pieces of wood, bone, ſtones, earthen veſſels, bits of ſtraw, and ſuch-like, are incruſted over by lying

lying in the Carlſbad waters, and that in a very little time. Theſe bodies in the ſpace of a night will be covered with a tophaceous cruſt, which continually increaſes. But human calculi, though hard in themſelves, are not incruſted thereby; but are rather diſſolved; which is the more remarkable. The ſame effects are obſerved upon pieces of the hardeſt cheeſe, which ſwell in theſe waters, and are changed into a kind of pultice.

In the treatiſe before us our author has given the detail of many experiments, which prove the ſolvent power of theſe waters. I ſhall lay a few of them only before you, from which an opinion both of our author's exactneſs in making them, as well as how far he is juſtified in his concluſions, may be formed. And here I muſt obſerve, which ſhould be a very comfortable conſideration for the inhabitants in theſe parts, that our author has been obliged frequently to ſuſpend his reſearches for want of human calculi, which is a diſeaſe exceedingly rare in Bohemia.

June 20, 1749. A ſtone of a brown colour, which weighed near two ounces and half, was placed in a china baſon near that ſource, which is called Brudel, in ſuch a manner as to be continually covered with the warm water. Upon the next day the external cruſt began to grow ſoft; upon the third, you might make an impreſſion thereupon with your nail as upon cheeſe; upon the fourth and fifth, it was diſſolved to the nucleus; upon the ſixth, the nucleus itſelf was diſſolved, and in the bottom of the baſon there was left a white viſcid maſs, like pultice, or newly ſteeped cheeſe: this was impalpable between the

the fingers. In this time the baſon was incruſted with a very hard tophaceous maſs, of the thickneſs of a quill. Certain calculi, not bigger than peaſe, were diſſolved thoroughly, ſome in one day and the reſt in two.

1750. June 12. A ſtone, weighing more than half an ounce, was placed in the ſame manner as the former, and not a grain of it remained on the fourth day. At this time a clergyman, who was in a courſe of theſe waters for gouty complaints, voided ſix ſtones, which all were diſſolved in the ſame manner.

A nobleman, who was afflicted with bloody urine, from calculi in the kidneys, came to Carlſbad for the relief of his complaints; and brought with him ſome ſmall calculi, which he had voided a few years before. By Dr. Lieberkuhn's advice Dr. Springsfeld divided theſe calculi into four equal parts, each of which weighed ſix grains. One part of theſe was infuſed in the water of the ſource called Brudel; the ſecond, in the New Spring; the third, in that near the mill. In twelve hours the firſt part had loſt five grains; the ſecond, four; and the third, only one grain. The fourth portion was put upon a linen rag, which was ſtretched over the bottom of a funnel. Into this funnel the nobleman was directed to make water every day before dinner, after his having drank his quantity of Carlſbad water. Upon this, theſe calculi, after eight days, had loſt two-thirds of their weight; viz. four grains. It muſt be here remarked, that this nobleman, during the regimen, did void ſeveral ſmall calculi, which he had not done for ſome years. A larger quantity of bloody urine than uſual attended the parting with theſe ſtones; but

but this continued only two or three days, and afterwards went quite off; and this nobleman from that time was relieved from his former complaints, has enjoyed and does yet enjoy the moſt perfect health.

In the year 1754, our author became poſſeſſed of a calculus, which was of a flinty hardneſs, and bore a bright poliſh. It weighed a quarter of an ounce. He conjectured, that a much longer time would be neceſſary to diſſolve this ſtone; but what was very remarkable it diſſolved ſooner than the reſt: for after having been immerſed twenty-four hours, two grains of it only remained undiſſolved. This ſtone was not placed in the china baſon as the others were, but ſuſpended in a little looſe-woven net, that it might more freely be waſhed by the water. Dr. Lieberkuhn was at this time at Carlſbad; he was preſent at this experiment, and was witneſs of its truth. The net uſed in this experiment was covered with a tophaceous cruſt, from being ſteeped in the water.

The next year, when Dr. Lieberkuhn returned to Carlſbad, he brought with him, for experiment-ſake, ſeveral calculi, ſome of which were large ones. He made there many experiments, in which our author aſſiſted. A large ſtone was ſawed into four pieces nearly equal. One of theſe, weighing 99 grains, was put into a little linen bag, and immerſed in the ſource called Brudel: the ſecond, in like manner, which weighed 96 grains, into that called the New Spring: the third, weighing 93 grains, into that near the mill: the fourth was ſet apart for other trials. After four days immerſion they were ſeverally examined. The firſt had loſt 85 grains; the ſecond,

thirty-

thirty-three grains; the third, only 16 grains. That it might be eſtimated in what degree the ſolvent power of the Carlſbad water did exceed that of lime-water, the following experiment was tried. Three pieces of calculi, each exactly thirty grains in weight, were put into ſeparate phials. Upon one was poured ſome freſh egg-ſhell lime-water: upon the ſecond, ſome Carlſbad water: upon the third, ſome of the urine of a perſon daily drinking theſe waters for the recovery of his health. Theſe phials were all placed in one of the canals, which carries off the waſte water from the baths: the degree of heat in this place was by Fahrenheit's thermometer 96, much the ſame as the heat of human blood. The lime-water, the Carlſbad water, and the urine, were changed every day, and the proceſs continued for fourteen days. Upon the fifteenth, the remaining fragments of ſtone were taken out of the phials, and weighed when dried. The piece macerated in lime-water had loſt one grain: that in the Carlſbad water, ſix grains: that in the urine, five grains. According therefore to this experiment the ſolvent power of the Carlſbad water was ſix times, that of the urine five times greater than that of the lime-water.

The ſolvent power of medicated urine is of very great importance, and requires more particular attention; as our greateſt expectations in diſſolving the ſtone in the bladder muſt ariſe from that. It was therefore very fit that our author ſhould inveſtigate, as far as was in his power, the ſolvent property of the urine of thoſe who drank theſe waters. He therefore ſuſpended to the end of a funnel a ſufficiently hard and compact calculus, weighing about an ounce.

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This was contained in a linen rag, ſo that the urine might readily paſs over it; and a perſon, who uſed the Carlſbad waters every morning, after having taken them, conſtantly made water into that funnel; from whence it came to paſs, that on the ſixteenth day the ſtone was half diſſolved, and the remaining part was become ſo porous and friable, that it almoſt fell to pieces. No one can ſuppoſe that the urine of a man perfectly in health would have the ſame ſolvent property; leſt however that ſhould happen, our author ſuſpended a piece of a calculus, weighing two drams, in the ſame manner with the preceeding, and made water upon it himſelf many times a day: but this piece of calculus, after twelve days, was ſo far from being leſſened, that it had increaſed two grains in weight.

Our author, leſt he ſhould be thought to have depended too much upon one ſet of experiments, made others. Among ſeveral calculi, which Dr. Lieberkuhn had communicated to him, there was one exceedingly hard. This he cut into four parts, each weighing exactly eighty grains. Each of theſe was put into a ſeparate phial. Upon the firſt was poured freſh oyſter-ſhell lime-water: upon the ſecond, Carlſbad water: upon the third, the urine of one who drank theſe waters: upon the fourth, the urine of one perfectly in health, and who only drank for his breakfaſt ſome cups of tea. Theſe phials were placed in the ſame manner with thoſe before-mentioned, and their heat kept conſtantly the ſame. Every day theſe calculi had freſh liquid poured upon them after the old was ſeparated. At the end of twenty days theſe ſtones were dried and weighed. The fragment in-

fuſed in oyſter-ſhell lime-water was found to have loſt almoſt three grains: that in Carlſbad water twenty-two grains: that in medicated urine fourteen grains: but that infuſed in the urine of the man in health had increaſed three grains. Theſe experiments therefore leave no room to doubt of, either the ſolvent power of the Carlſbad water itſelf, or that of the urine of thoſe who drink theſe waters.

Our author has a very curious remark in relation to a perſon who laboured under the ſtone, and who drank theſe waters for two months. He daily voided with his urine a large quantity of white viſcid mucus; which, after filtration of the aqueous parts from it, was found to be a white earthy powder, rubbed off as it were from a ſtone. The quantity of this powder ſaved during the ſpace of a month amounted to more than three ounces. If ſome of this powder was put into the urine of one who drank Carlſbad water, it was immediately converted into a pultaceous ſubſtance; but if into that of one, who did not drink this water, it fell quite undiſſolved to the bottom of the veſſel.

Dr. Springsfeld obſerves, that the Carlſbad water has great power in diſſolving the tophaceous cruſt, which frequently covers the teeth. During the courſe of theſe waters, this cruſt moſt generally ſeparates from the teeth, and falls off.

However great the power of theſe waters are in diſſolving the ſtone in the bladder, they have a quite contrary effect upon gall ſtones. So far from diſſolving theſe laſt, our author has frequently found that theſe waters envelope them with their tophaceous cruſt. Our ingenious brother Dr. Whytt has obſerved,

obſerved, that lime-water has no ſolvent power upon gall ſtones. Hence we draw another proof of the analogy of lime-water with Carlſbad water.

If it ſhould be wondered at, how it comes to paſs that the urine of thoſe who drink theſe waters ſhould have the power of diſſolving the ſtone, it is neceſſary to inform our readers, that this urine contains nearly the ſame properties which the water originally had. It has before been obſerved, that theſe waters are impregnated with an alcaline principle, and conſequently ferment with acids. The urine of thoſe who drink them, if made before dinner, has the very ſame quality as our author has frequently experienced; eſpecially if the accuſtomed quantity of water is taken, and nothing elſe is drank upon them. The cuſtomary doſe at Carlſbad is not leſs than ſix, ſeven, or eight pints of water taken every morning: for which reaſon we are not to wonder that the urine has the property of diſſolving the ſtone in the kidneys and bladder, if it is long retained. And our author makes no ſcruple, but that the injection of theſe waters into the bladder would be very powerful in relieving calculous complaints; though this he had never tried; neither was he much induced thereto, as the urine is poſſeſſed of all the powers which he was in ſearch of.

It remains that we juſt take notice, by what means theſe waters are poſſeſſed of their ſolvent power. It is well known, that acids, more eſpecially mineral ones, do diſſolve animal calculi, by acting upon their terreſtrial parts, dividing their maſſes, and becoming neutral thereby. Theſe effects do not ariſe from alcalies, as they leave terreſtrial ſubſtances untouched.

If ſometimes we carefully attend to the operations of nature, we now and then make diſcoveries which muſt otherwiſe have eſcaped us. If we pour nitrous or vitriolic acid upon that ſtoney ſubſtance, which is uſually called crabs-eyes, and let them remain in the glaſs for a conſiderable time perfectly ſtill, we ſhall find at the bottom of the veſſel, after the terreſtrial parts are thoroughly diſſolved, a membranous ſubſtance or jelly, exactly in ſize and figure reſembling the crabs-eyes, and which the acid had left untouched. Exactly ſuch a gelatinous maſs our author has obſerved in ſtones of the bladder, more particularly in ſmall ones, after diſſolving them in acids. If crabs-eyes are infuſed in an alcaline lixivium for a conſiderable time, we ſee no change in them, which can be properly called a ſolution: about them we obſerve a certain viſcid appearance like a cloud; if that is taken away, and the crabs-eyes are dried, and afterwards weighed, they have not only loſt part of their weight, but are become much more friable; which is a great argument that they have loſt ſomething. If afterwards theſe crabs-eyes are waſhed with warm water, to carry off the alcaline matter adhering to them, and afterwards ſet to diſſolve in acids, theſe crabs-eyes, after the ſolution of their terreſtrial parts, leave nothing gelatinous behind them, as they did in the other experiment; from whence it is plain, that the gelatinous ſubſtance had been extracted and diſſolved by the alcaline lixivium. The very ſame thing happens to the human calculus.

It appears therefore more than probable to our author, that lime-water and Carlſbad waters, on account of their alike partaking of the alcaline and calcarious

principle,

principle, do diſſolve the before-mentioned animal gluten only, by which the terreſtrial parts are united together; and upon the ſolution of which theſe parts muſt ſeparate and fall aſunder. From hence may be accounted for alſo the origin of that white viſcid matter, which adheres to the bottom of the veſſel like pultice, after the diſſolution of calculi in the Carlſbad waters; and which is nothing more than the terreſtrial parts of the ſtone deprived of the animal gluten, which makes them adhere together. Hence we ſee the reaſon why our predeceſſors adopted two ſorts of lithontriptic remedies, and thoſe of quite oppoſite properties. Baſil Valentine, Paracelſus, Helmont, and others, adminiſtered alcalies: Sylvius, Laurembergius, and Dippelius, acids. By theſe laſt they attempted to diſſolve the terreſtrial parts; by the former, the connecting gluten. But the caſe in gall ſtones is different: their connecting gluten, which unites the bilious parts, is not an animal jelly, as in the *calculus veſicæ*, but a fat inflamable oil, which is neither diſſoluble by the Carlſbad waters nor by lime-water.

Our author conjectures that he has proved demonſtratively, that the ſolvent power of the Carlſbad waters does exceed that of lime-water; beſides which it has this advantage, that it is not in the leaſt nauſeous, and may be continued, if neceſſary, for ſix or eight months, without any other inconvenience than that of drinking them upon the ſpot; which may indeed oblige perſons whoſe dwellings are remote from Carlſbad to take a journey thither; whereas lime-water may be drank at home.

I have been the more copious in my account of the work before us, as the ſubject of it is very intereſting; one, in which ſome of our brethren have remarkably diſtinguiſhed themſelves, which occaſioned Dr. Springsfeld to dedicate his performance to this learned Society. The experiments in his work, of which there are many, are well deviſed, and to appearance carefully executed. He has not attempted to amuſe us with vain and fruitleſs ſpeculations; but, on the contrary, has nobly turned his thoughts towards obviating the diſtreſſes, and relieving the miſeries, to which human life is unhappily ſubject.

W. Watſon.

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