immunity from suppuration, when injections are employed. If metallic substances are to be used for the cure of hydrocele, it therefore appears to me that a safer method would be, to draw off the fluid by the ordinary trochar and canula, and then insert through the puncture a probe, or some small metallic body. This in time might excite sufficient adhesive inflammation, and at all events be only half as likely as the seton to cause suppuration. In the time of Pott, a somewhat similar idea was proposed, but laid aside as inconvenient and sometimes dangerous. The hydrocele was tapped in the usual way, but the canula was allowed to remain in the sac till sufficient inflammation was supposed to have ensued. But the canula being a hollow body, enabled the interior of the cavity to communicate directly with the external air, a very important disadvantage, I should say.

I merely throw out this suggestion for those who are dissatisfied with the treatment by iodine injection; for I shall conclude by stating, that I am myself perfectly well contented to abide by that long valued and, in my experience, sufficiently successful and safe operation.

ARTICLE IV.—*On the Temperature of Mineral Waters.* By J. ALTHAUS, M.D., Member of the Royal College of Physicians of London, etc.

THE temperature of mineral waters exercises a most important influence upon the mixture and proportion of the solid and gaseous constituents they contain, and no less upon their effects on the human body. A low temperature enables the springs to hold in solution a large quantity of carbonic acid, and, consequently, to take up a large amount of the carbonate of lime, of magnesia, of oxide of iron, and other substances which are otherwise insoluble; while, on the other hand, an elevated temperature exalts the active powers of the waters, and renders them more stimulant, sometimes to such a degree that it is necessary to deprive them of part of their heat by previous cooling, especially if they are administered to sensitive persons. It is not, however, my object in this place to consider fully the temperature of the spas in all its bearings upon their composition, their physiological effects, and their therapeutical properties, nor to discuss the various theories which have from time to time been put forward by philosophers concerning the cause of the heat of thermal springs. I will only make a few remarks on the oft-mooted question,—Whether the heat of certain mineral waters is identical with ordinary heat, or whether the former possesses peculiar properties? There are great authorities on both sides: as Hufeland, Rullman, Kopp, Pattissier, and others

asserted that there was a difference between the two; while Struve Bischoff, Alibert, and others denied such to be the case.

The reason for first assuming a difference between ordinary heat and that of hot springs, was the circumstance that the indifferent thermal waters, namely, such as contain scarcely any solid ingredients, were proved to possess most remarkable curative properties, which did not belong to ordinary water of the same temperature. From this it was concluded that, until physics and chemistry should show other causes to account for these effects, the peculiar kind of heat possessed by the spas must be considered the cause of their therapeutical powers. This opinion seemed to be the more plausible, as certain experiments which were made on the nature of thermal heat went far to prove that there was indeed such a difference.

On going back to the sources, it appears that Paracelsus was the first to originate the theory of a heat peculiar to mineral waters. But it was especially Duclos, physician to Louis XIV., who first analyzed the more important mineral springs of France, who supported such theories. He stated, as the result of his experiments on this subject, that hot spas did not burn the mouth and tongue in the same degree as water heated by fire; that mineral water had not the same action upon certain delicate substances as common hot water; that sorrel-leaves, for instance, which became soft, and were easily cooked in ordinary warm water, did not soften in the thermal waters of Néry-en-Bourbonnais, which were the hottest in France, but, if put in it, became yellow, like dead leaves. Another remarkable circumstance maintained was, that the thermal waters were hotter at night than in the day, and that they lost their heat more slowly than water heated by fire, if they were exposed to the air at a distance from the springs. Finally, that it took just as much time to make hot mineral water boil as ordinary cold water. The explanations which Duclos gave of these phenomena, are, as might be expected, quite untenable; thus, for instance, he thought that thermal waters did not boil quicker than common cold water, because the fire had first to expel the hot vapours mixed up with them before they could boil. However, as Duclos wrote in 1675, we must not too severely criticize such explanations, as they were quite consistent with the then state of physical science. But the same tribute cannot be paid to certain modern writers, who, in their anxiety to maintain the mysterious character formerly attributed to mineral springs, have disregarded the most obvious physical laws by which all phenomena connected with the temperature of mineral waters may be satisfactorily explained.

In conducting experiments on the heat of the thermal springs, several points ought to be borne in mind. In the first instance, we must reflect that, if hot water is allowed to cool in a vessel, it is influenced by conduction. If the water be contained in an open vessel, the heat is conducted immediately to the air above; but below, and at the sides, it is first conducted to the supports of the

vessel, and from thence into the air. The vessel and its supports remain as they are, and, so far as they are concerned, it depends upon the power of conduction possessed by the substance of which they consist, and upon their greater or less thickness, whether the cooling will proceed slowly or rapidly. If the vessel is of thick wood or glass, it will take more time to cool; but if it is of thin metal, it will cool rapidly, although the temperature of the vessels and their contents may originally have been quite identical. It has been considered as proof of the different nature of ordinary and thermal heat, that in Gastein, where the springs used for bathing have a temperature varying from 100° to 118° F., it is necessary that such water as is to be used in the morning should be introduced into the bathing tubs the evening before so as to have time to cool sufficiently. This seems, at first sight, extraordinary; but we must cease to wonder at it, when we reflect that the water there is surrounded by very bad conductors, and that a large quantity of water enclosed in a stone bath can give off very little caloric, especially as water of the above temperature is constantly in the bathrooms during the whole season, so that the heat of the water can only be very slowly lost.

Liquids lose their heat more or less rapidly, according to whether the conductors remain stationary or not. Air, of itself, is a very bad conductor of heat; but as it is in perpetual motion, its power of conduction is thereby increased, the heated strata being continually carried upwards and succeeded by colder ones. If this movement is increased by other accidental disturbances of equilibrium, the cooling of the liquid will be still further accelerated.

Another influence which operates upon the temperature of liquids is radiation, to which all bodies are subject. The power of radiation greatly depends upon the colour and the surface of a liquid, of the vessel and its surroundings. It is greater in dark bodies than in light ones; it is also greater in proportion to the extent of the surface; uneven surfaces radiate more than smooth, and thin bodies more than thick ones. Radiation is also increased by the ascending current, which continually pervades a liquid while cooling. We must further take into account the influence of evaporation, which is very different, according to the extent of surface exposed, and the direction in which the vapours are carried off.

Such are a few of the difficulties which beset the experimenter if he wishes to compare the cooling of identical liquids, there being in that case no difference according to the specific heat of substances, that is, the quantity of caloric which they contain, according to their nature, at a certain degree of temperature. The specific heat is the same in identical liquids, but different in all different bodies; and water is cooled differently according to the quality and quantity of solid and gaseous ingredients it contains. It is therefore not to be expected that ordinary water should cool in the same way as a mineral water. The cooling of water is considerably retarded if it

contains salines in solution, by which the evaporation is diminished, the boiling-point becomes higher, and the freezing-point lower. On the other hand, salt-water is a better conductor of heat than ordinary water, and thus the relations become very complicated.

It has also been adduced as a proof of the peculiarity of heat possessed by certain thermal waters, that their boiling-point was lower than that of ordinary water. Thus the water of Gastein boils not at 212°, but at 207·5°. But as Gastein is situated 3000 feet above the level of the sea, it is only natural that water should there boil at a lower temperature than it does on the plain, as the boiling-point always becomes lower in proportion to the diminution of atmospheric pressure; and Von Græfe has shown that there was in this respect not the slightest difference between water taken from a common spring at Gastein and the thermal waters there. From all this it must be evident that we are justified in entirely rejecting the experiments by Dr Ritter, Scheitlin, and others, which were made without due regard to the circumstances alluded to, and which were thought to prove that thermal heat had a character of its own; while other experiments leave no doubt as to the non-existence of any fundamental difference between the two kinds of heat.

In conclusion, a few words may be said on the relation of the temperature of mineral waters to their specific gravity, as on this subject also most erroneous theories have been brought forward. The specific gravity of a water depends partly upon the solid ingredients contained in it, and partly upon its temperature. For this reason distilled water has a smaller specific gravity than water containing salines, provided both are of the same temperature. But as the density of water is greatest at 39°, and as it expands when it is above or below that degree of temperature, its specific gravity must become diminished in proportion as the water becomes hotter or colder. And it may therefore happen that a thermal water, which contains a small amount of salines, and has a comparatively high temperature, may have a smaller specific gravity than distilled water, which, although it does not contain any foreign ingredients, is of a lower temperature. This is actually the case with the waters of Gastein, the specific gravity of which varies from 0·990 to 0·985, and with the waters of Nocera, in the Papal dominions, in which it is 0·996, that of distilled waters at 32° being assumed = 1. M. Streintz has used this apparently extraordinary circumstance for attributing to thermal waters a character of their own, and which was entirely different from that of ordinary water.[1] It must, however, be evident from the foregoing remarks, that such a conclusion is by no means justified by the facts of the case. If one cubic centimetre of water weighs one gramme at 32°, it weighs 0·999 gr. at 50°, 0·998 at 68°, and 0·995 at 86°. It is, therefore, not surprising that the water of Gastein, the temperature of which, in the different springs of the place, rises from 95° to 118°, should have a specific

[1] Les Bains de Gastein, p. 45.

gravity varying from 0·990 to 0·985. On the contrary this is what would be naturally expected, and would be the case with any water of the same temperature, and therefore furnishes no reason whatever for assuming the specific gravity of thermal waters to be ruled by laws different from those which obtain for ordinary and distilled water.

18 Bryanston Street, London.

Article V.—*Some Remarks on the Treatment of Scalds and Burns.*

By John Young Myrtle, M.D., F.R.C.P.E.

(*Read before the Medico-Chirurgical Society of Edinburgh.*)

It is well known that, though burns and scalds are constantly coming under the notice of the surgeon, their treatment is too often a tedious and troublesome affair.

A consideration of the questionable success attending so many of the remedies usually resorted to; of the great pain inflicted on the patient, and the irritation caused to the injured parts; of the slowness of the healing process, frequently accompanied as it is by ugly ulcers, and followed by vexatious and disfiguring contractions; has induced me to bring under the notice of this Society a few simple observations on the treatment of this class of injuries, more especially as the plan I am about to recommend causes little or no pain to the patient, and is far more successful than the means commonly employed.

It is not my intention to mention or discuss the various plans adopted in the treatment of these injuries; nor do I profess to make wonderful cures of cases where the textures are seriously destroyed, and in which, should they not prove fatal, the cure is necessarily very tedious; still in cases coming short of this, a hastening of the healing process may be obtained, and the occurrence of troublesome granulations may be prevented—a desideratum by no means small under these circumstances. Neither do I mean to dwell upon the internal and constitutional treatment, but only to present a few practical observations resulting from a twelve or fifteen years' experience as to a peculiar mode of external treatment.

The two plans mainly depended upon in former times for the local treatment of scalds and burns were the sedative and the stimulating; of late the necessity of exclusion from the air has also been acknowledged.

I may at once mention that the plan I have long almost, if not altogether exclusively, put in practice, has been to use ointments, in such a form as most effectually to exclude the air, and at the same time to cool and soothe the parts; taking care, in the case of scalds, to puncture vesications when large, but then only because the pre-