first to observe this difference in the equivalence of atoms, and groups of atoms, or compound radicals, as they are termed, a difference which he marks, as shown in the following examples :

Radicals.

Equivalent to one atom of hydrogen.	Equivalent to two atoms of hydrogen
Nitric oxide $(NO)'$	Carbonic oxide $[CO]''$
Methyl $(CH_3)'$	Methylene $[CH_2]''$
Ethyl $(C_2H_5)'$	Ethylene $[C_2H_4]''$

The notion of equivalence enabled Professor Kekulé to form most interesting speculations on the constitution of organic bodies, and to explain the relation between composition and equivalents of such radicals as methyl, CH_3, ethyl, C_2H_5, methylene, CH_2 ethylene, C_2H_4 and acetylene, C_2H_2.

If from one molecule of marsh-gas, CH_4, one atom of hydrogen is abstracted, the residue, CH_3, called methyl, can combine with an atom of hydrogen again, and produce the original marsh-gas molecule. But methyl, instead of combining with an atom of hydrogen, can unite with an atom of chlorine, or an atom of bromine—that is to say, the place of the atom of hydrogen can be taken by an atom of chlorine or bromine. Methyl being thus equivalent to an atom of hydrogen, is said to be monovalent. If from a molecule of marsh-gas two atoms of hydrogen are removed, the residue CH_2, called methylene, can again unite with two atoms of hydrogen, or, instead of hydrogen, two atoms of chlorine or bromine, and from the compounds CH_4, $CHCl_2$, CH_2Br_2 respectively. Methylene, therefore, being equivalent to two atoms of hydrogen, is termed divalent. The radical CH, left after the abstraction of three atoms of hydrogen from marsh-gas, is able to reproduce with three atoms of hydrogen one molecule of marsh-gas, or to combine with three atoms of chlorine, and form chloroform, $CHCl_3$. The residue, CH, is thus trivalent equivalent to three atoms of hydrogen. But carbon, formen [CH], metylen, CH_2, methyl, CH_3, not only combine with hydrogen, chlorine, or other elements according to their equivalence, but also amongst themselves, and thus produce the so-called hydrocarbons, native as well as artificial. Methyl combines with methyl and produces dimethyl, or better known as ethylic hydride, $CH_3+CH_3=C_2H_6$; methylene combines with methylene, and forms ethylene, $CH_2+CH_2=C_2H_4$. Methylene is divalent, and methyl monovalent; therefore methylene combines with two equivalents of methyl and forms propylic hydride, C_3H_8, $CH_2+2CH_3=C_3H_8$. Six equivalents of formen are supposed to be contained in benzol $[C_6H_6]$, $6CH=C_6H_6$.

The Strength of different samples of Donovan's Solution.*

BY W. HEATHFIELD, F.C.S.

Great as has been the value to medicinal practice of the preparation suggested by Dr. Donovan, and designated by his name, it has been open to the serious inconvenience that those contributors to pharmaceutical science who have proposed alterations in the formula for its manufacture have either recommended an alteration in the original strength, or have advised such a variation in the mode of manipulation as to alter the character, such as was contemplated by the distinguished physician who first proposed its introduction, and then generously gave the formula to the profession.

These are, at least, five published formulæ for Donovan's solution, to be found in the archives of pharmaceutical contributions, and not one of which is precisely in accordance with the other. On examining the products which are the results of these processes, they vary considerably, and all differ in analytical constitution from that proposed by Dr. Donovan, and thus that reliance on uniformity of strength which the physician and the dispenser alike should secure, is entirely merged in the aim to improve or modify.

The formulæ that have been chiefly recommended are as follows:—

1. *Donovan.*

Arsenic metal	6·08
Mercury	14·82
Iodine	49·
Alcohol	q.s.
Water	℥ 8

2. *Pereira.*

Arsenic	6·08
Mercury	15·38
Iodine	50·
Alcohol	℥ 1
Boiling water	℥ 8

3. *Dublin Pharm.*

Pure arsenic	6·
Mercury	16·
Pure iodine	50½
Water	℥ 8
Alcohol	℥ ½

4. *Soubeiran.*

Teriodide of arsenic	35 grs.
Biniodide of mercury	35 "
Water	℥ 8

And a writer in the 'Pharmaceutical Journal,' with a view of avoiding the inconvenience resulting from the noncombination of the iodine with the arsenic, which, he states, frequently occurs, giving the following:—

5. Arsenious acid	7·92
Iodide of mercury	36·24
Hydriodic acid	30·49
Distilled water	℥ 8 ℥ 6

"Mix and make up to its original volume." "The hydriodic acid is best prepared by decomposing a known weight of iodide of barium with sulphuric acid."

Although the three first of these processes were recommended by very high authority, it will be perceived that they vary in the proportions of their ingredients; and, as it is admitted that there is some patience required and difficulty in effecting the complete combination of the arsenic with the iodine, M. Soubeiran proposed the direct union of the iodides of the metals. But, independently of the deviation from the strength originally contemplated by Dr. Donovan, M. Soubeiran's form is open to the objection that the iodides of mercury and arsenic vary in the proportions of moisture they contain, and thus lead to varying results. To alter a mode of manipulation may be perfectly legitimate, but to alter proportions of a preparation intended for public use, without leave of the introducer, is scarcely right. Great confusion has arisen in pharmacy from such a practice, and many very excellent preparations have been pronounced a failure, and been superannuated, owing to the difficulty entailed on a dispenser in attempting to determine which of many under one name is intended by the physician, and thus those, which for many reasons he may not see fit to use, become shelved. Dr. Donovan had in view a preparation which he seemed to have perfected, and the formula for which he most liberally published. He admits the difficulty of producing the combination with celerity, but he is fairly entitled to claim for a process which, if an alteration be made, shall not involve a variation in the proportions which he sets forth. When Dr. Donovan first made the solution, he found that it generally proved to be of a very pale yellow, and then only when seen in large quantity, sometimes being as pale as water. When a few grains of iodine were added, it became yellow; but when exposed to ordinary daylight, it resumed its original colourless appearance; and further additions of iodine presented the same phenomenon. Dr. Donovan's formula is entitled to all commendation; and, provided the materials are pure, and with due attention to the manipulation, a preparation of definite composition, and having invariable properties, may be obtained. Thus:—

Pure arsenic resublimed	6·08
Pure distilled mercury	14·82
Iodine resublimed	49·
Alcohol,	℥ 1 or q.s.
Water	℥ 8

The arsenic should be in the finest possible condition; the more minute, the more rapid the combination with the iodine. This combination should be first made with the arsenic by the addition of a little water, sufficient of the iodine being used for a perfect union: this should be carefully dried, and the remainder of the process completed by the entire and effective combination of as much of the alcohol as may be required. The proportion of water being added to make up eight ounces, there should result a solution of a permanent character, both physically and chemically. Dr. Donovan found that when the trituration of the ingredients was continued until the alcohol became as thick as treacle, he obtained the most effective and complete solution. This may be left to the operator, provided it be borne in mind that there should be no residue whatever. The process of Dr. Donovan may be advised for adoption, with these precautions, until the framers of any future Pharmacopœia see fit to authorize the recommendation of any other.

* From the Pharmaceutical Journal, London. Read before the British Pharmaceutical Conference, 1869.

Coal Naphtha and Benzole compared wit Petroleum and its Products.*

BY PROFESSOR VAN DER WEYDE, M. D.

Benzole, which has lately been introduced as a gas carbonizer, was originally obtained from the benzoic acid found in gum benzoes, hence the name. Later it was found to be produced in great abundance by the distillation of coal tar. This tar, being distilled, gives a black oil, called *dead oil*, which, by re-distillation, produces coal naphtha. This coal naphtha contains about seven per cent. of pure benzole, which it is quite difficult and laborious to obtain pure, for which reason most so-called benzoles are only coal naptha, consisting of a mixture of several hydro carbon oils, having some solids in solution, but all possessing a similar degree of volatability. These substances are, besides the benzole, tuluol, cymol, cumol, then a few solids in

* From the Journal of Applied Chemistry.