

cash, and every grace and beauty lopped off our daily lives which has not a direct bearing upon the balance at the banker's?

The question, however, is not so bare a one as this. Perfect efficiency is inconsistent with slovenliness. We must cultivate habits of economy and neatness. There is not an audience in the world which will take a suggestion in better part than the circle of readers of the SCIENTIFIC AMERICAN. Men who know how to keep good tools in order, and to use them deftly, cannot be oblivious of the value of system, of training, of care. Men who have carefully and laboriously learned to do work in good time and of good quality will respond at once to the suggestion that the appearance of a well-kept garden will instill into the minds of children a sense of order which will have its effect on their whole future lives. This consideration is even more important than the one previously stated, that of giving a wholesome occupation to the gardener—the proprietor.

Whatever modern science may do to disturb the child-like acceptance of the literal statements of "The Book," we find in it texts for sermons which may do us good. Take two:

One shall be mere citation and a single comment. God made man and put him in a garden—and he did very well as long as he had sense enough to stay there.

"Consider the lilies of the field—how they grow."

If the Master were preaching in Normandy He would doubtless draw His morals as much from the *espalier* as from the vine. What lessons of the effect of early habit and training would it not evolve! What of productiveness, of the different exposures, of the lavish pruning, or the slovenly neglect! Man works with God on his side; the apricots, pears, and peaches we see on the *espalier* are not wild; man's care for a score of centuries has encouraged the fruit in the line of its adaptability; by careful selection and improvement of its environment he has evolved a fruit so different from the original that scientific comparison alone establishes the relationship.

An admirer of the *fragaria* says, "God could doubtless have made a better berry than the strawberry, but He did not." This is mere encomium with an incisive accompaniment which strikes us like an epigram; the moral, however, was missed, perhaps because not looked for. Man made the strawberry in the same sense that he made the field of wheat, derived from wild originals. Diodorus Siculus says:

"Osiris taught the way and manner of tillage and good management of the fruits of the earth. Isis found out the way of cultivating wheat and barley, which before grew here and there in the fields, among the common herbs and grass, and the use of them was unknown."

It was a common custom of old to deify the people's benefactors, and we yet raise statues to such men as Harvey, Watt, Rumford, and Fulton.

"The world is too much with us,"

in the sense of the factory, the store, and even the library. We need to take things more at first-hand and to encourage the unartificial sense, the capacity to find—

"Books in the running brooks,  
Sermons in stones, and good in everything."

E. H. KNIGHT.

#### A GOOD DEAL OF PORK FOR A SHILLING.

Pigs were never so low priced as now. Fine ones, from four to six weeks old, are offered at \$1.50. They are so cheap and plenty that there will be but few born this fall, and this may occasion a demand for wintering. The immediate prospect for any profit in making pork is poor indeed. Pork will probably start in the Eastern markets at \$6.00 a hundred, and rapidly run down to \$4.00. At this rate corn must be had at 40 cents a bushel, the old rule being a dollar a hundred for every 10 cents in the price of corn. This is estimated to be the cost of making pork, and the profit lies in the extra price of pork over this ratio and in the manure. Some farmers never bed their hogs so as to make any extra manure. This is a mistake, as in the hog-pen the best manure may be made, and plenty of it, too, if litter is freely used. In the pig-yard is the place to dump all of the weeds and green stuff which may accumulate. One load of hog manure is worth, in the garden or in the corn field, as much, some good farmers think, as three of common barnyard or stable manure. This would give it a cash value of at least three dollars. Two loads of such manure can be made from each pig during the season, which is a very nice little profit. A home market saves the wear and tear of marketing the corn, and this is an item. So it is better to keep the pigs and feed and fatten them rather than sell them for a mere trifle. Young pigs do well on oats, and they are better for them than corn, as the latter is apt to founder them, while oats are not at all dangerous in this respect. We have known whole pens of pigs stiffened and spoiled by being fed too much corn. Barley is also nice and healthful food.—*New York Tribune*.

#### DECOMPOSITION OF ULTRAMARINE BY CARBONIC ACID.

By Mr. S. SUGUIRA (student in the Chemical Laboratory of the Owens College).

[Communicated by Prof. ROSCOE, F.R.S., to the Manchester Literary and Philosophical Society.]

It has been proposed to employ ultramarine for the detection of free hydrochloric acid in presence of carbonic acid, on the ground that it is not acted upon by the latter, while the former easily attacks it. In making some experiments in connection with this subject I found, however, that carbonic acid itself decomposes ultramarine, as the following experiments will show:

A glass cylinder about a foot in height and an inch in diameter was filled with distilled water, and carbon dioxide, evolved from sulphuric and sodium bicarbonate or hydrochloric acid and calcespar, was allowed to bubble up through the column of the liquid. In order to be perfectly sure of the purity of carbon dioxide gas, it was passed through a series of flasks containing distilled water, and then through a long tube containing solid sodium bicarbonate, to keep back any free acid which might be mechanically carried over.

After passing a steady current of the gas through for 15 minutes, the water in the cylinder was tested for acids other than carbonic. The absence of sulphureted hydrogen was also proved by exposing a paper moistened with lead acetate solution.

Then about 0.07 grm. of ultramarine infused in 2 c.c. of

distilled water was added to the water in the cylinder. Within five minutes the paper turned brown, showing the presence of sulphureted hydrogen, which, therefore, can only be attributed to the decomposition of ultramarine.

In order, however, to ascertain the presence of any alkaline sulphide existing as such and not as a constituent of ultramarine, a large quantity of the latter was treated with distilled water and quickly filtered. The filtrate contained no sulphide. Hence the evolution of sulphureted hydrogen was really due to the decomposition of ultramarine by the carbonic acid. The color of the pigment was dulled, but could not be destroyed completely even when metallic chloride existed in the solution.

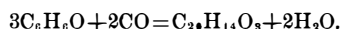
Through the kindness of Messrs. Jewsbury & Brown I got a dozen bottles of aerated water, one half of which were charged with two grains of sodium chloride in each. The effects of these waters upon ultramarine were compared together week after week by putting 0.07 grm. of the pigment into the cylinder containing these liquids. In all cases the following effect was observed: the decomposition of ultramarine did not commence at once, but on standing for about an hour the paper moistened with lead acetate solution and placed over the cylinder began to be blackened. A few minutes afterward the odor of sulphureted hydrogen was distinctly observed. To prove the absence of sulphureted hydrogen in laboratory air, a similar paper was placed over a jar containing the infusion of ultramarine in distilled water, which remained unchanged during the experiments.

These experiments, though qualitative, show that carbon dioxide in aqueous solution, viz., carbonic acid, can attack ultramarine, and, therefore, the latter is not a safe indicator of free hydrochloric acid in presence of carbonic if the former exist in very small quantity.

#### AURIN.

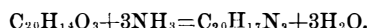
By R. S. DALE, B.A., and C. SCHORLEMMER, F.R.S.

In a paper read before the Manchester Literary and Philosophical Society on 31st October, 1871, we gave a short account of this coloring matter, which was discovered by Kolbe and Schmitt in 1861. We showed that the commercial product, which is called aurin or corallin, and is obtained by heating of phenol with sulphuric acid and oxalic acid, is a mixture of different bodies from which we isolated a coloring matter which crystallized exceedingly well and for which we retained the name of aurin.\* The analysis of this body gave numbers agreeing with the formula  $C_{20}H_{14}O_3$ , from which we concluded that it was produced by the action of nascent carbonic oxide on phenol:



We further showed that aurin, when treated in an alkaline or acid solution with zinc dust, combines, like most other organic coloring matters, with hydrogen, yielding leucaurin,  $C_{20}H_{16}O_3$ , which readily crystallizes in large colorless prisms, while on heating aurin with ammonia under pressure a new red coloring matter is formed, which is called red aurin or peonin.

The further investigation of this body showed that it contained nitrogen, which, on heating with soda-lime, was evolved in some cases completely as ammonia, while in others, where the action of the ammonia went on longer, it was given off, at least partly, in the form of aniline. We then found that, on continuing the heating, the red color of the liquid became paler, and at last a yellowish solution was obtained, from which water precipitated a white crystalline body possessing all the characteristic properties of rosaniline.† The formation of this compound might be explained by the following equation:



But Hofmann, who has most carefully examined rosaniline as well as a great number of its derivatives, found that the formula of this base is  $C_{20}H_{19}O_3$ , and this result has been confirmed by Caro and Gräbe,‡ who showed that rosolic acid, which is obtained from rosaniline by a reaction, which shortly may be stated to be the inverse of that above given, has the composition  $C_{20}H_{19}O_3$ , while its properties are in almost all respects so similar to aurin that some chemists, including ourselves, have been inclined to regard them as identical.

In order to clear up these points it was necessary to prepare a considerable quantity of pure aurin. We have already shown in our memoir read before the Chemical Society§ that a pure compound is readily obtained by heating pure phenol with oxalic and sulphuric acids for a few days to about 105° C. Although a good product is thus obtained, the yield is but small, while on heating the mixture longer or to a higher temperature by-products are formed. Some chemists have stated that the formation of the latter cannot be avoided, and that it is very difficult to obtain thus a pure aurin. We believe that we are able to explain these different results; the formation of a pure compound depends much on the proportions and the manner in which phenol and the acids are mixed. As, however, the preparation of pure aurin by this method is a very tedious process, we endeavored to obtain it from the commercial product by the method which we have described in our first paper, and purifying it by repeated recrystallization from alcohol, the crystals separating out first being used for further purification, because we found that the purer aurin is the less soluble it becomes, its solubility being increased by the admixtures which are present in the crude product.

Another method for purification which we employed consisted in washing good commercial aurin with cold alcohol until only a comparatively small residue was left, which was then further treated as above stated.

The different crops of crystals were analyzed, and the purification continued until the product did not change its composition any more. A great number of analyses were thus required, and we have great pleasure in expressing our best thanks to Mr. L. T. O'Shea, who performed them with great care.

The results did not, however, agree with our former; the product having a constant composition, and crystallizing exceedingly well, gave numbers agreeing with the formula  $C_{19}H_{14}O_3$ . We, therefore, again prepared aurin from pure phenol, and crystallized it repeatedly from alcohol, until its composition became constant, and found it to have the same formula.

Aurin, therefore, appears to be the lower homologue of

\* A full account of this investigation is found in *Journ. Chem. Soc.* (2), xi., 434.

† *Journ. Chem. Soc.* (2), xi., 434.

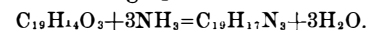
‡ *Liebig's Ann.*, clxxix., 148.

§ *Journ. Chem. Soc.*, 1877, ii., 121.

rosolic acid; like the latter, it readily forms a tetrabromo-compound, which we obtained pure by the following process: Pure aurin was dissolved in hot glacial acetic acid, and this solution poured into a mixture of an excess of bromine and acetic acid. The liquid remained perfectly clear, but on standing for a few days the tetrabromaurin crystallized out almost completely. It forms small brownish-green crystals, with a metallic luster, which dissolved in alkalis with a purple color. The determination of the bromine gave numbers agreeing closely with those required for the formula  $C_{19}H_{10}Br_4O_3$ .

While this investigation was going on a new light was thrown on the subject by the researches of E. and O. Fischer. In order to elucidate the constitution of rosaniline these chemists endeavored to convert rosaniline into the hydrocarbon from which it is derived. In this they did not succeed, but they were able to transform leucaniline,  $C_{20}H_{21}N_3$ , which stands to rosaniline in the same relation as leucaurin to aurin, into a hydrocarbon,  $C_{20}H_{18}$ , which is the mother substance of this base, and from which it follows that the hydrocarbon corresponding to rosaniline has the composition  $C_{20}H_{16}$ , which also confirms the correctness of Hofmann's formula for rosaniline. The leucaniline which they employed was obtained from commercial rosaniline; but Rosenstiehl has shown that this body, which is prepared by oxidizing a mixture of aniline, solid paratoluidine, and liquid pseudotoluidine, contains several, probably isomeric, bases. E. and O. Fischer therefore, in continuing their research,\* prepared one of them in the pure state by using a mixture of pure aniline and pure paratoluidine. The product was converted into the leuco-compound, from which, to their surprise, they obtained, not as before, the hydrocarbon  $C_{20}H_{18}$ , but one having the composition  $C_{19}H_{14}$ , or the lower homologue of the former. They found the new hydrocarbon to be identical with one already known, which was discovered by Kekulé and Franchimont, and called triphenylmethane,  $CH(C_6H_5)_3$ , as it is a marsh-gas or methane, in which three atoms of hydrogen are replaced by three phenyl-groups. Hemilian, who afterward obtained the same hydrocarbon by a different method, examined it more fully, and found among other results that concentrated nitric acid converts it into the tri-nitro-compound  $C_{19}H_{13}(NO_2)_3$ . E. and O. Fischer prepared the same body, which, by the action of nascent hydrogen, was converted into a base having all the characteristic properties of leucaniline. This was heated with arsenic acid in order to abstract hydrogen by oxidation, and the rosaniline which formed the starting point of their last investigation was obtained again.

From these results it follows that commercial rosaniline consists principally of the base  $C_{20}H_{19}N_3$ , and is probably a derivative of pseudotoluidine, while the rosaniline from paratoluidine, and which has therefore been called pararosaniline, is its lower homologue, having the formula  $C_{19}H_{17}N_3$ . The rosaniline which we obtained from aurin is undoubtedly identical with the latter,† its formation being readily explained by the following equation:



The question which now has to be solved is how to explain the formation of aurin. We have already made experiments in this direction and obtained interesting results, which, however, are not yet sufficiently worked out to publish them.

Another question to be elucidated is, What is the chemical constitution of aurin? According to E. and O. Fischer that of pararosaniline is  $C_{19}H_{17}(NH_2)_3$ , from which it follows that aurin is  $C_{19}H_{15}(OH)_3$ . Already in our first research we obtained results which seem to confirm this view. On heating aurin with acetyl chloride we obtained a colorless crystalline compound, which, on analysis, gave results nearly agreeing with the composition of triacetyl aurin,  $C_{19}H_{11}(OC_2H_3O)_3$ , and on using benzoyl chloride a similar benzol-compound was obtained. The analytical numbers did not, however, sufficiently agree with those required by theory, and therefore we did not publish them, and, as the purification of these compounds was found to be beset with several difficulties, we did not then examine them further, because we believed the study of red aurin would more readily throw light on the subject. We have now prepared them again from pure aurin, and hope to be soon able to settle these points.

#### NEW COMPOUND OF PALLADIUM.

By H. SAINTE-CLAIRE DEVILLE and H. DEBRAY.

ON heating a solution of palladium chloride,  $PdCl_2$ , with strong nitric acid in presence of sal-ammoniac the palladium is converted into an ammonia-chloride,  $PdCl_2 + NH_4Cl$ , which precipitates in small regular octahedra of a fine red color, sparingly soluble in water, and, like the corresponding compounds of iridium and platinum, almost insoluble in a concentrated solution of sal-ammoniac. The authors thought that on treating with aqua regia certain mother-liquors containing ammoniacal palladium chloride (dipalladamine chloride,  $PdCl_2 \cdot 2NH_3$ ) with excess of ammonium chloride the metal would be entirely thrown down as a double chloride, an expectation not fulfilled. Instead of the desired compound they obtained a reddish-black substance,  $Pd_2Cl_3 \cdot 2NH_3$ , the result of the combination of ammonia with a palladium chloride hitherto unknown.

#### EQUIVALENT OF GALLIUM.

By LECOQ DE BOISBAUDRAN.

THE existence of several chlorides of gallium has prevented the author from determining its equivalent by weighing the chloride or bromide of silver without having previously ascertained the conditions under which these salts are obtained in a state of purity. He has determined the equivalent by the calcination of gallo-ammoniacal alum, and by igniting the gallium nitrate produced from a known weight of the metal. The slight losses sustained in these two operations affect the value of the equivalent in an opposite manner. The former process gave as the result 70.032 ( $H=1$ ), and the latter 69.698. The mean value, 69.865, may be taken as the first approximation. Considerations founded upon a classification of the elements in accordance with their properties and the value of their atomic weights point to a maximum number, 69.97, and a minimum, 69.66 (mean 69.82). The author enters into some details on the comparison of the spectra of the metals Al, Ga, In, on the one hand, and K, Rb, Cs, on the other, and deduces hence for the equivalent of gallium the value 69.86.

\* *Ber. Deutsch. Chem. Ges.*, xi., 195.

† Since this was written E. and O. Fischer prepared some pure aurin according to our directions, and converted it into a leucorosaniline, from which they also obtained triphenylmethane (*Deutsch. Chem. Ges. Ber.*, xi., 473).