THE EXAMINATION OF MEDICINAL PREPARATIONS.

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The examination of medicinal preparations involves a rather wide range of knowledge. We should have a good working knowledge of inorganic and organic chemistry: of qualitative and quantitative analysis: of therapeutics, in order to know what to look for: of pharmacy, so that we can tell something about what simple preparations are likely to go into the complex mixture.

The agents used in medicine are almost numberless. I presume practically all plants have been used some time to relieve human ailments. New synthetic agents are being produced daily. There is no hope of ever knowing all about the analysis of these.

One of the first things to do in commencing such an examination is to find out for what the preparation is to be used. This may give us some idea as to the agents liable to be found, but when the preparation is claimed to be good for the whole category of diseases, probably it hasn't very much of any thing in it.

A trained nose and an expert taste are very convenient things to have and the evidence derived from these is some times more reliable than that obtained by chemical tests and often the only evidence obtainable.

Organic matter of some kind is generally present in the preparations to be examined and must be destroyed before making the analysis of the inorganic constituents. One of several well known methods may be used. But before destroying the organic matter, I generally apply Reinsch's test which is made by acidifying the mixture with hydrochloric acid, putting in a bright copper gauze and heating to boiling. If the test is negative, I generally presume that the metals depositing on copper are absent unless for some reason I think that they may be present in minute traces. The common metals which are deposited on copper are generally those which are most readily volatilized by destroying organic matter by dry heat.

While the estimation of inorganic constituents is complicated by the presence of organic matter, it is in the detection and estimation of organic compounds, like alkaloids, glucosides, neutral principles, and synthetic chemicals where we find the greatest difficulty. It is needless to say that there are many vegetable drugs that can not be identified because there are no definite principles in them or no characteristic tests for them.

In separating organic principles for identification the "shaking out" method is the one generally used, that is, shaking the preparation with an immiscible solvent. This method is very satisfactory sometimes and at other times is just the opposite. The trouble of course arises in making an emulsion between the preparation and the solvent. The presence of sugar and glycerin retard the separation of the solvent. If such drugs as senega, quillaja, sarsaparilla—drugs containing saponin-like principles—are present, it is almost impossible to avoid making an emulsion. Sometimes this tendency may be lessened by choos-

ing some other solvent. The emulsion may separate if allowed to stand for a time or breaks more easily by other means after the standing. Subjecting the emulsion to centrifugal action may break it up. The addition of a little solvent other than that originally used, such as alcohol or petroleum ether is often quite effective. The tendency to emulsify seems to decrease with the increase of the proportion of the solvent over the preparation. If the volume of the solvent be two or three times that of the preparation, there is but little danger. The addition of water to a syrup seems to cause emulsification more readily. Sometimes all these means fail and it becomes necessary to evaporate the solvent and start over. Often in cases where most of the emulsion is broken up, a little will yield only to evaporation.

In case of syrups and similar preparations, I have tried to avoid the trouble by drying up the preparation with filter paper, sand, kieselguhr, and extracting with strong alcohol, but this is slow and tedious and not very satisfactory.

Tablets frequently contain starch. The best way to extract them is to powder them, putting from 0.5 to 1.0 gram of the powder into a separatory funnel with 1 to 2 cc. of water and a few drops of ammonia water and then 15 to 30 cc. of the solvent. This can be shaken vigorously without emulsifying. Chloroform is the best solvent if it will dissolve the matter, because it is heavier than the water and powder and can be drawn off without disturbing the water or powder. The addition of much more water than that given above will be likely to cause an emulsion.

In choosing the immiscible solvent to be used in the shaking out process, we must be guided to some extent by what we expect to find. I do not think it is necessary or even advisable to use all the common solvents successively for in so doing some of the principles are apt to be lost. Of all of the solvents I prefer benzol because it is a poor solvent for alkaloidal salts and a fairly universal one for the free alkaloids, although not the best one for special cases. It will take out enough of any of the common alkaloids, except morphine, to get a test with the general alkaloidal reagents.

The method which I generally use for qualitative work is to evaporate off the alcohol, if much is present in the preparation, and make it acid with dilute sulphuric acid. Sulphuric acid is better than hydrochloric because the sulphates of the alkaloids are less soluble in immiscible solvents than the hydrochlorides, particularly in chloroform. For example, quinine hydrochloride is soluble in 0.8 parts chloroform. This acid mixture is extracted repeatedly with benzol, and in a few cases preceded or followed by ether or chloroform. The aqueous acid mixture is then made alkaline with ammonia and extracted repeatedly with benzol and later with chloroform, the chloroform being for the purpose of dissolving morphine. After having determined the principles present, the solvents best suited for their isolation and determination can be used.

The residue from the benzol washings of the aqueous acid mixture may contain caffeine, theobromine, narcotine, many glucosides, neutral principles, resins, oils, organic acids, synthetic compounds, etc. The glucosides and neutral principles are hard to separate, identify and estimate, and comparatively few have characteristic color reactions. The residues from the benzol washings of the aqueous alkaline mixture contain alkaloids and base principles. Fortunately

many alkaloids can be tested for in the presence of others but there are a few cases of interference. Brucine with strychnine, in the proportion in which they exist in nux vomica, lessens the delicacy of the strychnine test and if only a small amount of the mixed alkaloids be present, may entirely prevent it. If there is twice as much brucine as strychnine the test for strychnine will be negative. These can be sufficiently separated by converting the mixed salts in the free alkaloids and shaking with ether, strychnine being practically insoluble in ether, while brucine is quite soluble. A large amount of quinine with a small amount of strychnine, such as occurs in elixir of iron, quinine and strychnine prevents the getting of the strychnine test. Here again ether separates them. Quinine in large amounts prevents the tests for morphine. Antipyrin may prevent the quinine tests. Physostigmine and pilocarpine impair Vitalli's test for atropine but the mixture of these free alkaloids can be separated by carbon disulphide which dissolves atropine but not the other two. There are other combinations that cause trouble.

To separate alkaloids for quantitative determinations is generally tedious and often well nigh impossible. The presence of one alkaloid in solution frequently influences the solubility of others. Different combinations must be treated differently. Sometimes they can be separated by precipitants. Having a mixture of salts of cocaine and atropine, I converted them into sulphates and added a solution of platinum chloride to the solution of the sulphates. Platinum chloride does not precipitate atropine or the mydriatic alkaloids of the solanaceæ, but does most other alkaloids.

These examples are a few illustrations of the difficulties which beset the analyst when he comes to medicinal preparations, and these difficulties can be realized to some extent when we consider the great variety of forms of preparations, the many classes of agents used and the almost numberless individual constituents that may be found. Every preparation is a new problem, and in this lies the fascination.

THE MAN WHO DESERVES THE CHEER.

Never admire a man just because he has money. Any chump can get that, if he is mean enough to scrape it up and go without comfortable things to acquire it. But the man who thinks, strives, works, and sweats to grind out something that is of benefit to the whole race—that's the chap for whom to cheer! When I think of the telephone, the phonograph, and the electric light, I realize that all men are not born equal! Some get a bigger share of energy. —*Robert Lloyd.*