A starch injection mass.

A STARCH INJECTION MASS.[1]

(To replace pp. 139–140, Wilder and Gage's Anatomical Technology.)

A coarse injection mass which is cold-flowing, may be forced nearly to the capillaries, rapidly hardens after injection, leaves the vessels flexible, does not dull dissecting instruments, is suitable for permanent dry or alcoholic preparations, is simple in its manipulation, cleanly and economical, seems to be fully realized in the starch mass introduced by Ad. Pansch of Kiel, and since recommen led, with various modifications, by Wikszemski, Dalla Rosa, Meyer, and Browning.[2]

Mass for Ordinary Injections: [3,4,5]

Dry starch ("laundry" is good), ...	100 cc.
Water or a 2½ per cent. aqueous solution of chloral hydrate,	100 cc.
95 per cent. alcohol, ...	25 cc.
Color mixture, see below, ...	25 cc.

After thoroughly mixing the mass it should be filtered through one or two thicknesses of moistened paper cambric. To prevent the starch from settling, the cloth should be tilted from side to side or the mass may be stirred during the filtration. If the mass is not freshly prepared for every injection, the stock mass should be filtered occasionally to remove hair or any other object that might clog the cannula.

Since almost any animal injected may afford some organ worth preserving, it seems better to employ permanent colors for tingeing the mass. Among those which are available, probably vermilion, red lead, ultramarine, Berlin blue, chrome orange, yellow, or green, are preferable.

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1. The directions here given are but slightly modified from those given by Prof. Gage in the *New York Medical Journal*, June 7th, 1884.

2. See Ad. Pansch, "Archiv für Anatomie und Entwickl.," 1877, pp. 480–482, and 1881, pp. 76–78; Wikszemski, same journal, 1880, pp. 232–234; Dalla Rosa, same, pp. 371–377; Herm. von Meyer, same, 1882, pp. 60, 61, and 1883, pp. 265, 266; Browning, "Annals of Anatomy and Surgery," 1884, pp. 24–25.

3. The chloral and alcohol prevent fermentation in the mass when it is kept in stock; the alcohol also increases the fluidity and likewise the more rapid hardening in the vessels; both, of course, act as preservatives upon the animal injected.

4. The mass originally recommended by Pansch consisted of wheat-flour and cold water, to which was added a sufficient quantity of the desired coloring matter. Later experiments have shown that pure starch is better than flour.

5. As starch is insoluble in alcohol and cold water, it becomes hard when injected into the blood-vessels simply by the exudation of the liquid with which it is mixed. That the starch grains forming the mass remain entirely unchanged may be easily demonstrated by making a microscopic examination of the contents of an injected vessel.

Dry color,[6]	100 cc.
Glycerine,	100 cc.
95 per cent. alcohol,	100 cc.

To avoid lumps, which would clog the cannulæ, or small vessels, the color is thoroughly ground with the liquid in a mortar. It is stored in a well-stoppered bottle, and is prepared for use simply by shaking. If permanent preparations are not to be made, the mass may be stained by an aniline dye of the desired color (§ 344).

Special Mass.—For the injection of brains, and, perhaps, for other rapidly perishing specimens, it seems best, as suggested by Prof. Wilder, to use strong preservatives in preparing the mass:

Corn starch (that used for food),	100 cc.
5 per cent. aqueous solution of chloral hydrate,	50 cc.
95 per cent. alcohol,	75 cc.
Color mixture,	25 cc.

For convenience and economy, a considerable quantity of either of the masses described above may be prepared at once, and kept in a wide-mouthed specimen or fruit jar; but the mass must be thoroughly stirred before using. The syringe may be filled directly from the jar, and any mass remaining in the syringe after the injection is finished may be returned to the jar.

If it is desired to have the mass enter very fine vessels, some of the stock mass, as given above, diluted with an equal volume of water or chloral solution, may be injected first, and immediately followed by the undiluted mass, or, for large animals, a mass containing twice the usual amount of starch. In whatever form the starch is used, it is necessary to work somewhat expeditiously, because the exudation of the liquid in the smaller vessels takes place so rapidly that the mass hardens very quickly in them. The larger the vessel, the more slowly, of course, do the exudation and, consequently, the hardening take place. It sometimes happens that large vessels, like the aorta, are not fully distended after the exudation of the liquid. In this case some mass containing double the ordinary amount of starch can be advantageously injected in two hours or longer after the first injection.

In animals as large as the cat and larger, the great veins of the trunk would perhaps better be injected with plaster (§341), as the presence of blood in them prevents or greatly retards the hardening of the starch.

Permanent Preparations.—If a permanent wet preparation is to be made of a starch injected animal or part, the cut ends of the vessels must be tied in order to prevent the gradual escape of the starch.

Finally, if vessels injected with the starch mass are dissected free, soaked a day or two in Wickersheimer's preservative, and then dried, they retain their form, and to a great degree, their flexibility.

6. If Berlin blue is used to stain the starch, 25 cc. of the dry blue are dissolved in 100 cc. of water or a 5 per cent. aqueous solution of chloral hydrate.

Cornell University,
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