

varying proportions of bilirubin-calcium or biliverdin-calcium and cholesterin to, at the other extreme, calculi formed of close upon a hundred per cent. of cholesterin. Between these two extremes we encounter a series of forms passing almost imperceptibly the one into the other and characterized by possessing a larger or smaller proportion of the one and the other main ingredient. The only disturbing element in the series is a variable admixture of calcium carbonate. Minute accumulation of the salt may be detected in many gall-stones. Very rarely do we meet with small calculi of which this is the dominant constituent, so rarely that for our immediate purposes we may neglect them.

It is thus obvious that there are two prime constituents of gall-stones—Cholesterin and the bile pigments in combination with calcium.\* It is also to be noted that one bile pigment may take the place of another. This need not trouble us for we know that the whole series are but different stages of oxidation of the one substance bilirubin. Yet another constant constituent of all forms has to be kept in mind, namely the mucinous matrix which remains when these constituents are dissolved out. Such a matrix is found in all calculi-urinary, pancreatic, salivary as well as biliary; it is essential to their formation. In the pure cholesterin calculi it is reduced to the lowest limit.

On this occasion, I propose in the main to consider one of these constituents only, the cholesterin, how it comes to appear in the bile, how it is liberated and what are the factors leading to the formation of cholesterin calculi.

We shall best arrive at a knowledge of how these calculi are formed by discussing first the mode in which cholesterin makes its appearance in the bile. There are, it will be seen, three possibilities (1) that it is excreted by the liver cells, (2) that it is derived from the mucous membrane of the gall-bladder and bile ducts, and (3) that it is derived from both

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\*It is possibly more accurate and more suggestive to state that there are three—cholesterin, bile pigment and calcium salts, it being revealed that apart from the calcium carbonate above noted, there is in the ordinary gall-stones an interaction between these calcium salts and the bile pigments leading to the formation of bilirubin calcium compounds, etc.