much more importance then the negative. It should be of a permanent character, while the tool used in the making of it may perfectly serve its purpose, though it were so short-lived as to fade away immediately after it had yielded the print. But it is convenient, and often of great importance from an industrial point of view, that the negative shall be stable. And if the negative is not right the print must be wrong, and if the negative is produced by uncertain processes, we never can tell what the print will be. The science of negative-making becomes therefore, I think, of as much importance as the science of printing processes. As the chemistry of these latter has received enough attention to c able anyone to make prints that are proceet from a chemical point of view, while the chemistry of negative-making has been very largely neglected, I have spent a good deal of time during the last few years in examin-ing some of the operations in common use, and propose to look at one of two matters in connection with the chemistry of negative-making on gelatin plates.

The silver bromide particles held in the gelatino film are so changed by suitable exposure to light, that the developer is able to take away the bromine from them. In a chemically perfect negative, after fixing and washing, the image will consist of pure metallic silver, and it does not matter all at where the bromine has gone or what changes it has produced in the developer so long as no trace of it, or what it leads to, remains behind. But when bromino is added to an alkaline solution of pyrogallic acid, it produces a brown color, and as there is most bromine removed where there is most silver deposited, the brown coloring matter will be, roughly speaking, proportional in quantity to the density of the negative, unless some of it is removed. There is, perhaps, no prima facie reason why an image of this composite character should be objected to. Indeed, the presence of this brown stuff may improve the negative if the film has too little silver in it to give proper density alone, or if the exposure has been too short to change a sufficient amount of the silver bromide into the developable condition, or if the development has been unduly curtailed. It is easy to see, therefore, that a cheap manufacturer, and an incompetent, rule of thumb photographer, may have definite reason for advocating the use of stain-producing developers. But to rely upon staining matter in the making of negatives is to lean upon a broken reed. The residues obtained by the partial destruction of some complex organic substances are almost pitchy in character, and seem to be very unalterable by ordinary atmospheric influences. But the staining matter produced by the oxidation of developers, so far as I have yet discovered, is never of this kind. Pyrogallie acid generally yields brown products, inclining sometimes to red and sometimes to yellow; but twice I have obtained solutions of so fine a deep blue color, that it might have been mistaken for Prussian

These blue colors, on standing for blue. a few hours, faded to a yellowish-brown. The deep reddish-brown color obtained by simple aerial oxidation of a solution of pyrogallie acid and sodium carbonate, be comes perceptibly lighter in a day or two when bottled up, and in a week or so may have lost perhaps half the depth of its color. I think one is quite justified in saying that neither the quantity nor the quality of these staining matters can be controlled, that they are in every way uncertain, and that, therefore, they ought to be rigorously excluded, or perfectly removed, from every negative of value.

And these are far from being all the reasons why the presence of staining matter in negatives should be avoided. A silver image is reliable, and can be chemically worked upon with perfect certainty as may be desired. But staining matter cannot form a foundation for after work, and it will suffer change with almost every operation upon the negative. Its color will change and re-change, and by washing it will, under some circumstances, be partly removed. We know very well that when a part of the image is removed by applications to the surface of the film, the shadows lose a greater proportion of density than the lights, because the dark detail is in the upper or outer service of the film only, and so is more easily attacked. Therefore, granting for the moment that a negative with an image that con sists partly of staining matter has correct gradation, if a part of the staining matter is removed the gradation will be falsified, and this alone would be sufficient reason for condemning the use of staining matter in negativo making.

There is another source of staining matter, namely, the oxidation of the developer by its exposure to the air during development. The coloring matters so produced may or may not be the same as those resulting from the action of bromine, but, so far as my experiments go, they behave in a similar manner with reference to those changes that are of practical in terest to photographers. The darkened solution will soak into the gelatin and color it more or less uniformly, and it appears that it may perhaps also intensify the image by deposition upon it, if we take into account recently published experiments. Mr. A. W. Dolland* has shown how by the use of glycerin gold may be deposited upon the metal in a platinum print, the platinum apparently remaining quite unaffected, and merely determining by "contact action" the precipitation of the gold from a solution that is ready to deposit it upon the least disturbance. Mr. E. J. Wally has confirmed the result of earlier workers, who found that silver might be similarly deposited. And, coming still more closely to the point under discussion, Dr. R. E. Liesegang; has re cently observed that substances of the na-

*Journal of the Photographic Society, N. S., xviii, 189.

Hournal of the Photographic Society, N. S., xviii., 184.

Photographie Work, iii., 121.

ture of pigments may be deposited upon a metallic basis is an analogous manner. He found that the staining matter produced by the aerial oxidation of pyrogallic acid, hydroquinone, and similar substances in alkaline solution, would deposit upon and intensify the image of a silver print. - Л solution of amidol with carbonate of soda he found would deposit coloured oxidation products upon the image of a platinum print. It is, therefore, but natural to sup pose that probably some times the staining matters produced by a rul oxidation in developers will deposit upon the image in negatives, and add to the exidation products that are already there, produced by the action of the braining as before de scribed. I have made one experiment in this direction by soaking part of a nega tive in an alkaline solution of pyrogallie acid, allowing it to remain until the solution and the negative were both well col oured, and then washing for a short time. The colour, of course, retaided printing, but I could not discover any intensification effect. It is possible that the staining matter produced by acrial exidation may attach itself more readily to the image when the image is firshly formed, or it may be that it does not attach itself to the image at all under the conditions which hold during development.

Every photographer knows how to set to work to avoid the production of stain ing matter, but I think that very few know how to get rid of it when it is in a negative. The usual method is to apply an acid solution a so called "clearing solution." The stain may disappear, and then the photographer imagines that it has gone. The error of this empirical and rule of thumb method can be easily demonstrated. If hydrochloric acid, sal phurie acid, sulpharous acid, or alum is added to an oxidised alkaline solution of pyrogallic acid, the brown color is chang ed to a lighter brown, and immediately a yellowish insoluble matter begin; to fall out of solution, and continues to increase in quantity for some considerable time. In a negative where there is not much stain this change of color may cause it to disappear, and the superficial observ er would then think that he had got rid of it, while really he had made it, or a large part of it, more perma-nent than before by cendering it in soluble. It is easily shown that this precipitated matter generally constitutes a very important part of the staining material, by dissolving it in sodium carbonate and comparing the color so obtained with that of the original, or of the part not precipitated. Citric acid differs from the acids mentioned above, in that it gives no precipitate, but citrie acid and alum together give a copious precipitate oven when the quantity added is many timemore than sufficient to reader the solution strongly neid.

It appears, however, to be possible in aggravated cases to get a small residuam of stain from the use of pyrogallic acid, and rather more from the use of hydroquinone, which it is very difficult indeed,