tremely soluble in water and in alcohol. Duparc and Pearce[1] prepared the salt in the form of rhombic prisms.

The neutral ammonium salt of mandelic acid was prepared by the usual method in ether. When the ammonia was added there was first formed a white mucilaginous precipitate which soon changed to a fine crystalline powder, very soluble in water, methyl alcohol, ethyl alcohol and acetic acid, but insoluble in ether and acetone. The salt, being very deliquescent in the air, was quickly filtered, washed with ether, and dried for a short time over sulfuric acid in a vacuum desiccator. It gave a neutral solution when dissolved in water. It loses ammonia in moist air. The salt can be crystallized from ethyl alcohol in aggregates of fine needles.

Calc. for $C_8H_7O_3(NH_4)$: 8.28%; found: 8.29% N.

Ammonium Uvitate.—No record can be found of the preparation and properties of this salt other than being mentioned by Finck[2] that it is impossible to precipitate it out of its aqueous solution by alcohol. When dry ammonia gas was run into an alcoholic solution of uvitic acid, no precipitate was formed. Upon the addition of ether to this solution a white, flocculent precipitate was formed. This was filtered by suction, keeping the alundum crucible filled with ether to prevent the salt going into solution on account of the alcohol present. The salt dried in a vacuum desiccator to an amorphous powder. It is readily soluble in water to which it imparts a neutral reaction. It is soluble in methyl alcohol, ethyl alcohol, and acetic acid, slightly soluble in acetone and insoluble in ether. The salt is not deliquescent. The salt prepared in ether had these same properties, and analysis showed it to be the neutral ammonium salt of uvitic acid.

Calc. for $C_9H_6O_4(NH_4)_2$: 13.08%; found: 13.10% N.

This investigation is being continued with other organic acids, especially the substituted acids.

ST. LOUIS, MO.

SOME NATURAL INDICATORS.

BY H. W. BRUBAKER.

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Cohn, in his "Indicators and Test Papers," states that the coloring matter from roses (*Rosa Gallica*) gives a deep red with green fluorescence in alkalies and light red in acids. I found that the coloring matter from *Rosa rugosa* gives a green color in alkalies, red in acids and coloress between these two. The coloring matter was extracted by triturating the petals in a mortar with some sea sand and 95% alcohol. This was then filtered and the filtrate evaporated to dryness somewhat above room tem-

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[1] Duparc and Pearce, *Z. Kryst. Min.*, **27**, 611.

[2] Finck, *Ann.*, **122**, 186 (1862).

perature. Upon taking the red coloring matter up in water, most of the fatty substances were left undissolved. This water extract was of a very bright red color. To preserve the solution, enough alcohol was added to make a 50% alcoholic solution. The addition of the alcohol partly decolorized the solution. This solution, when used as an indicator, was changed to green by 0.1 *N* NaOH and, upon titrating with 0.1 *N* HCl, went through a blue green to colorless and then to pink in the acid solution. The neutral point was coincident with the colorless point which was changed to either green or pink by 1 drop of 0.1 *N* NaOH or, 0.1 *N* HCl, respectively. The fact that the neutral point is colorless is probably due to the mutual destruction of the coming pink by the going green or *vice versa*.

Upon titrating a 0.2 g. sample of sodium bicarbonate with 0.1 *N* hydrochloric acid, using methyl orange as the indicator, there were required 24.8 cc. of the acid. Upon repeating the titration, using the rose extract as indicator, the correct end point was not recorded unless the solution was boiled to drive off the carbon dioxide, in which case exactly the same amount (24.8 cc.) of the acid was required to give the colorless point. This indicator, therefore, behaves like phenolphthalein toward carbon dioxide. It is a weak acid substance. Rose test paper, made by dipping filter paper into the solution and drying, changed from green in alkalies to red in acids. It was found to be sensitive to 1 part of NaOH in 25,000 parts of water. The extracted coloring matter from several other species of roses behaved, in general, like the one described above.

The coloring matter from the Perennial Pea (*Lathyrus Latifolius* L) behaved in a manner similar to that from the rose, giving a green color in alkalies red in acids and colorless at the neutral point. This substance, when extracted from the blossoms with 95% alcohol, gave a nearly colorless solution, which acquired a slight pink color on standing and which developed color very sharply in either acids or alkalies.

The coloring matter from the Iris (Blue flag), extracted as described above with alcohol and evaporated to dryness, gave a purple substance which was taken up in water to separate it from fatty substances. This coloring matter changed to green in alkalies and red in acids and, like the rose color, gave a colorless solution at the neutral point. The alcoholic extract obtained from the purple Vetch gave the same color changes. The principal coloring substance of each of the above flowers seems to be the same, or very closely related chemically, as it behaves, in general, the same in all cases toward acids and alkalies. It is probably the same substance as found in the hollyhocks and dahlia, which is described by Cohn[1]. If the original alcoholic extract of certain varieties of roses is evaporated on a water bath, glucosides present decompose, giving rise to a large amount of caramel which obscures the natural red coloring matter. The petals of most flowers, especially the blue, red, pink, purple, etc., ones change color when placed in alkaline solutions and back to the original color or to some shade of red when placed in acids.

The following table gives a list of some changes noted:

Flower.		In NH_4OH.	In HCl.
Crimson geranium		dark purple	bright red
Orange red geranium		bright purple	orange-red
Martha Washington geranium		blue to greenish blue	red
White geranium		yellow	white
Mock orange (white)		yellow	white
White pansy		canary yellow	white
Purple pansy		greenish blue	red
Dark red pansy		dark blue-green (almost black)	red
Yellow pansy		no effect	no effect
Yellow and brownish red colors, mixed pansy		the yellow unchanged the brownish red changed to dark olive green	unchanged changed to blood red
Dandelion (yellow)		no effect	no effect
Phlox		olive green	red
Begonia		dark blue	red
Nasturtium		through olive green to brown	orange-red
Petunia		greenish blue to green	purple-red
Red rose		greenish blue to green	red
White rose		yellow	white
Cut leaf mallow		blue	red
Red poppy		purple	red
Field larkspur		green	red
Vetch		green	red
Bind weed	white	yellow	white
	pink	green	pink
Portulaca	pink	lavender	pink
	crimson	purple	crimson
	blood red	dark brown (almost black)	blood red
	yellow	no effect	no effect
Bachelor button (purple)		blue	red
Clover	white	yellow	white
	red	green	red

It is noticeable that the yellows are not affected by acids or alkalies. The whites are changed to yellow by alkalies and back to white again in acids.

The reds and purples are changed to some shade of green or greenish blue by alkalies and usually back to the original color or a brighter red color by acids. These natural coloring substances seem to be quite generally acid in character, in some cases neutral.

When it is observed that a certain flower or species of flower presents several different colors or shades of color, the question naturally arises, does each of these colors represent a different chemical compound?

Judging from the above observations, it seems likely that nature makes use of comparatively few basal coloring substances with which to produce many different colors by means of slight chemical changes. These substances are generally acid, sometimes neutral in character, and generally change color in acids and alkalies, alternately, acting as indicators. It is noticeable also that many of them are very sensitive to the action of light and air. The faintly colored alcoholic solutions of the Rose or the Perennial Pea, when evaporated to dryness, leave the bright red colored substance. The pink blossoms of the Perennial Pea, when picked and allowed to wilt, change to a violet color. The whole subject of natural coloring matters deserves a careful study from the chemical standpoint.

MANHATTAN, KANSAS.

THE PERIODIDES OF ACID AMIDES AND THEIR ADDITION PRODUCTS WITH METALLIC SALTS. SUBSTANCES OF EXCEPTIONALLY HIGH MOLECULAR WEIGHT.

BY F. J. MOORE AND RUTH M. THOMAS.

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It is well known that many organic bases form periodides usually containing more or less hydriodic acid, and that these substances, in their turn, form double compounds with metallic salts. The literature of such substances is extensive and widely scattered, and no complete review of it will be attempted here. It will be sufficient to call attention to the work of Geuther[1] who reviewed most of the work of others done up to this time; and that of François,[2] who devoted his attention chiefly to the periodides of the alkaloids. Little seems to have been done in the direction of preparing periodides of substances of the amide type, though Hoogewerff and van Dorp[3] studied the action of alkali and bromine upon the amide of benzene-*m*-disulfonic acid and observed the formation of a perbromide, $2C_6H_4(SO_2NBr_2)_2 + KBr + HBr$. Hofmann[4] noticed that acetamide formed a compound,

$$CH_3CONBr_2 + NaBr + H_2O.$$

Titherley[5] observed the formation of double salts of acetamide such as $2CH_3CONH_2$, NaBr and $2CH_3.CONH_2$, NaI; and André[6] fused acetamide with various metallic salts and obtained different products, such as

$$2CH_3CONH_2.CoCl_2.H_2O;$$

and Wheeler[7] also prepared some colored perhalides of acid anilides of

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[1] *Ann.*, **240**, 66 (1887).

[2] *J. pharm. et chim.*, [6] **30**, 193 (1909).

[3] *Rec. trav. chim.*, **8**, 173 (1889).

[4] *Ber.*, **15**, 415 (1882).

[5] *J. Chem. Soc.*, **79**, 413 (1901).

[6] *Jahresb. Chem.*, **1886**, p. 1303; *Compt. rend.*, **102**, 115 (1886).

[7] *Am. Chem. J.*, **18**, 85 (1896); **19**, 672 (1897).