can ever see any similar relation with our conceptions of purpose and design, or with those still higher conceptions which are embodied in our sense of justice and in our love of righteousness, and in our admiration of the "quality of mercy." These elements in the mind of Man are not less certain than others to have some correlative in the Mind which rules in Nature. Assuredly, in the supreme government of the Universe these are not less likely than other parts of our mental constitution to have some part of the natural system related to them—so related that the knowledge of it shall be at once their interpretation and fulfillment. Neither brute matter nor inanimate force can supply either the one or the other. If there be one truth more certain than another, one conclusion more securely founded than another, not on reason only, but on every other faculty of our nature, it is this—that there is nothing but mind that we can respect; nothing but heart that we can love; nothing but a perfect combination of the two that we can adore.

And yet it cannot be denied that among the many difficulties and the many mysteries by which we are surrounded, perhaps the greatest of all difficulties and the deepest of all mysteries concerns the limits within which we can, and beyond which we cannot, suppose that we bear the image of Him who is the source of life. It seems as if on either side our thoughts are in danger of doing some affront to the Majesty of heaven—on the one hand, if we suppose the Creator to have made us with an intense desire to know Him, but yet destitute of any faculties capable of forming even the faintest conception of His nature; on the other hand, if we suppose that creatures such as (only too well) we know ourselves to be, can image the High and the Holy One who inhabiteth Eternity. Both these aspects of the truth are vividly represented in the language of those who "at sundry times and in divers manners" have spoken most powerfully to the world upon Divine things. On the one hand we have such strong but simple images as those which represent the Almighty as "walking in the garden in the cool of the day," or as speaking to the Jewish lawgiver "face to face, as a man speaketh to his friend;" on the other hand we have the solemn and emphatic declaration of St. John that "no man hath seen God at any time." In the sublime poetry of Job we have at once the most touching and almost despairing complaints of the inaccessibility and inscrutability of God, and also the most absolute confidence in such a knowledge of His character as to support and justify unbounded trust. In the Psalms we have these words addressed to the wicked as conveying the most severe rebuke, "Thou thoughtest that I was altogether such an one as thyself."

And perhaps this word "altogether" indicates better than any other the true reconciliation of apparent contradictions. In the far higher light which Christianity claims to have thrown on the relations of Man to God, the same solution is in clearer terms presented to us. "Knowing in part and prophesying in part," "Seeing through a glass darkly," and many other forms of expression, imply at once the reality and yet partial character of the truths which on these high matters our faculties enable us to attain. And this idea is not only consistent, but is inseparably connected with that sense of limitation which we have already seen to be one of the most remarkable and significant facts connected with our mental constitution. There is not one of the higher powers of our mind in respect of which we do not feel that "we are tied and bound by the weight of our infirmities." Therefore we can have no difficulty in conceiving all our own powers exalted to an indefinite degree. And thus it is that although all goodness, and power, and knowledge, must, in respect to quality, be conceived of as we know them in ourselves, it does not follow that they can only be conceived of according to the measures which we ourselves supply.

These considerations show,—first, that the human mind is the highest created thing of which we have any knowledge, its conceptions of what is greatest in the highest degree must be founded on what it knows to be the greatest and highest in himself; and, secondly, that we have no difficulty in understanding how this image of the Highest, may, and must be, faint—without being at all unreal or untrue.

There are, moreover, as we have seen, some remarkable features connected with our consciousness of limitation pointing to the conclusion that we have faculties enabling us to recognize certain truths when they are presented to us, which we could never have discovered for ourselves. The sense of mystery which is sometimes so oppressive to us, and which is never more oppressive than when we try to fathom and understand some of the commonest questions affecting our own life and nature, suggests and confirms this representation of the facts. For this sense of oppression can only arise from some organs of mental vision watching for a light which they have been formed to see, but from which our own investigations cannot lift the veil. If that veil is to be lifted at all, the evidence is that it must be lifted for us. Physical science does not even tend to solve any one of the ultimate questions which it concerns us most to know, and which it interests us most to ask. It is according to the analogy and course of Nature that to these questions there should be some answering voice, and that it should tell us things such as we are able in some measure to understand. Nor ought it to be a thing incredible to us—or even difficult to believe—that the system disclosed should be in a sense anthropomorphic—that is to say, that it should bear some very near relation to our own forms of thought—to our own faculties of mind, and soul, and spirit. For all we do know, and all the processes of thought by which knowledge is acquired, involve and imply the truth that our mind is indeed made in some real sense in the image of the Creator, although intellectually its powers are very limited, and morally its condition is very low.

In this last element of consciousness, however—not the limitation of our intellectual powers, but the unworthiness of our moral character—we come upon a fact differing from any other which we have hitherto considered. It is not so easy to assign to it any consistent place in the unities of Nature. What it is and what it appears to indicate, must form the subject of another chapter.

PROGRESS OF BOTANICAL SCIENCE IN THE UNITED STATES.

By J. C. Arthur.

The sketch by Professor Bessey in the December *Naturalist* of the work in Botany done in this country during 1879 is very interesting, and offers an opportunity of comparing the present status of the Science in America with its progress elsewhere. The article shows which departments have been most cultivated, and indicates to some extent the thoroughness and value of the observations and researches. The principal activity was manifested in Descriptive and Systematic Botany, and that largely among Phanerogams and Ferns. Such examples as Mr. Watson's "Revision of North American Liliaceæ" and Dr. Gray's "Botanical Contributions" are of the highest scientific value. These are accompanied by others which are little, if at all, inferior. Large and elegant works like Eaton's "Ferns of North America," Meehan's "Native Flowers and Ferns of the United States," Goodale's "Wild Flowers of America,"

and Williamson's "Fern Etchings," are signs of the healthy growth of popular interest in the objects of the Science.

Among the lower orders of plants, systematic work has not been so vigorous. The literature is widely scattered, and of many of the groups is in a most disheartening chaotic state. The disentangling and critical arrangement of this matter is at present one of the most important services that could be rendered the student. The labor of consulting all the descriptions belonging to any one group is often very great, and is always accompanied with a doubt if complete success has been attained. Further perplexities are the unequal value of the material when found, and the difficulty of determining synonymy. Monographs of the groups are exceedingly desirable; but such exhaustive studies are not often made, and in lieu of them careful compilations, aided by as much investigation and verification as possible, are very useful. Professor Bessey's "Erysiphei," Mr. Peck's "United States Species of Lycoperdon," and Dr. Halsted's "American Species of Characeæ" are admirable examples of such contributions to the advancement of knowledge.

It is a law in the growth of a biological science that the objects with which it deals must be carefully identified and systematically described before much progress will be made in the recondite investigations of structure and development, and the relations to physical forces, or in the higher problems regarding the *rationale* of forms and processes. Every advancement in morphology and physiology, however, reacts upon classification and helps to establish it upon a more satisfactory basis. While systematic work is thus the very foundation of the science, it is only by following it up in the same zealous manner with anatomical and physiological researches that the science makes most substantial advancement.

It is manifestly the natural and wise thing for American botanists to collect herbaria and study floras till the species and their distribution are fairly known. For Phanerogams and Ferns this has been well accomplished, and approximately so for Mosses and Liverworts, but the Thalloyhytes (Algæ and Fungi) remain comparatively unknown. Not but what there is still room for excellent systematic work among Phanerogams, but that the stumps and stones and other obstacles in the field have been pretty fully cleared away and it is now a matter of plain cultivation, while the other departments of the science need earnest workers who are not afraid of difficulties, and are willing to clear up and cultivate single handed as large areas as possible.

In the article cited, the Professor feels called upon to apologize for the neglect of Anatomy and Physiology during 1879. He says:—"While we may regret that so much of the field has been so sadly neglected in our country, we should remember that, as a rule, our botanists are overloaded with other duties which render it often impossible for them to command the time for making the necessary investigation." Admitting that the plea partly accounts for the inactivity, it still does not seem to touch the chief cause of the difficulty. It is rather to be ascribed to a lack of enthusiasm for these subjects. They have not yet come into vogue with lovers of the science: the tidal wave of laboratory and experimental Botany is yet but slightly felt; the problems seem new and strange, and just where and how to attack them appears obscure and uncertain. The work already done in these fields has mainly related to the means and accompanying phenomena of the fertilization of flowers. Some excellent papers have been published, although not lengthy. Histology, Embryology, and Physiology proper, however, appear almost without followers, judging from the results communicated. At the present time, Germany is the centre of the most active researches relating to the latter subjects, and France is not far behind.

In order to keep informed of the latest discoveries and results in the botanical world, an acquaintance with the journals in which they are announced is imperative. It is a trite saying in matters of daily life, that if one wishes to be "posted" he must read the papers. This applies even more forcibly to botanists, because their usual isolation deprives them of most other means of obtaining botanical news.

Among the most important exclusively botanical journals are the following: *Botanisches Centralblatt*, abstracts of the latest writings, and a full index, for all departments of the science; *Botanische Zeitung*, anatomy and physiology chiefly; *Flora*, general botany; *Pringsheim's Jahrbücker.*, physiological botany; *Hedwigia*, cryptogams; *Annales des Sciences Naturelles Botanique*, general botany, but with a large share of anatomy and physiology; *Bulletin de la Société Botanique de France*, general botany; *Journal of Botany*, largely systematic; *Grevillea*, cryptogams; and the two home journals—*Bulletin of the Torrey Club*, largely systematic; and *Botanical Gazette*, general botany, but inclined towards physiology. The first two of the list are weeklies; *Flora* is issued in thirty-seven numbers, and the others are monthlies. Beside these there are a large number of periodicals which devote considerable space to botanical matters, such as the *Quarterly Journal of Microscopical Science, Hardwicke's Science Gossip, American Naturalist, American Monthly Microscopical Journal*, etc. If one were confined to two, probably the *Botanische Zeitung* and the *Bulletin de la Société Botanique*, would prove the most satisfactory, presuming that the home journals are also taken, as a matter of course. Mr. Douglas, of Richland, N. Y., proposes to issue a translation of the *Zeitung*, for less than the subscription price of the original (but without the plates, we suppose). This laudable undertaking should receive substantial encouragement from English speaking botanists.

Probably there is no better indication of the beginning of a new era for American botany, than the changes made in the recent text-books. Dr. Gray's "Botanical Text-book" is expanded into four volumes, treating of the Morphological Structure of Phanerogams, Histology and Physiology, Cryptogams, and the natural orders of Phanerogams, respectively. The second volume is to be written by Dr. Goodale, and the third by Dr. Farlow. The first volume of the series has already appeared.

THE DETECTION OF STARCH AND DEXTRIN.

By Spencer Umfreville Pickering, B. A., Oxon.

In conducting some experiments in which it was necessary to ascertain the presence or absence of starch in a liquid containing various amounts of dextrin, the few facts here described were brought to light, and may, perhaps, be of sufficient interest to warrant their publication.

When a solution of starch which has been colored blue by the addition of iodine is heated, it is found that the temperature at which the color disappears varies with the intensity which it possessed before heating. Thus, for instance, 100 c. c. of a rather dark iodine-starch solution on being heated gradually in a flask became perfectly colorless at 58° C., and, on being cooled, showed a slight reappearance of color at 49° C., whereas an opaque blue solution did not lose its color till heated to 99° C., and became visibly colored again when cooled to 63° C. Similarly variable results were obtained by experimenting on iodine-starch solutions in sealed tubes, the temperatures of reappearance being much more constant (generally about 50° C) than those of disappearance; this no doubt is due to the fact that, the stronger solutions having been heated to a higher temperature than