

trum taken for measurement, which we will call the unit of the color, a patch of the spectrum obtained by a diffraction grating, representing a range of fifty ten-millionths of a millimetre in wave-length, was selected. This gives an area of color of convenient size for comparison, and one which appears quite homogeneous to the eye, even in those parts of the spectrum where the change is most rapid. The wave-lengths here given represent the centre of the area selected. The location of the standards with relation to the absorption lines of the spectrum, where such a location was possible, will give a convenient means of ascertaining the position of the standards I have selected without recourse to the elaborate method required in the use of the goniometer.

The Standard Spectrum Colors.

Color.	Wave Length.	Location by Prominent Solar Lines.
Red	6587	Above the "C" line.
Orange	6085	Between lines 6123 and 6066.
Yellow	5793	Between lines 5816 and 5763.
Green	5164	Between lines 5189 and 5139.
Blue	4695	No prominent lines.
Violet	4210	No prominent lines.

To obtain the intermediate hues, which it may seem desirable to introduce between these standards, these should be combined in inverse proportion to what the artists call the "value" of the colors. This is not, perhaps, easily determined, yet its approximate measure can be ascertained with sufficient accuracy for this purpose. These, however, are of much less consequence than the standards. Using Maxwell discs in these standards, the following formulæ will serve to illustrate, viz.:—

Orange Red *R* 70, *O* 30, Red Orange *R* 41, *O* 59.

Here the orange, having what the artist calls a higher "value," is used in a smaller proportion than the red. The same will be true in producing the tints and shades of any color. The amount of white or black to be used must be determined by the value of the color.

It has been urged in objection to the spectrum colors that they are not the colors of nature. In reply to this objection, it should be said that nature has no other colors than those of the spectrum. With these, however, are combined more or less of white light and shadow, producing the beautiful effects which so charm us in the landscape as it is spread out before us. For purposes of instruction, a series of what we may call "broken" colors is valuable. These are mixtures of the standards with both white and black, in given proportions. The amount of white and black must be determined, as in the case of tints and shades, by the value of the color. For advanced educational purposes, these broken colors are valuable, but should not be used until the student is well grounded in the knowledge and use of the standards.

The adoption of this scheme for practical purposes is also a subject of interest. By the use of the Maxwell discs, made in these standard colors, it is possible to determine the components of any color with which one may meet. The formula for such an analysis will enable anyone, by means of a similar set of discs, to reproduce the color with perfect ease. New combinations of color may also be produced with equal facility. In cases of experimentation, to ascertain what combinations of color would be harmonious, this is a great saving of time, labor, and cost.

The use of such terms as vermilion, emerald green, ultramarine, and other similar terms to express the results of analysis, is impracticable in the extreme, on account of the variability in the use of the terms.

Discs made in these standards are manufactured and can be furnished at a moderate price. These discs are at present made in pigments, which are excellent reproductions of the spectrum hues. Some of them, however, can be produced in the brilliancy required only by the use of aniline colors, and these are not

permanent when exposed to the light. For this reason they must be carefully protected when not in use and have to be frequently renewed.

MISSOURI OFFICIAL GEOLOGICAL REPORTS.

BY F. A. SAMPSON, SEDALIA, MO.

THE late publications of the geological survey of Missouri contain lists of the reports of the survey, which lists are not complete and give but a part of the official geological reports of the State; the four below mentioned should clearly be added to the list.

By an act of the legislature of the State approved Feb. 11, 1839, a Board of Internal Improvements was organized to have supervision and control over all State roads, railroads, slack-water navigation, or canals. The act provided for the appointment of a chief engineer, who should cause to be compiled "a large and correct map of the State" showing in "a correct and minute manner" the geographical, topographical, and geological features of the State. In his office should be kept "all reports of engineers, geologists, and other scientific persons, either contributed by individuals or ordered by the State." A supplemental act, dated two days later, provided for surveys of four rivers, the Osage, the North Grand, the Salt, and the Merrimac, and one railroad route, that from St. Louis to the Iron Mountain.

The members of the board were appointed by the Governor, and these were assigned as commissioners of the above five routes. A State engineer and a geologist of the Osage River survey were also appointed. The journal of the board and the reports of the chief-engineer and geologist are among the scarcest of the publications of the State. I know of no copy in the State except my own. It was published in the appendix to the Senate journal of the eleventh General Assembly, 1840-41, and probably in the House journal also, but I have never seen any copy of the latter, I know of no copy of either journal in any library in the State. The report I have found in the tower of a court-house in Central Missouri, the journal part having been torn away, but leaving the appendix complete. The title of the report is "Report of a Geological Reconnaissance of that part of the State of Missouri adjacent to the Osage River, made to William H. Morrell, Chief-Engineer of the State, by order of the Board of Internal Improvement, by Henry King, M.D., Geologist, President of the Western Academy of Natural Sciences, etc., etc.," pp. 506-525.

Professor Swallow made a report on the southwestern branch, in obedience to the act of March 3, 1857, which required the State geologist to make a thorough survey along the lines of all railroads aided by the State, and to report in detail to the president and directors "all the mineral, agricultural, and other resources which may affect the value or income of the road under their direction." But one such report was published, but this is as much one of the official reports of the survey as any other of Swallow's reports. Its title is "Geological Report of the Country along the line of the Southwestern Branch of the Pacific Railroad, State of Missouri. By G. C. Swallow, State Geologist. To which is prefixed a Memoir of the Pacific Railroad. St. Louis: Printed by George Knapp & Co., 1859." 93 pp., plates and geological map of southwest Missouri.

Another edition of this report somewhat fuller was published in New York by the Pacific Railroad Company, but I have not seen a copy of it.

The third omitted report is a short one, but it could not have been omitted on account of that fact, as Swallow's third report is still shorter. It is entitled as follows: "Report to the Board of Curators concerning the Transfer of the Geological Survey to the School of Mines, and the work executed during the year. By Charles P. Williams, Ph.D., Director Missouri School of Mines and Acting State Geologist."

When preparing the bibliography of the geology of Missouri I found this report in the catalogue of the Missouri State University for 1876, pp. 213-216, a publication in which one would not look for a geological report, but for some years the catalogues of the university contained many papers of merit, as addresses and

lectures, contributions from the laboratories of the University and of the School of Mines, Bulletins of the Agricultural College, etc.

The latest of these omitted reports was found by me since the publication of the Missouri bibliography, in the House journal of the adjourned session of the twenty-sixth General Assembly, 1871-72, pp. 226-290, and I think it was not published except in that journal. Its title is "Report of Progress of the State Geological Survey, from August 30, 1870, to March 13, 1872. By J. G. Norwood, State Geologist, pro tem., State University, Columbia, March 13, 1872."

CHARACTER IN ANIMALS.

BY W. C. BARRETT, M.D., D.D.S., BUFFALO, N. Y.

MAN too often looks upon the lower orders as possessed of nothing but selfish instincts and impulses, and as being moved by nothing but animal appetites. He becomes a tyrant over them, and never for a moment dreams that they can comprehend his meanness and injustice. A little more of observation would remove this impression. Who that has been in close contact with any class of animals but can call to mind instances of the exercise of gratitude, real benevolence and magnanimity, that would do honor to the noblest human beings?

This is not confined to domestic animals, nor can the exhibition of special traits be attributed to their association with man. It is a truth which no observer will deny, that some are quite incapable of affectionate impulses. They seem to have sufficient intelligence, but like some men they are utterly and entirely selfish, while others are even morose and vindictive. There is as distinct and characteristic an individuality in their natures as in that of human creatures. It is an interesting exercise to study these personal peculiarities even in wild animals, and to detect the human traits which distinguish each. Birds that seek the companionship of man exhibit a wide variation in individuality. It is not difficult to obtain the confidence and trusting faith of some robins, for instance, while others are ever suspicious and distrustful.

I was once possessed of a common red squirrel, that was caught when but a few days old, and which had the most charming personal characteristics imaginable. I never saw in any human being a stronger and more marked individuality than this animal possessed. It was as playful as a young kitten, and delighted in the attentions of anyone of whom it was fond. It was as affectionate and as demonstrative as ever I saw a young child. It had withal a merry, playful mischievousness, that while it was at times vexatious, made it seem almost human. It was allowed to run about the rooms at will, and it found the most constant delight in entangling a piece of knitting or other work, and, when detected, in attaining some inaccessible height, then indulging in a chuckling kind of chatter. The chess table could never be set out with the animal at liberty, but that when the players became absorbed in the game and had forgotten all else, Jennie would suddenly alight upon the table, scattering rooks and pawns in every direction, and instantly disappearing up a curtain or into some nook in the book-cases. This would be repeated as often as the players forgot their surroundings, until it became necessary to catch her and shut her up in her cage. One could not lie down upon a couch, with a newspaper which he was reading held aloft over the head, but that like a lightning flash Jennie would light upon the paper or book, and instantly scramble away to some safe place, where she would absolutely chuckle at the success of the scheme. She never gnawed the furniture but once, for she never forgot the punishment which this brought.

She was subject to likes and dislikes, and every visitor who entered the room was carefully scrutinized. If it was a lady who was looked upon with favor, her hair was pretty sure to be pulled down by the demonstrations of affection, and out of a seeming pure love for good-natured mischief. If, on the other hand, the visitor was looked upon with distrust, he could never get near the animal. It loved to fondle those who were its favorites, and exhibited the utmost affection for them. Indeed, its attentions sometimes became too intrusive for comfort.

One unlucky day an accident deprived poor Jennie of her life, and I obtained another, caught at quite as early an age, and always treated with the same kindness and care. I had expected another such charming pet, but there was no more similarity in disposition than there might be between two utterly diverse children. The second animal was morose, sullen, vindictive, in every way disagreeable. The first one would never under any circumstances attempt to bite, while the second was at least always threatening it, and forever scolding and chattering, until at last I gladly gave it freedom in the woods and obtained a successor.

This one was unlike either of the others. It was not playful or affectionate, nor was it perverse and churlish. It was a complete exemplification of the miser, and its whole character was absorbed in its acquisitiveness. It was ever hunting for nuts and other things which struck its fancy, usually articles of food, which it carried away to a secret place in a closet. Occasionally these were taken out by some member of the family and placed in another room, for the purpose of watching the seeming exultation with which the squirrel made their discovery, and the enjoyment it appeared to take in carrying them away and again hiding them. It would run back and forth with such extreme assiduity that it would tire itself out and drop panting upon the floor, only after a few moments' rest to recommence the task. If the newly-found treasure were suddenly removed during its absence, there would seem to be the most poignant disappointment. The animal would for a time search anxiously for the vanished wealth, and then in succession visit the members of the family who were present, and seem to beseech its return, as if knowing that we were responsible for its loss.

There was never a moment during the day which was not spent in searching for something to add to its hidden possessions, or in arranging and rearranging its store. The animal, like some men, was so utterly absorbed in its avariciousness, that it had no time to devote to anything else. All affection was lost in its sordid nature. It had no special dislike for or fear of human beings, yet it sought solitude, apparently to enjoy the contemplation of its accumulations. It was unsocial, simply because of its covetousness. No human mind ever exhibited a meaner avariciousness, or a more parsimonious stinginess. It would suffer for lack of food, rather than take one nut from its great possessions. Its most salient characteristics were so disagreeable to witness that I finally gave the animal away, and after several other attempts gave up in despair that attempt to find another such cheerful, engaging, affectionate, trusting pet as the first one, being fully convinced that such characteristics are as rare among squirrels as they are among men and women.

CURRENT NOTES ON ANTHROPOLOGY. — XXIX.

[Edited by D. G. Brinton, M.D., LL.D., D.Sc.]

Modifying Agents of Skull-Form.

It looks now as if Broca, however eminent in many branches of anthropology, was no wiser as a prophet than others of that genus when he ventured this prediction: "The day will come when the characteristics of all the races and their subdivisions will be so well known, that the study of a series of skulls will be sufficient to determine their origin."

It is in pursuit of the realization of this dream that craniologists have labored ever since, with the result that they are farther from the goal than ever. Now, the wiser among them are turning their attention rather to the history of the development of the skull and its parts, both in the individual and, comparatively, in the realm of animal life, and not endeavoring to use it as a standard for the classification of races and peoples. It is found that in certain instances the shape of the same skull varies materially with the age of the individual; that the tendency to reversion to one or the other type in the parents is by no means equal in all cases; that there are marked correlations with greater strength, viability, and sexual life, which give one or the other form an advantage in a given *milieu* above its associate; that the prevailing type of a geographical province seems to exert an influence