this to be the case. Dr. Ramsbotham is of opinion that adhesions may bring on a favourable termination, by binding down the cyst, and preventing its further development; but this is a very exceptional case.—*Medical Gazette*, January 31.

UNIVERSITY OF CAMBRIDGE.

NATURAL SCIENCES TRIPOS.

CAMBRIDGE, MARCH 8TH, 1851.

Gentlemen who distinguished themselves and passed their examination March 8th, 1850:—

First Class.—Distinguished in Chemistry: Living, St. John's College; Harden, Magdalene College.—*In Physiology and Botany:* Hort, Trinity College.—*In Chemistry and Botany:* Evans, St. John's College.

Second Class.—Payne, Trinity College; Wilson, Trinity College.

This being the first year of the Natural Sciences Tripos the number of candidates was small.

QUESTIONS.

Comparative Anatomy.—1. Describe a primitive organic cell. In what respects are the simplest Infusoria analagous to such a cell, and in what does the analogy fail? In Infusoria having a mouth, are there any visible actions which correspond to the distribution of nutrient fluid, and to the aeration of the same? In what different ways are their motions performed? How are they propagated? How do you distinguish them from microscopic vegetable forms?—2. What are the anatomical characters which distinguish the Bryozoa from the Polypi? Mention some genera of the former class.—3. Acalephæ: What is the situation of the organs supposed to produce the sensation of stinging on touching many of these? Describe their form. What do you consider to be the respiratory organs in this order? What are the metamorphoses between the states of ovum and of full development.—4. In those star-fishes which have only a single opening into the digestive cavity, and in those which have an outlet from it also, what difference is there in the origin of the cœcal appendages?—5. Describe the typical ring of an animal of the Articulata (sub-kingdom). What are the appendages of such a ring? In those which breathe by gills or tufts, where are these attached?—6. What are the anatomical characters which distinguish winged insects from the class Arachnida on the one hand, and from the class Crustacea on the other?—7. Describe the six parts which enter into the composition of the masticatory apparatus of Insects (organa cibaria). Compare these different parts, and shew how they are modified in form and office in the Coleoptera and the Haustellata.—8. From the general economy of Insects, shew that it is at least as probable that the Malpighian vessels, or tubes, perform the office of a kidney as of a liver. State direct chemical experiments which determine the question.—9. Vertebrata: Describe the typical Vertebra, according to Professor Owen, defining its autogenous and exogenous elements. Shew how these elements make up a vertebra of a bird in the thoracic region.—10. What are the modifications of the spinal column in birds which relate to flying? Describe the bones which make up the frame-work of their shoulder.—11. What is the position of the Pancreas in birds: what the ordinary number of its ducts? How is the limit between the small and large intestine generally indicated in this class? Is it the rule, or the exception, that birds have a gall-bladder. Give instances of the exception. When there is a gall-bladder, what is the number and course of the ducts between the liver, bladder, and duodenum?—12. Have birds any of the following parts of the brain? Pons, lateral, lobes of Cerebellum, Fornix, Corpus callosum.—13. Mammalia: On what characters and their combinations is Cuvier's division of Mammalia into orders founded? What is it which properly constitute *the hand?*—14. Which of the following possess a clavicle: Whale, Kanguroo, Mole, Shrew, Horse, Rhinoceros, Hedgehog, Seal, Bear? What Mammalia have a persistent coracoïd bone?—15. How are the Larynx, Epiglottis, and Nasal passages modified in true Cetacea to fit them for aerial respiration, whilst feeding with the mouth under water?—16. What are the osteological characters of the Æthiopic, the Mongol, and the Caucasian races of man.—17. What are the peculiarities of the human brain?

Physiology.—1. Give illustrations, derived from observation on different animals, of the law that the more developed and complicated the individual parts of an organism are, the more dependent are they upon one another.—2. Give instances to prove that the modes, in which the excitable properties of organs are manifested, depend not on the nature of the stimuli, but on the peculiar vital endowments of the organs themselves.—3. Shew that in animals which have distinct, circulatory, respiratory, and nervous systems, the reciprocal action of these is necessary to life.—4. Give instances of fluids either at rest or in motion in contact with living surfaces being under the influence of the vital forces with which those surfaces are endowed. Assign the proofs of the existence of such influence.—5. What are the chief alimentary proximate principles in the food of man? State the tissues of the body with the constituents of which some of these principles more especially correspond.—6. What part, in the process of assimilation of the food, is performed by the agency of the stomach in vertebrate animals? and what forces are concerned in that agency?—7. What changes occur in the chyle in its course from the lacteals of the intestines to the termination of the thoracic duct in the vein?—8. Describe the mechanism and function of respiration in mollusca, batrachia, and insects.—9. In what consists the analogy between respiration and ordinary combustion? and how do you explain the generation of animal heat in the system generally?—10. Explain the physiology of hybernation.—11. What purpose does the tortuous course of the internal carotid and vertebral arteries subserve in man? State cases in the lower animals in which remarkable arteries assume the form sometimes called "rete mirabile," and explain the purposes supposed to be effected by them.—12. Trace the analogy between growth and secretion by reference chiefly to recent physiological observations.—13. Distinguish the absorbing function of the veins from that of the lymphatics, and support your statement by reference to experiments.—14. What are the elementary constituents of fat? what purposes does it serve in the animal œconomy? and what place in the scale of animalized substances would you assign to it?—15. What is the characteristic property which, according to Haller, is inherent in the muscular fibre? What are the principle facts alleged in proof of the existence of such inherent property? and according to his theory how is the nervous system related to it?—16. What are the functions respectively of the superior and inferior laryngeal nerves, as shewn by the experiments of the late Dr. J. Reid?—17. What do you understand by reflex or excito-motory action in the nerves? In what parts or organs of the human body are its phonomena principally manifested?

Chemistry.—If 1 lb. of Steam at 212° be passed into 100 lbs. of water at 60°, what will be the resulting temperature.—Describe and give the theory of Leslie's process for making Ice.—2. Explain the formation of dew, and the apparent radiation of cold. Can heat of

low intensity be refracted to a focus?—3. Describe the principles and process of Electrography, and the decomposition of Water by Voltaic Electricity.—Distinguish between true Electrolysis and secondary decomposition. 4. How may the chemical equivalents of Carbon, Sulphur, and Nitrogen be determined; those of Oxygen and Hydrogen being known?—5. Fifty grains of Oxide of Copper, reduced by Hydrogen, give 11.35 grains of Water: what is the atomic weight of Copper; Hydrogen being unity?—6. What quantity of Nitrate of Barytes will decompose 100 grains of Sulphate of Soda; the atomic weights of Barium and Sodium being 70 and 24? —7. Express by Symbols the decomposition of one equivalent of Phosphate of Soda by three equivalents of Nitrate of Silver.—8. Give a general formula for Alum Salts; and examples of Chemical Types. Does the Electro chemical theory accord with that of Types? —9. Give Tests for the Sulphuric, Nitric, Hydro-chloric, and Phosphoric Acids; and a formula for the combination of Potash with Oil of Vitriol considered as an Hydrogen Acid.—10. Describe a process for the Ultimate Analysis of Organic Substances including Nitrogen.—11. What are the Tests for Starch, Gum, Resin, Gelatine, and Albumen; and for the Oxalic, Tartaric, and Hydrocyanic Acids?

Botany.—[*N.B.* The questions are arranged in two divisions, and those in the second division will be given out after the expiration of the first hour, which is to be devoted entirely to the questions in the first division of the subject.]

1*st. Division. Chiefly Morphological, Anatomical, and Physiological.*—1. By what characters (structural, chemical, and vital) are plants most efficiently distinguishable from animals?—2. What are the proportions (or nearly so) in which the equivalents of the elements entering into the composition of Cellulose and Protoplasm are supposed to be combined?—3. What are the organic compounds and how are they constituted) which more immediately result from the action of the vital processes carried on in the cells?—4. Give Schleiden's view of cell-formation. Have any very essential modifications of it been suggested by the later observations of eminent Microscopists?—5. To what general laws are the arrangement of leaves (Phyllotaxis) subjected, whether in their normal or metamorphosed conditions?—6. Explain the origin and modifications that take place in the arrangement of placentæ.—7. What peculiarities are observable in the tissues of Coniferæ?

Botany.—2*nd. Division. Chiefly Structural and Systematic.*—8. Contrast the terms employed in describing the original position and parts of ovules (at the time of impregnation) with the terms used in designating the ultimate position and parts of the seed in the matured fruit.—9. Describe the general characters of the fruit of Papaveraceæ, Euphorbiaceæ, and Umbelliferæ, remarking any very peculiar modifications to which they may be subjected.—10. Give the essential characters of the following orders: Malvaceæ, Cucurbitaceæ. Chenopodiaceæ. Orchidaceæ, Juncaceæ.—11. How do you distinguish Solanaceæ from Scrophulariaceæ? Are there any genera whose positions may be doubtfully assigned to the one or the other of these orders? 12. Describe the plants and fruits lettered *A, B, C, D, E, F;* strictly confining your replies to the following particulars, so far as they may be observable.—(*a*) *Leaf.* Arrangement; Stipulation; Degree of composition; Form; incision. —(*b*) *Inflorescence.* General character; Bracteal appendages.—(*c*) *Flower.* Peculiarities of Calyx; Corolla; Stamens (insertion, &c.); Disk; Pistil (Ovary, Style, Stigma, Placentation).—(*d*) *Fruit.* General character; Dehiscence; Placentation.—(*e*) *Seed.* Arrangement; Reasons for assigning a peculiar character to the Embryo, if it be not present, or not very distinct. —(*f*) Is there any reason for supposing the plant would not be found in the Linnean class and order to which it might strictly be referred?—(*g*) To what natural order does it belong? What are the essential characters of that order?—(*h*) Do the species of the above order generally affect any peculiar "stations"? Are they mostly "endemic" or "sporadic"? And in what "Regions"?

Mineralogy.—1. Define the terms 'simple form' and 'combination.'—How many faces have each of the varieties of simple forms in the rhombohedral system? —What is the law of symmetery in the rhombohedral system?—2. Mention the number and situation of the planes that divide symmetrically a crystal belonging to the pyramidal system.—3. Arrange the collection of models of crystals placed upon the table according to their systems.—Point out and name any hemihedral forms you may happen to observe among them.—4. To which system do the crystals of the majority of the metals belong? Enumerate the exceptions.—By what processes have crystals of the metals been obtained in the laboratory?—5. What do you understand by isomorphism? Is the term strictly or only approximately correct? Give an example of isomorphism in each of the systems of crystallization.—The crystals of $As\ O^3$ belong to the cubic system, those of $Sb\ O^3$ to the prismatic system. Are these facts reconcilable with the theory of isomorphism?—6. Describe an experiment made by Mitscherlich which appears to account for the fact that crystals frequently contain isomorphous elements in all proportions.—7. What is a "pseudomorphous" mineral? Give some examples of pseudomorphous minerals.—8. Describe the scale of hardness adopted by Mohs, and the method of applying it to determine the hardness of any mineral.—Can different parts of one and the same crystal exhibit different degrees of hardness? If so, give examples.—9. Draw a figure of a crystal boracite exhibiting a combination of the faces of the cube, dodecahedron and octahedron.—By what peculiarities are the faces of the octahedron marked in crystals of boracite? —Give an account of the thermoelectrical properties of boracite?—By what names have Riess and G. Rose distinguished the thermoelectric poles at which vitreous and resinous electricities respectively appear during the process of cooling?—10. Describe the appearances seen when a crystal of blue or red sapphire is viewed in a direction perpendicular to its axis, through Haidinger's dichroiscope.—11. Give an account of the magnetic properties of bismuth.—12. Describe methods of distinguishing scolezite from mesotype.—13. Name the minerals marked *A, B, C,* &c., stating your reasons for supposing them to be the minerals so named.—Mention the systems of crystallization to which they belong.—Point out the twin crystals that occur among them.—14. Enumerate the essential constituents of the following minerals, and mention the systems of crystallization to which they respectively belong.—Analcime, apatite, aragonite, beryl, diaspore, felspar, gahnite, greenockite, leucite, malachite, realgar, topaz.—15. Give the formulæ expressing the chemical constitution of the following minerals:—Fluor, hematite; magnetite, cinnabar, orpiment, olivine.—16. By what metallic oxides have the globules of borax α, β, γ, &c., been coloured?—17. —Describe methods of detecting the following substances when present in a mineral:—Chlorine, fluorine, phosphoric acid, sulphuric acid, potash, soda, barytes.—18. The analysis of a mineral gave silica 24·99, oxide of zinc 68·66, water 7·75; compute its chemical formula, having given that the quantities of oxygen in 100 parts of silica, oxide of zinc and water are 51·96, 19·74 and 88·9 respectively.

[We have inserted the above examination papers as likely to interest those who have relations educating at Cambridge. The remainder shall be given in the next *Journal.*—ED. J.]

UNIVERSITY OF CAMBRIDGE.

NATURAL SCIENCES TRIPOS.*

CAMBRIDGE, MARCH 8TH, 1851.

QUESTIONS.

Geology.—1. Define Geology, enumerate its leading objects, and determine its place among the Natural Sciences.—2. Among great mineral masses, what are the leading distinctions between stratified and unstratified rocks? Are we able to determine the probable epoch of any mineral mass by its internal structure? Quote examples, in point, both from aqueous and igneous deposits.—3. Enumerate some of the old "Sacred Theories" of the Earth. Explain, very shortly, what is meant by the Huttonian theory; point out how far it is inductive, and how far hypothetical.—4. Explain the natural mechanism by which aqueous vapour is elevated, then diffused through wide regions of the atmosphere, and afterwards precipitated. Explain the laws which govern the precipitation, and illustrate them by examples derived from the British Isles.—5. Explain the geopraphical conditions necessary to the formation of Glaciers. Enumerate their leading phenomena, the effects produced by them on the contiguous rocks, their progressive motion, and their transporting power. Explain the causes of their onward movement according to the views of De Saussure, Charpentier, Agassiz, and Forbes.—6. Shew, by the evidence of sections, that the earth has been brought into its present condition after repeated elevations of the land. What mechanical effects might be expected, from deep-seated forces of elevation, in the production and direction of great fissures? Do the valleys in any parts of England (*e. g.* in Cumberland and the Wealden country) illustrate a mechanical theory of elevation. How far does such a theory modify the Huttonian views on the excavating powers of rivers? How far can we determine the first epoch of a valley by geological data? How far can we approach to the past duration of the existing conditions of drainage, in any given valley, by the help of natural chronometers? Answer these questions by an appeal to well-known examples; or by actual sections.—7. What do we understand by modern alluvial deposits—diluvial drift—till—bowlder clay? Shortly give the theories by which the diluvial drift of England has been accounted for. Give the geographical distribution of the bowlders of Shap granite. Describe the modern alluvial deposits, the great brown clay, and the common flint-gravel of Cambridgeshire. What is the relative age of these three deposits? Determine the question by sections, and by a list of the imbedded fossils found in each.—8. Shew historically, by an appeal to known examples, the sympathetic action of many distant volcanic vents. State the conclusions Humboldt draws from facts of this class. Explain the terms basaltic lava, tractytic lava, obsidian, pearl-stone, pumice, amygdaloid.—9. Among geological deposits how do we distinguish plutonic or volcanic masses from the aqueous deposits with which they are associated. Illustrate the distinction by examples. Define Granite, Syenite, Porphyry, and Greenstone. How can we define the epoch of any mass of granitic rock? What are the relative ages of the granitic rocks of Mont Blanc, of Devonshire and Cornwall, of Charnwood Forest, and of Cumberland?—10. Enumerate the several minerals that commonly pass under the name of Feldspar. In what consists their specific difference? Define the mineral characters of Augite and Hornblende. Are they different species, or but modifications of one? Assuming their specific difference, how can we interpret the experiments by which one is made to pass into the other? Describe the experiments of Watt in illustration of the structure and formation of basalt.—11. Enumerate some of the most remarkable species of crystalline stratified rocks. In what sense is this structure to be called metamorphic? What explanations have been given of this structure? When considered on a great scale, do rocks of this class fall into any natural arrangement resembling that of Werner's primitive rocks?—12. What are the four great primary divisions of the Animal Kingdom, on the system of Cuvier, and on what tests is it founded? Enumerate the Classes of the Vertebrate Sub-kingdom, and enumerate the Orders of the several Classes, stating the distinctive characters of each.—13. Define the meaning of the terms Primary (or Palæozoic) Secondary, and Tertiary, as applied to fossiliferous strata. Enumerate the systems, or groups of deposits, into which primary, secondary, and tertiary rocks are now commonly subdivided: using the British types of comparison; and putting them, also, in co-ordination with good foreign types. Quote a few examples of the most characteristic fossils in the several systems, as well as in the subordinate groups—from the oldest to the newest. Prove the truth of the order of succession by an appeal to actual sections.—14. Shew that an arrangement of successive systems by the evidence of natural groups is very nearly coincident with an arrangement on fossil evidence. Point out some cases where the arrangement of natural groups has been modified, during the progress of geology, by the application of palæontological evidence.—15. Explain the meaning of the word *Trias*. Are the groups of strata defined by this word well represented in Britain?—16. Explain the classifications of Fishes given by Agassiz. Enumerate some of the most famous palæozoic species, and describe their peculiarities in contrast with modern Fishes. What is their rank on the general organic scale?—17. Enumerate the Reptile Orders, on the system of Owen. Describe the anatomical peculiarities of the Enaliosaurs and Dinosaurs. Taken collectively, what is the rank of the secondary Reptiles, when compared with the Reptiles of the tertiary and modern periods?—18. Explain the terms Eocene, Miocene, Pliocene. In which of these subdivisions do we now group the several tertiary deposits of England?—19. In what subdivision can we place the raised beaches on the coasts of Devon and Cornwall, and similar deposits on the Western coasts of Scotland?—20. Explain the anatomical reasons that have led geologists to refer certain fragments of small jaws (found in the lower Oolites of Stonesfield) to Mammal genera.—21. State the arguments for and against the following inference, viz., that in the oldest palæozoic strata we have not only reached the oldest known traces of organic life, but the oldest terrestrial monuments of organic creation.—22. Reviewing the whole fossil evidence, shew that it does not lead to a theory of natural development through a natural transmutation of species.

GENERAL PAPER.

I.—*Chemistry.*—1. State the laws according to which chemical combination always takes place. What is the relation between the equivalent weight, the equivalent volume, and the specific gravity of a gas? The equivalent volumes of oxygen, hydrogen, and nitrogen are as 1 : 2 : 2 : and their specific gravities are 1·103, ·069, and ·973; find the equivalent weights of oxygen and nitrogen, that of hydrogen being unity.—2. Enumerate and describe the compounds of sulphur and oxygen, giving the chemical formulæ for each compound. Describe and explain the process for forming sulphuric acid by the combustion of sulphur and nitrate of potassa or soda.—3. What different classes of compounds are included under the general name of *salts?* What is the nature of the compounds termed by BERZELIUS *sulphur-salts?* What are the general characteristics of the nitrates?—4. State the chief points of distinction between

* Concluded from page 167.

organic and inorganic compounds. What are organic bases? Define *isomerism*, and give instances of it.—5. Describe the chemical changes which occur, and the other phenomena observed, when a solution of sugar is submitted to the action of *ferment*.

II.—*Mineralogy*.—1. All mineralogical arrangements must be, in effect, chemical. Give an account of the first and second chemical systems of BERZELIUS. Point out the superiority of the latter over the former, and the objections to which the latter is still exposed.—2. Does *pentagonal* symmetry ever exist among crystals?—3. Define a *zone*, and shew how to determine by observation all the faces that belong to a given zone.—4. State the systems of crystallization and chemical formulæ of *rutile, brookite, anatase*, and *oxide of tin*. Are any of these minerals isomorphous? In what geological formations do they usually occur?—5. To what system do the crystals of $CaO + SO^3$ belong? State the number and direction of the principle cleavages. Are the crystals isomorphous with those of $BaO + SO^3$? Compute the quantities of lime, sulphuric acid, and water contained in 100 parts of $CaO + SO^3 + 2HO$; having given $O = 100$, $H = 12{\cdot}48$, $Ca = 251{\cdot}5$, $S = 200{\cdot}75$. To what system do the crystals of this substance belong? In what direction or directions do they cleave most readily? Is it isomorphous with any other chrystallized substance? What is its hardness in the scale of MOHS? Shew how the presence of lime, sulphuric acid, and water may be detected in it.

III.—*Botany*.—1. Describe the appearance of transverse sections of the stems of exogenous trees, endogenous trees, and tree ferns. Explain the peculiarities of growth to which the differences are owing.—2. In what parts of a plant does assimilation take place? What are the principle chemical changes involved in this process?—3. State the opinions most worthy our attention on the structure and composition of starch granule.—4. In what natural orders do we find the whole structure of the plant composed of cellular tissue? Describe the general characters of the organs of reproduction in these orders. 5.—Describe the general structure of Pollen, and the phenomena observed at the period of impregnation.

IV.—*Anatomy and Physiology*.—1. Describe the appearance of human blood as seen under the microscope. What are the organic constituents of the solid and fluid portions respectively? What chemical elements are contained in each of these organic constituents? Describe the phenomena which are observed on the removal of the blood from the living body.—2. Give a general account of the chemical changes which take place in the blood in the course of its circulation through the body, and in its passage through the lungs and through the kidneys.—3. In what respects do the structure of the heart and the course of the circulation of the blood in reptiles, fishes, and crustaceans differ from those in mammals?—4. How far is the action of the heart dependent on the nervous system? Will the mechanical action of the heart account for all the phenomena of the circulation?—What are the peculiarities in the structure of the teeth and jaws of Rodents?—6. Describe the compound stomach in ruminants, its structure, and the mechanism of rumination. Give remarkable instances in vegetable feeders in which the complexity of the stomach varies inversely as that of the cæcum.—7. How do you account for the contraction and dilatation of the pupil of the eye?—What are meant by fissiparous, gemmipparous, oviparous, and viviparous reproduction? In what classes or orders of animals do we find these modes of reproduction respectively to prevail? Describe the mode of reproduction of the aphis. What explanation has been given of this and similar phenomena?

V.—*Geology*.—1. Define geology, and distinguish it from palæontology and physical geography.—2. What results have been arrived at experimentally respecting the internal temperature of the earth? How do these results bear upon the metamorphic structure of certain rocks? Has any theory been proposed for the continuance of metamorphic action during successive geological periods of the earth?—State the evidence in proof of the elevation of strata at successive periods. Give some modern examples of this process.—Give a brief outline of Darwin's theory of the formation of coral reefs, and his classification of them.—Enumerate and briefly define the divisions, systems, and groups into which stratified deposits have been separated. By what observations, and on what principles have their relative ages been determined?

Correspondence.

THE BENEVOLENT FUND.

To the Editor of the Provincial Medical and Surgical Journal.

MR. EDITOR,—Will you pardon me for begging a space in your valuable journal, for the advocacy of the Benevolent Fund, which may fairly be asserted to be *one great object* of my existence. It was said of one of old, who was pleading his own cause, with the sincerity and earnestness of honest conviction,—"Paul, thou art beside thyself; much learning doth make the mad." But his reply was,—"I am not mad most noble Festus, but speak forth the words of truth and soberness." So, I doubt not, there are many amongst my brethren, who set me down as a *maniac*, and who pity me as demented. I know full well that it is the common indication of insanity, that the patient thinks all the world mad, while he alone, in the solitary grandeur of his exclusiveness, is the only rational person; and therefore, this is no proof that I am not entitled to the sympathy and compassion of your readers, because I have been reft of my *reason*—that great prerogative and attribute of mind.

But if I shall succeed in proving that my own conduct is founded upon undoubted and acknowledged principles, and that I am not exclusive in my attachment to this "one great object of my life," I shall by such means have established my claim to sanity;—shall have shown the correctness of my judgment;—shall have proved the consistency of my conduct;—and shall have established my title to be listened to attentively, while, in the words of the great orator before alluded to, I may be permitted to say to each one of my readers,—"I would to God, that not only thou, but also all who hear (read) me, were both almost and altogether such as I am," *except*, indeed, those imperfections which attach to humanity. And if I shall succeed in establishing my premises, I shall be entitled to make an appeal to the reason and conscience—to the principle and feeling of all my readers, who may not have contributed to the support of the Benevolent Fund, or who may not now be subscribers to that fund.

I shall set out with the assertion, that the Benevolent Fund demands the support of every member of the profession; and I propose to establish this assertion by a reference to two principles—first, *secular*; and secondly, *moral or religious*.