carcinomata and sarcomata, the Peyton Rous chicken sarcoma, tar carcinoma in rabbits, and all kinds of human cancers, which qualitatively and almost quantitatively show the same result. We have here, therefore, a general characteristic of carcinoma and sarcoma cells which is entirely independent of any particular kind of irritation or of the nature of the normal tissue in which the tumours originate.

If, now, it be asked in what manner tumour metabolism arises out of normal cellular metabolism, it is necessary to inquire first of all under what conditions normal cells split glucose into lactic acid. Normal body cells produce lactic acid when their respiration is inhibited, either by cutting off the supply of oxygen or by poisoning. The production of lactic acid from glucose is, therefore, no peculiar property newly acquired when tumours first form, but is a property common to all body cells. But whilst in normal cells lactic fermentation is only set up by absence of oxygen, tumour cells always produce lactic acid, even when they are fully supplied with oxygen.

The results of these investigations may therefore be summed up in the statement that the tumour, so far as its metabolism is concerned, always behaves as a normal growing cell in a state of asphyxia. If normal growing cells be deprived of oxygen, then we have the reaction of a carcinoma cell. Since by deprivation of oxygen respiration is inhibited, fermentation cannot be masked or prevented, and the asphyxiated cells continue to produce lactic acid in excess, even when the oxygen supply is restored. Most of the cells so treated die because they are unable to live at the expense of energy of fermentation. Only a small number of them remain alive, and in their nature, magnitude and action they are indistinguishable from carcinoma cells.

Dr. Warburg then considered the question whether the asphyxia of normal growing cells sufficed to bring about the cancerous state, or whether other unknown factors also played a part. Reference was made in this connexion to the recent experiments of Carrel, Dresel and Wind, in which the attempt was made to discover whether carcinoma cells can not only exist without breathing, through energy of fermentation, but can also grow. The general conclusion was that tumour cells, like yeast, cannot live their full period without oxygen, but that both kinds of cells are able to grow for a time without oxygen, by the energy of fermentation, and that the asphyxiation of normal growing cells is sufficient to produce the cancerous state

Hæmoglobin.

HÆMOGLOBIN, the oxygen-carrier in the blood of vertebrates, upon which life depends, is a substance of great interest and importance, the investigation of which has received considerable attention from research workers. Prof. J. Barcroft, whose lecture on hæmoglobin, delivered before the Chemical Society on February 11, 1926, has been published in the Society's journal for May 1926, gives an account of recent investigations on the subject.

The old idea that hæmoglobin is a compound of two bodies, called *hæmatin* (containing iron) and a protein, *globin*, is not altogether untrue. The well-defined crystalline substance *hæmin* is obtained by the action of glacial acetic acid on dried blood. When hæmin is oxidised in the presence of alkali, hæmatin is obtained. Alkaline reduction of hæmin yields *hæm*, a substance having an ill-defined spectrum. Nicotine, pyridine, globin, etc., when added to hæm, produce a class of substances with well-defined and similar spectra, called *hæmochromogens*. Of these it appears that the globin compound alone can form a hæmoglobin by regulation of the hydrogen-ion concentration. Cytochrome, another substance well known to the biochemist, has been proved by examination of the absorption spectrum to consist of three hæmochromogens.

The determination of the equilibrium constant K for hæmoglobin and oxygen and for hæmoglobin and carbon monoxide by the ordinary methods of gas analyses is exceedingly difficult on account of the low pressures of the gases involved, and methods have been worked out which involve spectroscopic measurements. The velocity constants, k and k', for these reactions have been obtained by an ingenious form of apparatus which overcomes the difficulties due to the high order of velocity by very rapid mixing of the components. For the reaction $HbO_2 \longrightarrow Hb + O_2$, k' is relatively small, whereas the constant for the formation of the oxide is very large and is also comparatively independent of the temperature and hydrogen-ion concentration. It follows that the equilibrium constant, $K = k'/k$, must be a measure of the effect of the reduction phase. Parallel observations with carbon monoxide show that the slow-reduction phase in the case of oxygen is peculiar.

There is a shift towards the blue in the position of the important α-band in the absorption spectrum when the hæmoglobin is treated with carbon monoxide. This shift, measured in Ångström units, is called the 'span,' and a nearly linear relation is obtained between $\log K$ and the span of hæmoglobins from various sources, where $K[HbO_2] \times [CO] = [HbCO][O_2]$. This is supposed to indicate that "there are a limited number of hæmoglobins, say two, which in different animals are mixed together in different proportions." The difficulties encountered in the measurement of osmotic pressures are also considered and in conclusion attempts are made to reconcile the equation, $Hb_4 + 4O_2 \rightleftharpoons Hb_4O_8$, which these measurements indicate, with the shape of the equilibrium curves previously obtained.

Contact Catalysis.[1]

THE Committee on Contact Catalysis under the chairmanship of W. D. Bancroft has performed an excellent piece of work in collecting together and commenting upon the interesting peculiarities of surfaces in affecting the rates of chemical change of reactants at, or in close proximity to, those surfaces. Whilst certain purists may object to the term 'contact' in connexion with reactions the velocities of which are accelerated by the presence of substances which, although taking part in the chemical change, are not present either in the eactants or products in stoichiometric quantities; yet the word possesses advantages in differentiating homogeneous reactions from reactions heterogeneously accelerated.

In the United States, Dr. H. S. Taylor himself has been largely instrumental in stimulating interest in problems in this field, which during the last decade has attracted an increasing number of research students in all countries, and from which a remarkable crop of new technical industries, not without economic value, has already been harvested.

In 1917 Langmuir showed that chemical reaction

[1] Fourth Report of the Committee on Contact Catalysis. By Hugh S. Taylor. *Jour. Phys. Chem.*, xxx, 145, 171, Feb. 1926.

was probably restricted to the molecules of the reactants actually in contact with the surface. Whilst the experiments of Bone and others at high temperatures indicate that this generalisation may not be always true, yet in a large number of reactions such appears to be the case. Even in combustion at hot surfaces, reaction chains may start from, or, electrons or ions which in turn effect reaction may be emitted from the surface. Four years later it was shown simultaneously in England and the United States that the whole of a surface could not be equally uniform in affecting the rate of chemical action, certain portions of the surface being more active than others. Data both on the quantities and heats of adsorption of gases and vapours as well as the effect of poisons on the rate of catalytic action have amply confirmed the theory of active patches, as is shown in the present report.

It is clear that the existence of active patches is due to the fact that the surface of the catalyst is not uniform, but composite, consisting of various planes, corners and edges of minute crystals in addition to atoms isolated on planes and edges as well as atoms in the planes and edges. The work of Born and Lennard Jones on the surface energies of heteropolar compounds leads us to hope that the surface energies of the various portions of a composite metal surface may in time be computed. Only in the case of certain charcoals and of nickel do we possess any definite information on the extents and specific activities of various patches of different activities, but further information on this subject as well as the variation in relative areas will doubtless be forthcoming.

When we are in possession of data on the variation of the surface forces with chemical reaction rate taking place at the surface, some clue may be given to the mechanism of chemical activation, the elucidation of which is stimulating at the present time a renewed interest in the study of photochemistry.

It is to be hoped that such reports may be continued although the labour involved may render their appearance less frequent in future. Both the committee and Dr. Taylor are to be congratulated on this successor to the three reports already published.

ERIC K. RIDEAL.

University and Educational Intelligence.

CAMBRIDGE.—Mr. C. P. T. Winckworth, Christ's College, has been elected Eric Yarrow lecturer in Assyriology. Dr. C. L. Withycombe has been elected University lecturer in advanced and economic entomology. Prof. B. M. Jones has been nominated as a member of the Advisory Committee on Aeronautical Education. Dr. J. L. Witts, University of Manchester, and Mr. J. O. W. Bland, Jesus College, have been elected John Lucas Walker students in pathology. A grant of 100*l.* has been made from the Balfour Fund to Dr. H. Scott, Trinity College, towards the expenses of an expedition to Abyssinia. Mr. H. G. Cannon, Christ's College, and Miss S. M. Manton, Girton College, have been appointed to the University's table at the laboratory of the Marine Biological Association at Plymouth. An industrial bursary has been awarded by the Royal Commissioners for the Exhibition of 1851 to C. Salter, St. Catherine's College.

An interesting report has been published by the Appointments Committee giving a list of all the teaching appointments made under the new statutes and the grants made to the different faculties and departments from the Government grant. The total amount of new grants already thus allotted is 18,710*l.*, out of 20,000*l.* available for the purpose.

The following have been elected to research studentships: W. J. Dann at Trinity College; B. C. Saunders at Pembroke College; W. A. Waters (chemistry), R. V. Thomas (chemistry), E. G. Jones (economics), J. G. Adshead (mathematics), H. Stayt (anthropology), T. E. Allibone (physics), and W. R. Wooldridge (biochemistry) at Gonville and Caius College; G. H. Aston, A. Caress, O. H. Wansbrough-Jones and B. J. Wood at Trinity Hall; J. Hilton at Christ's College; J. H. Ratcliffe at Sidney Sussex College; G. E. Watts has been elected Charles Kingsley bye-fellow at Magdalene College.

Further details are now available of the will of the late Dr. J. E. Bles, whose bequests to the University of Cambridge have already been referred to in these columns. He left all his scientific instruments, scientific books, and the fittings and contents of his private laboratory to the University of Cambridge, and he empowered his trustees to expend a sum, not exceeding 500*l.*, in completing any researches made by him and publishing the results of any researches not published at the time of his decease. The value of his estate was 42,677*l.*; failing issue, and subject to his widow's life interest and after certain bequests, he left the residue of his property to the University upon trust for a professorship of animal embryology to be called the Charles Darwin professorship, for research and teaching in the subject from a purely scientific aspect; apart from economic, technical, or medical aspects, and subject thereto upon similar terms for a professorship of bio-physics. In the event of these chairs being already constituted, the legacy would have been devoted to the promotion of biological science and subject to a board consisting of the professors of biological subjects, which is also to examine the position of the fund every twenty-five years.

THE Calcutta University Poverty Problem lecturer, Captain Petavel, has for several years been carrying on a campaign of advocacy of a scheme for establishing near Calcutta a co-operative colony of middle-class 'home-crofters,' and in connexion therewith a school of which the pupils would "be systematically organised to produce their food by their own labour, the work being made instructive for them." In his magazine *Bread and Freedom* for July, he announces that a Mr. K. K. Dutta, a well-known Calcutta attorney, has placed at the disposal of his organising committee a village and farm, while another member of the committee has promised to contribute a sum of 10,000 rupees towards a fund for putting the scheme into operation "on business lines." A somewhat similar scheme was recently advocated by Prof. J. W. Scott, of University College, Cardiff.

FROM Loughborough College, Leicestershire, we have received a calendar for 1926–27, giving very fully detailed and illustrated descriptions of the College laboratories and courses in engineering and in pure and applied science including chemical technology. The College has also a Department of Administration and Economics, an Extra-Mural Department, a school of Industrial and Fine Art, and a secondary school for boys. The Faculty of Engineering is noteworthy for its system of concurrent theoretical and practical training, made possible by the large scale of the workshops, half the student's time being spent in productive work. The governors award annually five scholarships in the Faculty of Engineering, each of the value of 75*l.* per annum, open to British subjects in any part of the Empire. Candidates resident outside Great Britain can be examined at local centres.