floor pad of this area from neighbouring floor pads, and from columns supporting structures above, to ensure that this area will be mechanically quiet.

The east wing is a concrete frame structure with mullions at 5 ft. 4 in. intervals. It is predominantly a research and office block on three floors and has been designed so that all research rooms are on the west side of the block and all offices on the east side, thus economizing in electrical and mechanical services. Each lecturer will have a small office in which he can tutor students in groups of two or three. He may also have a research room conveniently situated opposite his office. The east wing also includes a class library, a common room, and a small lecture room which can be used for research seminars and occasional honours lectures. The flat roof of this wing has been strengthened at one end so that it can be used for experimental purposes.

The west wing houses all the teaching laboratories. The ground (podium) floor is given over to first- and second-year laboratories, while the first floor houses all honours laboratories. Since the first- and second-year classes are by far the largest, this arrangement minimizes traffic on stairways and provides vibrationally the quietest conditions where most needed, that is, in the honours laboratories. The guiding principle governing the layout of the laboratories has been to prefer small laboratories of a size that can be comfortably supervised by one person. This also has the merit of providing greater flexibility in the general day-to-day use of these laboratories. In addition, each group of laboratories is provided with its own services and store rooms, together with a number of photographic dark rooms. The first floor also provides a number of tutorial rooms, where first- and second-year tutorials in groups of 20–25 students each can be given.

The cost of the Building was approximately £700,000 provided by the University Grants Committee with a contribution from University funds.

The architect was Mr. E. D. Jefferiss Mathews of Messrs. J. Douglass Mathews and Partners, the quantity surveyors Messrs. John Dansken and Purdie, the structural engineers Messrs. C. V. Blumfield and Partners, and the contractors Messrs. Alexander Hall and Son (Builders), Ltd., Aberdeen.

AN EARLY OCCUPATIONAL HEALTH SERVICE

THE remarkable work of Samuel Greg and Dr. P. Holland in establishing an occupational health service at Quarry Bank Mill, Cheshire, in the late eighteenth century has recently been described by Dr. R. Murray, medical adviser to the Trades Union Congress (*Occupational Health*, **16**, No. 1; January/February 1964).

Quarry Bank Mill was built as a spinning mill in 1784 by Greg, who, by 1795, was employing his own family doctor, Dr. Holland, to provide medical care for the Company's apprentices for an annual fee of twelve guineas. Details of his work are recorded in two fully documented notebooks. The treatment was heroic and much of it consisted of purgatives—senna, calomel, rhubarb and ginger, jalap and salts. Clysters were frequently given; blisters, leeches and poultices were common. Coughs were treated with horehound and ipecac. The sick were usually given buttermilk or churn whey, though red wine, broth and even tea were sometimes prescribed. Itch was treated with sulphur, internally as well as externally.

The policy of Samuel Greg in appointing Dr. Holland as his works physician was not entirely philanthropic. He said, in answer to a correspondent, "The terms in which we take them are . . . (that) we keep them one month upon trial before (being) bound . . . to ascertain their probable healthiness". At this time the Boards of Guardians were anxious to rid themselves of the rapidly rising population of children in poorhouses, and the system of "binding them apprentice", which had served well enough for 200 years, was used to ensure a cheap supply of labour for the developing textile industry. For a variety of reasons, many of these children were physically or mentally unfit for employment, and several employers found it worth while to employ a physician to discard those who were unlikely to make useful workers.

Nevertheless, in the case of Quarry Bank, the treatment was much more generous than elsewhere. Out of a total of 17,000 apprentices who passed through the mill, only five, apart from those under nine years, were not employed. There are several instances of children being kept for a year or more, seen regularly by Dr. Holland, and well fed in the apprentice house before being indentured. The details of the pre-employment examinations indicate the extent to which tuberculosis was a scourge of the times. Eighty per cent of the children who were labelled 'unhealthy' were said to be 'delicate', to have inflammation of the eyes, enlarged glands or to be scrofulous. The fact that so many of them were ultimately able to be indentured says much for the philanthropy of Samuel Greg and the care of Dr. Holland.

SEARCH FOR OIL IN AUSTRALIA

THE pursuit of the elusive oil-pools in Australia continues with undiminished vigour, and unfortunately the two latest reports* do little to enliven the rather depressing trend of events, at least from an economic point of view, recently chronicled (*Nature*, **201**, 1080; 1964; and **200**, 123; 1963).

Publication No. 23 describes the exploratory borehole drilled as an off-structure stratigraphic test by the Conorada Petroleum Corporation and known as "Conorada Ooroonoo No. 1, Queensland". The location borders the Diamantina River, about 58 miles south of Middleton, on Western Highway, western Queensland. As a stratigraphic test, this project might be judged successful, in that the log disclosed a complete section of the sedimentary rocks of the Great Artesian Basin down to and penetrating the granitic basement complex. Operations lasted barely one month and the well was abandoned as a dry hole at a total depth of 3,852 ft., the granite floor being met at 3,840 ft. Considerable problems attach to the age determination of the rocks constituting the Great Artesian Basin in this region. The possibility of finding

* Commonwealth of Australia. Department of National Development. Bureau of Mineral Resources, Geology and Geophysics. Petroleum Search Subsidy Acts. Publication No. 23: *Conorada Ooroonoo No. 1, Queensland, of Conorada Petroleum Corporation*. Pp. 30+2 plates. Publication No. 42: *O.D.N.L. Penola No. 1 Well, South Australia, of Oil Development N.L.* Pp. 62+2 plates. (Canberra City: Bureau of Mineral Resources, Geology and Geophysics, 1963.)

Cambrian or Ordovician source-rocks of petroleum beneath the Mesozoic and Tertiary sequences here, envisaged at the outset of this test, was clearly dispelled by the presence of the granitic basement rocks below the Mesozoic sediments which, in the Great Artesian Basin, are believed to represent the only continuously deposited section from Jurassic into Lower Cretaceous times in the Continent.

Publication No. 42 deals with quite a different region of exploration. This project is known as "O.D.N.L. Penola No. 1 Well", located in what is termed "the north-east corner of Section 500, Hundred of Penola, South Australia". Penola is about 200 miles south-south-east of Adelaide, not far from the State Boundary with Victoria. This well was drilled by Oil Development N.L. under a 'farm-out' agreement with the General Exploration Co. of Australia, Ltd. After three months drilling it was abandoned as a dry hole at a total depth of 4,985 ft. The objective was to test the petroleum potentialities of the Coonawarra sub-surface structure which, on previous knowledge gained from a single reconnaissance seismic reflexion traverse made through the area, was thought to be a mass of Cretaceous sediments "draped over a buried topographic 'high' of a pre-Cretaceous erosion surface". This log discloses, beneath a thin Pleistocene cover, a sequence of marine Tertiary rocks, then marine and non-marine Mesozoic rocks; the sequence ranges in age from Oligocene to what is probably Upper Jurassic. Once again the stratigraphic evidence afforded by this well has proved of value when considered in the light of previous geological work in this part of South Australia, but otherwise the oil and gas possibilities here are certainly not encouraging.

As in previous reports of oil explorations in Australia carried out in conformity with the Petroleum Search Subsidy Acts and under the ægis of the Geological Branch of the Bureau of Mineral Resources, both these publications maintain a high quality, not only in presentation of data and illustrations, but also particularly in the detailed accounts of the petrology and palæontology of rock-samples examined by the specialists concerned. One could only wish that all the valuable academic work, quite apart from the expert geophysical and engineering operations involved, had resulted in more rewarding results in terms of natural gas or petroleum (or both) such as would encourage commercial developments. But the search will still undoubtedly continue.

H. B. MILNER

ROLES OF DEOXYRIBONUCLEIC ACID IN INHERITANCE

By PROF. BARRY COMMONER

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(I) Introduction

LIVING organisms exhibit a self-perpetuated capacity to create their own remarkably complex and specific organization from a far more disorganized environment, and to reproduce it in their offspring. How do self-duplication, reproduction and inheritance originate in the chemical attributes of the separate substances of which living things are composed ?

A theory concerning the chemistry of inheritance must explain the molecular origin of biological specificity, describe the molecular processes which transmit this specificity from cell to cell and from organism to organism, and account for the orderly emergence of specificity during development. Some, but not all, of the specific inherited characteristics of a number of organisms have now been reduced to particular chemical processes, such as the synthesis of a given substance. At the least, the task of a molecular theory of inheritance is to explain the origin, transmission and development of such biochemical specificity.

There is at this time a fairly widespread conviction that this task has already been accomplished by the theory of the 'DNA code'. Nevertheless, in this article I shall endeavour to demonstrate: (*a*) that the scheme which localizes the origin of inherited biochemical specificity solely in the nucleotide sequence of DNA fails to account for certain relevant data; (*b*) that when these data are taken into account, the genetic effects of DNA nucleotide sequence emerge as a special case of a more general genetic function of DNA; (*c*) that this new analysis places significant restrictions on theories regarding the relationship between the molecular properties of DNA and the properties of living things and suggests new experimental investigations of growth, development and inheritance.

(II) Molecular Origins of Biochemical Specificity

The chemical specificity of a living cell appears in two general forms: molecular reactions and molecular structures. In the chemical reactions of the cell, specificity is represented by the preferential occurrence of particular ones of the immense numbers of reactions which are thermodynamically possible among the cell's numerous reactants. Such kinetic biochemical specificity is represented by a particular metabolic pattern, for example, the Krebs cycle.

In contrast to such kinetic expressions of biochemical specificity, cells also possess potential or static manifestations of specificity. These are represented, for example, by the structure of macromolecular products of cellular chemistry, in which biochemical specificity is expressed by the stable arrangement of the component parts. Examples are the sequence of nucleotides in a nucleic acid, or of amino-acids in a protein. In such macromolecules the number of possible arrangements of residues is extremely large and the specification of a particular sequence represents an exceedingly narrow choice among them. Biochemical specificity is equivalent to 'information content' as used in recent discussions of molecular genetics.

It is evident that biochemical specificity must be achieved by processes which regulate the rates of intracellular reactions and thereby determine which of the very numerous reactions that are possible among cellular components actually take place at substantial rates. In what follows, a component or system which, in the chemistry of the cell, determines the kinetic specificity of a biochemical process or the static specificity of a macromolecule will be referred to as a regulatory component or system. If a regulatory component or system is also capable of regulating the specificity of its own synthesis, the regulatory system is itself replicated and, being replicated, may be transmissible in inheritance. Such an agent will be termed a germinal component or system.

The general problem to be solved in a molecular analysis of inheritance is the identification of the germinal components, or systems, which govern the biochemical