EIGHTH ANNUAL FIELD CONFERENCE OF PENNSYLVANIA GEOLOGISTS

THE eighth annual meeting of the Field Conference of Pennsylvania Geologists was held in Maryland, West Virginia and Virginia from May 27 to 30, inclusive. The total attendance of 96 members and guests included, besides Pennsylvanians, geologists from the U. S. Geological Survey, New York, New Jersey, Massachusetts, Delaware, Maryland, West Virginia and Virginia.

The conference hosts were the members of the Virginia Geological Survey. The 1938 committee consisted of Dr. Arthur B. Cleaves, *chairman;* Dr. Arthur Bevan, state geologist of Virginia, *local chairman;* Professors F. M. Swartz and R. E. Sherrill.

On Friday evening an assembly was held in Cumberland, Md., and details of the following day's stratigraphic trip explained by Dr. Frank M. Swartz.

On Saturday the entire conference participated in a field excursion covering strata ranging from Upper Cambrian to Upper Devonian, in the area lying between Cumberland, Md., Keyser, W. Va., and Winchester, Va. Drs. Frank M. Swartz and Charles Butts were the leaders.

The annual dinner was held at the George Washington Hotel in Winchester on Saturday evening. A welcome was extended to the conference by the president of the Winchester Chamber of Commerce. Other speakers were Dr. Arthur B. Cleaves, 1938 chairman, of the Pennsylvania Topographic and Geologic Survey; Dr. Arthur Bevan, local chairman, state geologist of Virginia; Dr. Charles Butts, of the Virginia Geological Survey; Dr. Frank M. Swartz, of Pennsylvania State College; Dr. Wm. M. McGill, assistant state geologist of Virginia, and Dr. Bradford Willard, of the Pennsylvania Topographic and Geologic Survey, who was the official representative of the conference at the International Geological Congress in Russia in 1937.

The field excursion on Sunday, led by Dr. Swartz and Dr. Butts, from Winchester to Luray, Va., covered strata from Upper Cambrian to Upper Devonian and included a study of the Massanutten Mountain syncline. In the evening a complimentary trip through Luray Caverns was enjoyed by the conference.

On Monday morning the party was led by Mr. George W. Stose, of the U. S. Geological Survey, from Luray to Panorama and Front Royal and studied the pre-Cambrian-Cambrian complex exposed on the north half of the Skyline Drive.

The conference as a whole disbanded at Front Royal on Monday noon, but a small group under the leadership of Dr. Arthur Bevan traveled to Leesburg, Va., and examined the Triassic beds exposed there.

The 1939 field conference will be held in West Virginia, where the West Virginia Geological Survey will be hosts. Members of the committee for the 1939 conference are: Dr. Paul Price, state geologist of West Virginia, *chairman;* Professor Benj. L. Miller, Department of Geology, Lehigh University; Professor R. E. Sherrill, Department of Geology, University of Pittsburgh, and Dr. Arthur B. Cleaves, secretary-treasurer, of the Pennsylvania Topographic and Geologic Survey.

The guide book for the 1938 conference was prepared in permanent form as a special bulletin of the Virginia Geological Survey. It is the first of a series planned by that state. It can be obtained from the state geologist of Virginia and the title is: Guidebook Field Conference of Pennsylvania Geologists, Virginia, 1938. Guide Leaflet No. 1.

ARTHUR B. CLEAVES,
Secretary.

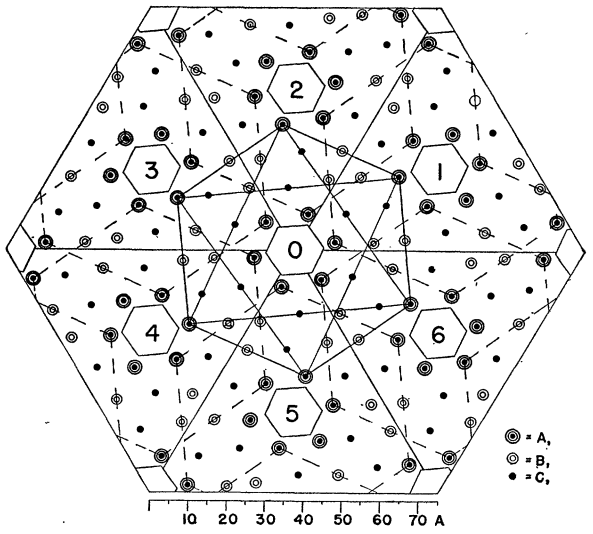
SPECIAL ARTICLES

THE STRUCTURE OF THE INSULIN MOLECULE

ON the basis of the Cyclol hypothesis,[1] a structure C_2 was proposed for the insulin molecule.[2, 3] C_2 is a cage structure consisting of a fabric carrying side chains, bent over a truncated tetrahedral framework.[2] The only metrical parameter, a (a mean between C–C and C–N bond lengths), taken[2] as 1.5 A, defines the dimensions of C_2. C_2 molecules with axes parallel fit the rhombohedral cell of the insulin lattice given by an x-ray analysis.[4] They can be arranged with any orientation α in the corresponding hexagonal cell, and α was necessarily left undetermined.[3] Further data, namely, Patterson-Harker diagrams, have now become available.[5]

It has been stated that these diagrams are incompatible with the structure I proposed for insulin.[5] I have therefore made a study of the Patterson-Harker diagrams given by C_2. The skeleton of C_2 is a truncated tetrahedron with six slits whose centers give an octahedron of side $l = 8\sqrt{6}a$. All the vectors between points on its framework lie on or within a truncated octahedron of side $2l = 16\sqrt{6}a = 58.8$ A. Postulating concentrations of atoms near these six octahedral

[1] Wrinch, *Nature,* 137: 411, 1936; *Proc. Roy. Soc.* (London), 160A: 59, 1937.
[2] Wrinch, *Nature,* 139: 972, 1937; *Proc. Roy. Soc.* (London), 161A: 505, 1937.
[3] Wrinch, SCIENCE, 85: 566, 1937; *Trans. Faraday Soc.,* 33: 1368, 1937.
[4] Crowfoot, *Nature,* 135: 591, 1935.
[5] Crowfoot, *Proc. Roy. Soc.* (London), 164A, 580, 1938.



points of the C_2 we obtain Patterson-Harker peaks for a molecule at 0 which lie at the corners and midpoints of the sides of the octahedron $2l$ with center at 0. The figure shows the projection on the c-plane of these 18 peaks giving a hexagon with center at 0, with side length 33.9 A. There are six at its corners, six at the midpoints of its sides and six at the midpoints of lines joining alternate corners; indicated for convenience as A, B and C, respectively.

We now notice that Crowfoot's c-plane projection also gives 18 peaks per molecule, reproduced in Fig. 1, which fall into a pleasing pattern of hexad, triad and dyad sets. Superposing the C_2 hexagon on this diagram, we turn this hexagon about its center, through an increasing angle α until any of its points falls upon a Crowfoot peak. We find with $\alpha = 6°$ that all A peaks fit on A peaks, B peaks on B peaks and C peaks on C peaks, as shown in Fig. 1.

This procedure allocates to the molecule at 0 one A peak in each of the hexad sets surrounding the points 1,2,3,4,5,6; the most remote B peak of each neighboring triad set; the near C peak of each neighboring dyad set. Drawing corresponding hexagons around other molecules all the A, B and C peaks are filled in. The six nearest A and B peaks around O are contributed, one each, by the molecules associated with the positions 1,2,3,4,5,6, and none of them by the molecule at 0.

So far the details of the skeleton and the positions of the side chains attached to the C_2 molecules have been left out of account. Nevertheless, the 18 peaks per molecule in Crowfoot's c-plane projection are given in the correct positions, on the assumption that there are concentrations of atoms at the six slits.

The full investigations will shortly be published. They show the direct relation between the diagrams obtained from the C_2 structure and all the diagrams given by Crowfoot and include also an account of the geometric method of interpreting Patterson-Harker diagrams in general, both for molecules and for mega-molecules.

D. M. WRINCH

LONG ISLAND BIOLOGICAL STATION,
COLD SPRING HARBOR, L. I., N. Y.

l-GLYCERIC ALDEHYDE AND TUMOR METABOLISM

IT was reported some years ago that dl-glyceric aldehyde inhibits glycolysis of tumor cells.[1] Under *anaerobic* conditions glycolysis is inhibited about 75 per cent. by 10^{-3} M. and almost completely stopped by 1.5×10^{-3} M. This applies to all malignant tumors, *i.e.*, to human and animal tumors, to spontaneous tumors and tumors transplanted or produced by carcinogenic substances, to sarcoma as well as to carcinoma, whether filterable or non-filterable. The *aerobic* glycolysis of tumors is less sensitive to glyceric aldehyde; 4×10^{-3} M. are required for an inhibition of about 75 per cent.

Some months ago J. Needham and H. Lehmann[2] found that d-glyceric aldehyde does not affect glycolysis of embryos. Nor does it inhibit glycolysis of tumors, as we have shown in a previous communication.[3] The effect of dl-glyceric aldehyde thus seems to be due to the l-form, and therefore it was of interest to examine the action of this isomeride.

H. O. L. Fischer and E. Baer recently succeeded in preparing pure l-glyceric aldehyde.[4] With this substance experiments were carried out on tumor slices, and it was found that l-glyceric aldehyde is about twice as effective as the racemic form. A slight inhibition (about 25 per cent.) of the anaerobic glycolysis of tumors is obtained with concentrations as low as 3×10^{-4} M., glycolysis is inhibited about 75 per cent. by 5×10^{-4} M. l-glyceric aldehyde, and almost completely stopped by 7.5×10^{-4} M. (see Table 1).

TABLE 1
ANAEROBIC GLYCOLYSIS OF RAT SARCOMA 39

l-Glyceric Aldehyde M/litre	$\frac{N_2}{Q}$ $\frac{}{CO_2}$ (second half hour)
.....	37.7
3×10^{-4}	27.2
5×10^{-4}	8.8
7.5×10^{-4}	3.7

Under aerobic conditions 2×10^{-3} M. l-glyceric aldehyde inhibits glycolysis about 75 per cent.

[1] B. Mendel, *Klin. Woch.*, 8: 169, 1929.
[2] J. Needham and H. Lehmann, *Biochem. Jour.*, 31: 1913, 1937.
[3] B. Mendel, F. Strelitz and D. Mundell, *Nature*, 141: 288, 1938.
[4] E. Baer and H. O. L. Fischer, SCIENCE, July 29, p. 108.