particles by collisions with the earth and other planets, they have computed the percentage, $\varphi_{\text{diff.}}$, to which the forbidden orbits are filled up, as a function of the magnetic rigidity of the primaries. From their results we have deduced the values of φ in column (2) of our table by some numerical integrations and a reasonable interpolation. It is to be noted that the 'average' φ of 90 per cent used by Dwight[2] gives values for the diurnal variation which are too high by a factor of 2–3 for the lower values of solar magnetic field. (This sensitive dependence on φ arises because the values of actual diurnal variation in columns (5) and (6) are obtained by multiplying (3) and (4) by $(100 - \varphi)/100$.)

(*c*) The final value for the calculated maximum variation, 2·5 per cent, must be reduced somewhat when comparing it with experimental results; a 'smearing-out' of the peaks of the variation occurs, as it is necessary to average over time intervals sufficiently long to give a statistically significant number of counts.

(*d*) We must therefore compare a calculated variation of 2 per cent (rather than 9 per cent) with the experimental value of $0 \pm \sim 1$ per cent[3]. We do not believe that they differ significantly.

(*e*) In combination with the conclusions of the preceding communication, it would appear then that none of the present *experimental* results in cosmic rays can be used reliably as evidence against the existence of a solar dipole moment up to a limit of about $0{\cdot}65 \times 10^{34}$ gauss-cm.^{3}.

The present investigation is perhaps of more than academic interest since, on one hand, it has been suggested that the sun's magnetic field undergoes a periodic variation[8]; on the other hand, the validity of drawing any conclusions about a general magnetic field of the sun from measurements of the Zeeman effect in the turbulent absorbing regions of the solar atmosphere has been questioned[9]. It is of importance, therefore, to examine critically all cosmic-ray evidence which purports either to deny or affirm a solar magnetic field.

Additional Considerations. The calculated diurnal variation can be reduced even further when it is noted[5] that the population of the trapped orbits is increased if planets, in particular Mars and Venus, possess a magnetic moment, as appears very reasonable. In addition, further holes can be punched in the magnetic screen by solar corpuscular streams carrying magnetic fields outward through the planetary system. Their rate of occurrence is appreciable compared to the time constant of the trapped orbit particles, which is about 5,000 years[5]. By means of these additional influences, particles may be admitted into the vicinity of the earth which have energies lower than the helio-magnetic cut-off. Such particles, which could enter the earth only at high latitudes, have not been observed in appreciable numbers. This objection may perhaps be met by noting that (i) they might be few in number originally; and (ii) if admitted they will be removed very quickly through ionization loss in interplanetary matter, an effect which can be neglected at higher energies[5]. (For example, a proton having a rigidity of $0{\cdot}5 \times 10^9$ V. possesses kinetic energy of $0{\cdot}12 \times 10^9$ eV., corresponding to a range of 10 gm./cm.^{2}. The average[5] path-length is 25 gm./cm.^{2} and may well be longer at low energies.)

These considerations again point to the importance of conducting cosmic ray measurements at high altitudes and high latitudes on a continuous basis, preferably correlated with similar measurements at intermediate latitudes.

S. F. Singer

Office of Naval Research,
U.S. Embassy, London.
Feb. 9.

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AN UNUSUAL TRANSFORMATION OF ISOMERIC FORMS OF TETRAACETYL D-RIBOFURANOSE

By Dr. JOHN DAVOLL* and GEORGE BOSWORTH BROWN
Sloan-Kettering Institute for Cancer Research, New York
AND
DONALD W. VISSER
Department of Biochemistry and Nutrition, University of Southern California School of Medicine, Los Angeles

1 : 2 : 3 : 5-Tetraacetyl D-ribofuranose was first prepared by Howard, Lythgoe and Todd[1] by hydrogenolysis of 1 : 2 : 3-triacetyl 5-trityl D-ribose, followed by acetylation of the resulting 1 : 2 : 3-triacetyl D-ribose. The compound had melting point 58°, $[\alpha]_D^{15°} + 20°$ ($c = 0{\cdot}645$ per cent in chloroform). Later, Bredereck and Hoepfner[2] obtained a tetraacetyl D-ribose of melting point 56°, $[\alpha]_D^{20°} - 3{\cdot}6°$ (in methanol) by treatment of 1 : 2 : 3-triacetyl 5-trityl D-ribose with acetyl bromide in acetic anhydride solution. There is no reason for doubting the identity of this compound with that obtained by Howard, Lythgoe and Todd. In 1950, Zinner[3] reported that direct acetylation of ribose yielded a mixture of 1 : 2 : 3 : 4-tetraacetyl D-ribopyranose and a new tetraacetyl D-ribofuranose, melting point 82°, $[\alpha]_D^{24°} - 12{\cdot}6°$ ($c = 12{\cdot}83$ per cent in chloroform), $[\alpha]_D^{24°} - 15{\cdot}4°$ ($c = 7{\cdot}227$ per cent in methanol), which was named 'β-tetraacetyl D-ribofuranose'. The present communication is concerned with its relationship to the previously known isomer.

In 1949, one of us (J. Davoll) prepared several batches of tetraacetyl D-ribofuranose by Bredereck and Hoepfner's method. While the first three of these preparations had melting point 56–58°, the fourth run yielded a compound of melting point 85°, $[\alpha]_D^{23°} - 12°$ ($c = 2$ per cent in chloroform), $[\alpha]_D^{22°} - 13{\cdot}5°$ ($c = 5$ per cent in methanol). This compound had the composition of a tetraacetyl ribose (found: C, 49·25; H, 5·75; acetyl, 53·9; calc. for $C_{13}H_{18}O_9$: C, 49·05; H, 5·7; acetyl, 53·9 per cent) and proved to be identical with a specimen of 'β-tetraacetyl D-ribofuranose' prepared by Zinner's

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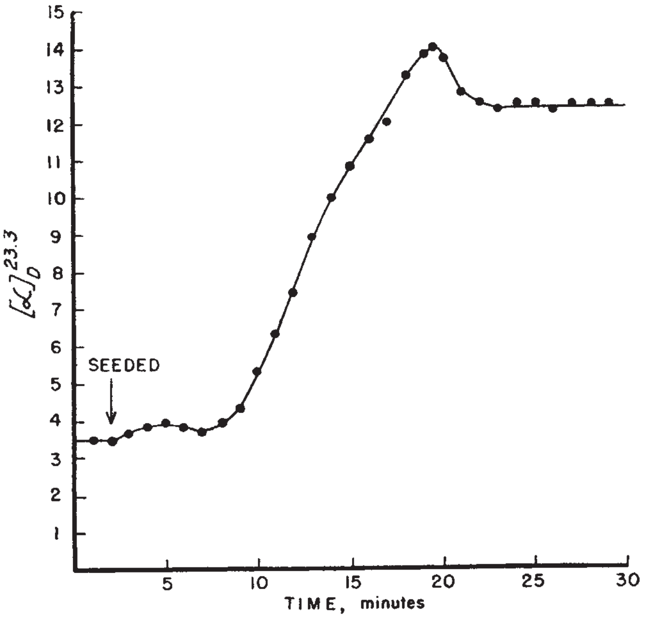
* Fellow of the National Cancer Institute of the United States Public Health Service, Federal Security Agency.



Changes in specific rotation accompanying transformation of the form of melting point 56° to that with melting point 85° in methanolic solution

method[3]. Its furanose structure was proved by its conversion, through the acetochloro compound, to adenosine[4], in yields similar to those obtained from the tetraacetyl ribofuranose of melting point 56–58°.

It was now found that the melting points of samples of the earlier preparations had risen to 85°, and it proved impossible to prepare the form of lower melting point. When a sample of melting point 56°, obtained from Prof. Todd's laboratory, was exposed to the air in a laboratory inoculated with the form of higher melting point, the crystals rapidly became opaque and their melting point was then found to be 85°. (We wish to thank Dr. S. Trippett for providing this sample. Prof. Todd, whom we wish to thank for his criticisms of the manuscript, has informed us that the transformation to the isomer of higher melting point has now been observed at Cambridge.) Dr. Visser has studied the catalytic effect in the solid state under more controlled conditions. Inoculation of a dried sample (1 gm.) of melting point 57° with 1 mgm. of that with melting point 85° (obtained from the Sloan-Kettering Institute) raised the melting point to 75–77° within two hours, and to 77–79° overnight; this was further raised to 84–85° by recrystallization. An odour of acetic acid was noted during the transformation.

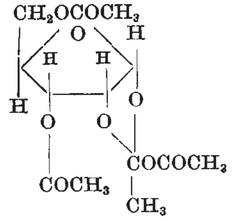
Dr. Visser has also shown that the catalytic effect operates in methanolic solution. Immediately after opening the sample of the isomer of melting point 85°, a previously prepared methanolic solution ($c = 2{\cdot}94$ per cent) of the isomer of lower melting point in a polarimeter tube was inoculated with a minute amount of the higher melting form. The subsequent changes in optical rotation of the solution, confirmed in a duplicate experiment, are shown in the accompanying graph.

A satisfactory explanation of these observations must account for: (*a*) a structural change in the molecule to account for the alteration in optical rotation; (*b*) the catalytic effect, in solution and in the solid state, of the form of higher melting point; and (*c*) the complexity of the change in specific rotation shown in the graph, which indicates the presence of at least three molecular species.

If the isomer of melting point 56° is denoted by *A*, and that of melting point 85° by *B*, the catalytic effect might be explained by a reaction (probably involving acetyl migration) between *A* and *B* to give a compound which might then become rearranged and dissociated to give two molecules of *B*:

$$A + B \rightarrow A\,.\,B \rightarrow B + B.$$

We have been unable to determine the nature of the difference between the two isomers. The closeness in specific rotation of the two forms, and the facility of the conversion of the 56° into the 85° isomer, are against simple α, β isomerism. It is also possible that one form has the orthoacetate anhydride structure shown (which, like the acetylated carbohydrate methyl orthoesters[5], might be expected to give rise to a normal acetyl glycosyl halide), though this structure is difficult to reconcile with the stability of both forms to water and ethanol. Only one compound of the same type appears to have been prepared, namely, an amorphous octa-acetyl maltose[6], the properties of which have not been reported.



The difficulty of again obtaining the lower melting isomer in either of these laboratories has prevented further study of this remarkable transformation.

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MANAGEMENT IN SCOTLAND

In a paper submitted to the Scottish Management Conference which was held at Gleneagles during April 25–27, Mr. B. A. C. Hills, controller of S. Smith and Sons, Ltd., suggested that what is most urgently needed in industry to-day is the realization that behind high-sounding labels lie ordinary actions which not only can be applied to businesses but also should be. Line production, for example, is too often only associated with mass production of cars and refrigerators, whereas it could, in fact, be used in the majority of factories.