It is not yet possible to say how much of the helium-4 in the Carbo meteorite is of radiogenic origin, since the quantity of helium-4 produced by cosmic rays together with helium-3 is not accurately known[6,9] and depends on the relative proportions of the primary and secondary radiations. From observations on another meteorite, we concluded[8] that there the helium-4 of cosmic ray origin could not be more than 3·2 times the helium-3; the limit derived for the Carbo meteorite is 3·5. The possibility of determining the quantity of radiogenic helium on which to base an age calculation is obviously much greater in meteorites with a low helium-3/helium-4 ratio[6,9].

The fact that the helium-3 content, even at a depth of about 30 cm., is only 27 per cent smaller than near the surface of the Carbo meteorite confirms present-day views about penetrating power and the action on matter of cosmic rays[9].

Experimental details and discussion of our work will be published elsewhere.

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Avidity of Terramycin and Aureomycin for Metallic Cations

It has been shown that the antibacterial action of 8-hydroxyquinoline is due to its ability to combine with ferrous, ferric and cupric ions accidentally present in the medium, the complexes thus formed being the true toxic agents[1].

It is therefore interesting to discover that terramycin and aureomycin also have high affinities for metallic ions. These affinities were put on a quantitative basis by potentiometric titration at 20° (with potassium hydroxide) of the chemically pure monohydrochlorides of these substances (0·001 *M*) in the presence of various metallic salts (0·0005 *M*) (0·00033 *M* for Fe^{3+}). Preliminary experiments had shown the formation, first of a 1 : 1-complex, and later, as the *p*H rose during titration, of a 2 : 1-complex, that is, one containing two molecules of the antibiotic to one atom of metal. Details of the titrations and the calculations were similar to those published for 8-hydroxyquinoline[2]. The results are given in the accompanying table, where K' refers to the 1 : 1-complex and K_s is the product of all the partial constants (of which a divalent ion has two and a trivalent ion three).

Stability Constants for Metallic Complexes

Metallic cation	Terramycin			Aureomycin		
	log K'	log K''	log K_s	log K'	log K''	log K_s
Fe^{3+}	9·1*a*	7·2	22·0*b*	8·8*a*	7·2	21·6*c*
Cu^{2+}	7·2*a*	5·0	12·2	7·6*a*	5·0	12·6
Ni^{2+}	5·8	4·8	10·6	*d*	*d*	*d*
Fe^{2+}	5·6	4·8	10·4	5·7	4·7	10·4
Co^{2+}	5·1	*e*	(9)*f*	4·8	*e*	(9)*f*
Zn^{2+}	4·6	*e*	(8)*f*	4·5	*e*	(8)*f*
Mn^{2+}	4·3	3·7	8·0	4·3	*e*	(8)*f*

(*a*) In these cases, the affinity was so strong that this first constant could only be obtained by back-titration with hydrochloric acid (4 equiv. in the case of Fe^{3+}).
(*b*) (*c*) These values include a log K''' of 5·7 and 5·6 respectively, three molecules of the antibiotics eventually becoming bound to this trivalent cation.
(*d*) Not attempted because of shortage of pure material.
(*e*) Precipitation of highly insoluble 2 : 1-complexes prevented readings being obtained.
(*f*) Deduced values (approximate).

Before these titrations could be undertaken, the ionization constants of the antibiotics had to be determined under similar experimental conditions. The terramycin was dried at 75° and 0·02 mm.; the aureomycin at 110° in air. The pK_a values for terramycin (0·001 *M*) were 3·10 (± 0·02); 7·26 (± 0·02) and 9·11 (± 0·03); and for aureomycin (0·005 *M*) 3·30 (± 0·02); 7·44 (± 0·01) and 9·27 (± 0·03), which are similar to the approximate values previously reported[3]. The values near 3 represent the ionization of cations, the others of anions. Trial calculations[4] showed that combination with metals required that the groups near pK_a 7 should be ionized but that those near 3 and 9 should not be ionized.

It is seen from the table that the constants for terramycin and aureomycin are almost identical within experimental error. These constants, and the order of preference for the various metals, are much the same as in the common amino-acids[4,5] with two important exceptions; (i) the position of Fe^{2+} is here elevated above its usual position between Mn^{2+} and Zn^{2+}, and (ii) Fe^{3+} is the most strongly bound ion, whereas amino-acids have little or no affinity for it[4,5].

It is interesting to note that the powerful antibacterial, 8-hydroxyquinoline, also combines preferentially with ferric iron; however, all the constants for terramycin and aureomycin are considerably lower. Moreover, because 8-hydroxyquinoline is inactivated by red blood cells, the comparison ought not to be pressed at this early stage of the investigation.

The copper and nickel complexes of these antibiotics were found to be green, the ferrous and ferric complexes red, and the others yellow. Unlike the free antibiotics, the complexes caused foaming when their solutions were agitated.

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