INVESTIGATIONS WITH A SAPROZOCIC NEMATODE, 
MESODIPLOGASTER LHERITIERI, 
ON A POSSIBLE RESPIRATORY FUNCTION OF AIR SWALLOWING

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Experiments were done in which the oxygen and carbon dioxide tensions could be changed in a medium containing nematodes in order to examine the hypothesis that air swallowing in saprozoic nematodes might have a respiratory function. In these experiments, alternating high and low oxygen and low and high carbon dioxide tensions were produced in a liquid medium containing nematodes by perfusing the medium with pure oxygen gas on the one hand and with pure nitrogen gas or a gas mixture (80 % N₂ + 15 % CO₂ + 5 % O₂) on the other. When applying oxygen and nitrogen alternately, a slight but significant increase in air swallowing occurred with nitrogen treatments compared with oxygen (table I). If the gas mixture was used instead of nitrogen thereby producing a low oxygen tension combined with an elevated CO₂-tension, the increase in the frequency of air swallowing was much more pronounced (Table II). In control experiments in which nitrogen or the gas mixture were used continually, no regular changes in frequencies of air swallowing were observed (Table III). The results presented are interpreted as supporting the hypothesis that air swallowing has a respiratory role in Mesodiplogaster lheritieri.

Air swallowing has already been seen in the following saprozoic nematode species: Rhabditis (Cephaloboides) oxycerca and Pelodera (Cruznema) lambdiensis (Doncaster, 1962), Meteorcholaimus sp. (Hopper & Meyer, 1966), Cephalobus persegnis (Kunz & Klingler, 1971), Panagrellus sp. (Ellenby, in litt., 1973) and Mesodiplogaster sp. (Doncaster, in litt., 1973). The significance of air-swallowing is not clear. It may be merely incidental to microbial feeding at the surface of the medium. Nematodes are usually supposed to obtain oxygen by passive diffusion, but Kunz & Klingler (1971) suggested that air-swallowing has a respiratory function. This hypothesis was tested here by manipulating oxygen and carbon dioxide tensions in the medium and attempting to correlate the frequency of air swallowing with these gas tensions.

Materials and methods

Nematodes of the saprozoic species Mesodiplogaster lheritieri were reared on non-sterile agar where they fed on microorganisms that occurred fortuitously. They were then extracted from the agar and transferred to experimental boxes (Fig. 1) containing a layer of agar (3 % Difco-Bacto) with two cavities. These cavities contained the nematodes, water at a level kept constant by communicating tubes, and fine
Fig. 1. Experimental box for observing air swallowing in nematodes living in media with different gas tensions. A: plan view, B: longitudinal section through axis 1, C: transverse section through axis 2; 3. basal plate, 4. gas canal, 5. agar, 6. cavity in the agar, containing water, glass fibres and nematodes (= “nematode medium”), 7. nylon net with 28 μm mesh, 8. communicating tubes, 9. tube, 10. water reservoir, 11. opening.

The gas enters at left (arrows), passes through the canal (4) and below the nematodes' medium (6), it enters the tube (9) and from above, the water reservoir (10) which it leaves through opening (11). By this means the gas tension in the water reservoir (10) tends to equal that in the nematodes' medium (6). Water which evaporates in (6) flows from the reservoir (10) through the communicating tubes to the nematodes' medium (6).

glass fibres which enabled the nematodes to move to the water surface (see Fig. 3-5). Gases could be passed below the agar at a rate of about 1 litre per minute in order to change the oxygen and carbon dioxide tensions in the nematodes' medium but not materially to affect the composition of air above the cavities. High and low oxygen and carbon dioxide tensions were produced alternately, during the day time, at intervals of 3½ hours. Steady gas tensions were reached after 3 hours, then nematodes which swallowed air were counted. After each count the gas was changed to obtain reversed conditions. High oxygen tensions were produced by using pure oxygen,