Dominant Short	Recessive Short
O. valdiviensis	*O. rosea*
O. hirta L., form *E*	*O. articulata* Savign.
O. tragapoda Salter	
O. bowiei Lindl.	

A more extensive publication elsewhere will be delayed so that inheritance of the Mid form in *O. articulata* may be included. I wish to thank Captain T. M. Salter for collecting and sending the South African species mentioned together with many others, and Sir Ronald Fisher for his constant help and encouragement.

V. C. FYFE

Department of Genetics,
University of Cambridge. Jan. 4.

[1] Fisher, R. A., and Martin, V. C., *Nature*, **162**, 533 (1948).
[2] Fyfe, V. C., *Heredity*, **4**, 365 (1950).
[3] Ubisch, G. von, *Biol. Zentralblatt*, **46**, 633 (1926).

Moult Adaptation in Relation to Long-distance Migration in Petrels

MEINERTZHAGEN[1] has described in South Greenland seas (*c.* lat. 60° N.) flocks of wing-moulting, and often temporarily flightless, great shearwaters (*Puffinus gravis*) which migrate trans-equatorially northward from their Tristan da Cunha breeding grounds (lat. 37° 6′ S.). He suggests that it "needs to be explained why the Great Shearwater moults in its winter quarters, whilst the Fulmar (*Fulmarus glacialis*) moults while the young are hatching". (The fulmar, of course, breeds locally.)

In the course of a study[2] of the breeding cycle in relation to the trans-equatorial migration of the short-tailed shearwater (*Puffinus tenuirostris*) we have accumulated data that have bearing on the point raised above.

Many widely unrelated species undergo a post-nuptial moult involving the uninterrupted and more or less serial replacement of the feathers of tail, wings, body and head (for example, the rook, *Corvus frugilegus*)[3]. In other species, such as the fulmar, body moult comes first, immediately followed by the shedding of wing-quills[1,4,5].

During our investigation of *P. tenuirostris* on its Tasmanian breeding grounds, we found that all fifty-three sexually mature examples examined in the post-nuptial phase moulted only on the head and body. Although ovulation occurred in November, flight- and tail-feathers were not replaced before the shearwaters departed in April on their long migration into North Pacific and Arctic waters. It was concluded that the annual replacement of the feathers most involved in flight must be delayed until the termination of this long journey.

Examination of the literature showed that this is indeed what happens. *P. tenuirostris* has been collected while moulting its wing- and tail-feathers in northern waters in June and July[6,7]. Further, two other shearwaters of broadly comparable trans-equatorial movement pattern exhibit a similar post-migratory wing moult. Thus, *P. griseus* has been observed moulting in wing and tail in the northern hemisphere summer[8,9] and *P. gravis* (as mentioned above) has been similarly observed by a number of authors[1,10–13]. An especially remarkable divergence in moult-timing probably occurs even between subspecies. Thus, while *P. puffinus mauretanicus* (which breeds in the Balearic Islands and undergoes only a restricted migration or dispersion) carries out the whole of its post-nuptial moult without delay[14], there is a suggestion that *P. p. puffinus* delays the replacement of its flight (but not most of its body) feathers until after crossing the equator to its southern hemisphere 'wintering' grounds[15].

From the above data there emerges clear evidence of the evolution of a moult adaptation related to the migratory requirements of species that undergo a long post-nuptial migratory movement. Moult in all adult shearwaters probably begins during the nesting period; but in trans-equatorial migrants there is a hiatus that allows the retention of the wing- and tail-feathers until after the completion of their post-nuptial journey.

Once the flocks reach their contra-nuptial quarters the moult is completed in a short, sharp burst. The sea is then bestrewn with moulted feathers[7,8] and in the case of one species at least some individuals may be temporarily unable to fly[1]. But the long, arduous journey is now behind them.

A. J. MARSHALL

Department of Zoology and
Comparative Anatomy,
St. Bartholomew's Medical College,
University of London.

D. L. SERVENTY

Wildlife Survey Section of the
Commonwealth Scientific and
Industrial Research Organization,
Perth, Western Australia.
April 5.

[1] Meinertzhagen, R. M., *Bull. Brit. Orn. Club.*, **76**, 17 (1956).
[2] Marshall, A. J., and Serventy, D. L. (in the press).
[3] Marshall, A. J., and Coombs, C. J. F. (in the press).
[4] Wynne-Edwards, V. C., *Proc. Boston Soc. Nat. Hist.*, **40**, 233 (1935).
[5] Fisher, J., "The Fulmar" (1952).
[6] Jacques, F. L., *Auk*, **47**, 353 (1930).
[7] Sudilovskaya, "The Birds of the Soviet Union", **2**, 319 (1951) (in Russian).
[8] Loomis, L. M., *Auk*, **38**, 528 (1921).
[9] Kuroda, N. (personal communication).
[10] Harvie-Brown, J. A., and Barrington, R. M., *Trans. Roy. Irish Acad.*, **31**, 72 (1897).
[11] Newton, A., *Ann. Scottish. Nat. Hist.*, **33**, 142 (1900).
[12] Murphy, R. C., "The Oceanic Birds of South America" (1936).
[13] Rankin, M. N., and Duffey, E. A. G., *Brit. Birds*, **41** (supp.), 13 (1948).
[14] Mayaud, N., *Alauda*, **3**, 230 (1931).
[15] Witherby, H. F., *Brit. Birds*, **25**, 169 (1931).

The Langmuir Paradox in Discharge Plasmas

IN a recent communication, Gabor, Ash and Dracott have described the detection of oscillations in a positive ion sheath separating a section of wall from the positive column plasma of a low-pressure arc in mercury vapour[1]. The oscillations were studied by passing a pencil of cathode rays through the sheath, and were found to have two main components, one with frequencies of up to about 100 kc./s., and the other with frequencies of the order of 100 Mc./s. We have been investigating the fluctuations of similar discharges by the alternative method of withdrawing oscillatory energy through the main electrodes (anode, cathode) and probes to tuned detectors, and have obtained what appear to be comparable experimental results. Our method does not permit of observation over individual periods of a few hundredths of a micro-second, as does Gabor's, but yields a long-time Fourier analysis of the fluctuations.

Accounts have already been published of the lower-frequency band[2]. It has some nearly monochromatic