

the reflection coefficient should depend little on the neutron spin direction.

This method sounds most attractive, as it relies on a basic definition of A , and has worked well in conventional superconductors¹². Once again, however, we have to worry about anisotropy. Without access to detailed computations, I would guess that the technique gives an average weighted towards the shorter values. If so, the value recorded in the table is a little short compared with the magnetization results and is definitely inconsistent with the μ SR values. In this case, the very directness of the reflection method may be a disadvantage as it measures a surface property of a sample, whereas μ SR looks at the bulk — but which is intrinsic? Also if there happened to be a nonmagnetic overlayer of just the right thickness to act like an anti-reflection coating, it could enhance the spin-dependence of the reflectivity¹³, which would look like a shorter A . The other neutron-scattering value for A in the table is obtained by a small-angle scattering technique. The interpretation of the data may be affected by inelastic scattering. The value is almost certainly incorrect.

So what can we conclude? Certainly that more work is needed — there are still some techniques, such as a.c.-field penetration and Bragg diffraction of neutrons by the flux-line lattice, that have not yet been reported. At least one of the techniques I have reviewed is probably giving misleading answers; the Ginzburg-Landau picture, especially its anisotropic form, might not be applicable to high- T_c superconductors at low temperatures.

It is a truism among workers in the field that experiments on single crystals are the answer. But, when made at high temperatures under atmospheric pressure, single crystals of the yttrium-barium material are oxygen deficient, tetragonal and not superconducting. To make them superconducting, they must be changed to orthorhombic by diffusing in oxygen. This may take 10,000 times longer for a 1-mm crystal than a 10-μm powder. Whatever technique is used, can I make a plea for those performing measurements in the vortex state to apply the field above T_c and cool down in constant field? It is well established that in samples with pinning, this gives a better quality flux-line lattice with a flux density close to that applied. □

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Birds learn song from aggressive tutors

It is a well-established fact that young male song birds (members of the sub-order oscinae) acquire the typical song of their species by copying the songs of older individuals. This capacity for imitative song learning has been exploited by generations of bird fanciers, both in Europe¹ and the Orient², who have taught birds of various species to whistle elaborate songs or even folk tunes. The scientific study of song learning did not begin until the technology for sound analysis became available in the 1950s, and only now, in studies such as those by Clayton³, are the social factors that influence song learning being elucidated.

In their classic studies, W.H. Thorpe⁴ and P.R. Marler⁵ raised young males in acoustic isolation and taught them with tape-recorded song under a controlled regime. These studies gave rise to two key concepts in song learning: the sensitive

Clayton³ has recently investigated. She comes to the interesting conclusion that young males learn from the adults who are most aggressive towards them.

Clayton performed two experiments on zebra finches (*Taeniopygia guttata*; see figure). These birds are normally raised by both parents until they are about 35 days old, when they reach independence. In one of Clayton's experiments, young zebra finches were raised only by their mother, and at independence were transferred to a cage with two live male tutors. Social interactions between the young and the tutors were monitored and when the young birds were 4 months old, their own songs and those of their tutors were recorded. Each of the 11 birds in this experiment were found to learn their song from the tutor that was most aggressive (measured by the number of pecks and chases) towards it.

In another experiment, Clayton analysed the role of the paternal song in the young male's choice of which tutor to copy. Chicks were raised by both parents until independence and then placed in a cage with two tutors. In this experiment the three birds were separated by wire mesh, so that physical attack, shown to be important by the experiment described above, could not influence which bird the pupil copied. The tutors of

each young male were chosen so that one had a song similar to the pupil's father and the other did not. Nine of the ten birds learnt their songs from the tutor with a song like the pupil's father, and the tenth bird learnt from both tutors. Thus, the early experience of hearing their father sing results in a young bird's subsequent tendency to learn from a tutor that sounds similar.

These experiments are among the first to investigate how specific kinds of social experience influence song learning⁷. They help to elucidate both the complex process of behavioural development and the fascinating problem of how and why local dialects of bird song arise.

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period and the inborn template. The first refers to the finding that young birds can learn from tape recordings only during a certain period in life — between 10 and 50 days in white crowned sparrows (*Zonotrichia leucophrys*), for example; whereas the second refers to the fact that pupils are not equally likely to copy from any taped song: they seem to have an inbuilt predisposition to learn their own species' song or at least sounds that are very similar to it.

In the past few years, however, it has become clear that the results of song tutoring can be very much influenced by the experimental method used. A crucial modification in recent experiments is the use of live teachers instead of tape-recorders. When young birds can see and interact with a tutor, they are not only able to learn new songs well beyond the traditional sensitive period, but they are also willing to learn the songs of other species⁶. These results demonstrate that social interaction is important in determining the duration and nature of song learning, but they do not show what features of social interaction are important, and this is the question that