in the spiral nebula N.G.C. 6946 was followed by the discovery of many other novæ in other extragalactic systems, and these discoveries opened up a new way for the determination of the distances of these systems if an absolute magnitude could be attributed to them. The results of the first efforts at this determination proved disappointing because of the very large range of magnitudes in the luminosities of the novæ observed. This unusually large range—up to eleven magnitudes—indicated one of two things: either there was a very large dispersion in the absolute magnitudes of the novæ; or there existed two groups of novæ differing in luminosity by a factor of the order ten thousand. The second alternative was shown to be the correct one as a result of Hubble's investigations of the Andromeda nebula, and Baade concluded that, in addition to the class of fainter novæ, to which most of our galactic novæ belong, there was also a class of supernovæ the average magnitude of which was about ten magnitudes brighter and hence they were visible in nebulæ so distant that the fainter novæ could not be observed there. The spectra of six supernovæ which were quite distinct from those of other stars, including ordinary novæ, obtained about the time of Baade's deductions confirmed Baade's views, which are now universally accepted. Dr. Jackson's address then went on to discuss fully the developments in this branch.

Turning now to other features in Baade's work, about a century ago Prof. G. P. Bond, in reporting on the rapid progress in photography, announced that stars to the sixth magnitude could be photographed; he then made the optimistic forecast that on some lofty mountain and in a purer atmosphere stars up to eighth magnitude might be photographed, and, by increasing the aperture threefold, all the stars up to the tenth and eleventh magnitude could be photographed. Bond lived long enough to see the aperture increase from 15 to 45 in. with a corresponding increase of about 2½ magnitudes in the stars that could be photographed. Dr. Jackson points out that there are other methods for increasing the photographic powers of telescopes, such as changing from a long-focus refractor to a short-focus reflector (which happened when he was at Greenwich) and improvement in clockwork and engineering; but unfortunately the stage is approaching in which fogging due to the light of the night sky is of the same order of intensity as that of the images formed by the faintest stars. The hope for the future lies with the sensitive plates, and at the meeting of the International Astronomical Union in Stockholm in 1938, Baade showed photographs of obscured regions of the sky taken with a new brand of red-sensitive plate. He stated that one plate showed eight hundred thousand stars to the square degree and that, with the optical means available, the limit had not yet been reached. It was a great triumph in 1942 when plates of the Andromeda nebula, taken with the 100-in. reflector, revealed for the first time "signs of incipient resolution in the hitherto apparently amorphous central region—signs which left no doubt that a comparatively small additional gain in limiting magnitude, of perhaps 0·3 to 0·5 mag., would bring out the brightest stars in large numbers". After this it was merely a matter of time for further investigations before successful plates were secured for about the restricted range of wave-length used, 6300–6700 A., so that the most troublesome part of the night sky was cut out.

Dr. Jackson's address dealt at length with the results obtained with these red-sensitive plates, and the following is a summary of Baade's view regarding Population i and Population ii in different regions of space (see *Astrophys. J.*, Sept. 1944). The method was applied to *M* 31 and the two companion nebulæ *M* 32 and N.G.C. 205, and, following their resolution into stars, Baade suggested that there are two types of stellar populations. Population i, in which bright giants and supergiant stars are common, is found in the arms of spiral galaxies but not in their central regions, and this population includes a higher proportion of binary stars but less novæ and supernovæ than Population ii. The latter includes no stars brighter than a normal giant, absolute magnitude about − 2, with comparatively low temperature, and also the high-velocity stars, stars found in globular clusters, in elliptical nebulæ and in the central unresolved regions of spiral nebulæ. In connexion with this subject, Baade's work on the Sagittarius cloud provides very interesting corroboration of the general view that our galaxy is a spiral nebula like the Andromeda nebula; if this resemblance is complete, the Sagittarius cloud, in the direction of which the centre of our galaxy lies, should contain stars of Population ii. Baade's investigations of this region with red-sensitive plates has shown that this is actually the case. Not only was the similarity to *M* 31 thus shown but also, allowing for a colour excess of 0·37 which involved a correction to the distance modulus of 2·6, the distance modulus was reduced to 14·7, indicating a distance of about 9 kiloparsecs. This is close to the generally accepted value for the distance to the centre of our galaxy, which is believed to be very similar in its contents to the Andromeda nebula—an intermediate spiral of type *Sb*.

At the end of Dr. Jackson's address, reference is made to the unsatisfactory position regarding determinations of very remote objects by the classical Cepheids and to the scheme which is being planned for settling the zero point. Direct trigonometric methods have supplied the distances of many stars of types *F* to *K* and, from these, reliable absolute magnitudes can be calculated. Baade hopes to observe such stars in the near future; but the work must necessarily occupy a long time as it involves not only accurate apparent magnitudes but also spectral classification or at least colour indices of very faint stars in clusters. In this scheme there lies great hope of deducing accurate absolute magnitudes not only of Cepheids but also of any other objects in the systems, and hence their distances. It is admitted, however, that the lack of transparency of space "remains a challenge but also a means of determining something about the contents of interstellar space".

## JAPANESE FORESTRY RESEARCH

THREE Bulletins (Nos. 63, 64 and 65) of the Government Forest Experiment Station (Meguro-Ku, Tokyo, 1953) have been received. Nos. 63 and 65 deal with various research inquiries and studies dealing with forestry work. No. 64 is confined to research connected with studies on fog-prevention forests. Fog in Japan has a very serious effect both on agricultural and other operations in the Islands, and a study of the Bulletin is of considerable interest since it presents aspects of a danger which is little known elsewhere except as a nuisance.

In Report 3 of the Station, research work into "Forest Soils of Japan" is dealt with in a monograph. The forest soil survey was undertaken of the Kamo management unit. The area surveyed is situated on the slopes of the Amaji mountain range, Izu Peninsula. The grade of weathering of this area is higher and consequently the topography is more complicated than that of the Tagata management unit, which is on the opposite face of the mountain range. This latter had been the object of a forest soil survey for beech carried out by the research station in 1951 (Report No. 1). The elevations of the Kamo research area vary from 300 m. to 1,400 m.; consequently, the climatic variations are considerable, mild at the lower elevations and severe at the higher altitudes. Fogs frequently prevail on slopes above 800–900 m. Eighty per cent of the area surveyed are artificial forests of Sugi (*Cryptomeria japonica*), a species of tree which is well known as an exotic in several parts of the world—for example, it forms the chief tree in the Station of Darjiling in the Eastern Himalaya, where it was largely planted to replace the indigenous forest swept away while the Station was being built—and the remainder is occupied by the natural forest of *Fagus crenata* at the higher altitudes. The soils of this area belong to the brown forest soil group. There is a fine large soil map showing the distribution of these classified soils, which is more complicated than that of the Tagata area.

The Japanese Forestry Society has presumably re-commenced the publication of its *Journal*, the monthly numbers for August–November 1953 having been issued. The office of the Society is at the Government Forest Experiment Station, Meguro-Ku, Tokyo, where the *Journal* is published. A list of contents of each number is given on the back cover in English. The articles are confined to research investigations of various types which would be more suitable to the research publications of a research station than to a journal of a forestry society. But Japan is not alone in this, for several of the journals of European and other forestry societies follow the same tendency.

E. P. STEBBING

# EFFECT OF IMPLANTATION SITE ON THE DEVELOPMENT OF AN IMPLANT IN THE CHICK EMBRYO

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THE ability of leg mesoderm to control the course of regional differentiation of wing-bud ectoderm in the formation of feathers and other epidermal structures has been clearly demonstrated in the results of transplantation experiments combining leg mesoderm and wing ectoderm in the 3½–4-day chick embryo[1]. Ectoderm-free mesoderm from the proximal portion of the leg bud (prospective thigh), implanted in the proximal portion of the wing bud, induces the formation of ectodermal derivatives characteristic of the proximal part of the leg (that is, thigh feathers) in the wing ectoderm which grows over the implant. Similarly, mesoderm of the distal part of the leg bud (prospective foot), implanted distally in the wing bud, has brought about the formation of epidermal structures typical of the foot (scales, large claws). Thus the regional characteristics of the induced epidermal structures correspond not only to the leg source of the mesodermal implant, but also to the precise origin of the graft along the proximo-distal axis of the leg bud.

Since, however, the grafts were placed at proximo-distal levels of the wing bud corresponding to their levels of origin in the leg bud, these results do not disclose whether the proximo-distal level of the implantation site on the wing bud, or the source of mesoderm with respect to the proximo-distal axis of the leg bud, controls the regional character of leg structures formed from wing ectoderm associated with the graft. Accordingly, experiments were undertaken to examine the effect of implantation site on the regional differentiation of leg structures induced in wing ectoderm by an implant of leg mesoderm.

Isolates of mesoderm from the posterior proximal portion of the leg bud, the prospective material of the thigh region which forms the largest feathers of the leg, were grafted to the apex of the wing bud in embryos of stages 19 to 23 (3½–4-day embryos[2]) in the manner illustrated in Fig. 1. The mesodermal

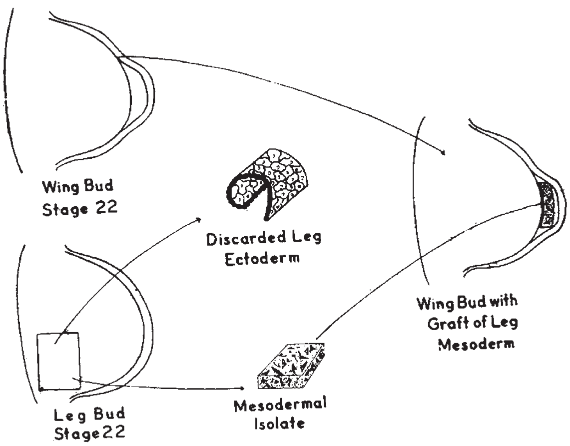


Fig. 1. Scheme of operation for combining prospective thigh mesoderm with ectoderm of the apical region of the wing. The graft becomes covered with ectoderm from the host wing bud soon after being implanted