Fig. 1

animals. At the north end of the enclosure are post-mortem rooms, a cold store, a gas cremator and a diagnosis laboratory. The wing is completed by a large lecture theatre with seating for more than one hundred people.

The Department of Veterinary Anatomy is responsible for the teaching of gross and topographical anatomy, histology and embryology. Recently installed equipment includes X-ray apparatus suitable for work with farm animals, including ciné radiography with a 9-in. image intensifier. There is also a completely equipped experimental operating theatre. Research projects in hand include studies on growth-rate of tissues, the hormonal control of lactation, the transport and fate of gametes, and structure and function in the hip joint.

The chair of veterinary anatomy has been re-established and Dr. A. S. King, of the University of Bristol, will be taking up the appointment in January.

The Department of Veterinary Pathology and Bacteriology undertakes the teaching of gross morbid anatomy, histopathology and microbiology including virology. The Department is also responsible for instruction in applied pathology, including the principles of food hygiene with particular reference to food of animal origin. The equipment of the Department now comprises all the more modern

apparatus necessary for microbiological and histopathological studies, including a cold laboratory operating at 4° C. and a unit able to provide all the photographic requirements of the Department.

Research work on the microbiological side of the Department consists of a series of projects designed to elucidate the pathogenesis of enteric infections, using fowl typhoid, coli-bacillosis in calves, and bowel oedema in pigs as models. The role of hypersensitivity in producing the lesions associated with these infections is of particular interest. Another problem in a somewhat similar field are the ante-mortem factors which may govern the post-mortem invasion of the carcass. This problem has a particular relevance to meat hygiene.

Research in histopathology is concerned with demyelination in the central nervous system, especially in swayback in sheep, and the histopathological changes in the reproductive system in certain forms of vitamin A deficiency.

Apart from teaching and research responsibilities, the Department undertakes a considerable volume of routine diagnostic investigations for the clinical Departments of the Veterinary School, and some work for veterinary surgeons in practice. In 1960 this amounted to 663 post-mortem examinations and 1,186 other diagnostic tests. D. L. HUGHES

PIGMENT CELLS IN ANIMALS

THE fifth International Pigment Cell Conference, in a series initiated by the late Myron Gordon, was held in New York during October 11–14 under the auspices of the New York Academy of Sciences and was organized jointly by them and by Dr. Vernon Riley, of the Sloan-Kettering Institute for Cancer Research, Rye, New York, and Dr. Joseph G. Fortner,

of the Memorial Sloan-Kettering Cancer Center, New York. As in previous conferences, contributions ranged from the fields of medical statistics and dermatology to those of genetics and cell chemistry. The generosity of the New York Academy of Sciences and the Damon Runyon Fund for Cancer Research enabled contributors from many lands to attend.

Despite the very large number of contributions (about eight papers were read during each morning, afternoon and, on one day, evening session), lively discussions followed almost all of them. It is hoped that, as with the previous conferences, this discussion will be published fairly fully in the *Proceedings*.

The opening session was concerned primarily with the occurrence, diagnosis and treatment of pigmentary disorders and malignant melanoma. The final presentation in this session was an elegant time-lapse cinematographic study by G. G. Rose of the secretion of melanin granules by the Golgi apparatus of melanotic melanoma cells in tissue culture. Two phases of secretion were shown which correlated well with later papers based on electron microscopy.

The second session was again primarily medical and concerned with the treatment of malignant melanoma. Natural resistance, radiation and selective perfusion were considered. Doubt was cast on the validity of results from gross inspection of intra-dermal nevi; little correlation was found with exhaustive microscopical analysis. There appeared to be differences in the methods used for the treatment of melanoma on the two sides of the Atlantic.

Contributions to the third and fourth sessions were primarily concerned with the 'natural history' of the pigment cell system in man and animals and it was pleasing to find Prof. R. D. Passey and Prof. S. Rothman as the chairmen for these respective sessions. A paper by A. S. Breathnach, M. S. C. Birbeck and J. D. Everall on the Langerhans cell was presented by Breathnach; these cells have variously been considered as effete melanocytes, effete Schwann cells, macrophages and non-pigmented dendritic cells which may be 'infectively transformed' into melanocytes. New evidence of their structure from electron microscopy of human skin in various normal, pathological and experimental conditions strongly supports the view that this cell form represents an alternative choice available to the melanoblast, which may be irrevocable.

R. G. Staricco has been able to demonstrate the existence of non-pigmented cells of the pigment cell system, normally indistinguishable from Malpighian layer cells in the unpigmented human hair follicle wall. These cells when involved in re-colonization of the surface after dermabrasion become or produce normal melanocytes.

H. Pinkus and Y. Mishima proposed, as a result of histological and cytological analyses of various normal and abnormal pigmentary conditions in man, that 'nevus cells' appear as a separate population ('neoblasts') during development and are not modified adult melanocytes.

G. Szabo presented an elegant experimental series; by sequential, topical application of certain carcinogens, pigmented (dermal) maculae are caused to appear in mouse skin. The epidermal pigment cell system produces melanocytes which may possibly invade the dermis, but in all probability the greatest contribution is from pigment cells of the hair follicles, around which the maculae appear and enlarge.

H. Rappaport and P. Shubik reported induction of pigmented (benign) tumours by a single application of carcinogen to the skin of Syrian hamsters, further evidence that a competent melanoblast system occurs in this skin. R. E. Billingham and W. K. Silvers, combining immunogenetic and transplantation techniques, have demonstrated finally that the phenomenon of 'pigment spread' in spotted guinea pigs is due to pigment cell migration, at least in the black-

to-white spread. Work on hormonal effects of radiation-induced tanning of skin was reported by W. C. Quevedo and J. A. Smith; correlation between certain genetic backgrounds and extent of effect was striking and may throw light on the complexities of sun-tanning and normal pigmentation processes.

H. B. Chase, W. E. Straile and C. Arsenaault consider, as a result of irradiation of mouse hair follicle with various ions (which penetrate to known depths) and with electron beams, that the depigmentary effect of the irradiation is indirect; the vascular system is not considered a likely mediator, but suspicion falls on the epidermal cells of the upper follicle, which will contribute to the next germ. Further evidence for the indirect action of irradiation (X-rays) in de-pigmentation was presented by J. Cohen; he showed that a competent pigment cell system was still present in irradiated, and therefore white, guinea pig ear skin and Brown Leghorn neck-feather areas. Such tissues produced many melanocytes in culture and supported pigmentation of implanted vibrissae or feather papillae. He presented evidence that the effect is indeed mediated by the ectoderm concerned.

Although the stromal pigment cells of different mammalian species vary considerably in the location and morphology of the granules, A. J. Tousimis showed that the iris pigment epithelium is remarkably constant; this may correlate with the different cell origins.

The fifth session involved a long-established schism among those interested in pigment cells—the origin of the melanin granule. M. Seiji, T. B. Fitzpatrick and K. Shimao maintained, as a result of electron microscopy and cell particle fractionation procedures, that the 'melanosome' is a distinct entity which may be shown to have origin in tiny (ribosomal?) granules which come into relation to the Golgi zone of the cell. H. du Buy and M. Woods, D. Burk and J. Hunter, on the other hand, considered the mitochondrion as a close relative of the melanin granule, based mainly, it appears, on mixed particulate studies and a common affinity for Janus green. M. S. C. Birbeck and S. R. Wellings and B. V. Siegel supported the melanosome theory, as did F. H. Moyer in an elegant correlation of genetic determination of pigment type and granular fine structure. Y. Mishima and A. V. Loud complemented this latter study with similar observations on progressive pigment granule development in xanthic goldfish scales, induced to melanise *in vitro*.

Consideration of the melanocyte-stimulating hormones, both from the clinical and biochemical points of view, formed the basis of the sixth session. W. Chavin has explored the pigmentation processes of the goldfish from an endocrinological and biochemical point of view. G. T. Ross and W. D. Odell have experimentally verified that the melanophore index of frogs, the duration of response to melanocyte-stimulating hormones and the time taken to respond vary inversely with temperature; they may therefore be used to study temperature kinetics of hormone action. A. C. J. Burgers demonstrated, by electrophoresis, the presence of various melanocyte-stimulating hormones in mammals and lower vertebrates.

Included in the seventh session, concerned with melanocyte genetics, were papers of exceptional interest. M. Foster, in an elegant correlation of genotype in the mouse (especially the *B* locus) with the biochemical situation which leads to the various coat colours, has brought us much nearer to a clear conception of the mode of gene action.

K. H. Kim, T. T. Tohen and F. Hu showed that when skin of xanthic goldfish produces melanocytes a cell division is involved; presumably the melanoblasts do not become melanocytes, but produce them.

G. Cleffmann presented a very impressive study of the mode of action of genes at the agouti locus in the mouse. He showed that yellow or black pigment production is not the result of intrinsic differences in the pigment cell system, but that it is determined by the environment of the melanocytes; there is considerable evidence of the importance of sulphhydryl groups.

Vernon Riley has evidence from very many tumour lines, in mice, of the existence of a serially transmissible virus-like factor, which is associated with high lactic dehydrogenase-levels in the body fluids. 'Virus-free' tumours newly induced by methylcholanthrene increased their capacity for anaerobic glycolysis five-fold after infection with the tumour; and blood lactic dehydrogenase-level rose 200-fold. Such results from the serially propagated lines is now, therefore, suspect.

Work on the mechanism of induction of melanoma in *Drosophila* and on the 'induced genetic change' resulting appeared, at presentation, to suffer from almost total absence of control experiments. Any generalizations from these results may well be premature. A paper by H. W. Lewis, in great contrast to the previous *Drosophila* papers, correlated genetic change with tyrosinase activity and lability, a specific tyrosinase activator (protein) and dialysable and non-dialysable inhibitors of the activated enzyme.

The eighth and ninth (final) sessions were devoted to "Molecular and Macromolecular Aspects of Melanogenesis" and included a paper by A. S. Fox and J. B. Burnett which dealt with a system from *Neurospora* which was substantially similar to Lewis's *Drosophila* system. These sessions also included discussions of such diverse topics as the importance of pterins in the pigmentation of fish and amphibians (T. Hama), the biochemical role of mitochondria (K. Giger), and the use of chromatography to detect the presence of melanin in the urine of a patient with metastatic melanoma (E. Ghislandi). The beautiful experimental work using ¹⁴C-DOPA described by S. S. Greenberg and M. J. Kopac has given more information about the pigment cell system, normal and abnormal, in xiphophorin fishes.

A number of phenolic intermediates in the formation of melanin from tyrosine are potentially cytotoxic agents, and the way in which these act was described by P. Hochstein and G. Cohen. The toxic effects of hydrogen peroxide (formed through the autoxidation of 3,4-dihydroxyphenylalanine) in melanomas are prevented through the action of the glutathione peroxidase pathway.

On the more purely chemical side, C. R. Dawson and W. B. Tarpley produced new evidence of the formation of *o*-benzoquinone, 1,2,4-trihydroxybenzene

and hydroxyquinone as intermediates in the tyrosinase-catalysed oxidation of catechol, which results in the formation of a dark, polymeric pigment. The apparently increased stability of *o*-benzoquinone in tyrosinase systems is explained in terms of catechol reformation and re-oxidation. H. J. Bright, B. J. B. Wood and L. L. Ingraham speculated on the role of copper in tyrosinase-catalysed reactions, but more experimental support for their theory is required. G. A. Swan summarized recent work on the chemical structure of melanins, emphasizing that not all black, insoluble, naturally occurring or synthetic polymeric pigments were identical, and presented evidence of the retention of intact methylene groups from the side-chains of 3,4-dihydroxyphenethylamine or 3,4-dihydroxyphenylalanine in melanins formed from these compounds under some conditions. He also indicated that 2,4,5-trihydroxyphenethylamine and 2,4,5-trihydroxyphenylalanine were unlikely to be major intermediates in the formation of melanins from the corresponding 3,4-dihydroxy-compounds, although B. Witkop expressed the view that some hydroxylation of 3,4-dihydroxyphenethylamine was likely to occur, even if only to a minor extent.

The last paper of the conference was by P. Brunet and discussed the metabolism of tyrosine in insects, leading to the formation of integumental pigments and to the formation of quinones, which are concerned in the 'tanning' of protein. This was followed by a brief, concluding speech by Dr. M. J. Kopac.

Emphasis in the biological papers seemed to be on two aspects of pigment cell biology. First, attention was directed to the melanoblast and melanocyte in their tissue relationships, responding both to local and to endocrine factors by a change of metabolic pathways; secondly, correlations between genetic and biochemical phenomena showed promise of great impacts on both subjects in the near future. On the chemical side, our very meagre knowledge of the processes leading to pigmentation was only too apparent. The conference can certainly be expected to stimulate increased and renewed effort on the medical, biological and chemical aspects of cellular pigmentation.

It was obvious from the excellent arrangements made for the conference that Drs. Riley and Fortner had devoted an enormous amount of time and energy to the organization of the conference. Its success may be judged from the fact that people were already looking forward to the possibility of a sixth.

At the conclusion of the conference, those visiting foreign participants who were able to stay were most generously entertained by Mr. Claude-Arpels at his Westchester summer home and later made a short visit to the new Walker Laboratory of the Sloan-Kettering Institute at Rye.

J. COHEN
G. A. SWAN

TECHNICAL CO-OPERATION UNDER THE COLOMBO PLAN

THE report for 1960-61 of the Council for Technical Co-operation in South and South-East Asia, while mainly providing a readable account of technical co-operation under the Colombo Plan during the year, giving besides figures numerous examples of such co-operation in economic development and in the development of social services, includes a chapter

which surveys briefly ten years of technical co-operation under that Plan*. Of the present nineteen full members of the plan, nine are members of the Commonwealth, and during the year 4,417 new

* Department of Technical Co-operation. Technical Co-operation under the Colombo Plan: Report for 1960-61 of the Council for Technical Co-operation in South and South-East Asia, Colombo, October 1961. Pp. 68. (London: H.M.S.O., 1961.) 4s. 6d. net.