

economic importance of the cinema industry. M. Georges Lecomte, the well-known writer, enlarged upon the aesthetic value of the cinematographic art.

Sir Robert Mond, dean of the distinguished foreign delegates present, outlined the historical development of the photography of movement, and expressed the high regard in which Louis Lumière is held throughout the world.

Historically, for the beginning of cinematography, one may go back to the animated drawings devised by the Belgian physicist Antoine Plateau in 1830, which were used in the phenakiteoscope. Improved by Clerk Maxwell in 1869 and enlarged by the American, Horner, the apparatus became known as the zoetrope. Molteni, in 1850, had his choreutoscope, consisting of a glass disc on which six different positions of a moving object were drawn, so that on turning the disc the appearance of movement was produced. In 1893 Edison devised his kinetoscope, consisting of an endless film about 20 metres long, moving at such a rate that 45 images were presented per second. It had the drawback of being visible to only one person at a time.

On the photographic side, we find the American Muybridge in 1872 utilising a series of thirty cameras to photograph a galloping horse. The astronomer Janssen devised a photographic revolver in which a circular photographic plate turns round, so that 48 pictures can be taken in 62 seconds; the physiologist Jules Marey developed his chronophotograph and M. Demyer his phonoscope.

All these separate inventions and improvements do not, however, detract from the great merit of Louis Lumière, that of having devised an apparatus which will both photograph an object in motion and

reproduce it afterwards upon a screen so as to give the impression of movement, in the form in which we see it to-day.

The invention of the moving picture apparatus, though the most spectacular of Lumière's inventions, forms but part of his numerous activities. In 1899 he made an apparatus for taking 'rotary' photographs, so as to be able to make a complete tour of the horizon. In 1901 he devised a 'photogramic' method of projection, and in 1907, after numerous trials, he perfected the Lumière method of colour photography still used throughout the world.

During the War, Lumière had to divert his inventive genius in other directions. He devised a method of heating the cockpit of aeroplanes, and he improved artificial limbs for mutilated soldiers. To-day, at the age of seventy-one years, we find him still active in research and invention. Recently he gave before the Academy of Sciences an exhibition of stereoscopic cinematography. At his villa at Neuilly-sur-Seine, M. Lumière has installed several laboratories that enable him to carry out his investigations in cinematography and related matters.

No account of Louis Lumière would be complete without mention of his brother Auguste, by two years his senior, who has been a constant collaborator, though specialising in the fields of chemistry and biology. The original patent for a cinema apparatus in 1895 was, in fact, taken in the joint names of Auguste and Louis Lumière, but the elder brother has made it clear that in this particular case the originator of the idea was Louis. Both brothers are members of the Paris Academy of Sciences, and have received numerous honours from scientific bodies in France and elsewhere.

Human Genetics and Human Ideals*

TWO widely held opinions on human genetics may be summarised as follows: (1) It is essential in the interests of national hygiene that the unfit should be sterilised; (2) some races are superior to others, the members of which cannot rise to the highest levels possible to humanity.

Both theories are largely based on analogical reasoning from the breeding of domestic animals. Although the laws of heredity are the same in men as in other mammals, the analogy is suspect because our domestic animals are far more genetically homogeneous than any human groups, having been established by intense inbreeding and selection. We must, therefore, examine the evidence for these propositions in detail.

ABNORMALITIES AND STERILISATION

Human abnormalities which are genetically determined fall into five main classes:

(1) Those due to autosomal dominant genes, which determine the abnormality in all cases; for example, lobster claw, cleidocranial dysostosis. Here the abnormality is handed down only by affected

persons, and to about half their children, regardless of sex.

(2) Those due to autosomal genes with manifestation in some, but not all cases. For example, blue sclerotics are due to a dominant gene with 100 per cent manifestation. A fraction of the patients develop bone fragility, deafness due to otosclerosis, or both. Huntingdon's chorea, due to a dominant gene, may not develop until the age of seventy years, though the average age is thirty-five. Such abnormalities run in a family, are handed down to less than half the progeny of affected persons, and often skip a generation.

(3) Those due to sex-linked genes. These are often manifested wholly, or almost wholly, in males and transmitted by females, for example, hæmophilia. But they may be incompletely recessive in heterozygous females, and affect a proportion of them, as with Løber's disease (atrophy of the optic nerve).

(4) Those due to autosomal recessive genes. These are not hereditary in the ordinary sense. They are very rarely handed down from ancestor to offspring, but occur in one or more children of a pair, both of whom are heterozygous. They are very much more frequent in the offspring of parents who are related to one another, for example, of first cousins, than in the general population. They include amaurotic

* Substance of a Sir Halley Stewart Trust Lecture delivered by Prof. J. B. S. Haldane, F.R.S., in the Memorial Hall, Farringdon Street, London, on November 5.

idiocy, some kinds of deaf mutism, and xeroderma pigmentosum, a skin affection two thirds of the victims of which die of cancer in less than fifteen years.

(5) Those due to the co-operation of many genes. It is highly probable that many of the milder forms of mental defect are of this kind, but the analysis is still incomplete.

No far-reaching eugenical programme can be framed until we know the relative frequencies of these five classes. They are not known at present.

Sterilisation of the unfit would be very effective against type 1, moderately so against types 2 and 3, slightly so against type 5, and wholly ineffective against type 4. Here the possible eugenic measures are the discouragement of inbreeding, and the termination of marriage, or at any rate breeding, in couples who have produced one defective child. In order to deal effectively with types 2 and 3 by sterilisation, it would be necessary to sterilise large numbers of fit persons. It is doubtful whether the sterilisation of all mental defectives would reduce the number in the next generation by as much as 15 per cent.

In all cases, other measures than sterilisation are available, for example, continence and birth control for mentally normal persons, and segregation for defectives.

RACIAL COMPARISONS

When we say that race *A* is superior to race *B* in a given respect, we may mean one of five things:

(a) Members of race *A* have had a better chance than those of race *B* of displaying the character in question. For example, the pre-Columbian inhabitants of America were severely handicapped in their progress to civilisation by the lack of domesticable animals.

(b) All members of race *A* are superior to all members of race *B*. No case of this kind is known.

(c) No member of race *B* can possibly reach the level attained by some members of race *A*. This may be true in some cases, but is certainly not scientifically proved.

(d) The median performance of race *A* is superior to that of race *B*. This is probably true with reservations. Thus it is likely that, in Europe, Europeans are more socially efficient than Negroes; but the converse seems to be true in West Africa (the so-called white man's grave).

(e) Race *A* produces more exceptional individuals, for example, great musicians, than race *B*. This is also probably true in some cases, but as it may be due to greater variability, implies no superiority in the mass of the race.

It is emphasised that innate psychological characteristics of races overlap. Thus there is no evidence for an innate psychological characteristic found in all Negroes, but no Europeans. The so-called races of western Europe (Nordic, Alpine, Mediterranean, and so on) overlap in physical as well as psychological characteristics.

Our knowledge of the effects of human race-crossing is slight. In animals, such a cross may be advantageous in the first generation, but harmful in later generations, but there is no clear evidence as to whether this is true in man, though some facts seem to support this hypothesis.

Great caution is required in the application of our existing knowledge of human genetics, and far more extensive information is needed.

Educational Topics and Events

CAMBRIDGE.—On behalf of a body of subscribers, an offer of £540 has been made to the University to form a fund in memory of Dr. J. E. Marr, Woodwardian professor of geology. This fund is to be used to provide grants for the study of geology in the field.

The Council of the Senate recommends the approval of the plans for a new high-tension laboratory for the Cavendish Laboratory prepared by Mr. Charles Holden. The new laboratory will cost about £15,500.

OXFORD.—Henry Balfour has been granted the title of professor during his curatorship of the Pitt-Rivers Museum.

An exhibition to illustrate the work of Robert Hooke (1635–1704), in the Museum of the History of Science, will be opened by the Dean of Christ Church, on November 20, at 2.15.

The course of lectures on the scientific contributions of members of the Oxford Colleges has been continued by Dr. R. T. Gunther at New College and at All Souls. Although neither College was primarily endowed for the training of men of science, yet their early successes were remarkable. The physicians Bentley and Walter Bayley of New College, and Linaero, Warner, Bartlot, Recorde, Sydenham, Needham, Millington and Mayow of All Souls all achieved fame in various ways before a long period of quiescence in the eighteenth century. In the nineteenth century, the brothers Duncan of New College restored the Old Ashmolean as a zoological museum, while Acland of All Souls effected its removal to the new University Museum that he founded in the Parks. New College owns the house and observatory of Halley, Bradley and Bliss, and has attached to it the Savilian professorships of astronomy and geometry, which were held by Charles Pritchard, founder of the University Observatory, and H. H. Turner, who inaugurated the Seismological Department.

A COURSE of eight lectures on tropical hygiene for men and women outside the medical profession proceeding to the tropics will be given at the London School of Hygiene and Tropical Medicine, commencing on December 2. The lectures will be given by Lieut.-Colonel H. B. Newham, H. H. Clay and Sir Malcolm Watson. Further information can be obtained from the Organising Secretary, Ross Institute of Tropical Hygiene, London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1.

ACCORDING to the recently issued report of the Commonwealth Fund Trustees, there were 150 applications for fellowships in 1935, and thirty-one appointments were made. These comprised twenty-four ordinary fellows, two Dominion fellows and five service fellows. The fellowships are offered to British subjects, and are tenable at certain American universities for two years. The same number is being offered for 1936. Women are not eligible for appointment. Further information may be obtained from the Secretary, Commonwealth Fund Fellowships, 35 Portman Square, London, W.1.