DOCTEUR PIERRE VASSAL

TITRES ET TRAVAUX SCIENTIFIQUES

PARIS 1962

TITRES ET TRAVAUX

DU

DOCTEUR PIERRE VASSAL

TITRES HOSPITALIERS

Externe des Hôpitaux de Paris, décembre 1946. Concours normal.
Interne de l'Hôpital Franco-Musulman, Concours de 1950.
Médecin-Assistant de l'Hôpital Franco-Musulman, Concours de 1954.
Faisant fonction de Médecin de la Consultation de l'Hôpital Franco-Musulman, 1957.
Détaché à l'Assistance Publique à dater du 1er janvier 1962.

CERTIFICATS D'ETUDES SPECIALES

Certificat de Médecine Aéronautique, Paris, 1952.
Certificat de Biologie Médicale, Paris, 1953.
Certificat d'Hygiène Industrielle et de Médecine du Travail, Paris, 1953.
Certificat d'Immuno-Hématologie, Paris, 1954.

QUALIFICATION

Qualifié compétent en Rhumatologie, Paris, 1960.

TITRES UNIVERSITAIRES ET ADMINISTRATIFS

Licencié ès Lettres, Paris, 1945.
Boursier de l'Etat Norvégien (avec le n° 1), Oslo, 1947.
Biologiste du Centre National de la Recherche Scientifique, Paris, 1953.
Docteur en Médecine, Paris, 1954.
Assistant à la Faculté de Médecine de Paris, 1954-1960 (Chaire d'Anatomie).
Professeur d'Anatomie Anthropologique à l'Ecole d'Anthropologie, 1956.

12, rue du Bac
PARIS (7e)

Professeur d'Anatomie à l'Ecole Odontologique de Paris, 1958.
Auditeur au Centre de Hautes Etudes Administratives, 1960, Paris, 20e Session.

SOCIÉTÉS SAVANTES

Membre de la Société d'Anthropologie de Paris depuis 1948.
Membre du Conseil de cette Société depuis 1951.
Membre de la Société Anatomique de Paris, 1957.
Membre de la Société de Biotypologie, 1951.
Membre de l'Association des Anatomistes depuis 1954.
Membre du Bureau de l'Association depuis 1955.
Membre de la Société pour l'Etude du Rythme en Biologie, Stockholm, depuis 1955.
Membre de la Société de Pathologie Comparée depuis 1951.
Membre du Conseil de cette Société depuis 1956.
Membre de l'Association Française pour l'Etude de la Phonation et du Langage au Laboratoire de Physiologie de la Sorbonne, depuis 1957.
Membre de la Société de Statistique de Paris, depuis 1959.
Membre de la Société Anatomique brésilienne depuis 1960.
Membre correspondant étranger du Colégio Anatômico Brasileiro, Rio de Janeiro, 1961.
Membre de l'Association des Dermatologistes et Syphiligraphes de langue française, 1962.
Membre de la Société Française de Physiologie et de Médecine Aéronautiques et Cosmonautiques, 1962.

ACTIVITÉS SCIENTIFIQUES

Laboratoire d'Anatomie de la Faculté de Médecine, Oslo, 1947.
Centre d'Etudes Scientifiques de l'Homme du C.N.R.S. (Professeurs L.-C. Soula et H.-V. Vallois), de 1948 à 1954.
Laboratoires d'Anatomie de la Faculté de Médecine de Paris (Professeur G.-J. Cordier, Professeur André Delmas), de 1954 à 1960.

ACTIVITÉS D'ENSEIGNEMENT

Participation au Cours d'Anthropologie de la Faculté de Médecine de Paris, 1952 (Chaire d'Hygiène, Professeur Joannon).
Travaux Pratiques d'Anatomie à l'Ecole Nationale Supérieure d'Education Physique de Jeunes Filles, 1957.
Conférences d'Anatomie Fonctionnelle à l'Ecole Nationale Supérieure d'Education Physique de Jeunes Gens (Chaire d'Anatomie Fonctionnelle. Professeur André Delmas), 1957.

Participation au Cours des Masseurs de l'Hôpital Lariboisière (Service du Professeur de Sèze), 1957.

Cours d'Anatomie Générale.

Cours d'Anatomie Cranio-faciale à l'Ecole Odontologique, Paris, depuis 1958.

Enseignement des élèves au Laboratoire d'Anatomie de la Faculté de Médecine, 1954-1960.

Membre des Jurys d'Anatomie et Physiologie de l'Examen et du Concours d'Entrée aux Ecoles Nationales Supérieures d'Education Physique depuis 1955.

Membre du Jury de l'Examen du Diplôme d'Etat de Masseur Kinésithérapeute depuis 1956.

DISTINCTIONS

Mention Honorable du Prix Charles Grollet, 1954, de la Société de Pathologie Comparée.

Lauréat de la Faculté de Médecine de Paris, Prix de Thèse, Médaille d'Argent, 1955.

Lauréat de l'Académie Nationale de Médecine :
Prix Blondet (Physiopathologie), 1956.
Prix du Baron Larrey (Statistique médicale), 1957.

Membre de l'Académie des Sciences de New York, 1962.

TITRES MILITAIRES

Médecin-Capitaine de Réserve de l'Armée de l'Air.

Première année du Diplôme d'Etat-Major (Formation Générale).

PARTICIPATIONS AUX CONGRÈS, MISSIONS

Participation au 5e Congrès Fédératif International d'Anatomie, Oxford, 1950.

Participation au 6e Congrès Fédératif International d'Anatomie, Paris, 1955 (Membre du Comité).

Participation au 7e Congrès Fédératif International d'Anatomie, New York, 1960.

Voyages d'études au Brésil, 1959 et 1961, en mission du Recteur de l'Université de Paris. Au cours de ces voyages j'ai été invité à faire des conférences dans les Facultés de Médecine de São Paulo et de Florianópolis, ainsi que dans les Universités du Brésil à Rio de Janeiro et du Parahyba à João Pessoa.

Participation à la Création du Musée de l'Homme Américain, Université de Santa Catarina, Brésil.

Voyage d'étude au Canada, 1960. Conférences à la Faculté de Médecine de l'Université Laval, Québec.

EXPOSÉ GÉNÉRAL

Dès le début de mes études médicales j'ai été attiré par les disciplines biologiques. Qu'il me soit permis d'adresser ici le témoignage de ma gratitude respectueuse à la mémoire du Professeur Pol Bouin et à celle du Professeur Rémy Collin à qui je dois pour une large part cette orientation.

Titulaire en 1947 d'une Bourse d'Etudes de l'Etat norvégien à l'Université d'Oslo, je m'initiai à la craniologie au Laboratoire d'Anatomie de la Faculté de Médecine chez le Professeur K. E. Schreiner. Après avoir effectué sous la direction du Professeur Vallois une mission d'études en Laponie, je poursuivis de 1948 à 1954, sous l'égide des Professeurs Vallois et Soula, une enquête d'anthropologie et d'anatomie sur le vivant chez des militaires de la garnison de Paris. Les résultats de cette enquête portant sur plus de 150 000 mesures ont donné lieu à différents travaux publiés dans *les Archives d'Anatomie, Biotypologie, les Bulletins et Mémoires de la Société d'Anthropologie de Paris.* Leur publication complète est en cours.

En 1954, je soutins ma Thèse de doctorat en Médecine à partir de recherches poursuivies au Laboratoire des Travaux Anatomiques de la Faculté de Médecine de Paris sous la direction du Professeur André Delmas. Cette Thèse a reçu la Médaille d'Argent de la Faculté.

Nommé aussitôt après Assistant de la Chaire d'Anatomie à la Faculté, je continuai mes recherches anatomiques et anthropologiques sous l'égide du Professeur G. J. Cordier et du Professeur André Delmas. De ce fait, mes travaux ont été orientés dans le sens de l'Anatomie biométrique et de l'Anatomie fonctionnelle. Ils cherchent à dégager de l'Anatomie descriptive les données utilisables en clinique médicale et à rattacher les faits anatomiques à leurs causes.

Parallèlement à ces activités des recherches et à mes activités d'enseignement poursuivies à la Faculté de Médecine, dans le cadre de l'Ecole d'Anthro-

pologie et de l'Ecole Dentaire, j'ai suivi la voie des concours hospitaliers. Externe des Hôpitaux dans les Services des Professeurs de Gaudart d'Allaines, Mollaret, Lenègre, Lemaire et Deparis, je fus à l'Hôpital Franco-Musulman l'Interne du Professeur Jausion et du docteur Ordonneau, puis l'Assistant du docteur Nicolas et, depuis le rattachement de l'Hôpital Franco-Musulman aux Hôpitaux de Paris, suis chargé de la Consultation Externe de Médecine.

C'est sous la direction du Professeur agrégé Jausion que je poursuis, à l'Hôpital Franco-Musulman, depuis douze ans, des recherches de pathologie générale et comparée. J'ai ainsi été amené à étudier le comportement physiologique et pathologique des populations d'origine nord-africaine et à étudier successivement les variations du cholestérol sérique chez le Nord-Africain, la pathologie cutanée, le comportement du Nord-Africain devant la tuberculose et le cancer. Tous ces travaux publiés ou en cours de publication ont été effectués au Laboratoire de Recherches de l'Hôpital Franco-Musulman (Professeur Jausion) et pour la pathologie osseuse du Nord-Africain en collaboration avec les docteurs Ordonneau, Rouvillois et Djian). Ces travaux ont été publiés notamment à la Société de Pathologie Comparée qui m'a fait l'honneur de m'admettre au sein de son Conseil, en 1955.

Mon orientation anatomique s'est donc doublée du fait de mes activités hospitalières d'une orientation vers la physiopathologie et la pathologie générale et comparée.

LISTE DES TRAVAUX SCIENTIFIQUES

ANATOMIE GÉNÉRALE

I — LA SYMÉTRIE DES ORGANES BINAIRES CHEZ L'HOMME

1. Sur quelques asymétries chez l'homme. *VI*e *Congrès Fédératif International d'Anatomie*, Oxford, juillet 1950.
2. Etude de quelques asymétries fonctionnelles, *Biotypologie*, septembre 1950, pp. 37-48.
3. Les asymétries normales du corps humain, *in L'Attitude*, ouvrage édité par la *Fédération Française d'Education Physique* à la suite de ses *Journées médicales de 1951.*
4. Les asymétries de la face. Le syndrome d'allongement d'une hémiface. *Actes du Congrès de l'Association Française pour l'Avancement des Sciences*, Luxembourg, 1953, pp. 432-438.
5. Les asymétries de la face. *Revue de Pathologie Comparée*, nº 653, décembre 1953, pp. 1540-1568.

Ce travail a fait l'objet d'une longue analyse du Doyen Baudouin, dans la *Revue du Praticien* du 21 mars 1954 (Le mouvement annuel en Neuro-Psychiatrie, pp. 755 sq) et obtenu la Mention Honorable du Prix Charles Grollet de la *Société de Pathologie Comparée* pour 1954.

6. Asymétrie sensorio-faciale. *Soc. Anthrop*, Paris, février 1954.
7. L'asymétrie de l'oreille externe. *C. R. Ass. Anat.*, 1954, Gênes.
8. Recherches sur les bases morphologiques d'une prépondérance latérale sensorielle. Organes de la vision et de l'audition. *Thèse de Doctorat en Médecine*, Paris, 1954, 115 pages. Ce travail a obtenu le prix de Thèse, Médaille d'Argent de la Faculté.
9. Prépondérance latérale oculo-auriculaire. *Archives d'Anatomie*, 1956, 32, 1.

10. Recherches sur la gaucherie en France. *VI^e Congrès Fédératif International d'Anatomie*, Paris, 1955.

Analysé par le Docteur V. V. Ginzburg, Professeur d'Anatomie à la Faculté de Médecine de Léningrad, dans les *Archives Russes d'Anatomie*, 1956-2.

11. Gaucherie oculaire et gaucherie manuelle. Fréquence et mode de transmission. *C. R. Ass. Anat.*, 1955. Analysé dans l'*Encyclopédie Médico-Chirurgicale*, supplément annuel 1957, p. 4140, C. 10. *Pédiatrie*, tome 3.
12. Asymétrie du membre inférieur et pli fessier, *Association des Anatomistes*, Lisbonne, 1957.

Ces recherches sur la symétrie des organes binaires ont obtenu le Prix Blondet, Prix septennal de Physiopathologie décerné en 1956 par l'*Académie Nationale de Médecine*.

II — LA LOBATION DES ORGANES PLEINS

13. Ampliation thoracique et fissuration du poumon. *Soc. Anat.*, 27 fév. 1958.
14. Cinétique viscérale et formation des lobes. *Soc. Patho. Comparée*, 11 mars 1958 et *Revue de Pathologie Comparée*, octobre 1958, n° 701, pp. 1335-1343.

EXTRÉMITÉ CÉPHALIQUE - CRANE - FACE

15. Poids des yeux et orbitométrie, *C. R. Ass. Anat.*, 1954, Gênes.
16. Une nouvelle méthode de moulage orbitaire, *C. R. Ass. Anat.*, 1954, Gênes.
17. L'oreille alpine. *C. R. Ass. Anat.*, 1954, Gênes.
18. Etude corrélative des mesures de la tête chez le jeune adulte français. *VI^e Congrès Fédératif International d'Anatomie*, Paris, 1955 et *C. R. Association Anatomistes*, XLII^e Réunion, pp. 1350-1359.
19. Appareil destiné à déterminer les mesures en hauteur de la tête. *C. R. Ass. Anat.*, 1955, XLII^e Réunion, Paris.
20. Les proportions de la tête chez le Français. *Congrès International des Sciences Anthropologiques*, Philadelphie, 1956.
21. Les variations avec l'âge des proportions de la tête. *Ass. Anat.*, 1957, LXIV^e Réunion, Leyde, pp. 764-786.
22. Les variations sexuelles du squelette céphalique. *Revue Anthropologique*, 1957.

Analyse par le Professeur Georges Olivier dans les *Archives d'Anatomie Pathologique*, 1958.

23. Les variations des diamètres céphaliques chez le jeune adulte français en collaboration avec Henri Pineau, *Soc. d'Anthrop.*, Paris, février 1956, *Bull. Mém. Soc. Anthrop.*, Paris 1958, t. 9, X^e série, pp. 93-124.

Les travaux ont obtenu le Prix du Baron Larrey, de l'*Académie Nationale de Médecine*, pour 1957.

24. Etude corrélative des dimensions de l'occiput et du trou occipital, en collaboration avec Th. Thiounn, *Soc. Anat.*, novembre 1957.
25. Etude corrélative des mesures de la base du crâne, avec MM. Thioun et Pineau, *Assoc. Anatomistes*, 1958.
26. L'oxycéphalie. Un cas chez un Nord-Africain, en collaboration avec MM. Bellalouna et Massari. *Bull. et Mém. Soc. Anthrop.*, Paris, 1955, t. 6, 10e série, pp. 181-198.
27. Etude radiocraniométrique d'un cas de sténocéphalie, en collaboration avec MM. Clerc et Clément. *Société Anatomique*, 5 juillet 1956.
28. Etude radiocraniométrique d'un sujet atteint de dysostose craniofaciale, en collaboration avec MM. Bénard, Clerc et Clément. *Société Anatomique*, 5 juillet 1956.
29. Conférences sur le développement du squelette et sur ses variations avec l'âge, le sexe, les types humains morphologiques et raciaux. Conférences faites à l'Ecole d'Anthropologie depuis 1957.
30. Anomalies costales et variations du rachis, en collaboration avec MM. Djian et Sfar. *Archives d'Anatomie Pathologique*, Paris, 1957-1.
31. A propos des os parasternaux, en collaboration avec MM. Djian et Sfar. *Archives d'Anatomie Pathologique*, Paris, 1960-1, pp. 37-38.
32. Etude de quelques variations costales compensées, *Association des Anatomistes*, Leyde, 1957.

VARIATIONS MUSCULAIRES

33. Aplasie partielle congénitale du muscle grand pectoral, en collaboration avec le Professeur G. Olivier et M. R. Moynier. *Soc. Anatomique*, 1er juillet 1954.
34. L'aplasie partielle congénitale du diaphragme droit, en collaboration avec M. Djian, *Archives d'Anatomie Pathologique*, Paris, 1957-1, pp. 165-177.

PEAU ET PHANÈRES

35. Répartition et morphologie du système pileux suivant les types humains. *Revue de Pathologie Comparée*, no 638, 1952, pp. 326-346.
36. La topographie pilaire chez l'Homme. Essai d'explication. *Anthrop. Diff. et Science des Types Constitut.* 1954-2.
37. L'hyperthélie en Afrique du Nord, en coll. avec P. Voizard. *C. R. Ass. Anat.*, 1955. XLIIe Réunion, pp. 1371-1380.

BIOMETRIE HUMAINE

38. La taille du Français. *Archives d'Anatomie Pathologique*, 1956, 32-1, pp. 40-41.
39. Capacité vitale et mesures du thorax. *Association des Anatomistes*, LXIII^{e} Réunion, Lisbonne, 1956.
40. Variations actuelles du poids et de la taille en France. *Société Anatomique*, juillet 1957.
41. Etude des relations entre les circonférences des différents segments du corps et certains caractères uni- ou tridimensionnels, en coll. avec H. Pineau. *C. R. Acad. Sciences*, t. 245, pp. 1343-1345.
42. Les principaux périmètres somatiques, leurs liaisons réciproques et leurs relations avec la taille et le poids. Etablissement d'un morphogramme de corpulence, en coll. avec H. Pineau. *L'Anthropologie*, 1958, t. 62, N^{os} 1-2, pp. 53-61.
43. Le profil périmétrique de l'adulte masculin, en coll. avec H. Pineau. *C. R. Ass. Anatom.*, 1958, LXIV^{e} Réunion, Gand.
44. Relations entre le périmètre et la largeur de la main, en coll. avec H. Pineau. *C. R. Ass. Anatom.*, 1959, LXV^{e} Réunion, Montpellier.
45. Valeur comparée de l'indice de Pignet et d'épreuves d'aptitude fonctionnelle à l'effort. *Soc. Médecine Militaire Française*, année 1960, N^{o} 8, 13 octobre 1960. Analyse dans *l'Education Physique*, t. 59, N^{o} 29, p. 95.
46. Nouvelles recherches anthropométriques sur le jeune adulte français, en coll. avec MM. S. Bouisset et H. Pineau, *Biotypologie*, 1960.
47. Etude anthropologique de la différenciation sexuelle chez l'adulte français de 20 à 26 ans, en coll. avec S. de Felice. *Actes du VI^{e} Congrès International des Sciences Anthropologiques et Ethnologiques*, Paris, 1960, t. I, pp. 359 sq.
48. Etude anthropométrique de la différenciation sexuelle chez l'adulte français de 20 à 26 ans. I. - *Caractères classiques. C. R. Acad. Sciences*, t. 252, pp. 4037-4039, séance du 19 juin 1961, en coll. avec S. de Felice. II. - *Indices nouveaux. C. R. Acad. Sciences*, t. 253, pp. 315-317, séance du 10 juillet 1961, en coll. avec S. de Felice.
49. Les variations de l'angle bipétreux. L'X de la base du crâne. *C. R. Assoc. Anat.*, 1959, LXV^{e} Réunion, Montpellier.
50. Nouvelle méthode de détermination du prognathisme, *Soc. Anthrop.*, Paris. février 1962.

ANTHROPOLOGIE PHYSIQUE

51. Observations anthropologiques et ethnographiques sur les Lapons de Norvège. *Bull. Mém. Soc. Anthrop.*, Paris, t. 9, IX^{e} série, 1948, pp. 33-61.

52. Quelques données récentes en Anthropologie. *Revue des Sciences Médicales*, janvier 1951.
53. Anthropologie et Médecine. *Revue des Sciences Médicales*, décembre 1952.
54. Persistance du type de Mechta el Arbi en Afrique du Nord, *Anthropologica*, Vienne, 1952.
55. Persistance de types anciens à travers les âges : la race de Mechta Afalou, variante africaine du Crô-Magnon chez les Berbères actuels. *Anthrop. Diff. et Science des types constitutionnels*, 1954-2.
56. Le Musée de l'Homme Américain, *La Presse Médicale*, 14 avril 1962, p. 916. Au cours d'une mission d'études au Brésil, en 1961, j'ai participé à la fondation du Musée de l'Homme Américain dans le cadre de l'Université d'Etat de Santa Catarina. Ce Musée, justifié par la personnalité et les particularités anatomiques, physiologiques et pathologiques des habitants préhistoriques ou actuels du Nouveau Monde, a été créé en liaison avec le Musée de l'Homme de Paris.
57. Etude anthropologique des Hommes Fossiles de Florianópolis, Etat de Santa Catarina, en coll. avec le R. P. A. Rohr, *Soc. Anthrop.*, Paris, avril 1962.

ANATOMIE FONCTIONNELLE

58. La transillumination du crâne. Quelques résultats. *Société Anatomique*, Paris, juin 1959.
59. Les recherches actuelles sur la symétrie du corps humain. Le point de vue anatomo-fonctionnel. *Conférence au Laboratoire d'Anatomie de la Faculté de Médecine de l'Université de São Paulo.* (Chef : Professeur Odorico Machado de Sousa), 2 septembre 1959, São Paulo.
60. Remarques sur la présence de certaines scissures pulmonaires rares chez le foetus et chez l'adulte, en collaboration avec le Professeur M. Papamiltiades. *Première Réunion Européenne d'Anatomie*, Strasbourg, 1960.
61. Gaucherie des membres et des organes des sens. *Radio-Lausanne*, 14 octobre 1960.

ANATOMIE COMPARÉE

62. L'équilibre de la tête dans la série animale. *VII*e *Congrès Fédératif International d'Anatomie*, New York, avril 1960.
63. Musculature de la main et du pied du Paresseux Aï, en coll. avec M^lle F. K. Jouffroy et M. J. Lessertisseur. *Actes du I*er *Congrès Brésilien d'Anatomie*, Salvador, 1960.

64. Particularités musculaires des extrémités du Bradype Aï (Bradypus tridactylus) dans leurs rapports avec la suspension arboricole, en coll. avec M^lle F. K. Jouffroy et M. J. Lessertisseur. *C. R. Assoc. Anatomistes*, Naples, 1961, pp. 392-400.

ANATOMIE PHYSIOPATHOLOGIQUE

65. Les variations du cholestérol sérique avec le sexe, l'âge, le poids et la tension artérielle minimale chez le Français et le Nord-Africain, en coll. avec M^lle A. Rollen, M^me Birman et M^lle C. Durand. *C. R. Acad. Sciences*, 20 janvier 1959.
66. Brachycéphalie, goitre et terrain granitique. *Revue Pathologie Comparée*, mai 1957, N° 688, pp. 767-781.
67. La physiopathologie dans le Panthéon égyptien, les dieux Bès et Phtah, le nain et l'embryon. *Bull. Mém. Soc. Anthrop.*, Paris, 10^e série, N^os 3-4, 1956, pp. 168-181.

PATHOLOGIE - DERMATOLOGIE

68. Sur quelques traitements récents des alopécies, en collaboration avec MM. Jausion, Bigou, Boisselier et Bénard. *Archives hospitalières*, août 1951.
69. Réflexions sur l'actuel et l'avenir de l'eczéma et des dermites de contact, en collaboration avec le Professeur agrégé H. Jausion. *La Vie Médicale*, mai 1952.
70. Epidermolyse bulleuse congénitale à forme dystrophique, en collaboration avec MM. Jausion, Bénard et Massari. *VII^e Congrès des Dermatologistes et Syphiligraphes de Langue Française*, Nancy, 1953.
71. Les rythmes de la peau. *Congrès International de la Société pour l'Etude du Rythme en Biologie*, Stockholm, 1955.
72. Pour une meilleure définition de la photoallergie, en collaboration avec MM. Jausion et Bénard, *Revue de Pathologie Comparée*, décembre 1956, N° 683, p. 1756 sq.

PATHOLOGIE GENERALE ET COMPAREE

73. La vaccination B.C.G. en Norvège. *Revue d'Immunologie*, 1948.
74. Le B.C.G., l'expérience norvégienne. *Semaine des Hôpitaux*, 3 janvier 1949.
75. Sciatique tuberculeuse paralysante opérée, en collaboration avec MM. Ordonneau, Djian et Massari. *Revue du Rhumatisme*, décembre 1953.

76. D'où vient le mot scorbut ? *Revue de Pathologie Générale*, N° 680, juillet 1956, pp. 1279-1283.
77. Etude médicale des ex-voto des sources de la Seine, *R. A. E.*, Dijon, N° 36, octobre-décembre 1958.
78. La maladie coronarienne et les artérites des membres inférieurs. Les deux localisations majeures de l'athérosclérose. *IX^e Journées Médicales et de Pathologie Comparée de Langue Française*, Caen, 1962.
79. Le diagnostic de l'amibiase chez le Nord-Africain. *La Médecine Aéronautique*, N° 4, 4^e trimestre 1955.
80. Le pèlerinage aux sources de la Seine chez les Gaulois, les ex-voto du Musée de Dijon. *L'Ethnographie*, Paris, 1960, pp. 110-128.
81. Etude comparative des variations de la cholestérolémie chez des sujets de groupe ethnique différent traités par le 67-82. *Gazette Médicale de France*, 1^er juin 1960, p. 1399.
82. A propos de la pathologie du Nord-Africain. *Gazette Médicale de France*, t. 68, 25 octobre 1961.

REVUES GENERALES

83. Le *V^e Congrès Fédératif International d'Anatomie*, Oxford, 24-28 juillet 1960. *Conférence à la Section Française de la British Broadcasting Corporation*, 18 août 1950.
84. *Le Congrès de la Société d'Etudes Constitutionnelles*, Tubingue, juillet 1951. *Biotypologie*, décembre 1951, tome XII, N^os 3-4.
85. *Le IV^e Congrès International des Sciences Anthropologiques et Ethnographiques. Vienne*, 1^er-8 septembre 1952, en collaboration avec le Professeur M. Verdun. *La Presse Médicale*, 4 décembre 1952.
86. Sir Arthur Keith (1866-1955). *Revue de Pathologie Comparée*, N° 674, janvier 1956, pp. 238-243.
87. Le Professeur Hubert Jausion (1890-1959), *Bull. C.E.A.*, 1959-1960, N° 2, pp. 13-14.
88. Rédaction des *Comptes Rendus de la Société d'Anthropologie de Paris*, dans *La Presse Médicale* et *La Semaine des Hôpitaux*, depuis 1951.
89. Analyses de travaux anatomiques et anthropologiques dans *La Presse Médicale*, *La Semaine des Hôpitaux*, *l'Anthropologie*, *Les Archives d'Anatomie Pathologique*, *Biotypologie*, *Excerpta Medica*.
90. Les études morphologiques en France, tendances actuelles. *Conférence au Département d'Anatomie de la Faculté de Médecine de l'Université Laval*, Québec (Professeur Pierre Jobin), 20 avril 1960.
91. La Médecine au Brésil, en coll. avec Ph. Wery. *Médecine et Hygiène*, déc. 1961, janvier et février 1962. N^os 527, 528, 529 et 530, 1961 ; 532 et 535, 1962.

be in a better position than A, and so C the owner of the vacant plot may build even though he obstructs B's light. This seems difficult to justify, especially when the problem may arise only years afterwards. Research among old deeds may show that my predecessor in title purchased either before or after the predecessor of my neighbour, and whether or not I have an easement may depend on this fortuitous circumstance. The years to come may see a modification of the rigidity of the 1879 decision.

Modern courts prefer to adopt an objective test to ascertain the common intention of the parties, and what easements are needed for the reasonable enjoyment of property. In this atmosphere the question who was grantor and who grantee many years ago does not seem so important as the question of what the law should impute to the parties as fair dealers. Whatever the future, happy is the man who is wise before the event and, whether he is buyer or seller, makes express provision for the easements that he requires and in equally clear terms negatives easements that the other party might otherwise claim by implication.

—Third Programme

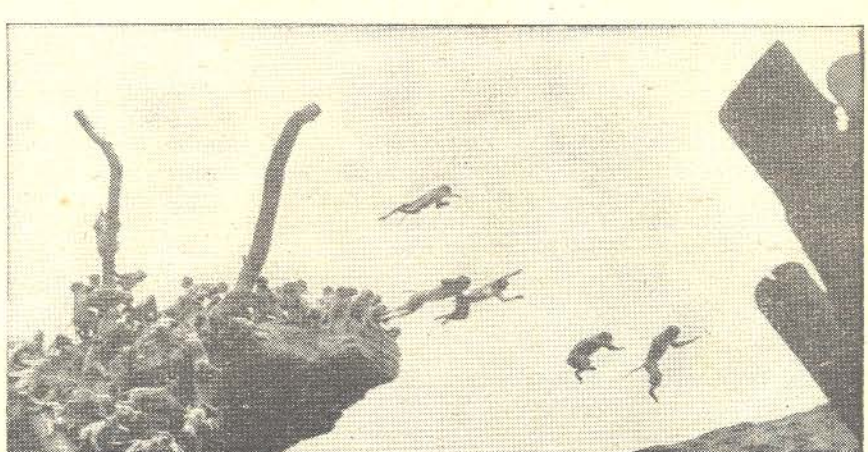
Violence, monkeys, and man

The affluent crowd

by W. M. S. RUSSELL

IN THE FIRST of these two talks*, I described the results of field observation in the wild on societies of primates; that is, monkeys and apes. To everyone's surprise, it has now been established for every species observed that a healthy wild primate society shows no trace of serious fighting, either within or between bands. It is now undeniable that primates can live without any violence at all.

But let us consider what happens to a primate society, so peaceful in the wild, when it is subjected to crowded conditions in the zoo. The very observations I shall mention, together with the know-how of zoo directors, have helped many zoos to provide their monkey and ape communities with better living conditions. But until all this became clear, zoo conditions provided a natural experiment in the exposure of a society to stress. For one thing, the zoo colony of monkeys provided its members with little opportunity for the versatile skills, the exploratory know-how, and the individualistic enterprise which they normally exercise in the wild in search of food and refuge from predators. The selection of leaders was no longer, as it is in the wild, geared to responsible leadership, for there was nothing constructive for the leaders to do. And the society was subjected to a high degree of crowding, as compared with a wild primate band of the same species. As Ernst Inhelder has observed, it was essentially an urban community. The only stress that was lacking was food shortage, for food was provided in ample quantities by the zoo. This, then, was an affluent society; in terms of material prosperity, the monkeys had never had it so good.



An affluent and urban community: monkeys in a zoo

As I explained in my first talk, the beautiful functioning of a wild primate society is based on a number of automatic mechanisms. Group conflict is averted by the principle of territory, held in common by each band and respected by its neighbour bands. Within the band, each individual has his rights of access to the common territory. Order is maintained by a hierarchy of ranks, evolved peacefully as each generation grows up, and subject to rearrangement in accordance with the performance of the leaders in guiding and protecting the rest. The monkey president and his establishment settle all quarrels within the band before they become violent, and show realism in respecting the rights of other bands. Since discontent always leads to violence, the reduction of violence, including his own, is the natural criterion of a primate leader. And, finally, the wild society is held together by bonds of friendship and affection which are more prominent in day-to-day life than the occasional episode of pulling rank.

But these automatic mechanisms break down outside the conditions in which they evolved. If too many monkeys are confined together, hierarchy cannot be developed on a basis of individual recognition. Fighting is now the only means of establishing rank. But this brutal method does not even work. The wrong monkeys come to the top. They do not have to meet the test of useful performance in solving environmental problems. Unlike wild leaders, they are insecure and trigger-happy. They are unable to assert themselves by a posture of self-assurance and so they try to maintain their spurious authority by threats and violence. Government by consent degenerates into an unstable system of 'absolute despotism tempered by assassination'. And during a tyrant's brief authority, his subjects have no room to respect his swollen territorial rights by keeping out of his way. So he spends much of his time bullying them. The result is that all the subjects are under ceaseless pressure of attack and threat. In this society, relations of friendship disappear; even grooming your neighbour's coat, the mark of affection in wild monkeys, becomes only a means of currying favour with superiors.

This loss of positive social relations, and the ceaseless frustrations and fears to which the animals are exposed, result in persistent mental conflict for the individual. Studies on other animals, by Michael Chance, Moynihan, Tinbergen, and Kortlandt, have shown us that there are three main mechanisms by which individual animals resolve momentary mental conflict. All three have been observed fleetingly in wild primates. First, there is cut-off. A subordinate animal avoids provoking a dominant one by avert-

* In THE LISTENER of November 5

ing his eyes or otherwise cutting off the sight of anything that would tempt him to do so. Like a wise monkey, he sees no evil. If you throw an orange between two Japanese monkeys, as Imanishi reports, the superior behaves as if the food is his own, and takes it; the subordinate simply looks away. But this method will not work for long; for monkeys, like Oscar Wilde, can 'resist anything except temptation'.

Mechanism of redirection

The second mechanism is redirection. If an animal is torn between attacking from frustration and fleeing from fear, he can resolve the problem for the moment by avoiding the animal that provoked him, and attacking someone less formidable. This is a device well known in human bureaucratic and commercial offices. In the ceaseless tension of the zoo society, all this does is to transmit stress down the hierarchy. A kicks B, B kicks C, ultimately there comes a point when everybody kicks the office-boy. In a zoo society observed by Hans Kummer, one low-ranking female was threatened almost without pause, for at any moment one of the others was likely to be redirecting attack. She had no room or cover to dodge or hide, and was soon in a poor way.

Kleiner and Tuckman recently examined the stresses in a *human* hierarchy by studying the admissions to state mental hospitals in Pennsylvania. They found that hierarchical status was determined by colour, religion, and sex, in that order. White Protestant men had the least mental illness—coloured Catholic women the most. Material affluence did not affect status, or help to relieve stress at the bottom of the hierarchy.

The third method of momentarily easing conflict is displacement activity, that is, neither attacking nor fleeing but doing a third, originally irrelevant thing. In primates, the chief displacement activity consists of movements of presenting the rear to another animal or mounting another animal; these have been observed in wild monkeys and they look superficially like sexual activities. But they can be distinguished in several ways from true sexual acts. They are not limited to the wild breeding season: they are invariably incomplete and sterile—often homosexual; and they often, though not invariably, involve different postures. And so these monkey displacement activities have been described as pseudosexual. The interpretation was made and the same name given simultaneously by Maslow and his colleagues in the United States, and by Claire Russell and myself in this country. Both they and we have examined its enormously important role in human behaviour, where it is not necessarily sterile.

Automatic social signals

Huxley, Lorenz, and Tinbergen have shown that those acts which appear in animal social conflicts are often modified and standardized, or ritualized as Huxley called it, to serve as automatic social signals. These signals ease the conflict for the signaller by producing an effect on the other animal. Threat itself in many animals is a signal built up from incomplete movements of attack and flight: it serves to drive away the more timid of two animals without a fight. Cut-off, too, may be ritualized; a pair of black-headed gulls often engage in a ceremony of ritually turning away from each other the threatening black masks on their faces. Konrad Lorenz has shown that many animals use social signals which are actually little redirection activities reduced to mere gestures. He tells of two gander friends who engaged in such a ceremony repeatedly. Each would peck at the other, striking aside at the last moment as if to attack somebody else instead, so that the two heads and necks shot past each other. But one day, while engaged in letting off steam like this, the ganders became more and more excited, and finally the beaks met in the middle. From that day their friendship was over. As it happens they had plenty of room, and so they were able to keep out of each other's way, cutting each other whenever they met: had they been closely confined, the story might have ended more bloodily. Ritualizing aggression, for animals or man, is a delicate matter.

Displacement activities, too, may be ritualized. Monkey pseudosexual activities serve in this way as social signals of appeasement; they momentarily inhibit an aggressive animal, who is allowed to mount. In zoo societies of baboons and rhesus monkeys, observed by Kummer and Michael Chance, this feature has led to a still more complicated social interaction, which Kummer calls protected threat. Two females approach the tyrant male. The nearer one provokes him by coming too close. At this moment she suddenly presents her rear to him, and at the same time threatens her rival with the forepart of her body. The tyrant is inhibited from attacking her by the appeasement signal, while her threat draws his attention to the rival female, and he redirects threat and attack on to her. This, too, is a device well known in human societies.

Cut-off, redirection, and ritualized pseudosexual activities are all observed in wild monkey societies, but so rarely and briefly that they might have escaped attention but for the observations in the zoo. Under the stresses of zoo life, they become more and more prominent. Pseudosex, in particular, takes up much of the zoo monkeys' time; like violence itself it is a symptom and a reliable index of stress in society. It is true that prohibition of displacement activities in man has been known to produce large-scale violence. But it is certainly not true that wild monkeys curb an incorrigible urge to violence by using these devices. In the wild, they were evolved as a refinement, to resolve the most fleeting deadlocks in a society which shows little sign of violent urges; in the old zoos, where the stress was intense and never let up, threat itself served rather to provoke than to control aggression. Quarrels between individuals were endemic, and every now and then the whole society collapsed in an orgy of wholesale violence, in which females and young were indiscriminately slaughtered. Such is the logic of automatic social mechanisms in an affluent crowd of primates.

Controlling population

Monkeys and apes owe much of their evolutionary success to their exceptionally low fertility. Nevertheless, if the environment smiles upon them, wild monkey populations do grow. How do they avoid in the wild those conditions of crowding which prove so disastrous in the zoo?

In the first instance, they do so by redistributing their population. When a monkey band grows unduly big, it splits without violence into two, and one of the daughter bands seeks its fortune elsewhere, like a band of colonists from a Neolithic village or a classical or Hellenistic Greek city. This has been observed in howlers, rhesus, and Japanese monkeys. But what happens when the whole population of a confined space becomes too big? Southwick has recently pointed out that we have an opportunity of observing this among the howlers of Barro Colorado island. This is one group of monkeys for which we have extensive population records ranging over more than thirty years, and the population has been increasing for some time. Bands have been splitting in the normal way, but there are beginning to be too many bands for the island. Howlers avoid conflict between bands by the simple method of howling whenever two bands meet. The noisier band is evidently the larger and its right to a larger territory is conceded without violence by the quieter band. But recent observers have noticed an ominous increase in the volume and duration of howling. From the zoo observations, we may expect matters to come to a head soon, even if food shortage is averted by human assistance. Bands will then be faced with the alternative of contracting their territories and becoming affluent crowds, with all that this entails, or going to war.

In a single society confined in a zoo, redirection distributes and amplifies the stresses within. But what if a band is not so confined? Carpenter performed a partly unintentional experiment in the 'thirties. He brought a number of rhesus monkeys from India, and settled them on Santiago Island off Puerto Rico. On the voyage, he confined the females

monkeys, each with her young, in separate cages. Now the Harlows and others have recently been rearing rhesus monkeys under various controlled conditions. They find that it is socially disastrous for young monkeys to be raised by their mothers alone, without the precious experience of daily play with youngsters of their own age. In these conditions, they fail to develop the usual friendship bonds and the usual peaceful and realistic hierarchy. What is more, such suburban isolation with their own young has a stress effect on the mothers as well. Work of this kind has by now been done on three generations of monkeys; and from this we know that defects in the behaviour of mothers are still wreaking havoc unto the third generation at least. Neglectful mothering, in particular, produces juvenile delinquent monkeys, precociously aggressive and pseudosexually active. Carpenter's mothers were under such stress on that voyage in the 'thirties that at least eight of them actually killed their babies. Family life in the whole group suffered a blow from which it is only gradually recovering in the pleasant conditions of Cayo Santiago, where Koford was still observing a certain pugnacity decades after the voyage.

On arrival at the island, Carpenter's monkeys showed a degree of tension and fighting that we can now see to be completely untypical of wild primates. Lack of contact between young monkeys during the voyage had upset the mechanism of leader selection. In one particular band a tyrant monkey rose to the top of the hierarchy. He attacked his subjects with such persistence that they were all in the mood for intense redirection. As they were not confined in a zoo, they did not attack each other but spread out in space. The other bands were surprised to find that this one did not follow the primate territorial rules. Its members fought savagely until the band owned far more than its share of the island. Carpenter now brilliantly completed his originally unplanned experiment. He caught and removed the tyrant. More realistic leaders took over, the territory of the band shrunk to a size appropriate for its numbers, and peace returned to the island.

Stress and violence

From this we can tentatively conclude that when either crowding or an aftermath effect produces much redirection within an unconfined society, the outcome may well be war; indeed we may see this happening soon among the howlers on Barro Colorado. And in human history, it is not hard to find alternations of civil and foreign war; the Plantagenet kings of England form such a sequence, as Shakespeare observed. The redirection factor will tend to mean violence either at home or abroad. But, on the other hand, the sheer absolute degree of violence, as a symptom or measure of the absolute stress in society, will have the contrary effect: the greater the stress, the greater the violence both at home *and* abroad. In gross statistical surveys, the two factors will cancel out. Rummel has just reported the results of such a survey. He concludes, as I would expect, that 'foreign conflict behaviour is not a necessary and sufficient condition for domestic peace'. But he also concludes that 'foreign conflict behaviour is generally completely unrelated to domestic conflict behaviour'. Here I believe he is misled by the coarseness of such a survey; and certainly we might conclude otherwise from the rhesus monkeys of Cayo Santiago.

There is one more factor whose dim beginnings we can discern among monkeys, but which must have become increasingly prominent as human society evolved. In Japanese monkeys, the different bands have been observed to diverge widely in all aspects of their behaviour, including mating taboos, food habits and economies, social mobility in the class system, and above all in their code of social automatic signals. These differences are cultural; they are transmitted traditionally by mothers and leaders, who in each band encourage some things and discourage others. With this goes already a certain intolerance of strangers from other cultures, though nothing as extreme as the murderous xenophobia of the ants' nest. Human societies have diverged more widely in their automatic behaviour, and there are more of them. Monkey bands do not have to mix; but, for human trade and international organization, so vital for human progress, thousands of cultures have to mingle daily if only through their representatives. When beckoning is a summons in Britain, a dismissal in Italy, and an insult in Malawi, cross-purposes readily arise. At their mildest, they give rise to staff tensions in international organizations, a problem serious enough to earn discussion in the journal *Nature* earlier this year. At their worst, they can lead to massacre. If, like monkeys, we had nothing but these automatic signal codes, the outlook for *Homo sapiens* would be far from bright. Fortunately, we do have something the monkeys have not: we can talk.

Human symbolic language

For some time it has seemed likely that human symbolic language was either evolved, or at least enormously improved, at a rather late date in human evolution, certainly long after the appearance of tool-making. Such a conjecture was hinted at by the late Gordon Childe, when he commented on the great acceleration of technical progress in the Upper Paleolithic. Claire Russell has recently been playing with a tentative conjecture which may be worth exploring. Suppose that small early human bands, making crude tools, persisted for a long time; they had little contact with each other, and no true symbolic language at all. Even a tool-making band might be run for a long time by the sort of automatic traditions and codes we observe in monkeys.

Suppose a time came when many divergent societies had evolved, whose diverse tool-kits we eventually find. They might now be under high incentive to meet, perhaps mingle for trade and the exchange of technical information. Such meetings would lead to cross-purposes, the breakdown of the primate inter-band system, and the origin of human war. But they must also have brought about a partial solution of the problem, by the creation of rational language independent of cultural differences and capable of expressing intelligible needs and offers to any other human being. On this conjecture, language and war were born together, as the goddess of learning and battles sprang from the head of Zeus. That war appeared, and has been with us ever since, may mean that language is still used mainly for the purposes of technical exchange; while we are still a long way from applying it fully to the understanding and satisfaction of human needs. It does not mean that we cannot eventually solve the problem of violence, by the fuller use of language, and by universal education in that use.

'The last refuge of the incompetent'

We have seen that only an insecure monkey in a zoo must fight for what he cannot otherwise get: 'violence is the last refuge of the incompetent'. Human beings can in principle get what they want by talking, by explaining their needs material and mental, to each other. As one can see in the consulting-room, it is inarticulateness, an inability to explain one's wishes to others, that leads to resentment and aggression. Training may be necessary in our complex societies but training alone produces docile technicians; and training does nothing to reduce violence unless it is accompanied by education; for education means teaching a human being how to get what he or she wants by the use of human language. Not for nothing did the ancients make 'rhetoric', the art of speaking, the basis of their educational system. Education is the only factor that can bring the selection of human leaders under rational control; and increasing education is one of the few known factors that seems to reduce the human birth-rate. From the tragic failure of the monkey society in the crowded zoo, we may learn not to trust to automatic mechanisms: they can never embrace the greater complexities of human life. It is no use our trying to turn ourselves into animals. For various reasons, we are not much good at being animals. For us the future lies elsewhere, and to solve our problems we shall have to turn ourselves into human beings.—*Third Programme*

Britain's changing towns

The burghs of Fife

by IAN NAIRN

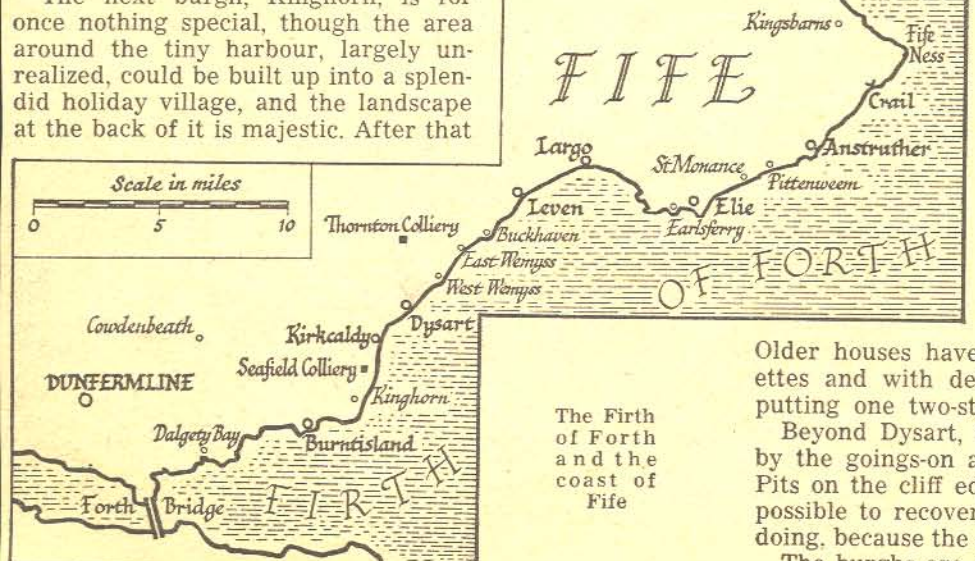
WITH THE OPENING of the Forth Bridge many more people may be tempted across to see what is on the other side. If they don't know the coast of Fife, they are in for a great surprise. In twenty-six miles, there are fifteen towns of widely different character. Some of them have only a few hundred people, but they feel like towns all the same—like Italy, Scotland has very few villages.

They began as fishing ports, and some of them still are. But the coal measures of western Fife extend as far as the coast and beyond, and so industry has played all manner of tricks with the towns from Burntisland to Leven. With the industry has come decay, after the decay has come urban renewal, the best of which is as good as anything in the country. And all this is set in rolling countryside which always provides some kind of drama at the sea-edge even when the cliffs are only fifty feet high. The sea itself can be like blue velvet or a bristly grey serge, but it is never just another stretch of water. It has all the bracing virtues of the eastern coastline of Britain without the bleakness and monotony which may depress the visitor to Yarmouth, Skegness, or the East Riding.

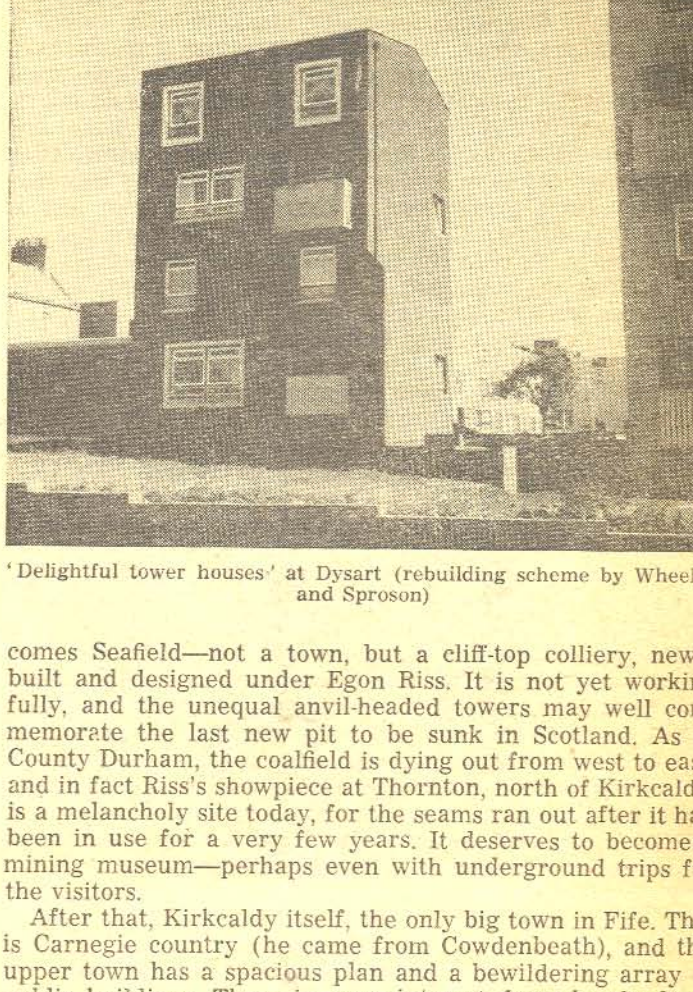
Beyond that, generalization is impossible, and this is one of the delights of Fife. The only way to describe it is to work round topographically, not forgetting to follow even the most unpromising and unsignposted entry down to the sea-shore, because that is where the interest lies.

The first town, Burntisland, is a good indication of the range of Fife. There is one outstanding old building—the kirk, built in 1592, and one of the very few which in its centralized plan attempted to come to grips with the new conditions imposed by the Reformation. Mostly, the Church of Scotland seemed to assume that eternal salvation in the next world made unnecessary any visual delight in this one. Burntisland also has its decayed centre, and two schemes of urban renewal, by Wheeler and Sproson of Kirkcaldy. Their earlier scheme on the south side of the High Street was built in 1957 and looks a little faded now—though it was pioneering work, especially in that it included the rehabilitation of some old buildings, mixing them in with the new. Their later block, opposite, requires no qualification: a zigzag plan hard up to the street line, giving each flat a view of what is going on. The old rhythms have been caught and effortlessly translated.

The next burgh, Kinghorn, is for once nothing special, though the area around the tiny harbour, largely unrealized, could be built up into a splendid holiday village, and the landscape at the back of it is majestic. After that



The Firth of Forth and the coast of Fife



'Delightful tower houses' at Dysart (rebuilding scheme by Wheel and Sproson)

comes Seafield—not a town, but a cliff-top colliery, new built and designed under Egon Riss. It is not yet worki fully, and the unequal anvil-headed towers may well co memorate the last new pit to be sunk in Scotland. As County Durham, the coalfield is dying out from west to ea and in fact Riss's showpiece at Thornton, north of Kirkcald is a melancholy site today, for the seams ran out after it h been in use for a very few years. It deserves to become mining museum—perhaps even with underground trips f the visitors.

After that, Kirkcaldy itself, the only big town in Fife. Th is Carnegie country (he came from Cowdenbeath), and th upper town has a spacious plan and a bewildering array public buildings. There is more interest down by the bus harbour. Wheeler and Sproson's office in Sailors Walk directly opposite the docks and stands as a symbol of the activities: a beautifully cared for seventeenth-centu house with an elegant and completely modern extensio Behind it, a set of alleys runs up the cliff-side. They a kept in good trim by the corporation, freshly whit washed, but the houses they once served are all derelict demolished. It is a wonderful opportunity, and so far it h not been taken up.

But at Dysart, the next place to the north, the opportunit has certainly been seized. It is an o port which has now become part of Kir caldy, and, as at Burntisland, there a two rebuilding schemes by Wheeler ar Sproson. The first won a Saltire Socie award in 1960: a remarkable *tour* *force* on the cliff edge, monopitch roo gesticulating at the sea as though th town around the corner were Canne not Kirkcaldy. Their new scheme is few yards inland, will be finished ne year, and is a masterpiece; the best the country, I would say, for reinterpr tation of the existing character and th effortless combination of old and ne Older houses have been rehabilitated, mixed with maiso ettes and with delightful tower houses created by simp putting one two-storey house on top of another.

Beyond Dysart, the coast becomes bizarre, matched on by the goings-on around Whitehaven in West Cumberlan Pits on the cliff edge and coaly black beaches—it would b possible to recover the sand, and this would be well wort doing, because the sites are still full of charm.

The burghs are quite unpredictable. East Wemyss is hal

Violence, monkeys, and man

The wild ones

by W. M. S. RUSSELL

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EARLIER THIS YEAR, W. G. Hoskins published a study of the changing price of bread in England from 1480 to 1619. He found that in the early Tudor period, high prices tend to occur in runs of several years at a time. Hoskins ascribes this to very low margins of food and money. He argues that, after a bad harvest, part of next year's seed had to be used for food, so that things got worse and worse until the next exceptionally good harvest (and he observes that this terrible dilemma of eating next year's seed is not a thing of the remote past: the Chinese experienced it on a huge scale a few years ago).

It is easy, as Hoskins has also noticed, to correlate these bad runs of years in Tudor England with outbreaks of violence. But in the first thirty years of the reign of Elizabeth I there were noticeably fewer bad runs. The Queen's financial measures had created the marginal reserve that could make a society proof against the occasional bad harvest. In fact, permanent grain stocks were maintained in many towns, such as Norwich and Great Yarmouth. And during this period England enjoyed an unprecedented relief from violence. Abroad, wars were few, short, and cheap. At home, riots were rare and small, and the number of government political executions was almost unbelievably low; hundreds in decades as compared with thousands in years for the continental countries in that violent century. Unfortunately, in the fifteen-nineties the environment did its worst. From 1594 to 1597 rain fell solidly over Europe from Ireland to Silesia. Even Elizabeth could not cope with this, and violence broke out on a large scale. It was worse than in the bad runs of the early Tudors, for the population had risen steeply all the time—a fact that makes Elizabeth's earlier feat the more remarkable.

Violence as a symptom of stress

Observations like this have led thinking people in all ages, from Thucydides to Buckle and William Bolitho, to see human violence as a symptom of stresses in human societies; notably the stress of population pressure. Treating symptoms is never any solution in medicine or elsewhere. However, you can use this symptom to diagnose social disease. On this view, violence is no more inevitable than famine or plague. It can be reduced by such things as social organization, education, and effective leadership.

The events of the present century have tended to support this idea that violence is a symptom of social stress. Inflation preceded Hitler's first *Putsch*; as the economy recovered, he sank into insignificance; but depression and unemployment imposed a second shock on Germany, and permitted Hitler's final rise to power. Yet, in spite of such evidence, there has been a tendency in recent years to revert to a still older view of violence as the result of innate, ineradicable forces in the individual. Violence will out, we are told; it is a natural means of self-assertion. It is a thing we have to live with, for which we must find outlets. Supporters of this view point to the modern highly industrialized nations of the west. In these affluent societies, they argue, we have never had it so good. In fact, the affluence is pretty unevenly spread, and not nearly as universal as they make out. But at least in this country we do not have widespread unemployment or catastrophic inflation, and we certainly do not have to eat next year's seed. So why do juvenile delinquents still cosh and stab each other in British towns?

The question is an important one; it extends from seaside brawls to global war. I believe there is one field of scientific observation which has just reached the point of providing at least part of the answer; and I want to consider evidence some of it extremely recent, from this field. I am referring to the study of violence in societies of monkeys and apes. These societies are probably not unlike those small, chiefly food-gathering, bands from which the genus *Homo* arose by the latest count nearly 2,000,000 years ago.

Xenophobia among ants

The surviving communities of social animals represent the outcome of two very different lines of evolution. At one extreme we have communities of ants; we have known a good deal about them for some time. The ants have gone in for extremely high fertility. With this goes a wastefulness of individual life, for all but a few individuals are totally expendable. And among ant communities we find extreme xenophobia and militarism, culminating, in many of these societies, in organized total war, with compactly drilled task forces despatched on definite missions, regardless of casualties, to enslave or exterminate their neighbours. After 50,000,000 years of this totalitarian way of life, a few ant societies have achieved agriculture or stock-raising: a pretty modest record of achievement in comparison with our own.

At the other extreme, monkeys and apes represent the culmination of the trend among mammals towards progressively lower and lower fertility. With this goes a high evolutionary valuation on the life of every individual in society. Early in the Cenozoic era an observer might have known that the future lay with this individualistic way of life. He could have predicted that such a way must involve a tendency not to waste precious individual lives in fighting.

But what, in fact, is the place of violence in these societies? Monkey and ape societies are much more difficult to observe in the wild than are ants' nests. Pioneer studies were made by Sir Solly Zuckerman at the end of the nineteen-twenties. He was concerned chiefly with South African baboons in the zoo; and further important work on zoo monkeys was carried out later by Carpenter, Chance, and Kummer. This work provides a vital half of the total picture and Zuckerman's study was already rich in discoveries of permanent value. But the immediate effect of his observations was to give a sinister impression of monkey societies as anarchic mobs, kept in sporadic subjection by repressive police states headed by dictators with exclusive harems. Zuckerman found that tensions were acute and led to ceaseless bickering and threat, collapsing periodically into wholesale carnage. It was a matter of surprise that monkeys survived at all in the wild. The notion of violent aggression as an innate quality of primates, or at least of baboons, was impressed upon a whole generation of scientists.

Field observations of the necessary scale and depth were begun in the nineteen-thirties by Carpenter, and after the second world war the field study of monkeys and apes suddenly mushroomed. The reports of the field observers are virtually unanimous. Carpenter himself reported that fighting is rare in wild gibbons and apparently absent in wild howler monkeys. In many years of field observation, Haddow and his colleagues never saw one fight among wild African redtail monkeys. Washburn and Devore saw signs of internal violence in only one in seven of their bands of wild East African baboons; and no fighting at all between bands. Southwick took over the study of wild howlers in the 'fifties, and new

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W. M. S. Russell is the author (with R. L. Burch) of 'Principles of Humane Experimental Technique' and (with Claire Russell) of 'Human Behaviour'. This is the first of two Third Programme talks; the second will be published in THE LISTENER *next week.*

EARLIER THIS YEAR, W. G. Hoskins published a study of the changing price of bread in England from 1480 to 1619. He found that in the early Tudor period, high prices tend to occur in runs of several years at a time. Hoskins ascribes this to very low margins of food and money. He argues that, after a bad harvest, part of next year's seed had to be used for food, so that things got worse and worse until the next exceptionally good harvest (and he observes that this terrible dilemma of eating next year's seed is not a thing of the remote past: the Chinese experienced it on a huge scale a few years ago).

It is easy, as Hoskins has also noticed, to correlate these bad runs of years in Tudor England with outbreaks of violence. But in the first thirty years of the reign of Elizabeth I there were noticeably fewer bad runs. The Queen's financial measures had created the marginal reserve that could make a society proof against the occasional bad harvest. In fact, permanent grain stocks were maintained in many towns, such as Norwich and Great Yarmouth. And during this period England enjoyed an unprecedented relief from violence. Abroad, wars were few, short, and cheap. At home, riots were rare and small, and the number of government political executions was almost unbelievably low; hundreds in decades as compared with thousands in years for the continental countries in that violent century. Unfortunately, in the fifteen-nineties the environment did its worst. From 1594 to 1597 rain fell solidly over Europe from Ireland to Silesia. Even Elizabeth could not cope with this, and violence broke out on a large scale. It was worse than in the bad runs of the early Tudors, for the population had risen steeply all the time—a fact that makes Elizabeth's earlier feat the more remarkable.

Violence as a symptom of stress

Observations like this have led thinking people in all ages, from Thucydides to Buckle and William Bolitho, to see human violence as a symptom of stresses in human societies; notably the stress of population pressure. Treating symptoms is never any solution in medicine or elsewhere. However, you can use this symptom to diagnose social disease. On this view, violence is no more inevitable than famine or plague. It can be reduced by such things as social organization, education, and effective leadership.

The events of the present century have tended to support this idea that violence is a symptom of social stress. Inflation preceded Hitler's first *Putsch*; as the economy recovered, he sank into insignificance; but depression and unemployment imposed a second shock on Germany, and permitted Hitler's final rise to power. Yet, in spite of such evidence, there has been a tendency in recent years to revert to a still older view of violence as the result of innate, ineradicable forces in the individual. Violence will out, we are told; it is a natural means of self-assertion. It is a thing we have to live with, for which we must find outlets. Supporters of this view point to the modern highly industrialized nations of the west. In these affluent societies, they argue, we have never had it so good. In fact, the affluence is pretty unevenly spread, and not nearly as universal as they make out. But at least in this country we do not have widespread unemployment or catastrophic inflation, and we certainly do not have to eat next year's seed. So why do juvenile delinquents still cosh and stab each othe in British towns?

The question is an important one; it extends from seaside brawls to global war. I believe there is one field of scientific observation which has just reached the point of providing at least part of the answer; and I want to consider evidence some of it extremely recent, from this field. I am referring to the study of violence in societies of monkeys and apes These societies are probably not unlike those small, chiefly food-gathering, bands from which the genus *Homo* arose by the latest count nearly 2,000,000 years ago.

Xenophobia among ants

The surviving communities of social animals represent the outcome of two very different lines of evolution. At one extreme we have communities of ants; we have known a good deal about them for some time. The ants have gone in for extremely high fertility. With this goes a wastefulnes of individual life, for all but a few individuals are totally expendable. And among ant communities we find extreme xenophobia and militarism, culminating, in many of these societies, in organized total war, with compactly drilled task forces despatched on definite missions, regardless o casualties, to enslave or exterminate their neighbours. After 50,000,000 years of this totalitarian way of life, a few ant societies have achieved agriculture or stock-raising: a pretty modest record of achievement in comparison with our own

At the other extreme, monkeys and apes represent the culmination of the trend among mammals towards pro gressively lower and lower fertility. With this goes a high evolutionary valuation on the life of every individual in society. Early in the Cenozoic era an observer might have known that the future lay with this individualistic way o life. He could have predicted that such a way must involv a tendency not to waste precious individual lives in fighting

But what, in fact, is the place of violence in these societies? Monkey and ape societies are much more difficul to observe in the wild than are ants' nests. Pioneer studie were made by Sir Solly Zuckerman at the end of the nine teen-twenties. He was concerned chiefly with South Africa baboons in the zoo; and further important work on zo monkeys was carried out later by Carpenter, Chance, an Kummer. This work provides a vital half of the total picture and Zuckerman's study was already rich in discoveries o permanent value. But the immediate effect of his observa tions was to give a sinister impression of monkey societies a anarchic mobs, kept in sporadic subjection by repressiv police states headed by dictators with exclusive harems Zuckerman found that tensions were acute and led to cease less bickering and threat, collapsing periodically into whole sale carnage. It was a matter of surprise that monkeys sur vived at all in the wild. The notion of violent aggression as a innate quality of primates, or at least of baboons, was im pressed upon a whole generation of scientists.

Field observations of the necessary scale and depth wer begun in the nineteen-thirties by Carpenter, and after th second world war the field study of monkeys and ape suddenly mushroomed. The reports of the field observers ar virtually unanimous. Carpenter himself reported that fightin is rare in wild gibbons and apparently absent in wild howle monkeys. In many years of field observation, Haddow and hi colleagues never saw one fight among wild African redta monkeys. Washburn and Devore saw signs of internal vio lence in only one in seven of their bands of wild East Africa baboons; and no fighting at all between bands. Southwic took over the study of wild howlers in the 'fifties, and nev

I'm certainly not either. What strikes me is that exactly the same thing is happening now as happened to the beatnik cult about three or four years ago. There were people around who were beatniks, and suddenly the press got hold of it, and the fashion people got hold of it, and suddenly everybody was slightly beatniky and exactly the same thing happened. I think there's much more of an emphasis on commercial pressures because of things like clothes; there are clothes specifically for 'mods' and 'rockers', and magazines specifically for 'mods' and 'rockers', and I think the press has played a tremendous part in creating a sort of identity that people want to form, because at the age of fifteen or sixteen, especially in a situation like mine, you've got an acute need to feel that you're somebody, and it's rather like using an advertising technique: you create an image, and this image is that you're either a 'mod' or a 'rocker'; there's nothing else for you to be.

You don't feel leanings towards being a 'mod'?

It is rather funny, because I suppose I do tend to wear 'mod' clothes now, in that I usually walk round with washed-out jeans and I wear a white T-shirt and 'sneakers', and people come up to me and say 'Are you a "mod"?'; and I sort of stand there and scratch my head, and think well what on earth do they mean. I suppose I am a 'mod' because I dress like one, but I'm not really.

You're just a person? And all these people are, too, really. Do you agree?

I agree. This is the main thing. You've got the one idea of people being 'mods' or 'rockers' or beatniks or any other group you care to name them, and the other idea of people just being people.

Can you look back on any incident in your own life or career that illustrates what happened at Clacton or Brighton, so you can say how—even if it's only a spark—how that spark jumps? How does it jump, what happens?

It's very difficult to say. I remember when I went to Brighton on the raves about three or four years ago, with the beatnik-type people. We'd sit around on the beach playing guitars, listening to music, and jumping into the sea with clothes on, and everybody would stand and watch us, and suddenly somebody would do something—it doesn't really matter what—and you'd get a crowd, and as soon as you get a crowd policemen start coming, and the thing builds up from there. I think exactly the same thing has happened at Brighton and Clacton. But the thing is with the 'mod' and 'rocker' idea, in the public mind there is such a fixed concept that with 'mods' and 'rockers' hooliganism is always there, and so it is bound to happen.

Dislike of violence

Let me ask you, personally, first of all: have you ever felt violent towards anyone?

Well, ever since I've had fights with my father I've always tried to avoid feeling violent towards anybody. Whenever I felt violent I have just on purpose calmed myself down. I've never wanted to feel violent towards anybody, and I've always hated people who made a thing of violence: people who go around, and the first thing they want after they've had a couple of pints of beer is to have a fight with the nearest policeman or the nearest person who gets in the way.

Is it that these people who fight at Clacton or Margate or wherever, and push old-age pensioners over the edge, is it that they can't think, they're not intelligent enough, or what?

It's not a question of intelligence, because some of the people who are violent are probably also intelligent; it is probably a question of thinking in a particular kind of way, because so often violence or similar sort of behaviour is the only way you can express yourself, the only way you can feel that you have an identity, that you've actually done something which means something, even if it's beating up an old lady. I think lots of crimes among young people are committed not because they want to feel criminal, not because of their background so much, but because they want to feel that they're something, they mean something. It's a kind of recognition process.

Where do you think authority goes wrong in its attitude to people who get violent?

I think authority goes wrong in that they're thinking in very rigid terms instead of thinking about the situations behind what's happening. I think that on first examination I will be regarded by someone in authority as a bit of a criminal, a wild one; but if you look at my background, I think you could probably say that a lot of my view-points, a lot of my ideas, have been controlled by my background and the way I've behaved with my parents, with my mother and father and I think there should be much more emphasis on looking at people objectively, not thinking of them as people with free will who do right and wrong according to whatever they feel, and that they're either good or bad; but looking at people as very complex beings who can be influenced by all manner of events.

You mean going right into their backgrounds and taking all kinds of psychological things into consideration?

Yes. I think violence and 'mod' and 'rocker'-type behaviour is going to be inevitable in a highly competitive society. The more competitive you become the more people there will be who can't reach ordinary financial status or social-position status by the normal routes.

Changes in the education system?

In twenty or thirty years' time, if you pass all your examinations, you're going to be authority, aren't you? How would you deal with young offenders then?

It depends what the young offenders were doing; but the very first thing I'd do is to try and look into all the influences that are involved. I think today a great deal could be changed in the education system, because I can remember from my own primary school education that rather than being taught about people, about things, the way people behave, I was taught things like the height of Mount Everest or how many beans make five. The thing that strikes me, especially with friends of mine who were at school with me, is that they're not taught to be creative. They're taught to think in very stereotyped ideas of learning facts and trotting them out in the examination rather than really thinking.

Just now you went back over your own life as an illustration; you went back to your father, but then we've got to take into account the fact that you are that much more intelligent, therefore can we use you as a yardstick in any way?

Yes, because although in one sense I am more intelligent I've done exactly the same things as people with less power of communication have done. I've committed crimes, I've taken drugs, I've been, I suppose in one sense, immoral, I've had trouble with my parents: so there is not really such a difference between me and anybody else.

Apart from possibly the direct trouble with the law, have you any regrets?

I always get the feeling that I should regret what has gone on, and in a sense I do regret not being able to be friendly with my father because I have always felt that some time in the future I will be able to be friendly with him. But I've never, I suppose, had any real regrets about what I've done. I've never thought, well, this is a time in my life that I should erase and forget about because this is just part of my experience.

Will you change? Do you think you're set now because you have packed a lot into nineteen years?

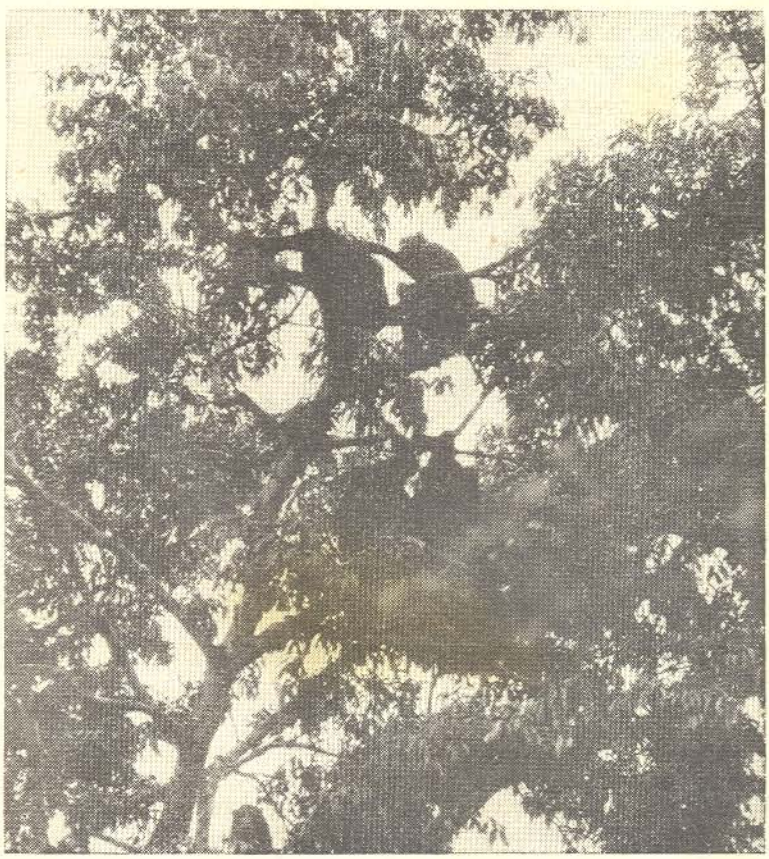
I don't think I'll change very much. I think that quite probably I shall enjoy the idea of getting married, of having children, of doing some sort of a job, even if it is writing or anything like that. I shall probably settle down fairly sensibly.

You'll become very respectable in fact, will you?

Obviously I want the same things as everybody else in the long run. I want to have my own house. I probably shall end up with a car, with a family. If that's what you call respectable then I suppose I shall be.—*Third Programme*

saw one fight, within or between bands. Jay gives a similar report on wild langur bands, and Imanishi on wild Japanese monkeys. Goodall saw little evidence of fighting in wild chimpanzees, nor Hall in wild bands of the very baboon species that Zuckerman had studied in the zoo. And Emlen and Schaller saw not the slightest trace of aggression within wild gorilla bands; and relations between bands were so friendly that, when two bands met, they might bed down together for the night, and individuals could come visiting for as long as they liked.

These unanimous reports are even more impressive than they first appear, for many of the observers were expecting the reverse. The early zoo findings had made such a deep impression that at first each field worker assumed that his or her species must be unusual. Carpenter and Southwick felt that howlers must be different from other primates, especially baboons. Haddow thought that red-tail monkeys must be uniquely peaceful, and Jay reached the same conclusion about her langurs. We can now see that they were wrong: all monkey and ape species are peaceful in the wild. But it would be foolish to disparage the all-important observations made by Zuckerman and the later observers in zoos. Putting together the field and zoo reports, we now know that aggressiveness is not an innate feature of individuals, appearing in some primate species and not in others. All primate species are peaceful in some conditions and violent in others. Violence is a property of societies exposed to stress.



Wild chimpanzees in the Budongo forest, Uganda, expressing mutual affection by grooming one another

Dr V. Reynolds

This conclusion can be extended to other mammal societies besides the primates. As Cloudesley-Thompson put it, writing this year about wild mammals in Africa: 'The concept of "nature red in tooth and claw" seems to be largely a figment of the imagination'. And last autumn, at a symposium on aggression, Harrison Matthews surveyed the field literature and his own considerable field experience for instances of higher mammals fighting each other in the wild. He concluded that violent fighting, leading to severe wounds, stress-diseases or death, only occurs when wild mammals are subject to serious overcrowding. Virtually no mammals fight violently at moderate population densities in the wild, and virtually all mammals fight violently under population pressure or when crowded in captivity.

Evidently, fighting is normally averted in the wild by automatic control systems. These systems are evolved to meet one range of situations, but they break down, like all automatic controls, in situations outside this range. In fact we find that there are two systems, and together they control the distribution of the assets of an animal society. Under their influence, individual animals are seldom frustrated in the satisfaction of their needs; and the greatest good of the greatest number is achieved without any violent fighting at all. These two systems we call 'territory' and 'hierarchy'.

I can illustrate both systems in communities of what we are pleased to call domestic cats, from recent studies by Paul Leyhausen, a world authority on the behaviour of the cat family. Cats accept from their human friends a marginal reserve against food shortage. But they cannot live by cat's meat alone. They still like to go out hunting and exploring. For these activities each cat has his own small territory and hunting routes. Within this familiar territory he is fearless, while his neighbours, finding it unfamiliar, are timid and uncertain. Hence any encounter is always resolved by a home win without fighting. However, the paths used by two cat neighbours may include common stretches, and so relations between neighbours are settled on the basis of a hierarchy of ranks. Within each territory, the owner is supreme. On the common highway, the cat of higher rank takes precedence. But, as in the human highway code, there are situations in which priority in time grants precedence even over absolute rank.

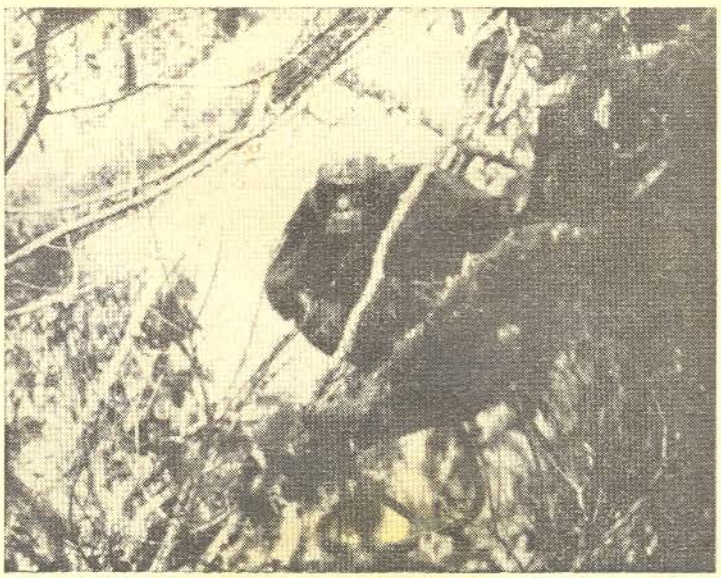
These arrangements work so amicably that a group of cat neighbours will meet in the evenings for purely friendly social gatherings. This kind of social organization is called by Leyhausen a 'relative hierarchy', and he has observed that territory and hierarchy are the mammalian bases, respectively, of individual freedom and privacy on the one hand, and social efficiency and order on the other. In a relative hierarchy, the two systems are in balance. But if cats are caged in overcrowded conditions, the territorial system of individual rights disappears and gives way to an absolute hierarchy of rank, which in turn breaks down into desperate violence.

Members of a band of monkeys or apes live close together, moving around a much larger shared group territory—feeding-grounds, sleeping-grounds, and migration routes which they all hold in common. Here, as between individuals, the territory system serves to avert conflicts, this time between bands, each of which is familiar with one territory and therefore dominant within it. Within a band, an individual's own territory is now represented by his rights of movement within the common group domain. The individuals are ranked in a relative hierarchy, and each monkey's rank may be measured in what is called 'social space'—in other words, by the amount of room he is given as they all move about. Monkeys of lower rank keep out of their superiors' way, as Carpenter and Chance have shown. It is as if the superior had a bigger territory around his own body. The hierarchy of ranks is mitigated in practice by considerable social mobility, and by the real responsibilities by which the leaders earn their privileged position.

From the field reports I have already mentioned, we are beginning to form a picture of the unexpectedly complex structure of wild primate societies. They are of many kinds. Gibbons, for instance, live in small monogamous families, while baboon or rhesus bands may contain as many as 100 individuals. In howlers, the two sexes are of roughly equal status in the hierarchy. But langurs enjoy what is virtually a matriarchy. Young male langurs are disciplined by mothers and aunts to display the utmost chivalry as adults, and full-grown males will meekly accept slaps and abuse from clubs

of formidable females who keep a watchful eye on any male approach to the nursery.

But in spite of these differences, one pattern of organization appears to be rather widespread: we can see many of its features in baboons and rhesus monkeys—and, in particular, in Japanese monkeys, which have been studied in great detail by the zoologists of that country. When they are at rest on the feeding-ground, a band of wild Japanese monkeys forms a circular grouping. In the central area, or court, are the upper-class males, with a not too absolute president at their head, together with the babies, the very young males, and all the females of any age. On the outskirts, outside the court, are the lower-class adult males. When the band moves around, the court moves in the middle of the column, with the lower-class males as advance and rearguards. The court personnel have absolute priority over feeding, and the peripheral males may only eat before or after the court is at dinner. At court the president takes priority, then the first minister, then the other magnates, and they are spaced accordingly from centre to perimeter. The females are arranged in a similar hierarchy; in fact, in most of these bands the president is simply the consort of Madame President, and the females are in control.



Male chimpanzee leader in the Budongo forest
Dr V. Reynolds

When a young male reaches a certain age he is relegated to join the lower-class males at the periphery. His chances of rising in rank and getting back to court depend on his acceptance by the females, usually as a sexual partner. In three bands observed by Itani, some lower-class males have adopted an interesting method of ingratiating themselves with the females at court. When the females are having new babies, the social climbers slip into the court and take charge of last year's offspring. In return for their baby-sitting, they are tolerated until after the new babies are born, and one at least seems to have won a permanent place at court. In other bands, children of dominant mothers tend to be dominant among their peers; this has also been noticed in other monkey species. Indeed, in the Japanese monkey we may be witnessing the birth of a matrilineal nobility. For one young crown prince in one band has been permitted to stay at court long after he should have left for the outer circle, and he may remain there for life.

Evidently in this species the females control the selection of male leaders. But in East African baboons, presidential elections are in the hands of a male establishment. If the president loses his grip, they appear to transfer their support gradually to a new candidate. Long observations on rhesus bands have shown that social mobility reaches to the palace. Presidents are changed frequently, by bloodless *coups d'état*. The retiring leader suffers, at worst, temporary exile; he may take up with another band. Sometimes he just slips discreetly back into the role of first minister.

These methods of leadership selection are important, because leaders play a vital part in monkey societies. Their experience is valuable in seeking food and avoiding danger. In grave emergency, they come out fearlessly from central headquarters to defend any citizens threatened by predators. But their chief function, almost the defining function of primate leaders, is the reduction of violence, including their own, to an absolute minimum. In all primate species, when quarrels threaten within the band they are at once stopped by the intervention of the leader, supported by the establishment, who never quarrel among themselves. The establishment outranks any individual, however tough, and this confers great stability on the society.

Violence between wild primate bands is averted on the territorial basis. When two bands meet, numbers usually decide the issue, the smaller band giving way. In this way large bands have large territories, which is an appropriate way of dividing assets of the whole species. The only problem is to make it clear which band is the larger. The howlers have solved this problem by the simple method of setting up a howl: the louder band is recognized as the winner, and the less noisy band gracefully withdraws. In rhesus monkeys, the president is responsible for assessing the situation. In face of predators, he is a hero; but when faced with other rhesus bands he is as realistic as Falstaff or the Duke of Plaza-Toro. While some of his young officers threaten the other band, he sits making his appreciation. If he decides his band is the smaller, he is the first to give the example of retreat.

In practice, life in a wild primate band involves little friction and much sociability. There are lasting friendships between animals of the same sex, who will sit or sleep together and spend much time grooming each other's coats. Friendships of this kind do much to weld the society peaceably together, and in the wild they are more prominent than the occasional episode of pulling rank.

But even if there is no fighting when a hierarchy has been established, we might well think that some fighting would be necessary to decide who was going to outrank whom. From the early zoo observations this was almost taken for granted, and it is true for some mammals. Leyhausen has shown that an immigrant tom cat has to fight everyone in the gang before he is accepted as a member of the local establishment. But we know now that wild primates have eliminated even this occasional violence. Harry and Margaret Harlow observed baby rhesus monkeys playing together for twenty minutes a day in a large and commodious playroom, under conditions approximating those of the wild. At first the young monkeys explored and handled everything in the room, living or inanimate. Then they began to romp and wrestle with each other. Next they played games of chasing each other, and finally they evolved elaborate games including both wrestling and chasing. All this was done entirely in fun. By the time they had reached this stage of elaborate play, the young monkeys had formed friendly relations and special friendships. Without any real aggression, they had formed some idea of their relative strength, agility, and resource, and so they had the basis of rank hierarchy. And finally, they had become adept at dodging and evasion. It was only *after* all this that fighting tendencies appeared, and so the monkeys at once formed a hierarchy to control it without any serious injuries in the process. As the Harlows have put it, 'the monkeys had gained skills of evasion . . . during the more relaxed and carefree stages of infant-infant affection'. Although a rank hierarchy was now firmly established, 'firm affectional bonds, formed earlier, remained'. On the other hand, rhesus monkeys reared for some time in total isolation from each other and their mothers, and then put together, fight long and fiercely, and never form a stable hierarchy. In other words, fighting is neither necessary nor sufficient even for forming the primate hierarchy itself. Violence, then, plays no part in the healthy life of a wild primate society. What happens to such a society when it is exposed to stress, and in particular to crowding, is another story.

THE NEWS OF THE WEEK IN SCIENCE

Toward Man

By WALTER SULLIVAN

How did rational, ingenious, loquacious man evolve from the dumb beasts? Ever since Darwin and other early protagonists of evolution persuaded the scientific world that this had happened, the question has intrigued mankind.

The initial evidence for evolution came from the classification of plants and animals. Subtle clues—the design of a tooth, the pattern of embryonic growth—made it possible to reconstruct family trees and unravel the evolutionary histories of modern species. Yet even today surprisingly little is known of man's own family tree.

Last weekend authorities on the origin of man, from Africa, Europe and North America, met at the University of Chicago to compare notes on the latest evidence and the most recent theories. Before them was a record, extending back more than 30 million years, of creatures that were either directly ancestral to man or close relatives of his ancestors.

The record has been enlarged by exciting finds in East Africa, Egypt and India and its timetable has been pinned down with considerable precision by various dating techniques based on rates of radioactive decay. Yet there are still enormous gaps, some of them measured in millions of years.

Intolerant Ancestor

One reason is that the first of man's ancestors to become efficient in the use of tools and in hunting did not tolerate rival species. Usually a student of evolution has at his disposal a variety of closely related species representing various stages in evolution. Long, long ago man destroyed all of his close relatives, either directly or by monopolizing the available food.

Nevertheless, it now appears that, perhaps for millions of years, more than one man-like species lived in the jungles of Africa. At the Chicago conference Dr. Louis S.B. Leakey, whose finds at Olduvai Gorge in Tanzania have greatly enriched the debate, told of finding remains suggesting that three species coexisted there, about a million years ago.

While this was questioned, it was widely agreed among the conferees that two species coexisted: one apparently a vegetarian with a face so massive as to frighten even a gorilla; the other smaller than modern man, but his direct ancestor.

According to Dr. Elwyn L. Simons, curator of vertebrate paleontology at Yale University's Peabody Museum, emergence of man's ancestors from the broad stream of primate evolution may have begun with Propliopithecus, a gibbon-like creature that lived from 30 to 33 million years ago. Its fossil remains have been found by Yale expeditions at Fayum, Egypt, on what, apparently, was an ancient, jungled shoreline 100 miles inland from the present coast of the Mediterranean.

A further step was the appearance, some 19 million years ago, of a genus with certain tooth features typical of man and the great apes. In the vicinity of Lake Victoria Dr. Leakey and others have found specimens ranging in size from that of a gibbon to that of a gorilla. He classes these as the genus Proconsul.

They have many points in common with creatures that lived from Europe to the Far East, as well as in Africa, over an enormous time span, from 9 million to 19 million years ago. Dr. Simons and others class all of them, including the Proconsuls, in a single, "cosmopolitan" genus known as Dryopithecus.

Midway through the lifetime of this genus, about 12 million years ago, ape-like creatures with almost human faces appeared. This was the genus Ramapithecus, named for one of the Indian gods because it was found in the Siwalik Hills of northwest India.

Like Dryopithecus, this genus seems to have spread far and wide over a period of several million years. At Fort Ternan, Kenya, Dr. Leakey has found a similar or identical type of creature which he calls Kenyapithecus. As with so many of his finds, the remains are associated with material that can be dated. This is done by measurement of the extent to which the radioactive form of potassium, within it, has decayed into argon. The age of Kenyapithecus has thus been put at some 14 million years.

During this period another creature that may have walked upright was living in Italy. Known as Oreopithecus, it seems to represent the end of an "unsuccessful" line of evolution.

Blank Record

Between the disappearance of Dryopithecus and the other early precursors, some nine million years ago, the record is blank for seven million years. This period, which lies within the so-called Pliocene, seems to have been very dry. The primate population may have shrivelled and, after a long period of evolutionary stability, been driven into rapid change.

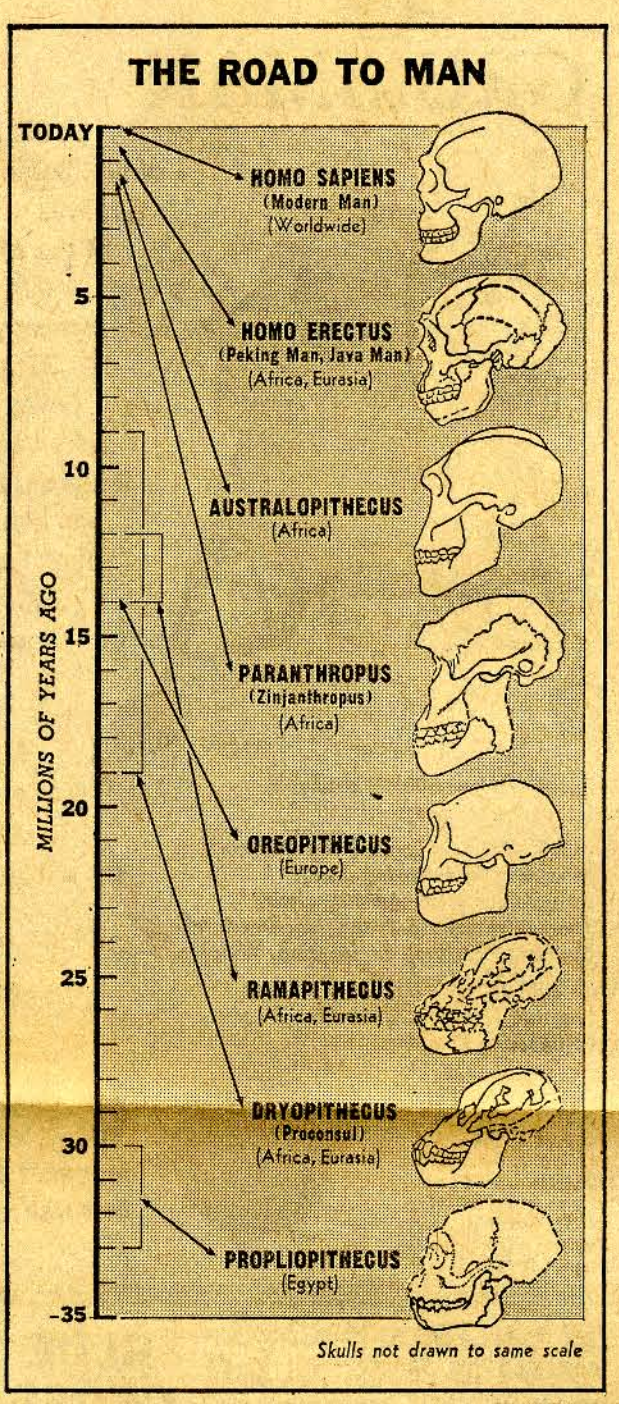
In particular, as proposed last weekend by Dr. John T. Robinson, man's ancestors may have been forced into the first use of tools—stones used, because of their natural shape, as missiles, choppers or hammers. Such unworked tools are found with remains of primitive, man-like creatures that lived in Africa from one to two million years ago.

Dr. Robinson, now professor of anthropology at the University of Wisconsin, is an emigré from South Africa, where he was a leading authority on the precursors of man.

The immediate predecessors of man are divided into two types: Australopithecus and Paranthropus. It was the latter that had an enormously broad, gorilla-like face. The crown of the male skull was a ridge, like that of the male gorilla, to which were attached powerful chewing muscles. It is thought that this creature lived on coarse vegetation and probably was identical to the Zinjanthropus discovered by Dr. Leakey at Olduvai.

The other genus of this period, Australopithecus, may have been directly ancestral to man. He was smaller, more human in appearance, and it was probably he who used tools. The manner in which these precursors of man probably lived is described in today's New York Times Magazine.

The gorge at Olduvai cuts through two deep beds of fossil remains. Bed One, on the bottom, contains remains of these early precursors. One of them, an apparent tool-user described by Dr. Leakey as Homo Habilis, is classed by Dr. Robinson and others as a form of Australopithecus.



At least 30 million years ago the features that distinguish man from all other animals had begun to emerge. Yet, despite the many fossil finds of recent years and the use of radioactive decay rates to date them, large gaps exist in the record of man's evolution. Last weekend a conference on the origin of man was held at the University of Chicago under the auspices of the Wenner-Gren Foundation for Anthropological Research. The timetable that emerged from that conference is shown here.

Above, in Bed Two, more advanced forms are found that some regard as the first true men—Homo Erectus, like the Peking Man and Java Man, who lived between 400,000 and 800,000 years ago and were followed by modern man —Homo Sapiens.

How does one define "man?" It was noted at the conference that tool use, by itself, is a poor criterion since apes, birds and sea otters all make use of sticks, stones and thorns for a variety of tasks. For example, as noted by Dr. Robinson, the woodpecker finch of the Galapagos Islands uses a thorn to extract bugs beyond the reach of its tongue.

However, the appearance of Homo Erectus was marked, not only by the use of tools but their manufacture with considerable skill. It also saw the ballooning out of the brain and, perhaps, the birth of speech. The prospects are good for ultimate decipherment of the timetable for some of these developments since the Olduvai deposits were repeatedly buried by volcanic material. The latter apparently came from near by Ngorongoro crater and preserved "living floors" representing various stages of evolution.

So far the botton of Bed One has been dated at almost two million years old and the top of Bed Two is about 500,000 years old. While some four intervening dates have been established in Bed One, little is known of the critical Bed Two period, when true man was emerging. One of the most exciting discoveries in Bed One has been a foot whose big toe was clearly adapted to give the final thrust in the stride of an upright walker 1.75 million years ago.

The recent finds have not filled in enough of the history to show the precise genealogy. Nevertheless they have provided landmarks along the road to man. Some clues to his changing way of life may also be found in a microscopic examination of the tools. It was pointed out by Dr. John Desmond Clark of the University of California in Berkeley, that stone tools still employed by a few vestigal tribes display patterns of wear that reveal the nature of their use.

As Dr. Robert Ascher of Cornell University put it, "stone tools are congealed behavior." Their careful study may tell, in considerable detail, what our ancestors did with them. The conference was sponsored by the Wenner-Gren Foundation for Anthropological Research.

Fight on Smog

By DAVID R. JONES

Special to The New York Times

DETROIT, April 10—Photochemical smog, an atmospheric condition that has been plaguein Los Angeles for more than 20 years, is beginning to become a national controversy.

Air pollution experts in several major cities, as well as authorities in the Public Health Service, believe that several other large metropolitan areas will undergo before long the same discomfort and potential health hazard that afflicts Los Angeles.

The mounting concern over the subject was high lighted this week here and in Washington, where the Senate Public Works Committee's subcommittee on air and water pollution held three days of hearings on the matter. The committee took testimony on proposed legislation that would require exhaust control devices on new automobiles sold after Nov. 1, 1966.

Senator Edmund S. Muskie, the Maine Democrat who heads the subcommittee, and leading pollution experts are zeroing in on the automobile industry because they believe it is a major contributor to the air pollutants that form smog.

The automakers admit they are the main culprits in California, where they will be required by law to install ex-

El pulgar humano

John Napier, D. Sc.
Departamento de Anatomía
Royal Free Hospital School of Medicine, Londres

Existen buenas razones para considerar el desarrollo del pulgar como una de las más importantes adaptaciones en la historia de los primates. Condujo primeramente a la utilidad para la vida en los árboles y más tarde, paradójicamente, a igual utilidad en la vida sobre el suelo, al menos para un representante de este orden: el hombre.

La autonomía funcional del pulgar, que constituye el factor principal de la habilidad de la mano, no fue un accidente original en el curso de la evolución. Su perfeccionamiento progresivo puede seguirse a base de materiales fósiles de comprobación y con auxilio de algunos apoyos especulativos a través de los 70 millones de años con que cuenta la existencia de los primates.

En la evolución del pulgar desde su estado primitivo se pueden distinguir cuatro fases: 1) convergencia, 2) oponibilidad de falanges, 3) falsa oponibilidad, 4) oponibilidad.

Anatomistas y paleontólogos están hoy de acuerdo en que la tupaya, uno de los insectívoros contados entre los primates por muchos investigadores, puede servir, «cum grano salis», como modelo de la primera fase de la evolución de los primates. Las tupayas son animales vivaces, inquietos, curiosos, que viven en los lluviosos bosques del trópico, donde se los puede hallar en cualquier altitud. Para nuestro tema tiene especial importancia el hecho de tratarse de pequeños animales que tampoco en épocas pasadas tuvieron mayores dimensiones. La facultad de asimiento de las manos no constituye una condición «sine qua non» de la vida en los árboles si el animal tiene garras y es suficientemente ligero para balancearse de las ramas más delgadas al buscar el alimento. En cambio, se hace necesaria en cuanto el volumen del cuerpo rebasa unas proporciones críticas; porque en las ramas pequeñas los animales mayores sólo pueden mantenerse en equilibrio con ayuda de manos y pies con facultad de asimiento. Su ulterior desarrollo filogenético permitió a los primates seguir moviéndose sobre ramas delgadas de forma que pasaron a comer en posición suspendida. Como Avis (1962) ha afirmado, esto puede conducir al desarrollo del caminar a brazos, es decir, la locomoción con ambas manos, en la que el cuerpo pende de las extremidades anteriores. La locomoción mediante impulso de los brazos es una forma de conducta de casi todos los primates cuyas dimensiones corporales rebasan las del macaco (cercopiteco); pero sólo el orangután, el chimpancé y el gibón se han especializado en esta técnica.

La mano de la tupaya (fig. 1) es bastante larga y las puntas de sus dedos están provistas de afiladas uñas. Es convergente, es decir, un movimiento de la articulación metacarpo-falange aproxima las puntas de los dedos sobre la mitad de la palma de la mano, formando así una especie de cuenco. El movimiento opuesto es la divergencia, que extiende los dedos en forma de abanico y produce un ancho plano de sustentación. La convergencia es el primitivo mecanismo de apoyo de todos los mamíferos dotados de patas; aún no existe la auténtica facultad de asimiento, por lo que los objetos sólo pueden sostenerse con la cooperación de ambas manos. Dos manos constituyen así el equivalente funcional de una mano con facultad de asimiento. Un ejemplo típico de esta técnica de comer lo ofrece la ardilla. La tupaya está ya algo más especializado, pues la disposición particular de los músculos de las manos deja ya conocer las características del pulgar del primate, la autonomía de movimiento (Napier 1961).

La auténtica facultad de asimiento, es decir, la posibilidad de asir un objeto con una mano y empuñarlo, presupone no sólo la posibilidad de realizar un movimiento del pulgar en el conjunto de la mano (divergencia), sino también en ángulo con ella, formando así una pinza, conjuntamente con los demás dedos. En evolución paralela, en muchos vertebrados, como por ejemplo los papagayos, lagartos, canguros y primates, ha tenido lugar con este objeto una prolongación del pulgar; pero incluso los últimos no tuvieron que tomar dos impulsos, sino tres, para desarrollar un dedo oponible (fig. 1c).

La primera prueba fósil de la facultad de asimiento la ofrece la mano del Notharctus, un lemúrido del eoceno norteamericano. Es interesante que el meñique de este animal tenía una oponibilidad más acusada que la del propio pulgar. La oponibilidad del pulgar del Notharctus era probablemente similar a la del tarsio actual, que vive en los bosques lluviosos de la India oriental. Pero en el tarsio, la oposición no se lleva a cabo como en el hombre, con ayuda de la articulación carpo-metacarpo, sino por un movimiento correspondiente en la articulación metacarpo-falange. En él esta articulación tiene una movilidad abductora, adductora y rotativa suficiente para servir de base a la facultad de asimiento. Por su localización, este movimiento es denominado «oponibilidad de falange» (Napier 1961); se ha conservado de manera interesante en gran número de individuos humanos (fig. 2), para los que constituye una parte importante del mecanismo de oposición del pulgar (Napier 1952).

El tarsio es considerado por muchos investigadores como descendiente vivo de la familia de que proceden también los monos y los hombres. Su mano presenta una importante especialización

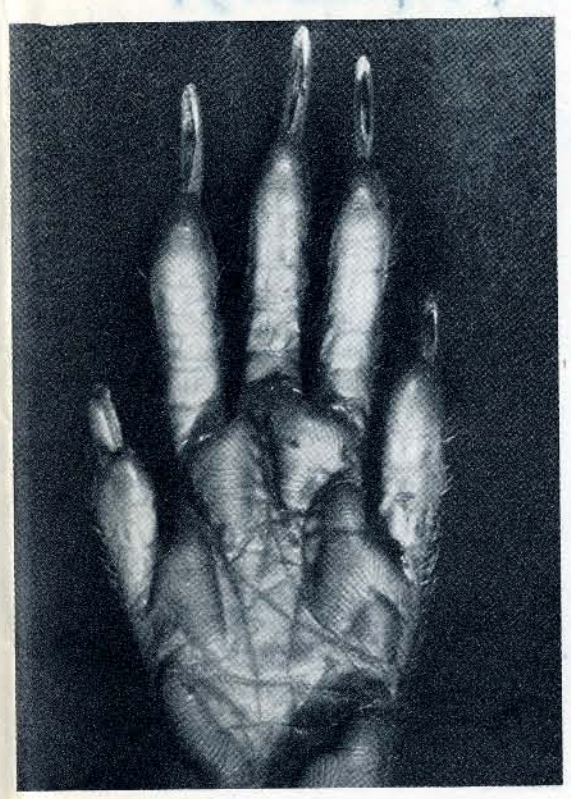


Fig. 1a. Tupaya.

Fig. 1b. Tarsio.

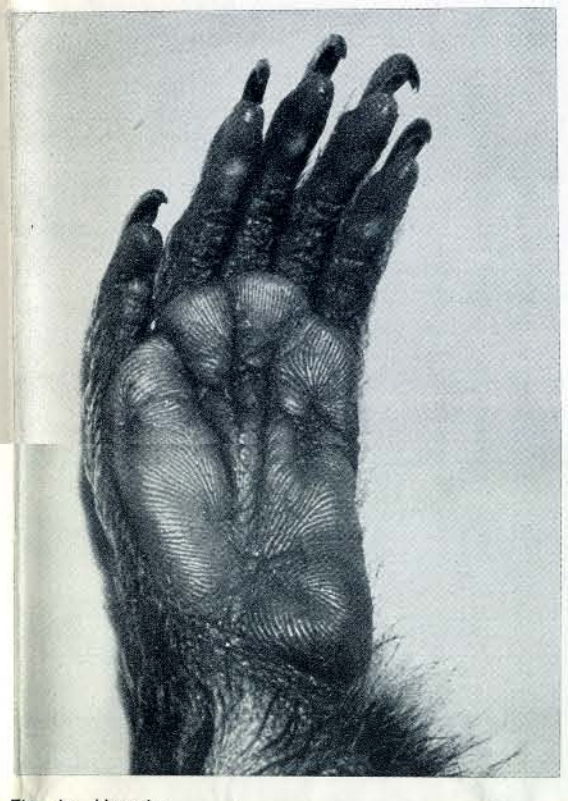


Fig. 1c. Hapalo.

Fig. 1d. Periodicticus.

(fig. 1b): en las puntas de los dedos se encuentran unas anchas láminas carnosas cubiertas de finos surcos papilares sobre los cuales se destaca una uña triangular y aplanada. Estos panículos están provistos de numerosos nervios sensoriales y corresponden a las yemas de los dedos en el hombre. Como dijo el fallecido profesor F. Wood: «El pequeño tarsio tiene mucho que decirnos».

Tras la fase de la evolución del pulgar en el tarsio (oponibilidad de la falange) la prueba paleolítica siguiente la encontramos en una época 30 millones de años posterior. A mediados del mioceno de Africa oriental nos encontramos con el grupo **proconsul,** homínidas fósiles a los que probablemente perteneció también una especie morfológicamente próxima al simio y al hombre. El «sospechoso» más pequeño, mejor conocido y por tanto también el más cercano es el **proconsul africanus.** Su mano, conservada casi totalmente, ha podido ser reconstruida (Napier y Davis 1959). Aunque falta el hueso metacarpiano del pulgar, el os trapezium (multangulum maius), con el que integraba una extremidad, señala que el pulgar de los primates había extendido en aquel tiempo su movilidad a la articulación carpometacarpiana. Sin embargo, aún no era perfectamente oponible: la verdadera oponibilidad requiere una articulación en la unión del carpo y el metacarpo. Una articulación permite los movimientos normales de flexión-extensión, abducción-adducción, y, además, una especie de rotación combinada con circulación por la que el pulgar puede moverse sobre un eje en el punto central de la articulación y oponerse al plano de los demás dedos. Pero este movimiento parece ser en los primates una adaptación que tarda en presentarse en el curso de la evolución.

La «falsa oponibilidad» del pulgar del procónsul recuerda funcionalmente el status de ciertos monos sudamericanos, como por ejemplo el capuchino (Cebus), que, no obstante, y merecidamente, gozan fama de tener gran inteligencia y afición al uso de «instrumentos». La falsa oposición del pulgar de estos animales se debe a que el os multangulum maius está vuelto hacia dentro y dirigido contra el centro de la mano.

Los monos del Nuevo Mundo, que en comparación con los «avanzados» del Viejo Mundo, representan una fase generalizada de la evolución de los primates, ofrecen diversas especializaciones del pulgar. El atele o mono araña, que se sirve de los brazos para andar, carece de pulgar, caso extremo que puede parangonarse a la reducción, menos radical, aunque también muy amplia, del pulgar entre los grandes simios del Viejo Mundo (fig. 1f). El lagotrix tiene el pulgar situado inmediatamente junto a los demás dedos (fig. 1e), lo mismo que los hapalos, que han conservado, además, las uñas en las puntas de los dedos (fig. 1c).

En lo que se refiere a sus pulgares, los monos del Viejo Mundo se han mantenido conservadores, habiendo desaparecido aquéllos únicamente en el caso del colobo, en tanto que en los demás se da auténtica oponibilidad.

La primera prueba de verdadera oposición en la línea de los homínidas la dieron los fósiles del pleistoceno del desfiladero de Olduvai (Tanganica), donde el Dr. L. S. B. Leakey y sus colaboradores descubrieron en 1960 un estrato que contenía restos del cráneo, de una mandíbula y algunos huesos pertenecientes a pies y manos de un ser semejante al hombre y anterior a él (fig. 3), cuya edad provisionalmente se ha calculado en un millón y medio de años. Entre los huesos de la mano se encontró un multangulum maius, que probaba claramente una auténtica oponibilidad, y una ancha articulación de pulgar que señala una mano funcionalmente similar (no idéntica) a la del hombre actual (Napier 1963). Otro documento sobre el pulgar oponible procede de Swartkrans (Africa del Sur) donde se hallaron huesos metacarpianos fósiles del grupo de los australo-

Fig. 1e. Lagotrix.

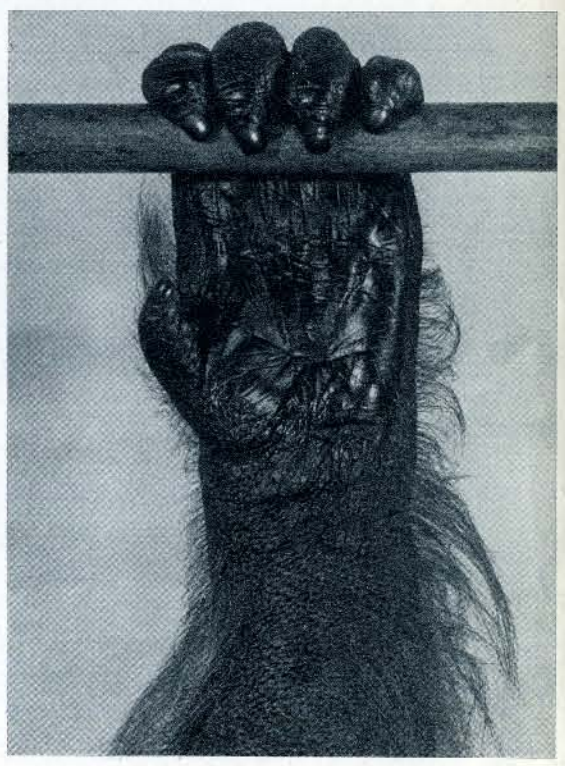


Fig. 1f. Orangután.

Fig. 1g. Macaco.

pithecus. Aquí el hueso metacarpiano del pulgar señala, en comparación con los demás dedos, un pulgar bastante corto, como en el gorila de hoy. No puede ponderarse bastante la importancia de la auténtica oponibilidad del pulgar para la evolución humana. Cuando nuestros remotos antepasados abandonaron los bosques para vivir en regiones más abiertas y despejadas y poco a poco empezaron a hacer uso de las piernas para la locomoción, las manos adquirieron mayor importancia. Dejaron de ser órganos meramente pasivos que únicamente servían para sujetarse o colgarse de los árboles, y se convirtieron en medio que capacitó al hombre primitivo para emprender la lucha contra el ambiente, una lucha que le convertiría propiamente en hombre. Necesitó sus manos para procurarse el sustento, para cazar, para cosechar. Cada una de estas actividades requería un alto nivel de función manual. Un cazador sin dientes especiales de carnívoro necesita armas para matar la presa e instrumentos para descuartizarla; el recolector ha de construir recipientes para recoger y transportar los alimentos. En época posterior, el hombre utilizó sus manos para construir la vivienda, para encender fuego, para confeccionar vestidos con las pieles de los mismos animales sacrificados para su sustento personal, para fabricar armas e instrumentos perfeccionados, para desarrollar herramientas con que poder fabricar otras herramientas. En nuestra época de automación, por último, el hombre usa sus manos para fabricar herramientas fabricantes de instrumentos con los que a su vez se puede fabricar automáticamente otras herramientas e instrumentos. En el curso de esta evolución llegó un momento en que el hombre comenzó a dirigir sus energías manuales e intelectuales de lo puramente práctico a lo ornamental: a pintar las cavernas, a formar figuras de barro, a hacer collares y prendedores.

Fig. 2a. Oposición del pulgar por abducción y rotación en la articulación metacarpo-falange.

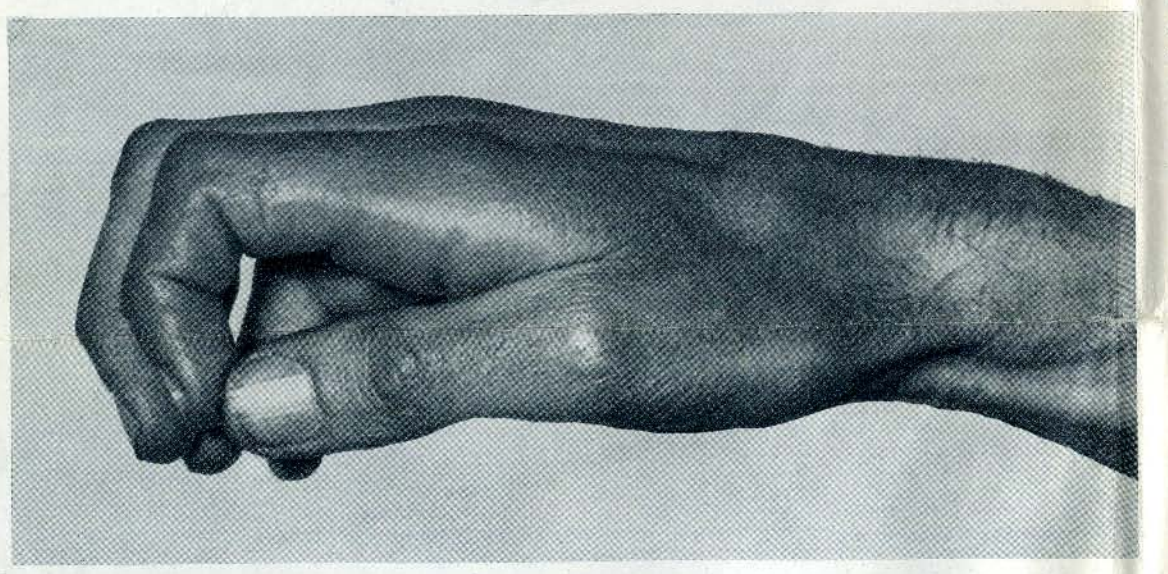


Fig. 2b. Intento de oposición del pulgar en la hemiplejía. Sin abducción en las articulaciones carpo-metacarpo y metacarpo-falange.

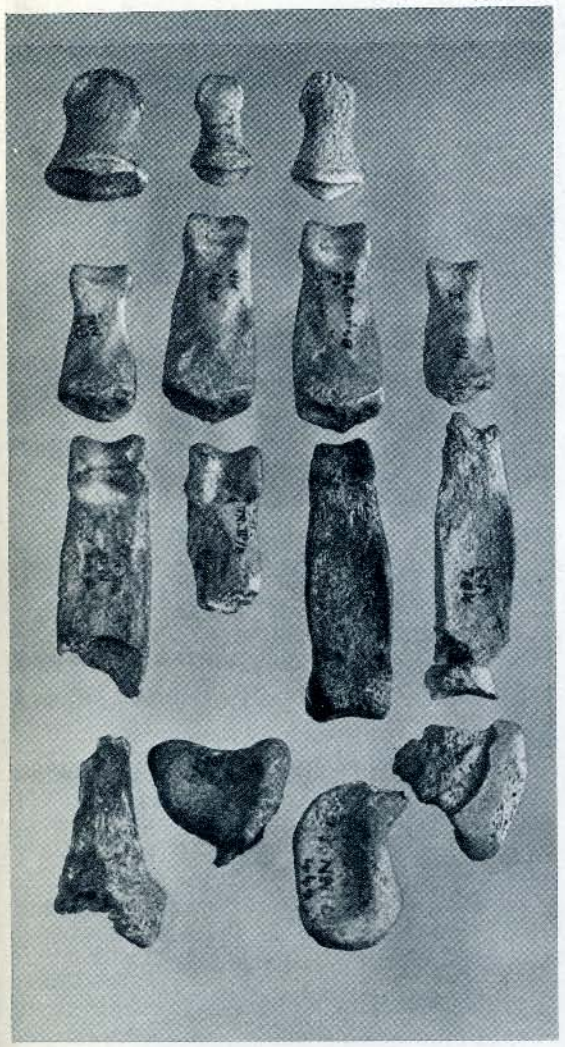


Fig. 3. Composición de los huesos de la mano de varios individuos de distintas edades, del desfiladero de Olduvai, Tanganica (de «Antiquity» 1962, XXXVI, 41-47).

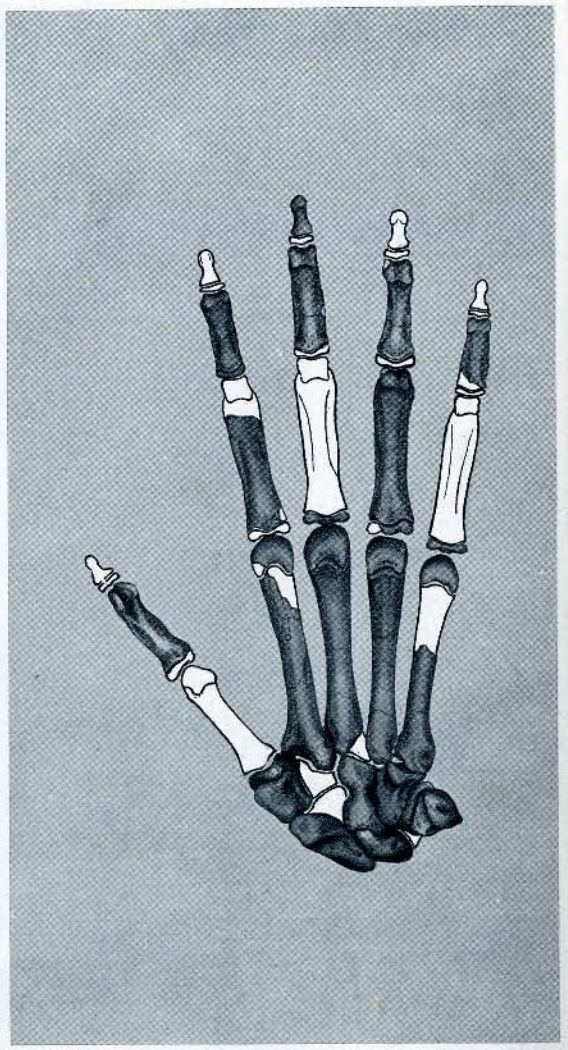


Fig. 4. Reconstrucción de la mano del Proconsul africanus. (Según Napier y Davis, Fossil mammals of Africa No. 16, British Museum, 1959).

El principio de este proceso evolutivo consiste en la selección natural de formas convenientes de comportamiento. Al mejorar la locomoción en forma erecta sobre las piernas, las manos también se perfeccionaron. Esto implicó la correspondiente evolución del cráneo, particularmente en las partes de la corteza motora y sensorial que afectan a las funciones de la mano, y a la acumulación de impresiones sensoriales y habilidades motoras. El aumento del encéfalo permitió nuevas tentativas de la fuerza imaginativa, lo que a su vez volvió a motivar una más acusada precisión de selección respecto al volumen y diferenciación del cerebro. Así, en incesante renovación de causa y efecto continuada a través de millones de años, se fueron perfeccionando los tres atributos del hombre: el tamaño de su cerebro, su habilidad manual y su andar erguido.

La evolución de la mano a lo largo de los 70 millones de años de historia de los primates representa un proceso de desarrollo. Las disposiciones de anteriores fases no se han perdido. Los movimientos del pulgar humano en la articulación metacarpo-falange se remontan a las fases de convergencia y oponibilidad de la falange, mientras los movimientos en la articulación carpo-metacarpo pueden considerarse como falsa oponibilidad, en tanto se trata de flexión y extensión, y como auténtica oponibilidad con relación a la componente de rotación circunductora. Este esquema de perfeccionamiento filogenético es una parte integrante del signo indeleble que, según palabras de Darwin, el hombre sigue llevando como testimonio de su origen animal «a pesar de todas sus nobles propiedades y de su espíritu semejante a Dios».

Avis V. (1962): Southwestern J. Anthrop. *18*, 2, 119.
Napier J. R. (1952): J. Anat. (Lond.) *88*, 4, 335.
Napier J. R. (1961): Symp. Zool. Soc. Lond. *5*, 115.
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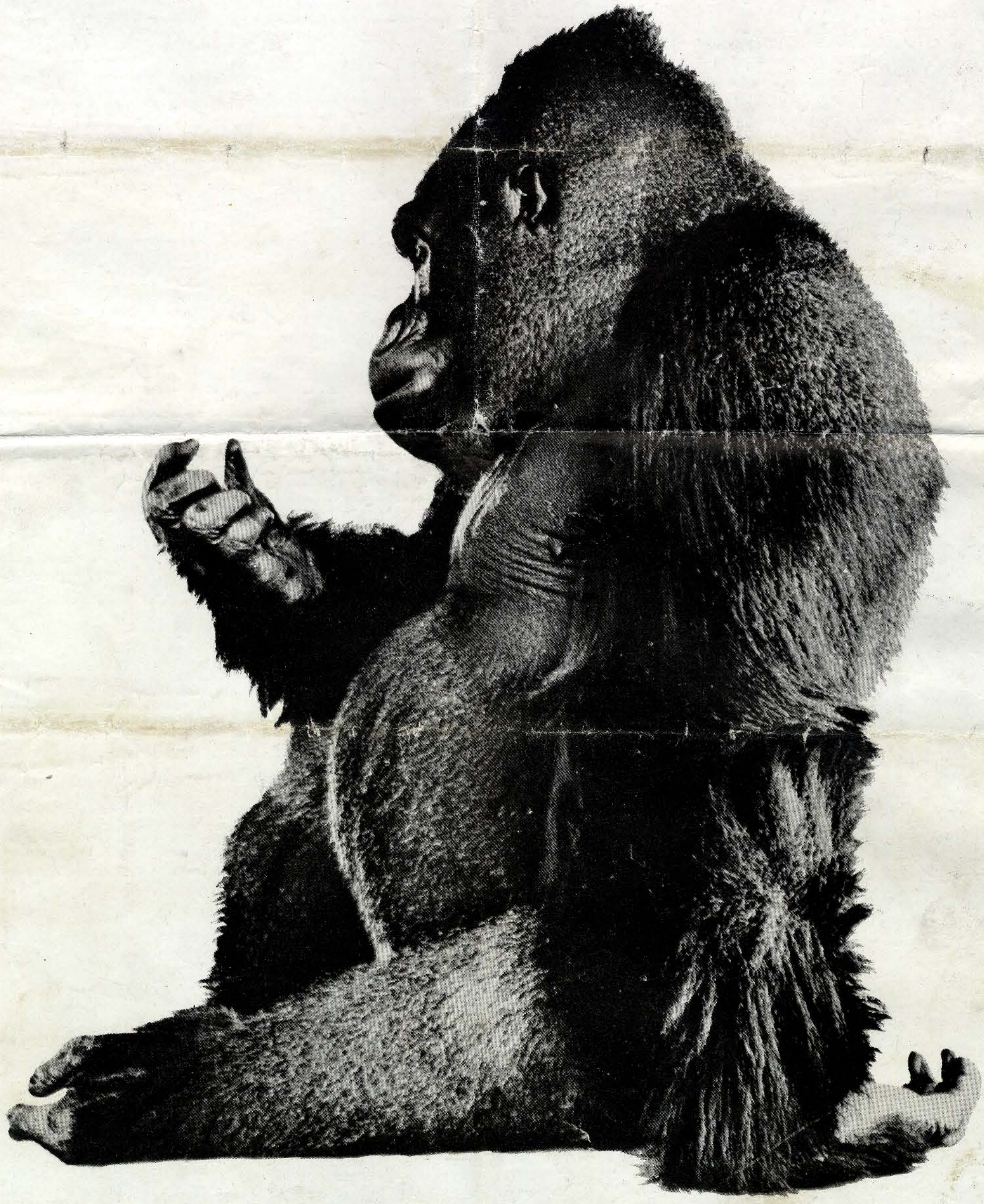
Hist. descubrimiento del Gorila.

Panorama médico

una publicación Sandoz

Mayo 1962



Los accidentes de tráfico constituyen, tal vez, la más asoladora plaga del mundo civilizado. PANORAMA, atento a todo cuanto sea problema de actualidad, insiste en el presente número sobre este tema, ciñéndose de un modo especial a aquellos aspectos, tan frecuentes, que tienen relación con la medicina.

Accidentes mortales de automóvil

William G. Eckert, B. A., M. D.
William T. Kemmerer, M. D.
(Departments of Pathology and Surgery, Tulane University School of Medicine, Louisiana, U.S.A.)

Hace poco se practicó en Nueva Orleans, Luisiana, una investigación sobre una serie de accidentes mortales de automóvil. Del material disponible – 300 casos con sus correspondientes informes policíacos – se obtuvo una primera demostración de que la índole de las heridas depende, en primer lugar, de la posición de las víctimas en el momento del accidente y de la circunstancia de si el accidentado es lanzado fuera del auto o no.

Heridas de las personas que permanecen en el coche

Es, ante todo, el choque con una parte del coche (volante, salpicadero, marco de la ventanilla, parabrisas o techo) lo que puede tener consecuencias mortales. En lo que atañe a la localización de las heridas, no se observó ninguna diferencia esencial, entre conductores y pasajeros heridos mortalmente. En cambio sí es diferente el grado de gravedad. Se ha demostrado que para el conductor el peligro de una herida mortal es menor que para los pasajeros: en un total de 80 accidentes, en los cuales uno de cada dos viajeros resultó muerto, sólo en 7 casos (9%) se trató del conductor, mientras que en 65 casos (81%) 10 fue un pasajero.

Las víctimas sufrieron con frecuencia múltiples y graves heridas. Las de la cabeza aparecen en el conductor y el acompañante aproximadamente en el mismo número. Las fracturas aparecen sin embargo, con doble frecuencia en los conductores que en los acompañantes. Más datos numéricos se pueden ver en el cuadro adjunto.

Las heridas en las personas despedidas del coche

Son en general muy graves. Lo que nos impresionó especialmente en estos casos fue la frecuencia con que se observaban múltiples heridas cada una de las cuales podía ser considerada mortal por sí sola. En este aspecto nuestros resultados concuerdan en su totalidad con los investigados por el grupo de Cornell; éstos llegan claramente a la conclusión de que el peligro de herida mortal para los ocupantes que salen despedidos del automóvil es cinco veces mayor (véase PANORAMA, Noviembre, 1961).

En estas investigaciones, también aparecen como expuestos a un especial peligro los acompañantes situados en el asiento delantero: en 10 accidentes en los que uno de los pasajeros salió despedido fuera del automóvil, muriendo a continuación, dicho pasajero ocupaba el asiento de delante. El conductor o un pasajero de los asientos traseros corrieron la misma suerte sólo en 2 ocasiones.

El siguiente cuadro informa sobre la localización y frecuencia, en tantos por ciento, de las heridas sufridas por 150 ocupantes de automóvil, muertos a consecuencia del accidente.

Localización de las heridas	Accidentados que quedan en el coche		Personas despedidas	Total
	conductor	pasajeros		
cabeza . .	58 (60%)*	59 (36%)*	62 (50%)*	54 (48%)*
cuello . .	13	8	9	15
torax . . .	49	52	67	52
abdomen .	31	34	52	37
pelvis . .	4	10	7	5

* Números entre paréntesis: lesiones de la cabeza con fractura.

Las heridas en los peatones

están condicionadas en primer lugar, por el choque con el vehículo. Las extremidades inferiores son las que corren mayor peligro: en 121 accidentes mortales, el 64% presentaban graves heridas en las piernas; entre ellos el 28% mostraban fracturas de las dos piernas; en una tercera parte de los casos se encontraron heridas abdominales y de la pelvis. El hígado y el bazo estaban afectados poco más o menos con la misma frecuencia. En el tórax, pudieron observarse lesiones aproximadamente en la mitad de los cadáveres; el 67% eran fracturas de las costillas.Observamos traumatismos craneales en el 61% de las víctimas; dos tercios de ellas tenían fracturas o heridas cerebrales. No hace falta subrayar que la

causa de muerte en los accidentes de automóvil

sólo pueda determinarse después de una cuidadosa autopsia. Esta autopsia será especialmente minuciosa en la región cervical. En nuestras investigaciones se apreciaron tres o más heridas independientes entre sí, cada una de las cuales, podría considerarse como causantes de muerte. Pueden existir también heridas, relativamente inofensivas, que, sobre todo en las personas ancianas, provoquen un choque irreversible.

Como más frecuentes, nosotros encontramos las heridas de la cabeza y del torax combinadas entre sí o con otras heridas. Las heridas de la pelvis causan frecuentemente complicaciones (por ejemplo la grave hemorragia retro-peritoneal a consecuencia de la fractura o separación de las vértebras sacrolumbares). Una herida de la región cervical, a veces muy difícil de demostrar, puede conducir a una muerte repentina por edema pulmonar. Las heridas de las extremidades son capaces de originar la formación de embolias gaseosas, o grasosas. También existe la posibilidad de acelerar la evolución de procesos patológicos existentes. Así por ejemplo, una herida abdominal relativamente insignificante condujo a la ruptura de un aneurisma de aorta. De la misma manera un trauma relativamente ligero puede contribuir al estallido de un hígado enfermo. Deben mencionarse también aquellos casos en que la muerte aparece a consecuencia de una aspiración de sangre o de vómitos. Este último caso es especialmente frecuente si el accidentado ha bebido antes con abundancia.

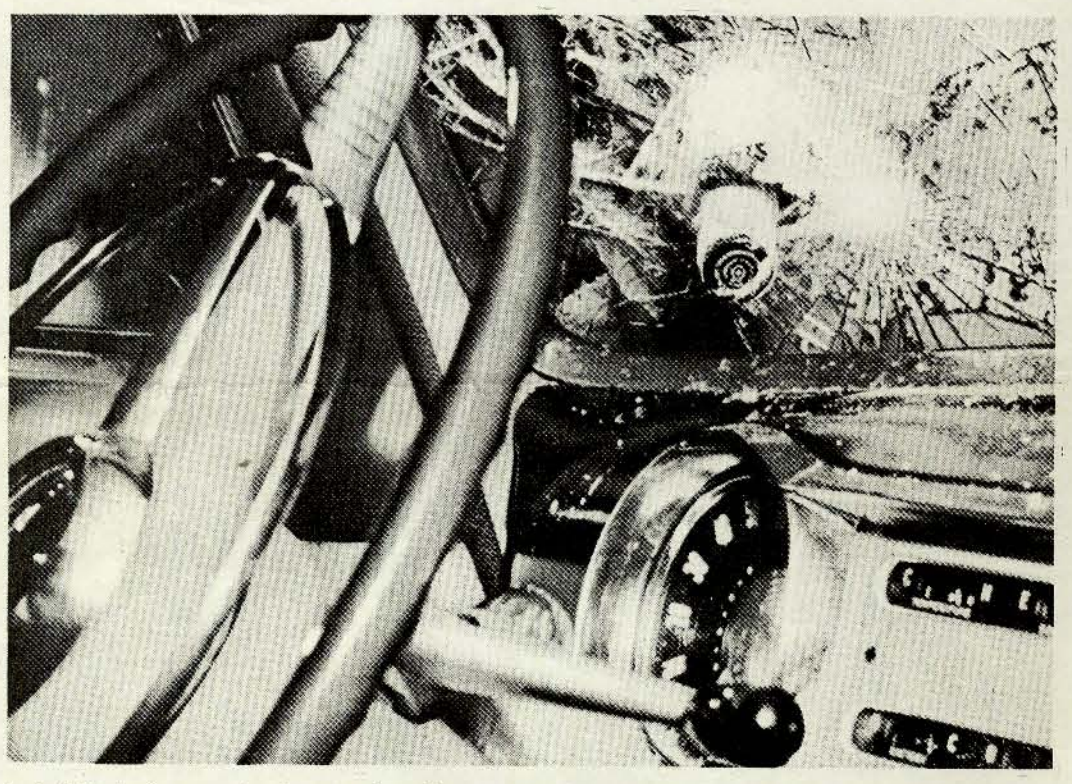
El alcohol interpreta un papel muy importante en la muerte de muchos conductores y peatones. En nuestras estadísticas el 60% de los conductores, el 36% de los pasajeros y el 55% de los peatones habían bebido inmediatamente antes del accidente, lo que sin duda influyó en su comportamiento antes, durante y después del mismo. La benzedrina, barbitúricos, narcóticos o monóxido de carbono, por el contrario, nunca pudieron demostrarse en nuestros estudios experimentales.

Para la explicación de los casos de muerte, hay que tener siempre en cuenta que en el automóvil también se puede morir de muerte natural o – lo que es más frecuente – que determinados estados de enfermedad (por ejemplo esclerosis de las coronarias, epilepsia, enfermedades vasculocerebrales, tumores cerebrales, etc.) pueden conducir a un accidente con consecuencias mortales. Evidentemente, existe también la posibilidad de

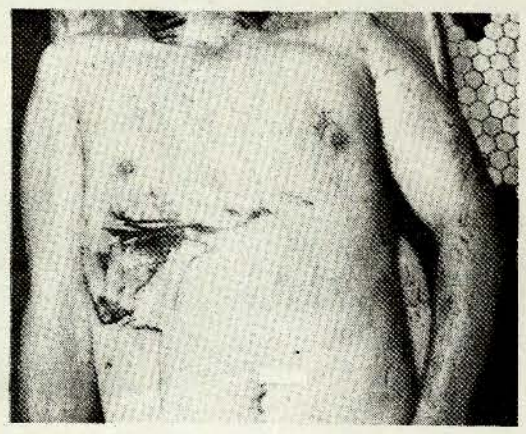
suicidio, homicidio o asesinato.

Realmente, el automóvil se emplea raras veces para el suicidio; sin embargo, el Dr. R. Ford, de la Harvard Medical School de Boston, informó sobre 9 casos. Nosotros mismos hemos encontrado algunas ocasiones en las que la sospecha de suicidio era muy fundada, aunque es bien cierto que nunca pudimos alegar una prueba evidente.

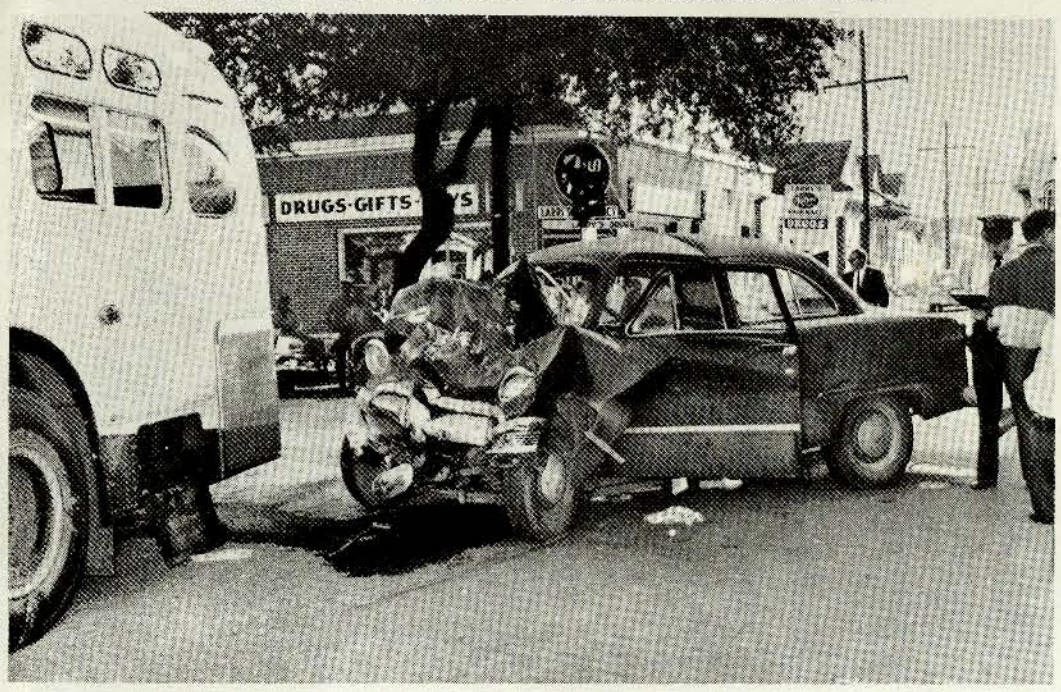
Con mayor frecuencia se presenta el hecho de que un conductor atropelle a un peatón, y después se dé a la fuga, con lo que se hace culpable de homicidio. También puede ser empleado el auto para un asesinato premeditado: la víctima es atropellada o bien el vehículo está preparado de tal forma que durante el viaje ocurra el accidente. También se utiliza el automóvil, para el encubrimiento de un asesinato: sabemos de un caso en el que la víctima, ya cadáver, fue colocada en un automóvil, que se incendió después, para terminar arrojándolo a un precipio. La posibilidad de un acto criminal no debe ser excluída, por tanto, en la investigación de un accidente de tráfico.



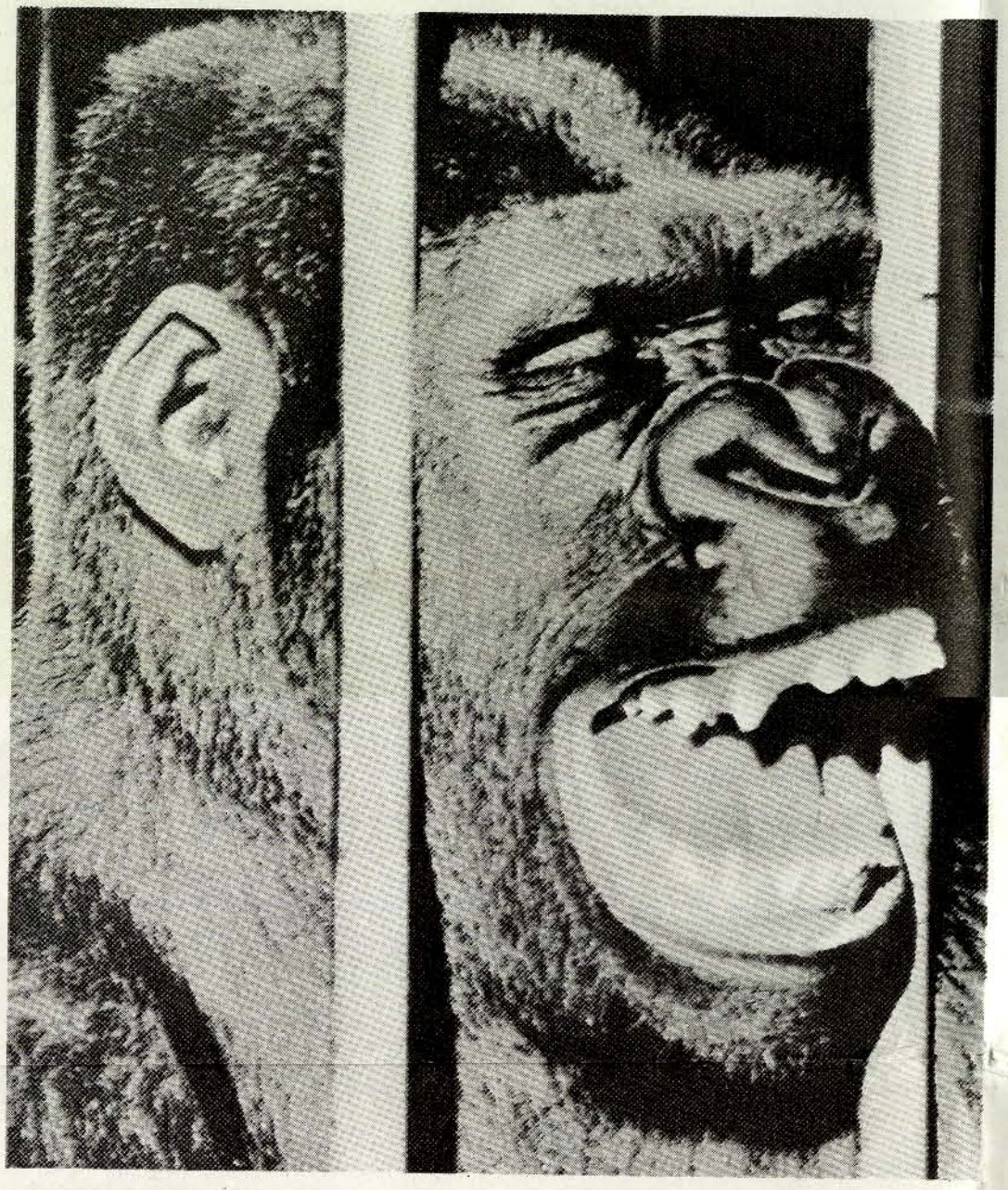
La botella de vino que chocó contra el parabrisas, quedando allí enclavada, la llevaba una peatón ebria que murió en el accidente.



Caso clásico de una herida de torax producida por el volante (foto de la izquierda) en un choque frontal (foto de la derecha).



Nuestro primo el gorila es, a pesar de tan cercano parentesco, poco conocido. Pero el interés que suscita hoy día es tal, que basta que uno de sus hijos nazca en cautividad (como ha sucedido recientemente en el Zoo de Basilea) para que la multitud se conmueva. Nosotros le hemos pedido a Bernard Heuvelmans, colaborador del «Institut Royal de Sciences Naturelles» de Bélgica, miembro de numerosas sociedades científicas internacionales y al que su obra «Sur la piste des bêtes igno rées», editada en diez idiomas, ha hecho célebre en todo el mundo, que tuviera la amabilidad de concretar en las páginas de PANORAMA, lo que se sabe y lo que se ha creído saber sobre este tema.



El abominable

El pasado siglo XIX también tuvo su abominable hombre de las nieves. Más exactamente, su «abominable hombre de los bosques»: un gigante bípedo y peludo, de aspecto aterrador, que, a decir de los indígenas y de ciertos viajeros, frecuentaba los bosques de la Guinea Inferior. Del mismo modo que ahora sucede con el yeti, abundaron sus descripciones y corrieron toda clase de rumores sobre su comportamiento. Desde luego, salvo raras excepciones, nadie, en los medios estudiosos, creía en la existencia de este ogro africano. Pero en nuestros días, se le ve figurar entre los especímenes de los diversos zoos del mundo. Este es, el gorila.

¡Cuidado con el yeti!

Los indígenas de Nepal atribuyen hoy a los hombres de las nieves numerosas hazañas fantasmagóricas.

Uno de los sherpas de la expedición francesa que, en 1953, conquistaba el Makalu, contaba a todo el que quería escucharle una terrorífica anécdota. En su juventud había visto cómo un yeti de dos metros de alto, derribaba a un yak a puñetazo limpio, destripaba con sus colmillos al buey de lanosa vestidura y metía su bestial hocico entre las humeantes entrañas.

Según las informaciones espigadas en 1957 por la expedición americana de Tom Slick, en el valle de Barum, el monstruo, cuando mata a un hombre, sólo se come los ojos, los dedos y los testículos. Pero, de acuerdo con otros rumores, no siempre se comporta como un «gourmet» tan refinado. De un hombre de negocios desaparecido en Katmandu, sólo se encontraron en la nieve un zapato y algunos jirones de ropa. El yeti puede ser tan glotón que, en épocas de penuria, la hembra llega a devorar a su marido.

La mala reputación del yeti no se limita a su glotonería; recae también sobre su lubricidad. Los machos raptan a veces a las mujeres para hacerlas sus esposas, y las hembras, reconocibles por sus grandes senos, que rechazan por encima de sus omóplatos cuando corren, hacen otro tanto con los hombres.

Ni siquiera los niños están a cubierto de las acechanzas de este gigantesco «kidnapper». Hace cinco años, en la región de Katmandu, un centinela vio como un hombre de las nieves se llevaba entre sus brazos a una chiquilla. Disparó sobre el raptor. Este, lanzando un rugido de dolor, descuartizó a la niña con la misma facilidad con que se rasga una entrada de cine usada. Sin embargo, si hacemos caso de otra opinión diferente, emitida por un sherpa del pueblo de Tarke, llegado en peregrinación a la capital, el guardia hubiera hecho mejor en no intervenir. Su hermana pequeña, Yuli, fue raptada por un yeti a la edad de 6 años; el yeti la guardó durante cinco años «con cuidado y cariño» en su cueva. Sólo a causa de una enfermedad de la niña, el ogro consintió, bajo petición, devolverla al sitio donde la había encontrado.

Si usted estima que la inverosimilitud de tales anécdotas traduce el carácter mítico de su protagonista – que sólo sería una creación imaginaria de los inocentes indígenas – debe pensar también otra cosa: los gorilas que usted contempla en el Parque Zoológico o en el Circo Americano no son más que fantasmas... En efecto, también ellos han sido acusados, en otros tiempos, de fechorías no menos fantásticas; por tanto son merecedores de la misma incredulidad.

¿Eran gorilas los gorillai?

Para convencerle, retrotraigámonos brevemente hasta el descubrimiento de los gorilas y, más aún, hasta su prehistoria, que se remonta a 25 siglos.

Hacia el 470 antes de J. C., el almirante cartaginés Hannon viaja, comisionado para fundar nuevas colonias, a lo largo de toda la costa occidental de Africa. Es una empresa atrevida, pues los vientos alisios hacen que la navegación en este sentido sea muy difícil. Hannon parte, a pesar de todo, con una flota considerable – de sesenta galeras, dice – y, después de múltiples etapas, dobla una montaña de fuego, llamada el Carro de los Dioses, antes de recalar en una bahía, de cuyo fondo emerge una isla.

«Habiendo arribado a esta isla – cuenta Hannon en la relación de su famoso periplo – la encontramos habitada por salvajes. El número de mujeres sobrepasaba en mucho al de hombres: eran muy peludas, y nuestros intérpretes las llamaban «gorillai». Perseguimos a los salvajes, sin poder alcanzar ningún hombre: huían a través de los precipicios con una agilidad impresionante y nos tiraban piedras. A pesar de todo, conseguimos apresar a tres mujeres; pero como rompían sus ataduras y nos mordían y atacaban con furor, nos vimos obligados a matarlas. Hemos conservado sus pieles». Plinio el Viejo dice, mucho tiempo después, que dos trofeos de esta expedición adornaban todavía el templo de Astarté, en Cartago, en la época de la invasión romana (es decir, en el 146 antes de J. C.).

Muchas conjeturas se han hecho acerca de la identidad de estos gorillai. Algunos han pensado que eran gorilas; de ahí que su nombre fuera aplicado a estos grandes antropoides, cuando la ciencia del siglo XIX los descubrió o, mejor dicho, los redescubrió. Pero a esta identificación se le han hecho grandes objeciones.

Hay quien pretendía que estos salvajes peludos, no pasaban de ser chimpancés, mientras otros decían que eran simples babuínos, y los de más allá, incluso, los asimilaban a los pigmeos.

La última hipótesis puede rechazarse con toda tranquilidad: los pigmeos no son más peludos que los cartagineses.

La hipótesis de los babuínos merece, todavía, menos consideración, pues los cartagineses conocían muy bien a los monos cinocéfalos, que, por otra parte, se parecen más a los perros que a los hombres.

Así pues: ¿eran chimpancés o gorilas?

Para zanjar la cuestión es preciso estudiar, ante todo, el área de distribución de los dos géneros. En el oeste africano, el dominio del chimpancé se extiende alrededor de todo el golfo de Guinea, desde Sierra Leona hasta el río Congo, mientras que el gorila sólo se encuentra al sur de dicho golfo: en Gabón y la Guinea Inferior. Los defensores de la hipótesis del chimpancé alegan que Hannon no pudo, con los medios de navegación de su época, llegar hasta esta última región, por lo que no habría sobrepasado la actual Liberia. En tal caso, evidentemente, no hubiera podido ver al gorila.

Pero a esto puede responderse que los cartagineses, ya un siglo antes, habían demostrado sobradamente sus cualidades de navegantes, dando la vuelta completa a Africa en sentido contrario. Para mayor abundamiento, como máximo argumento, tenemos que el único volcán visible en toda la costa oeste – el Carro de los Dioses – es el monte Camerún, situado en la parte baja del Golfo de Guinea. Además, es interesante saber que en nuestros días los indígenas llaman a este volcán «Mongo ma Lobe»: la montaña de los dioses. Si Hannon, pues, sobrepasó el Camerún, sus compañeros y él muy bien pudieron haber encontrado gorilas, sobre todo si se tiene en cuenta que es precisamente un poco más allá de Banya, donde estos antropoides llegan hasta la costa.

Es cierto que en estas regiones también existen chimpancés, pero un argumento – esta vez de orden filológico – permite deshacer cualquier equívoco. Se sabe, en efecto, que el gigantesco mono recibe en su país de origen nombres tales como «n'giya» (en la región de Eveia) o «n'guile» (en Bakueli). Este nombre es, con toda claridad, semejante al que, pronunciado por los intérpretes, podía ser entendido como gorillai por oídos Cartagineses.

El nacimiento de los gorgones

Después de su descubrimiento en el siglo V antes de J. C., el gorila desapareció del pensamiento de los Europeos, por lo menos como objeto de estudios científicos. Pero resurgió, metamorfoseado, en la leyenda. ¿No es esto lo que sucede siempre con los seres raros o insólitos, los cuales experimentan, antes o después, profundas transformaciones en el espíritu de las gentes?

Por esto, a primera vista, puede resultar extraño que la imagen Gorgona, a la que nos imaginamos como una mujer fascinante con cabellos formados por serpientes, pueda haber sido inspirada por el gorila. Sin embargo, así parece haber sido.

En efecto, según la leyenda los gorgones vivían en lo más profundo de Libia, tenían los caninos tan prominentes como el jabalí y estrangulaban a los leopardos con las manos; esto concuerda bastante bien con lo que sabemos de los gorilas. Además, en las antiguas reproducciones sicilianas, Gorgona es representada con un rostro redondo que nada tiene de femenino, una nariz muy aplastada, dientes de gorila y mechones de cabello, rizados en sus extremos, que hacen pensar irremediablemente en pequeñas serpientes. Aquí se inicia la transformación radical del gorila en la Gorgona clásica.

Si a todo esto se añade que en algunas versiones del Periplo de Hannon, el término «gorillai» es ortografiado «gorgadas», sin duda como consecuencia de una mala transcripción, debe aceptarse que el origen del nombre de «gorgona» podría muy bien derivarse del de «gorila». Que los zoologos nunca hayan creído en Gorgona, con su cabeza erizada de serpientes amenazantes y su mirada que petrifica es muy comprensible; pero, por desgracia, su incredulidad persistió demasiado tiempo. Sin embargo, de la Gorgona original – es decir, del gorila – se hizo una descripción infinitamente más prosaica.

Dos mil años de incógnito

El primero que volvió a hablar del gorila, después de Hannon, fue un aventurero inglés, Andrew Battel, de Leigh, en Essex, ...casi veinte siglos más tarde.

Hecho prisionero por los portugueses, en Brasil, en 1582, Battel fue enrolado en las tropas coloniales, y enviado al otro lado del Atlántico, a San Pablo de Luanda. Durante los 18 años que pasó en el este del Africa Ecuatorial, recorrió los bosques de la región de Mayombe y del río Banya, dando detalles de gran interés sobre su fauna:

«Los bosques están hasta tal punto poblados de babuínos, de monos de todo tamaño y de loros, que cualquier hombre tiene miedo de aventurarse en ellos. Hay dos clases de monstruos que son muy comunes en estos bosques y muy peligrosos. El más grande es llamado por los indígenas Pongo, y el más pequeño Engeco.»

No es difícil darse cuenta de que el Engeco no es otra cosa que el chimpancé, que siempre ha

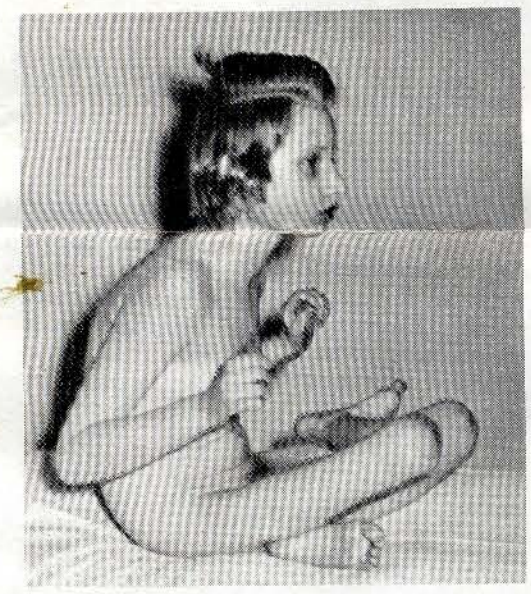
Una forma curable de retraso mental

La fenilcetonuria

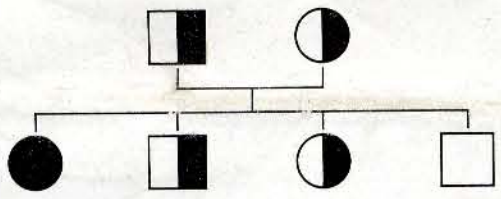
P. D. Dr. Heribert Berger
(Clínica Pediátrica de la Universidad de Basilea . Director: Prof. Dr. A. Hottinger)

Durante los últimos años, entre los numerosos tipos de oligofrenia, han sido estudiados con especial interés los que obedecen a causas metabólicas, quizá porque existe una cierta esperanza de que estas formas de retraso mental puedan ser influidas favorablemente por la terapéutica.

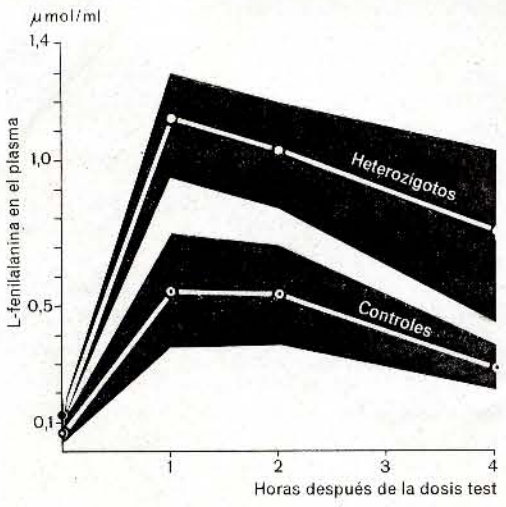
En todos los casos de oligofrenia se encuentran trastornos bioquímicos del metabolismo; puede decirse, aun cuando esto no sea demostrable en todas las ocasiones, que existe una relación directa entre las alteraciones metabólicas y los trastornos del desarrollo psíquico, en el sentido de causa a efecto. Los trastornos más conocidos son: *la fenilcetonuria; la valin-leucin-isoleucinuria; la enfermedad de Hartnup* (elevada excreción de aminoácidos y presencia de combinaciones de indol en la orina); *la arginin-succinin-aciduria;* la oligofrenia con convulsiones, edemas y *excreción de ácido alfa-hidroxi-butírico; la cistationinuria; el síndrome óculo-cerebro-renal* de Lowe con hiperaminoaciduria global; *la enfermedad de Wilson; la galactosemia;* ciertas formas de *hipoglicemia; la intolerancia a la fructosa; la sucrosuria; las mucopolisacaridosis* (por ejemplo, gargolismo); *la lipidosis;* probablemente ciertas formas de la *esclerosis difusa cerebral;* y, en un sentido más amplio, los casos con convulsiones a consecuencia de una «*vitamin B_6-dependency*» de una *hiperbilirrubinemia* y de una *hipo o hipercalcemia* con lesiones cerebrales. Para el diagnóstico de muchas de estas enfermedades, ha sido muy valiosa la determinación de la eliminación de aminoácidos por la orina: la hiperaminoaciduria parcial o global es un síntoma relativamente frecuente.



Tipica postura del sastre en una idiota fenilcetonúrica de once años (según K.Lang, Ergebn. inn. Med. Kinderheilk., N.F. Bd. 6, 78, Springer-Verlag, 1955).



Paso hereditario recesivo de la fenilcetonuria: negro: niño completamente sano; blanco: fenilcetonuria manifiesta; negro-blanco portador de genes (según D. Y.-Y. Hsia).



Prueba de tolerancia con fenilalanina: heterozigotos, es decir portadores de genes clínicamente sanos, muestran un comportamiento muy alejado de la curva fenilalanina en suero después de administración oral de 100 mg. de fenilalanina por kg. de peso corporal. Superficies grises: desviación estandard del valor medio (según D. Y.-Y. Hsia).

La fenilcetonuria es el cuadro clínico más conocido y mejor investigado entre este grupo de enfermedades. Su descubridor fue A. Foelling (Noruega) que, en 1934, pudo demostrar la enfermedad en 10 individuos entre 430 retrasados mentales en estudio.

Las probabilidades de vida en los enfermos no tratados son reducidas: sólo un tercio, aproximadamente, alcanza el tercer decenio, con cierta ventaja a favor de los pacientes femeninos. La causa de muerte la constituyen enfermedades secundarias no específicas.

Los síntomas clínicos aparecen en el cuadro compuesto por Knox, atendiendo la frecuencia de su aparición.

Síntoma	Frecuencia en %
Hiperactividad e irritabilidad	90–32
Anomalías EEG	80
Hipertonía muscular	75
Microcefalia	68
Reflejos aumentados	66
Cabello rubio, ojos azules	62
Incapacidad para hablar	63
Hipercinesia, esterotipia	50
Incapacidad para andar e incontinencia	35
Temblor	30
Eczema	19–34
Convulsiones	26

Los síntomas capitales son el *retraso mental* (sólo en raras ocasiones la inteligencia es prácticamente normal; más del 90% de los pacientes son idiotas o imbéciles), trastornos graves del comportamiento *neuro-muscular y psíquico*, y un *olor especial*, frecuentemente emanado por estos pacientes. En el período neonatal y durante los primeros meses de vida, la fenilcetonuria no es clínicamente evidente. Los signos iniciales de un retraso del desarrollo psicomotor no pueden reconocerse hasta el quinto o sexto mes. Rápidamente aumentan de un modo claro, mientras el crecimiento somático continúa normal.

Anatomapatológicamente se encuentra una atrofia del cerebro que puede condicionar una microcefalia, un retraso en la mielinización y una proliferación gliocelular reconocibles en los niños pequeños; en los pacientes de más edad se observa una gliosis de los oligodendrocitos y astrocitos con mielina más o menos normal en apariencia.

Los trastornos metabólicos, en esta enfermedad, se expresan por una anomalía congénita del metabolismo de las proteínas (véase esquema). En los individuos sanos, el aminoácido esencial fenilalanina se transforma, por la fenilalaninahidroxilasa, en tirosina. En los fenilcetonúricos, dada la gran disminución de esta actividad fermentativa – se ha supuesto una formación defectuosa de la enzima, condicionada genéticamente – este importante proceso metabólico está inhibido. La consecuencia es una acumulación de fenilalanina, que por un nuevo camino (transaminación a su cetoácido) es reducida a ácido fenilpirúvico, el cual se elimina en grandes cantidades por la orina.

Todo esto se puede demostrar de una manera sencilla, añadiendo algunas gotas de solución de cloruro férrico al 10%, a 5 cm³ de orina reciente: aparece un color verde-azulado que alcanza su mayor intensidad después de 2 ó 3 minutos. La prueba puede ser negativa cuando el contenido de la orina es menor de 10 mg%; en orinas muy diluídas; en caso de insuficiente ingestión de proteínas; o en muestras que tienen un día o más. Un color verde puro aparece en presencia de clorpromazina y bilirrubina, y en la valin-leucin-isoleucinuria. En caso de duda, puede ser útil la demostración del ácido o-OH-fenil-acético, que existe simultáneamente en grandes cantidades, o la determinación de la L-fenilalanina después de la administración oral de este aminoácido. Esta prueba de ingestión ha dado también buen resultado en el diagnóstico clínico de heterozigóticos sanos.

Todavía más sencillo es el empleo de unas tiras de papel especialmente preparadas, del tipo Phenistix, existentes en el comercio (Ames Co Ltda. Nuffield House, Piccadilly, Londres W L). Estas están impregnadas en uno de sus extremos, con sulfato férrico amónico, un tampón y una sal de magnesio. El extremo impregnado se introduce un segundo en la orina o se pone en contacto con un pañal mojado, hasta que el papel está bien empapado. En presencia de ácido fenilpirúvico, el papel se colorea de verde.

Además de la citada hiperproducción de ácido fenilpirúvico, que es reducido a ácido fenil-láctico o a ácido fenil-acético, la fenilalanina puede ser trasformada en o-tirosina, lo que se manifesta por una excesiva secreción de ácido o-OH-fenil-acético. La insuficiente hidroxilación de la fenilalanina a tirosina tiene como consecuencia un déficit *relativo de tirosina* (prácticamente se encuentran sólo disponibles la tirosina procedente de la alimentación y la existente endógenamente). Esto conduce a una insuficiente formación de melanina y adrenalina. Por el contrario la síntesis de la tirosina no se perturba.

La presencia de tales metabolitos en altas concentraciones no fisiológicas repercute sobre los procesos metabólicos más íntimos, por lo general en el sentido de una elevación de la adaptación o en el de una inhibición de la actividad enzimática. Posiblemente, la elevada secreción del ácido p-OH fenilpirúvico se deba a un impedimento de la p-OH-fenilpiruvatoxidasa en el proceso de degradación normal de la decarboxilasa, lo cual permitiría explicar el bajo contenido de adrenalina hemática en muchos de estos pacientes.

Pero también es sorprendente la forma que tiene de comportarse – en lo que a su metabolismo se refiere – un aminoácido aromático, *el triptófano*. La disminuida concentración de serotonina en los fenilcetonúricos puede explicarse por una inhibición de la 5-OH-triptófano-decarboxilasa. De aquí, y por una influencia del triptófano hidrolizado en posición 5, así como posiblemente de la triptofanopirrolasa, puede derivar la aparición, en gran cantidad, del ácido indolpirúvico, de ácido indol-láctico y de ácido indol-acético, en la orina de estos pacientes.

Estas cantidades de metabolito encontradas en proporciones anormales se pueden explicar, además de por una inhibición del proceso normal de degradación, por un aumento general del proceso de transaminación, que no está limitado sólo a la fenilalanina acumulada, sino también a la tirosina y al triptófano. Para ambas hipótesis existen pruebas directas.

Finalmente, la acumulación de fenilalanina conduce a una disminución conjunta de la concentración hemática de la mayor parte de los aminoácidos libres, y a una hiperaminoaciduria, que corresponde preferentemente a la fenilalanina.

Cuál de los metabolitos exitentes en cantidades anormales es el que finalmente ejerce una influencia tóxica sobre el metabolismo cerebral y cómo tiene lugar esto, no está explicado todavía. Es seguro que en los pacientes con una alimentación pobre en fenilalanina, un nuevo suministro de fenilalanina o de ácido fenilpirúvico conduce otra vez a la aparición de los característicos síntomas neuro y psicomotores. Se ha discutido siempre, como causa posible de los trastornos del desarrollo psíquico, la carencia de serotonina que se observa en estos casos. La inhibición de la degradación de la serotonina con iproniazida disminuye la excitabilidad de los fenilcetonúricos y mejora las modificaciones del EEG. Por otra parte, la iproniazida conduce, por inhibición de la oxidación de la o-tiramina a ácido OH-fenil-acético, a un aumento de este último en el cerebro, lo cual va ligado, según ha demostrado la experimentación en el animal, a una hiperactividad de origen claramente central y a una excitación simpáticotónica.

La terapéutica está basada en la administración de una dieta pobre en fenilalanina (menos de 16–40 mg. de este aminoácido por Kg. de peso y día), de tal manera que quede garantizada una concentración normal de fenilalanina en sangre (1 a 2 mg./100 m¹.). Con esto remiten todas las modificaciones bioquímicas anteriormente citadas, y la reacción del cloruro férrico será negativa al cabo de unos pocos días. Puesto que la mayor parte de las proteínas alimentarias contienen aproximadamente un 4–6% de fenilalanina, es también necesario, por lo general, una reducción del suministro de proteínas. Esto no es factible en los niños pequeños, por lo que estaremos obligados a recurrir a preparados especiales de aminoácidos pobres en fenilalanina.

El resultado terapéutico depende, en primer lugar, del momento en que se comience el tratamiento, sobre todo en lo que concierne a impedir la aparición del retraso mental. De acuerdo con lo que hoy se sabe, éste puede ser evitado si se lleva a cabo un tratamiento adecuado ya desde los primeros meses de vida. Si se comienza este tratamiento en el segundo año, ya no se podrá esperar un desarrollo psíquico completamente normal. Con una actuación terapéutica iniciada antes de los 5 años, todavía puede conseguirse una cierta mejoría de la inteligencia; pero si el tratamiento se instaura más tardíamente, solamente podrá lograrse una disminución de los trastornos del comportamiento, del estado neuromotor, de las convulsiones y del EEG, así como de las modificaciones de la piel y de las anomalías de la pigmentación. Hay que señalar que una dieta pobre en fenilalanina, establecida de un modo demasiado brusco, puede originar, en algunos casos, un estado epiléptico.

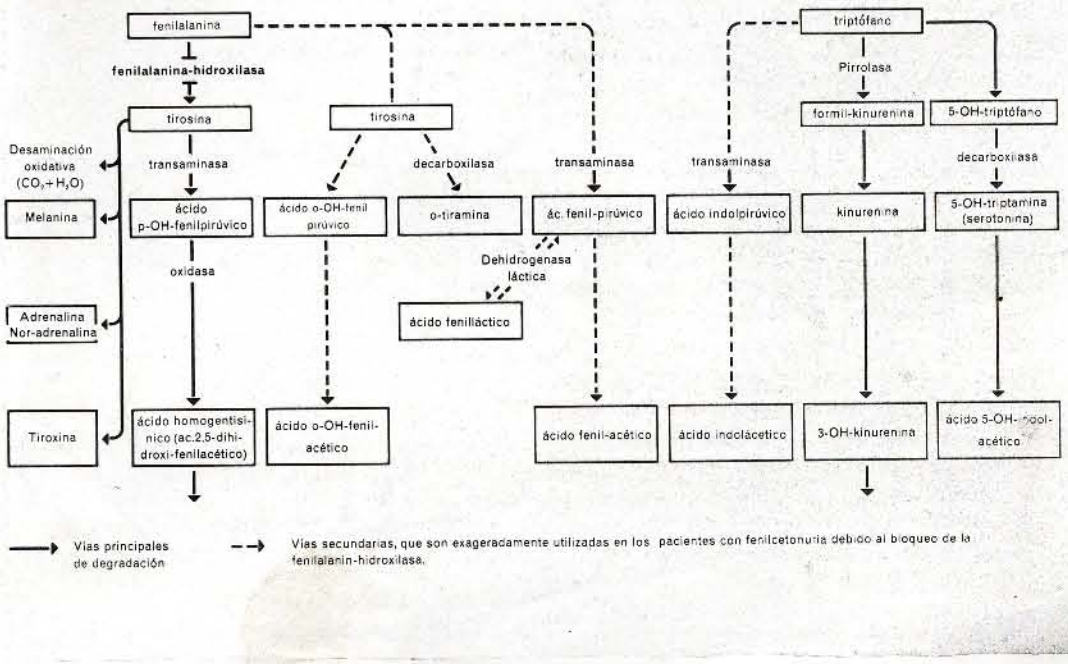
El éxito terapéutico viene condicionado, así pues, por la precocidad del diagnóstico. Puesto que en los primeros meses de vida faltan los síntomas clínicos, el diagnóstico sólo podrá ser determinado mediante ensayos bioquímicos; por esta razón es importantísima la investigación del ácido fenilpirúvico en la orina de todos los lactantes, una vez cuanto menos, a las 4–6 semanas del nacimiento. En las primeras cuatro semanas de vida, no es raro que los fenilcetonúricos no presenten ácido fenilpirúvico demostrable, debido a que en esta edad la actividad de transaminación está muy disminuida. Los casos dudosos deben ser aclarados lo más rápidamente posible en una clínica; si el diagnóstico es afirmativo será preciso establecer una dieta pobre en fenilalanina. Los hermanos de los fenilcetonúricos deben ser examinados ya en la segunda semana de vida, para determinar si existe una elevada concentración de fenilalanina en sangre.

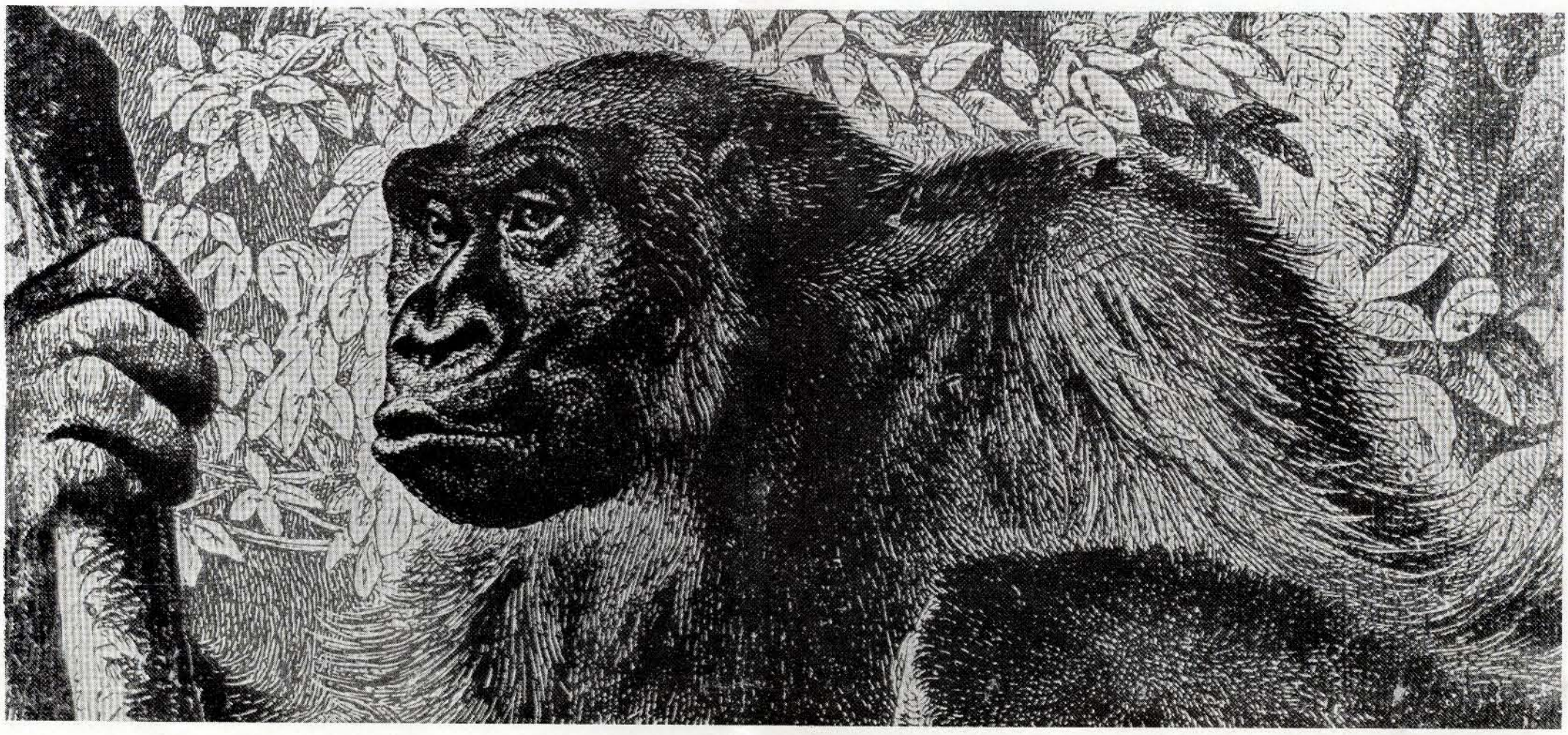
De esta manera se reconocerán una serie de casos con la suficiente precocidad para ser tratados con completa eficacia.

Todavía no se sabe durante cuanto tiempo debe ser administrada la dieta pobre en fenilalanina. En todo caso, el período crítico de la vida son los cinco primeros años, con su proceso de evolución cerebral. Más adelante quizá sea posible procurar a los niños una dieta menos rigurosa. Cuando, desde el punto de vista económico sea posible, se deben también tratar dietéticamente los casos tardíamente diagnosticados; con ello siempre se ha observado una notable mejoría de los trastornos del comportamiento y de las crisis convulsivas. Cuando el tratamiento dietético no se puede llevar a cabo por cualquier motivo, puede intentarse una terapéutica con iproniazida.

Siempre habrá de valorarse la posible aparición de un efecto paradójico a causa de la mencionada acción acumulativa de la o-tiramina. Pero todos estos puntos distan mucho de estar aclarados todavía.

El ejemplo de la fenilcetonuria muestra, una vez más, cómo la Bioquímica ha llegado a ser una base de gran importancia para la Clínica. No sólo ha abierto un nuevo camino para el estudio de la fisiología y patología del metabolismo cerebral; los conocimientos obtenidos permiten ante todo el eficaz tratamiento de una enfermedad que hasta hace pocos años se consideraba incurable.





hombre de los bosques

sido llamado n'djeko por los aborígenes. En cuanto al Pongo, hay que pensar que es, evidentemente, el gorila, denominado por los Fiodhs de Loango n'pungu.

«Estos Pongos – precisa Battel a continuación – se nutren de los frutos que encuentran en el bosque y de nueces, pues no comen ninguna clase de carne. No pueden hablar y no tienen más inteligencia que cualquier animal (...). Caminan en grupos y matan muchos negros entre los que se aventuran en los bosques. Muchas veces atacan a los elefantes que vienen a alimentarse allí donde ellos viven, y los golpean de tal forma, a puñetazos y con palos, que los hacen huir bramando. Estos Pongos nunca son capturados vivos, pues son tan fuertes, que diez hombres no consiguen dominar a uno solo.»

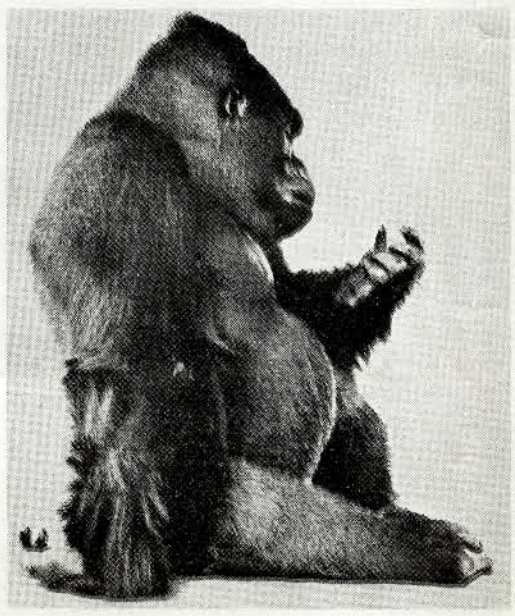
Samuel Purchas, que incluyó la narración de Battel en una colección de relatos de viajes, editada bajo sus auspicios en 1613, añadía este detalle recogido de boca del mismo narrador.

«En el curso de una charla, me confió que uno de estos Pongos raptó a uno de sus boys negros, con el que convivió durante un mes. Es verdad que no hacen daño alguno a los que sorprenden de improviso, a menos que estos no les miren fijamente, lo que hay que guardarse mucho de hacer. Dice que su altura era como la de un hombre, y dos veces más gordos. Yo he visto con mis propios ojos al negrito.»

A su vuelta de un viaje por Angola, de la Brosse, en 1738, dio la pincelada final al cuadro, contando que los gorilas (que, aparte de todo confundía con los chimpancés y los orangutanes de Asia) intentan sorprender a las negras «a las cuales guardan para divertirse con ellas, y a las que alimentan muy bien.» «Yo he conocido en Lowango – precisa – una negra que ha permanecido tres años con estos animales.»

El increible gigante peludo

Naturalistas tan preclaros como Buffon, en Francia, y lord Monboddo, en Escocia, que tenían el oido atento a los relatos de los viajeros, fueron prácticamente los únicos que, en el siglo XVIII, tomaron en serio la narración de Andrew Battel. Tanto el uno como el otro recogieron además algunos testimonios que parecían confirmarlo; desde entonces admitieron la existencia del antropoide gigante, como una especie distinta del chimpancé. El tamaño del monstruoso mono – dicho sea de pasada – se exageraba a veces. Así, Monboddo cita una carta de un capitán que traficaba por la costa occidental de Africa, según la cual el gorila, al que llamaba impungu, alcanzaba en la edad adulta de 7 a 9 pies de altura, es decir de 2,15 m. a 2,75 m.



El abominable hombre de los bosques era entonces tan poco tomado en serio como lo es hoy su colega de las altura del Himalaya. Por eso no hay que asombrarse de que Radermacher escriba hacia 1780 que «la mayor especie, descrita por Buffon y otros autores como alcanzando la talla de un hombre, es considerada por mucha gente como una quimera».

¿Cómo podrían creerse todas estas historias de gigantes peludos, sedientos de violencia, raptores de niños, violadores de mujeres, de cuya persona nadie podía exhibir el menor trofeo, el menor trozo de hueso?

Sólo el capitán, por otra parte anónimo, citado por lord Monboddo pretendía que su hijo había estudiado un fragmento anatómico de uno de estos monstruos.

«En el curso de su último viaje, ha visto la mano de uno de ellos, cortada unos 10 cms. por encima de la articulación de la muñeca. Estaba seca y marchitada, y sin embargo, aun en este estado, los dedos eran tan gruesos como tres de los suyo, o más gordos que su propia muñeca y más largos, proporcionalmente, que los nuestros; por último, la parte por donde había sido cortada era, en este estado de momificación, más ancha que un brazo en su mayor anchura; la parte superior de los dedos y todo lo demás estaba cubierta de pelos negros; la parte inferior era parecida a la de la mano de un negro.»

No puede dejar de pensarse (¡sigue el paralelismo!) en la mano momificada atribuída a un hombre de las nieves, que se conserva en el monasterio nepalí de Pangbotyi, sobre cuya naturaleza están muy divididas las opiniones de los expertos.

La verdad es acogida con desconfianza

En 1846, un misionero protestante norteamericano – J. Leighton Wilson – tropezó por casualidad, en Gabón, entre los desperdicios de una cocina indígena, con un primer cráneo de gorila; y más adelante, con otro. Poco después, su colega el Dr. Thomas Savage encontró otros, que envió a Boston al profesor Jeffries Wyman. Savage y Wyman publicaron en colaboración, en 1847, una descripción científica del desconocido mono, considerado como una especie gigante de chimpancé. En consecuencia, le dieron el nombre genérico de Troglodytes, que por aquel entonces era el del chimpancé, y el específico de gorilla, como recuerdo de la antigua denominación citada por Hannon. Además, Savage hizo llegar dibujos del cráneo del gorila al Cuvier británico, profesor Richard Owen. Este, espíritu conservador y testarudo, se negó a admitir la existencia de una nueva especie, fundándose en detalles tan nimios como esos croquis, aun cuando fueran acompañados de testimonios individuales y de creencias indígenas. Pero cuando, un año más tarde, cayeron entre sus manos dos cráneos completos, no tuvo más remedio que dar marcha atrás.

Es tal la repugnancia del espíritu humano a reconocer aquello que se sale de lo acostumbrado, que nadie quería aceptar al gorila como representante de un género verdaderamente nuevo. Simplemente, se trataría de un chimpancé de gran talla. Fue necesario que los primeros restos de gorila llegasen al museo de París, – enviados en 1849 por el Dr. Gautier-Laboullay y, después, en 1851, por el Dr. E. Franquet y en 1852 por el almirante Penaud – para que Isidore Geoffroy-Saint Hilaire, con su lucidez y valor habituales, reconociera en el gorila un género de antropoide totalmente distinto, al que denominó Gorilla gina, recordando este último vocablo el nombre indígena de n'gina.

Pero no creamos que con esto terminó la era de incredulidad: pensar así, sería desconocer la naturaleza humana.

Cuando, en 1861, el explorador franco-americano Paul de Chaillu, señaló que durante sus cuatro años de aventuras en Africa, se había encontrado en diversas ocasiones cara a cara con el gorila y que, incluso, había matado algunos, pocos fueron los sabios que le creyeron. Sin embargo, todo lo que contaba era rigurosamente cierto, aunque lo hiciera con gran riqueza de verbo y excelente sentido dramático.

Contaba que para desafiar a sus enemigos, el gorila se golpea el pecho con sus enormes puños, haciéndolo resonar como un tambor que se puede oir, por lo menos, hasta una milla de distancia. Pretendía que, con un solo zarpazo, el gorila era capaz de despanzurrar a un hombre y destrozarle los miembros.

Todos estos detalles, juzgados como inverosímiles, sirvieron de pretexto para afirmar que Chaillu no había matado un solo gorila y que, ni siquiera, los había visto. (Sin embargo, su veracidad ha podido ser demostrada, después, muchas veces.) Winwood Reade, especialmente, escribió: «Después de cinco meses de estudios detallados, he podido comprobar que el gorila jamás se golpea el pecho de esta manera, ni ataca al hombre de la forma descrita. M. du Chaillu ha escrito sobre el gorila bastantes cosas que son verdad pero no son nuevas, y algunas otras que son nuevas pero no verdad.»

De las calumnias siempre queda algo. El primer hombre blanco que, en nuestros días, hizo frente al gorila, es tenido todavía como una especie de barón de Munchhausen.

¿No debería todo esto hacer reflexionar a quienes se encogen de hombres ante la sola mención del abominable hombre de las nieves y que, incluso, pretenden que se ha demostrado su inexistencia?

Bernard Heuvelmans

Nuevas investigaciones de SANDOZ

Ololiuqui, la tercera droga azteca

En la antigua civilización mejicana, las plantas cuyos principios activos originan profundas acciones psíquicas, cumplían una importantísima misión en las ceremonias religiosas tan unidas, en aquellas culturas, con las prácticas médicas. Las tres plantas fundamentales eran el peyotl (un tipo de cactus), el teonanácatl (variedad de hongo) y el ololiuqui (especie de enredadera).

La sustancia activa del peyotl (mescalina) es conocida desde hace mucho tiempo. Las del teonanácatl – psilocibina y psilocina – fueron aisladas en los Laboratorios SANDOZ hace algún tiempo (ver PANORAMA, noviembre 1961).

Hace aproximadamente un año, R. Gordon Wasson, con el que ya habíamos colaborado en nuestras investicaciones sobre el hongo mágico mejicano, pudo proporcionarnos dos muestras diferentes de semillas de ololiuqui, recolectadas por un indio zapoteca en las proximidades de Oaxaca, en el sur de Méjico. A partir de estas semillas, se pudieron cultivar en estufa la Rivea corymbosa y la Ipomoea tricolor (véase figura).

De OLILIVHQVI, seu planta orbicularium foliorum. Cap. XIV.

OLILIVHQVI, quam *Coaxihuitl*, ſeu herbam Serpentis alij vocant, volubilis herba eſt, folia viridia ferens, tenuia, cordis figura. caules teretes, virides, tenueſq; . flores albos, & longiuſculos . ſemen rotundum ſimile Coriandro, vnde nomen. radices fibris ſimiles, calida quarto ordine planta eſt . luem Gallicam curat . dolores è frigore ortos ſedat . flatum, ac præter naturam tumores diſcutit . puluis reſina mixtus pellit frigus . luxatis aut fractis oſſibus, & lumbis fœminarum laxis, aucto robore mirum auxiliatur in modum. S eminis etiam eſt vſus in medicina, quod tritum, ac deuoratum, illitumq; capiti, & fronti, cum lacte & *Chilli*, fertur morbis oculorum mederi . deuoratum verò, venerem excitat. Acri eſt ſapore, & temperie, veluti & planta eius, impensè calida . Indorum ſacrifici cum videri volebant verſari cum Superis, ac reſpõſa accipere ab eis, ea veſcebãtur planta, vt deſiperent, milleq; phantaſmata, & dæmonũ obuersãtium effigies circumſpectarent . qua in re Solano maniaco Dioſcoridis ſimilis fortaſſe alicui videri poſſit.

El dibujo más antiguo conocido de la Rivea corymbosa (de «Rerum medicarum Novae Hispaniae thesaurus» de Francisco Hernández), siglo XVI.

El primer dibujo conocido del ololiuqui (véase figura) procede de un médico español, Francisco Hernández, que llevó a cabo por encargo de Felipe II, entre los años 1570 y 1575, una extensa investigación sobre la flora y fauna de Méjico. En el año 1897, el ololiuqui fue identificado por Manuel Urbina como la Rivea corymbosa (L.).

Sus semillas son empleadas hoy día con fines mágicos por ciertos descendientes de los indios, que viven relativamente aislados en la comarca montañosa del sur de Méjico, en la provincia de Oaxaca.

El farmacólogo sueco C. G. Santesson[1], en el año 1937, emprendió un primer ensayo para aislar el principio activo de la rivea corymbosa. Sin embargo no consiguió aislar ningún compuesto definido cristalizado. Por el contrario, encontró que el extracto alcohólico ocasionaba en ratones y ranas «una parálisis parcial del cerebro, una especie de narcosis o sub-narcosis». En el año 1955 H. Osmond, psiquiatra canadiense, hizo una serie de auto-experimentos con semillas de ololiuqui: después de la ingestión de 60 a 100 semillas caía en un estado de apatía, con pérdida de los impulsos, que iba acompañado de una hipersensibilidad visual. Después de cuatro horas aproximadamente, seguía un período de bienestar con relajación que duraba largo tiempo.

La extracción de las simientes, procedentes de Méjico, mediante los cuidadosos métodos desarrollados en nuestros laboratorios para sustancias muy delicadas, condujo al aislamiento de una fracción alcaloide que presenta la reacción del indol. Los experimentos muestran que esta fracción alcaloide contiene la materia activa psicotropa. Mediante un procedimiento de separación cromatográfica, se consigue separar la mezcla de alcaloides en seis componentes sencillos cuanto menos; de ellos, han podido obtenerse en estado cristalizado cinco componentes esenciales. Una investigación química más amplia condujo a la sorprendente aparición de bases del tipo del alcaloide del cornezuelo del centeno. Uno de los tres alcaloides cristalizados resultó ser idéntico a la d-amida del ácido isolisérgico; el segundo era la d-amida del ácido lisérgico; y el tercer componente cristalizado se pudo identificar como chano-clavina, un alcaloide que hace algunos años fue aislado en nuestros laboratorios a partir de un cultivo saprofítico de un hongo del cornezuelo del centeno. Los cuarto y quinto compuestos demostraron ser idénticos al alcaloide elymoclavina, y al alcohol correspondiente al ácido lisérgico, el lisergol.

El tipo de acciones farmacológicas, resulta de la estructura especial de la chanoclavina (véase fórmula) está todavía por aclarar. En todo caso, parece ser que no existen en la chanoclavina las propiedades típicas de las sustancias del cornezuelo del centeno, como por ejemplo las acciones uterotónica y vasoconstrictora.

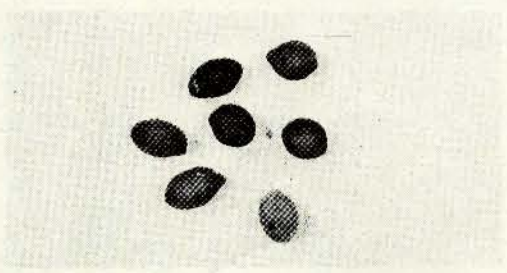
Como se deduce de la fórmula, existe una especial afinidad químico-estructural entre la sustancia activa del ololiuqui y el principio psicotrópico de las sustancias activas del hongo mágico mejicano (teonanácatl), esto es psilocibina y psilocina. Como estas son también sustancias derivadas del indol, muestran, como él, un caracter estructural que hasta ahora sólo había sido encontrado en los alcaloides del cornezuelo del centeno, y ahora en los del ololiuqui. Este carácter estructural reside en la sustitución en posición 4. Sobre la posible relación entre esta sustitución en posición 4 y la actividad psicoticomimética, ya se ha hablado anteriormente.

La aparición de los alcaloides del cornezuelo del centeno en la antigua droga mágica azteca ololiuqui, representa un hallazgo muy interesante desde el punto de vista citoquímico, puesto que los derivados del ácido lisérgico hasta ahora, sólo han sido encontrados en los hongos inferiores de la especie claviceps. Por esto fue sorprendente encontrar en una planta superior, de la familia de las trepadoras, algunos representantes de los alcaloides empleados, en tantas ocasiones, en terapéutica.

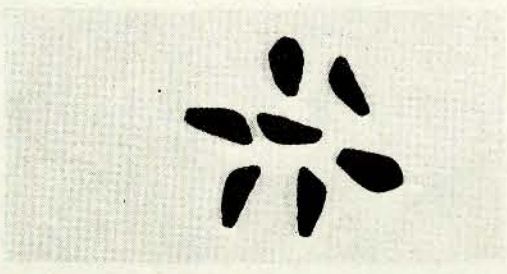
La gran actividad psicoticomimética de las amidas del ácido lisérgico obtenidas por síntesis, por ejemplo, la d-dietil amida del ácido lisérgico (LSD 25, Delysid), fue descubierta en nuestros laboratorios antes de que tales combinaciones se extrajeran de la naturaleza formando parte los principios activos de una antigua y secreta droga mágica.

Rivea Corymbosa

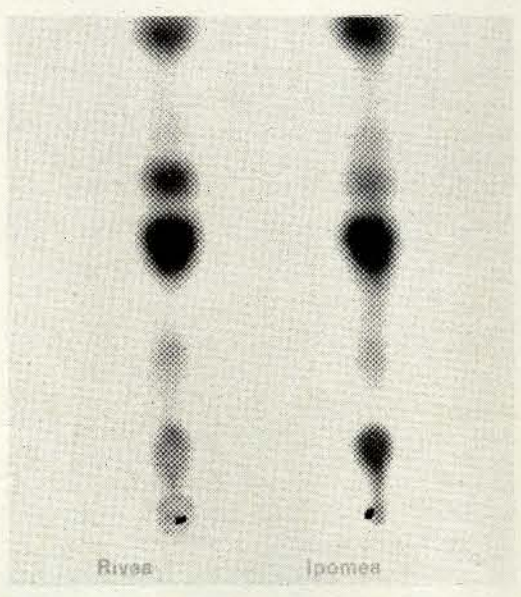
Ipomoea tricolor



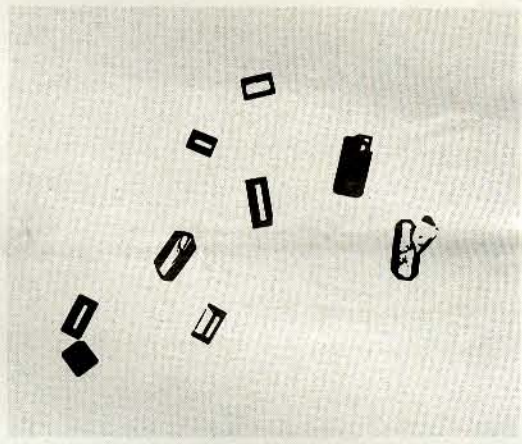
Semillas de rivea corymbosa

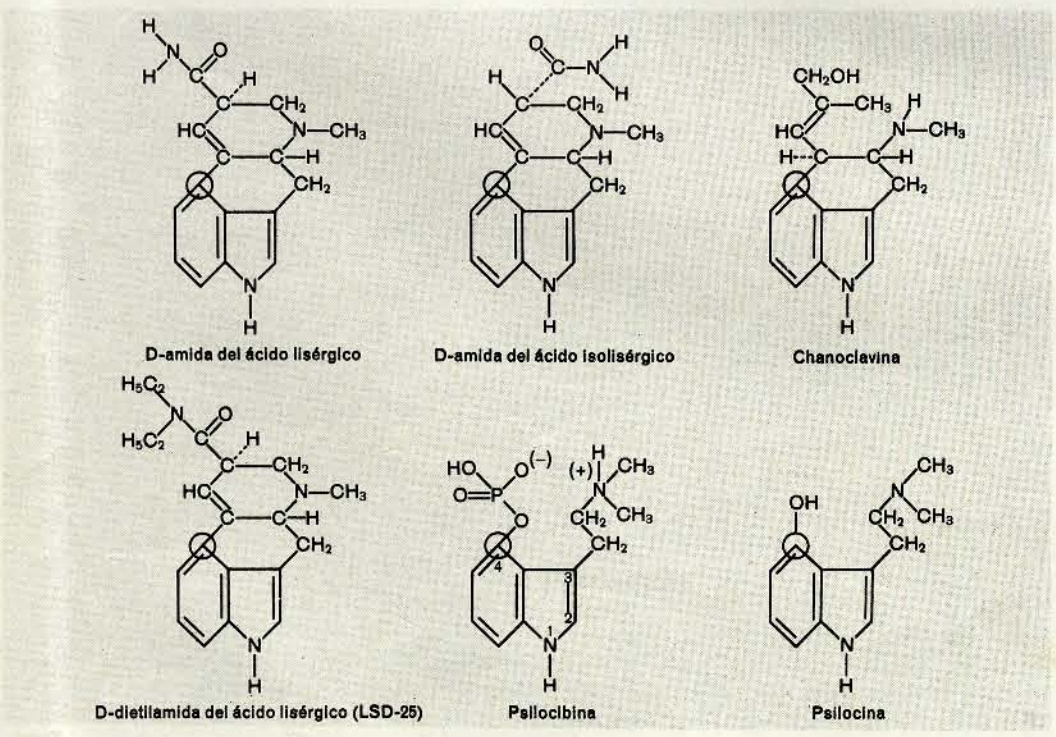


Semillas de Ipomoea tricolor



El cromatograma muestra que las semillas de cada una de las dos plantas contiene, por lo menos, cinco alcaloides diferentes.





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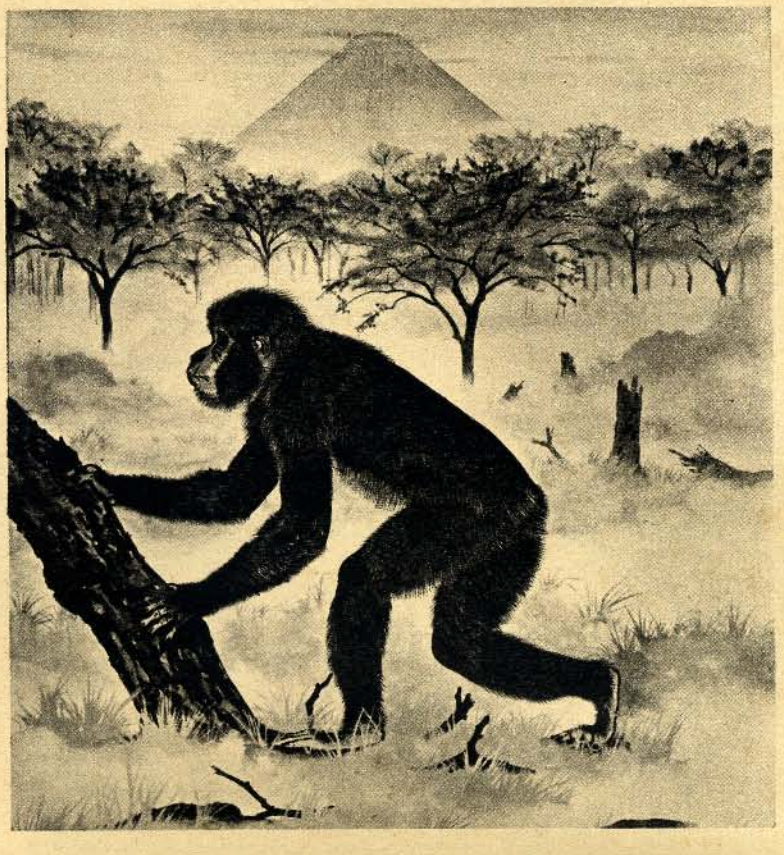
When Man First Stood Up

By JOHN PFEIFFER



PRE-MEN — Man's emergence may be considered in three stages, the first (some 10 to 4 million years ago) that of an advanced ape, standing erect and using sticks and stones as tools. No remains are known, but it probably resembled these still earlier creatures: Proconsul (top) and *Oreopithecus*.

SOMEWHERE in Africa, perhaps four million or so years ago, our remote ancestors arose from a variety of unusual apes, and evolution was off on a new tack. They were innocents about to be corrupted, peaceable vegetarians about to become aggressive meat-eaters, clever primates about to be transformed into a breed of relative geniuses. Members of a minority species on the make, they may have found the going rough in the beginning. But their rise was steady until—quite recently, perhaps 100,000 years ago or less—modern man, *Homo sapiens*, emerged with pre-eminent status in a world once dominated by stronger and faster and bigger animals.

The scientific study of this notable feat of social-climbing is on a rising curve. Much of what we know has been turned up within the past five years or so—although the first big discovery, of Neanderthal man in a dynamited cave near Düsseldorf, Germany, came more than a century ago—and new discoveries continue, like evolution itself. There is a growing awareness among social scientists and psychiatrists that a fuller understanding of what we were in times past can provide significant insights into why we behave as we do today—and what may become of us from here in.

Current studies confirm the notion that things did not happen in a blaze of glory, a great evolutionary spurt. Man's coming, like the coming of the half-billion species that preceded him, was a gradual affair resembling a sunrise rather than a bolt of lightning. But it may be considered as a three-stage process:

(1) An advanced-ape stage which saw early developments in achieving an upright stance and using tools. The changes may have taken place during the period from 10 to 4 million years ago.

(2) A transition stage marked by the increasing use of stone tools and the beginnings of regular meat-eating. The trend was well under way two million years ago, give or take a few hundred millenia.

(3) An early-man stage featuring the rise of hunting and increasingly sophisticated social behavior. This stage probably started a million to half a million years ago, and lasted until the rise of *Homo sapiens*.

FOR an idea of life in Stage 1 times, imagine an aerial view of an African landscape as it appeared early one July morning in the year 4,000,000 B.C. Below us are yellow-brown grasslands on a wide level plain that extends to the horizon. Trees are scarce, except for dense groves growing along the banks of a small river and forming a long winding ribbon of dark green.

Now we descend for a close-up of one tree where hairy animals are stirring. The branches part and we see an ape, a slim-bodied creature which looks something like a chimpanzee, with a wrinkled face and large ears and a quizzical look in its eyes.

Then 50 to 60 individuals, the entire troop, come down from the trees and we notice what distinguishes them from other apes. They do not go on all fours but stand erect, somewhat stooped over as if they were still learning the trick. They are hungry and their eating place lies more than a mile off; on the way are stretches of tall grass and bushes where lions and other killers lurk. All at once, the troop is on the go. A group of large juveniles and adults takes the lead—followed by a nucleus consisting of females, infants, younger juveniles and the biggest and most dominant males. Another group of large juveniles and adults forms the rear guard.

The little regiment reaches an open area, and feeding begins. Some individuals dine in conventional style, pulling up shoots and roots with their fingers. But one of the apes is hard at work with a rock in its hand, awkwardly making a crude point at the end of a stout branch; others are using such branches to dig deep for succulent tubers and bulbs.

Suddenly a warning call indicates danger. All eyes are focused on a clump of bushes about 100 yards away. One of the older leaders has a digging stick in one hand, he moves steadily toward the spot and, without stopping, picks up a heavy stone with his free hand. Half a dozen similarly

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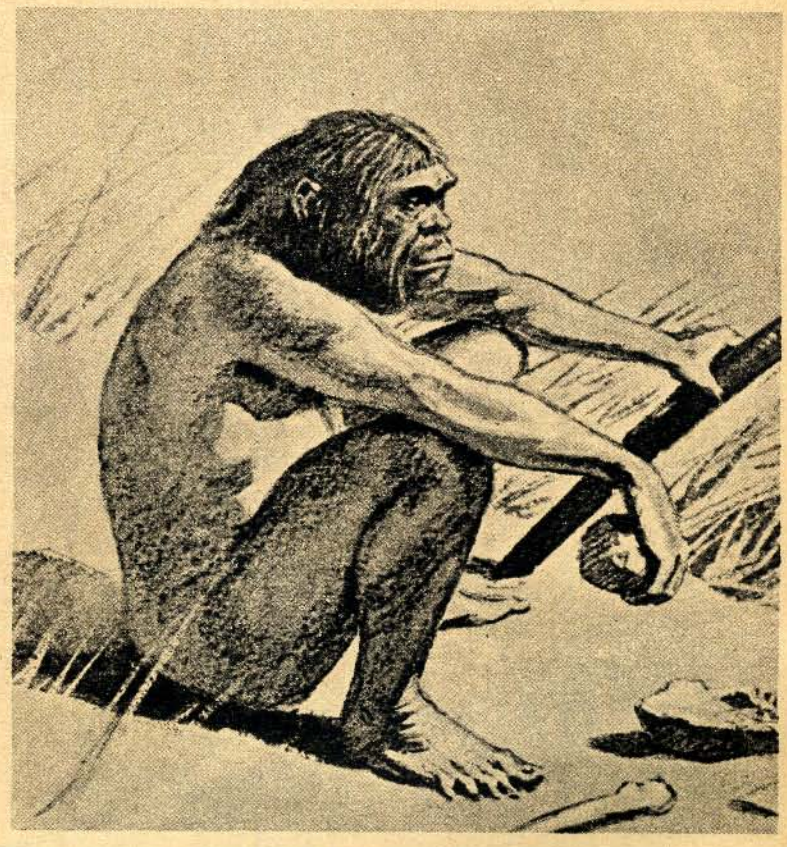
JOHN PFEIFFER has written several books on science and worked with Carlton S. Coon in the preparation of Horizon's "The Search for Early Man."



APE-MEN—By two million years ago, a group knowr. as Australopithecines had emerged. They were meat-eaters and hunters (top), and one of them, *Zinjanthropus* (shown in a reconstruction based on remains found in Tanganyika's Olduvai Gorge), was the first known tool-maker.

TRUE MEN—Stage 3 began a million to half a million years ago. These early men included Java man (top) and Peking man, both *Homo erectus*. Their hunting and social organization were well-developed. Modern man, *Homo sapiens*, appeared perhaps 100,000 years ago.

armed males join him. The group is too much for whatever is crouching up ahead, and something swishes away through the grass in search of prey with less formidable weapons.

THIS reconstruction of the distant past is not based on fossil records or other remains. The evidence is indirect, involving, among other things, new and continuing studies of contemporary monkeys and apes in the wild. Many of the observations have not yet been published, but already enough is known to upset some long-held beliefs about the limitations of subhuman primates. For example, it is a safe bet that tools were used by extinct apes in the process of becoming men. Chimpanzees, which presumably rank somewhat lower on the evolutionary scale, show hitherto unsuspected abilities in this direction—unsuspected, that is, until a young Cambridge zoology student named Jane Goodall started observing them nearly five years ago in the forests of northwest Tanganyika.

She has seen more than one chimpanzee use a crumpled leaf to sop up drinking water from a hollow log, or use a leaf as a napkin to wipe sticky hands. But her most publicized observation concerns a form of toolmaking, or at least incipient toolmaking. According to Miss Goodall (now a baroness, having married Baron Hugo von Lawick, a photographer assigned to record her *(Continued on Page 73)*

When Man First Stood Up

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work in Tanganyika), a chimpanzee will go after termites by taking a twig or vine, pulling off side branches, and sticking it into a hole in a termite hill.

From there on, things happen quickly. Termites cling to the intruding implement and other termites cling to the clingers, so that by the time the ape pulls it out there is a teeming blob of insects at the end. Then he promptly licks them off—like a lollipop. Termites are one of his favorite foods, and he may keep up this form of hunting for as much as two hours. Furthermore, he may anticipate a meal, preparing a twig before setting out to find a suitable termite hill. Investigators feel that if chimpanzees are capable of such ingenious workmanship, it seems reasonable to assume a rather higher order of behavior among more advanced species —for example, using a tool to make a tool as in the case of sharpening sticks for digging.

BUT we can infer just so much from reports of chimpanzees. Those observed to date roam in forests where they have hardly any enemies, and live a loosely organized, easy-going life. This was certainly not the case with our apish forefathers, who occupied grassy savanna lands, were more vulnerable to predators and needed a talent for social organization.

For a rough parallel among present-day primates, we turn to baboons, which generally live in such country and happen to be relatively easy to observe. For example, Sherwood Washburn of the University of California and Irven DeVore of Harvard University have seen baboons moving across Kenya savannas in vanguard - rear - guard formation and there is every reason to believe that prehuman primates did the same thing. (Indeed, this universal pattern was used in covered-wagon trains and the naval convoys of World War II.)

There is a great deal more to be learned from such studies. An emergency is no time to jockey for position or choose a leader or debate a suitable course of action. That must be done beforehand, which is one reason why we have fire and air-raid drills. The baboon troop operates on a similar principle, the big difference being that it has evolved as an organic unit and life is a continual series of "drills" from infancy onward. Every member of the troop knows, or will soon know, its

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place in a strictly organized hierarchy.

Baboons are relaxed and affectionate much of the time. In a typical domestic scene one female may be grooming another, an act which not only helps control ticks and other parasites, but also produces intense sensual pleasure. Infants scramble nearby, playing the baboon equivalent of king-of-the-hill or follow-the-leader or hide-and-seek. Adult males are always around to keep an eye on things and stop games when they get too rough.

Of course, there is always an undercurrent of tragedy. Baboons would have good reason for sustained sadness if they were built that way. A troop, the product of ages of evolution, is designed above all to preserve and nourish its young and it does a good job; after all, baboons have survived for some 30 million years. But still life is cheap. About 7 out of every 10 infants and juveniles die before the age of 3 or 4, the victims of injury and disease and predators. Our primate ancestors may not have had a much better record.

Furthermore, they probably had to contend with drier times and constantly threatened food shortages. Even a slight decrease in rainfall on the savanna is enough to reduce vegetation appreciably, and to encourage the first signs of premeditated meat-eating. Wild monkeys and apes eat practically nothing but plant food, with an occasional snack of insects for variety. They will eat meat on occasion — for example, when a baboon happens to find a nest with eggs or fledglings in its path, or a newborn gazelle. Sometimes there is a brief chase for a hare or a small monkey. But meat-eating tends to be quite rare and casual.

The apes that preceded us lived under greater pressure and may have begun to be more conscious of meat as a dietary supplement. Perhaps they were part-time scavengers, competing now and then with jackals and vultures for the remains of lion kills. But the odds are that they were not habitual killers. Not yet.

THAT came during Stage 2, about 2 million or 3 million years ago. To picture what was happening then, we take another imaginary trip to Africa for a view of another kind of creature. It is a grassy savanna scene, dry and dusty and hot, and the troop rests on a rocky rise overlooking the plains. Judging by the sight of troop members squatting and feeding at their leisure, evolution has not made

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BABOONS—Studies of their behavior in the wild have given scientists a rough parallel for that of our apish forefathers.

(Continued from Page 76)

any spectacular advances since Stage 1. Although the squatters are a bit more slender and less hairy than their predecessors, they still look very much like chimpanzees.

But differences become evident as soon as one of them suddenly gets up, ready for action. There is nothing awkward or stooped-over about his stance. He moves erect, looks over to a ledge in the near distance at his right and breaks into a run. He races at top speed among the rocks, chasing and shouting at a brown animal about the size of a collie. The animal, a small gazelle, runs faster but cannot keep it up for long, and finally we see it cornered with its back to the ledge. The hunter comes in for the kill with a rock in his hand.

He picks up his victim and carries it back to a place where some hand-sized stones have been piled. Taking one of them, he knocks chips off opposite sides with another stone, and makes himself a crude but effective cutting and chopping edge. Within 10 to 15 minutes he has dismembered his prey and is busy eating. Vultures fly overhead. They will come down later and clean up what remains. A new predator is establishing itself among the animals of the savanna.

The killer and others related to him belong to a group of extinct species known collectively as "australopithecines," which, literally translated, means "southern apes" (they were discovered about 40 years ago in South Africa's Transvaal). But no one regards them as apes. They were somewhat more than that, though somewhat less than men—so, logically enough, they have been called ape-men. They exhibit an extraordinary combination of features — something like a house with a colonial exterior, Victorian furniture and gaslights in the living room, and a kitchen equipped with a built-in, eye-level radar range. Mankind was in the process of being shaped, but not very systematically. Different parts of the body evolved at different rates.

The ape-man had a hand only slightly more advanced than that of the chimpanzee. Fossil remains indicate that the thumb was broad and flat at the end, hinting at the beginnings of a human-style grip. Otherwise, the hand might be difficult to distinguish from an ape hand. Moreover, his brain was basically an ape brain. Most brain-case specimens indicate a capacity of 450 cubic centimeters to 550 cubic centimeters, which is about a pint. This compares with 350-480 cubic centimeters for male chimpanzees, 380 to 655 for male gorillas and 1,200 to 1,500 for modern man.

So far, the ape-man seems to be all ape, but there is considerable evidence on the human side. Most of it has come from the Olduvai Gorge in Tanganyika, a small-scale Grand Canyon rich in the remains of our ancestors and their fellow animals.

This remarkable site is the fossil-hunting reserve of Louis Leakey, certainly the most accomplished showman among top-ranking investigators of human evolution. Six years ago, at a meeting in Leopoldville, he invited a few privileged colleagues to a behind-closed-doors showing of a new find, which he removed gingerly and dramatically from a black box. It was the beautifully preserved skull of an 18-year-old ape-man, the first such find at Olduvai.

Leakey continues to pull significant material out of black boxes, and further announcements may be expected in the not too remote future. His latest finds include two skull fragments belonging to an individual with an estimated brain capacity of about 675 cubic centimeters and perhaps representing an early man rather than an ape-man. (The distinction is not always easy to make.) Certainly these species moved erect in the fullest sense. Their feet were no longer the slight-

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ly modified grasping limbs of apes, but had been redesigned for effective walking and did not differ significantly from 20th-century feet.

Working together with his wife Mary, a prominent archeologist, Leakey has obtained further material bearing on the advanced capabilities of these strange transition creatures. They have excavated a number of "living floors"—that is, sites where objects lie relatively undisturbed in about the same positions they had in prehistoric times.

Careful digging has revealed an intriguing living floor at the bottom of Olduvai Gorge, a site by the shore of a lake where campers built something that endures after the passage of 2,000 millennia. They left a shallow saucer-shaped depression about 10 feet in diameter surrounded by stones in a semicircular pattern, some arranged in piles. This may be the remnant of a sheltering wall or windbreak, the oldest structure of its kind known. Incidentally, the stones it was made of did not exist anywhere near the site and were brought in, perhaps from places at least three or four miles away.

Other excavations indicate the nature of Stage 2 meat-eating. Numerous chunks of rock, also brought from a distance, were probably used "as is" to bash bones so that the marrow could be extracted. The earliest known manufactured implements, so-called pebble tools, served to open up and dismember prey. Leakey, a do-it-yourself enthusiast as far as prehistory is concerned, has himself made pebble tools and performed the entire operation — all within 20 minutes. Incidentally, he has reason to believe that manlike prehistoric creatures caught animals with their bare hands. In his younger days (he is now 61) he ran down hares by anticipating which way they would dodge, and he once stalked a gazelle until he was close enough to bring it down with a flying tackle.

There is more to the meat-eating story. The lowest and oldest Olduvai sites include the remains of birds, frogs, fish, lizards, rats and mice and the young of larger animals, including various kinds of antelopes.

If prehuman apes were indeed scavengers, their descendants had gone at least a step or two further. The earliest Olduvai inhabitants did not depend on the success of local carnivores. They obtained their own meat. But notice that all the bones found at their sites are the bones of small animals. Since they concentrated on prey which could be

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caught by an individual working on his own, they certainly did not rate as great hunters. On the other hand, they were regular meat-eaters.

THEIR descendants dominate the records of Stage 3 times, as we can tell from a reconstruction of Olduvai about half a million years ago. Once again, we take an imaginative trip into the past. A lake more than five miles across is fed by streams winding gently across the open plain, the run-off from nearby mountains. There is a stirring not far from the lake. Half a dozen hunters, strung out in a line, walk steadily forward, beating the ground with branches.

They obviously represent a new breed of animal; there is nothing chimpanzeelike about them. They stand some 5 feet tall, and their faces no longer resemble the almost human, and yet so remote, faces of apes. We see a human expression, a recognizable look in their eyes which signifies a higher intelligence and new purposes. These creatures are the first true men—members of the genus *Homo erectus*.

ANTHROPOLOGIST—Dr. Louis Leakey, expert on the ape-men of Olduvai in Tanganyika, shows jaw and skull fragments.

Crashing along through the underbrush ahead of the hunters is the prey—a sheep, but a sheep far more formidable than the domesticated variety familiar to us. This one is a giant, high as a horse, with horns that measure some 12 feet from tip to tip, or more than twice the distance between the headlights on your car.

Suddenly the crashing stops; the hunters shout in mounting excitement. The sheep has been driven into a bog, and the hunters proceed to kill it with bashing rocks and pick-like tools and wooden spears. There is a feast as they sit near the bog, devour the meat, break the marrow bones and throw the jawbones and other debris over their shoulders.

Traces of this scene have been uncovered at Olduvai, in a more recent living-floor layer above layers containing evidence of the ape-men. The foot bones of the sheep were found sticking up vertically in a clayey depression, a type of deposit marking the location of a prehistoric bog. Splintered bones lay near the clay and, farther away, were quantities of unshattered inedible bone. So the record tells what occurred, almost as clearly as if it had been written down in words. It is a plausible guess—but no more—that the sheep was driven into the bog with malice aforethought, instead of having wandered there accidentally.

THE remains of many other animals have been found at sites of about the same period—giant forms, including pigs as big as rhinoceroses, and baboons bigger than gorillas, as well as buffaloes, giraffes with antlers and horses. Although less massive animals were also killed, the trend is clear. It was a steady shift from small game to big game—a shift which provided more food for more mouths, with less total effort.

Another reason for the shift may have been psychological—an increasing taste for red meat. In any case, the reper-

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cussions were considerable. There is an enormous difference between bagging a hare with a rock, or running it down, and going after a creature that can kill you—and often does.

Our ancestors did not start with a big brain, ready-made for hunting and advanced tool-making and speech. They started with a relatively small brain, an ape brain, but one which could create conditions favoring its own expansion—its own obsolescence, if you will.

Big-game hunting was important in this Operation Bootstrap, calling for a new order of organization. Ten individuals working together could do far more killing than 10 rugged individualists each going off on his own. Hunters had to communicate with one another and explain plans. They often gathered not where their prey was, but where it would be at some future time, and they had to wait and share after the killing was done.

Such demands put a premium on increased intelligence. Individuals with special talents for playing on teams lived longer and had more offspring than their less cooperative brethren. As a result, there was a notable increase in the size of the brain. In fact, by 500,000 to 300,000 B.C., it had increased 75 per cent to nearly 100 per cent—putting it in the lower range for contemporary brains.

THE expansion of the brain was accomplished at a price—and we are still paying. Nature faced a difficult engineering problem. The female pelvis could be enlarged to allow for the delivery of bigger-brained babies, as it had been during Stage 2—but only to a point. Individuals with wide hips and related modifications do not make good runners, and running had advantages with predators on the prowl.

A compromise had begun to be worked out over the millenia of Stages 1 and 2. It called for babies with brains as big as possible short of severely endangering the mothers' mobility and safety—and an arrangement whereby most cerebral growth, about 75 per cent, took place after birth. One effect was that offspring remained helpless much longer—six to eight years as compared with a year for chimpanzees and perhaps three years or so for the apemen.

We are still struggling to make the best of this compromise. The infant now has time to form exceedingly deep attachments to its parents, particularly to its mother, and its future security and mental health depend largely on the quality of those attachments. Psychiatrists have yet to determine the benefits, and drawbacks, of this situation for individuals living in a world no longer made of little bands hunting in the wilderness.

Studies of human evolution draw attention to another problem. The notion that we can blame our extreme aggressiveness on the "animal" side of our prehuman nature simply does not jibe with observations of monkeys and apes in the wild. We are the only primates to have made a major thing of fighting. According to one theory, that was tolerable as long as hunting was in its heyday and men, or pre-men, could take out their aggressions primarily on other species. But this form of release lost its point some 10,000 years ago with the invention of agriculture, probably by women who were in charge of gathering vegetable foods.

"Agriculture frustrated man's chief outlet for aggression. So men turned their aggressiveness on themselves and created war."

For modern men — or, at least, some modern men—agriculture was a catastrophe. It produced the first technological unemployment, reducing hunting to an invigorating, but essential, sport for people with time on their hands. To make things worse it also led to food abundances and population explosions and cities — where people, more people and more kinds of people, were brought closer than ever before.

In other words, agriculture frustrated man's chief outlet for aggressions—at the same time confronting him with a variety of his fellow creatures, close at hand. So men turned their aggressiveness on themselves and developed such things as organized crime, social and political in-fighting and warfare.

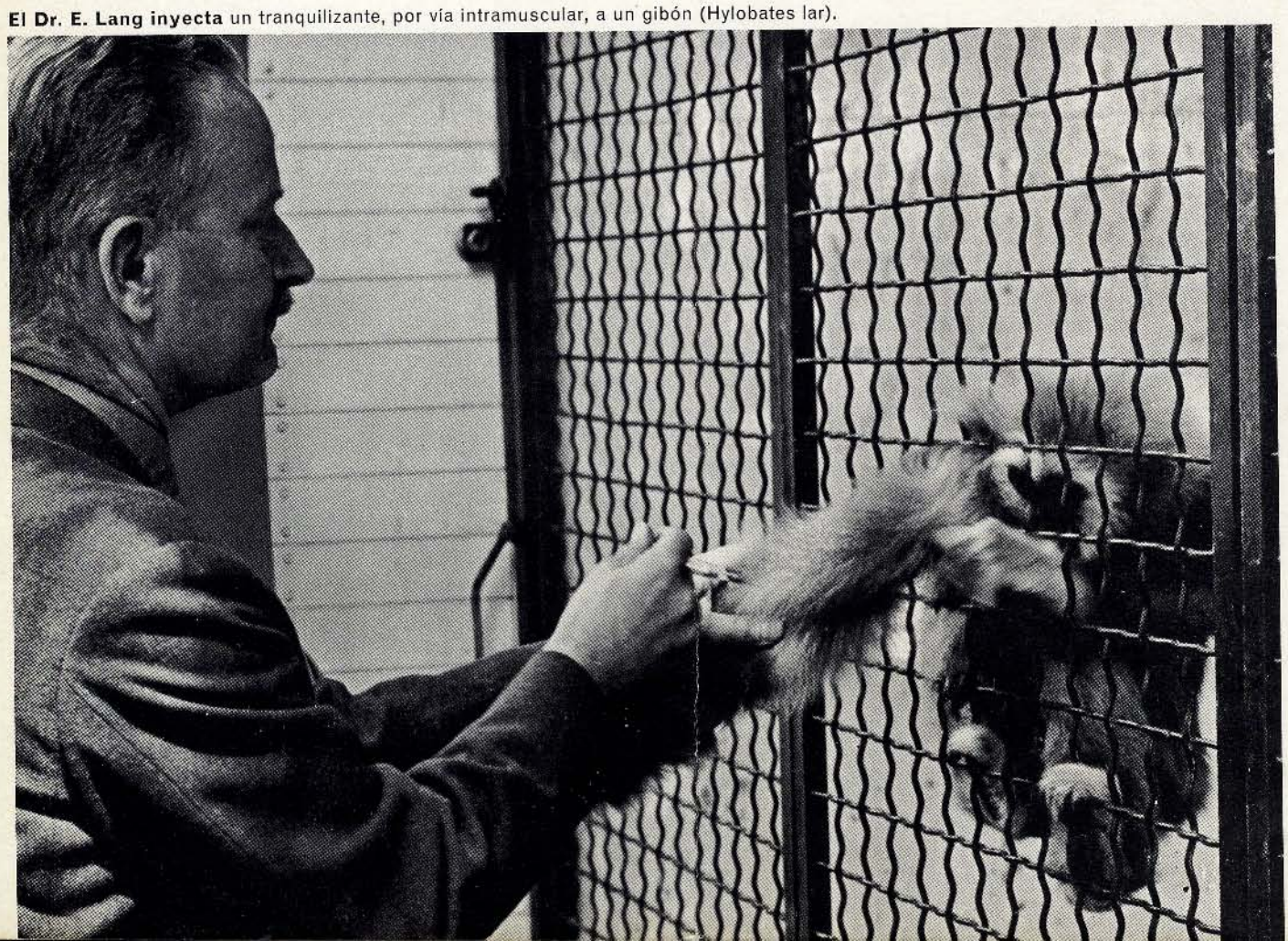
Whether or not this theory can account for our present problems, violence is essentially our creation and not a heritage from lesser species. That implies it can be unlearned. As the Austrian naturalist Konrad Lorenz once commented: "Man appears to be the missing link between anthropoid apes and human beings."

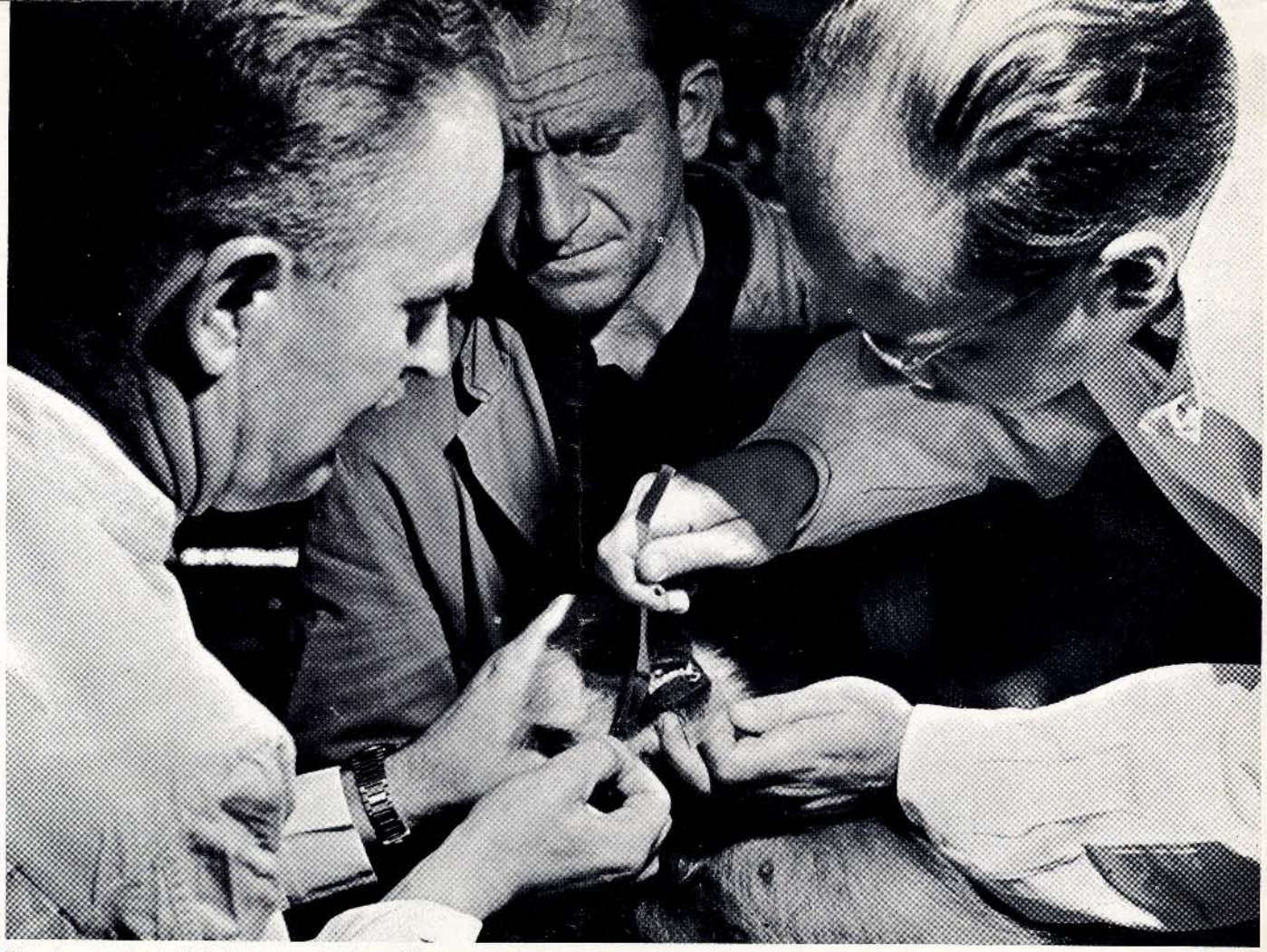
Los cromosomas y la evolución de los primates

Hace apenas cien años, Darwin publicaba su obra «Del origen de las especies». Desde entonces, muchos hombres de ciencia, inspirándose en sus trabajos, se han esforzado en reunir pruebas que, en gran parte, confirman la verdad de las doctrinas darwinianas.

Métodos nuevos, de los que cabe esperar toda clase de revelaciones sobre los mecanismos de la evolución, permiten, desde hace poco, estudiar en detalle los cromosomas de los mamíferos. Salvo algunas excepciones, se admite generalmente que el número y la morfología de los cromosomas, aunque varían con frecuencia de una especie a otra, son los mismos en los individuos pertenecientes a una especie. Y por otra parte, se sabe que los cromosomas se hallan estrechamente ligados a la constitución genética de las especies (véase CHU y BENDER[1]). Gracias a estas dos circunstancias, es posible descubrir, en parte, el carácter genético de una especie mediante la morfología de sus cromosomas. Aunque tan sólo en parte; pues los datos que proporciona el estudio de los cromosomas tienen un carácter estrictamente limitado, y ello por diversas razones que no vamos a analizar aquí. La principal dificultad radica en el hecho de que un cromosoma puede presentar las mismas características morfológicas en dos especies diferentes y, sin embargo, no ser homólogo, es decir, no transmitir la misma información genética porque la semejanza morfológica es pura coincidencia.

El Dr. E. Lang inyecta un tranquilizante, por vía intramuscular, a un gibón (Hylobates lar).





El autor raspa al gibón la mucosa de la mejilla con una espátula para obtener algunas células que permitan estudiar la cromatina sexual de los núcleos durante la interfase. Bajo la acción del tranquilizante, el animal muestra una total indiferencia.

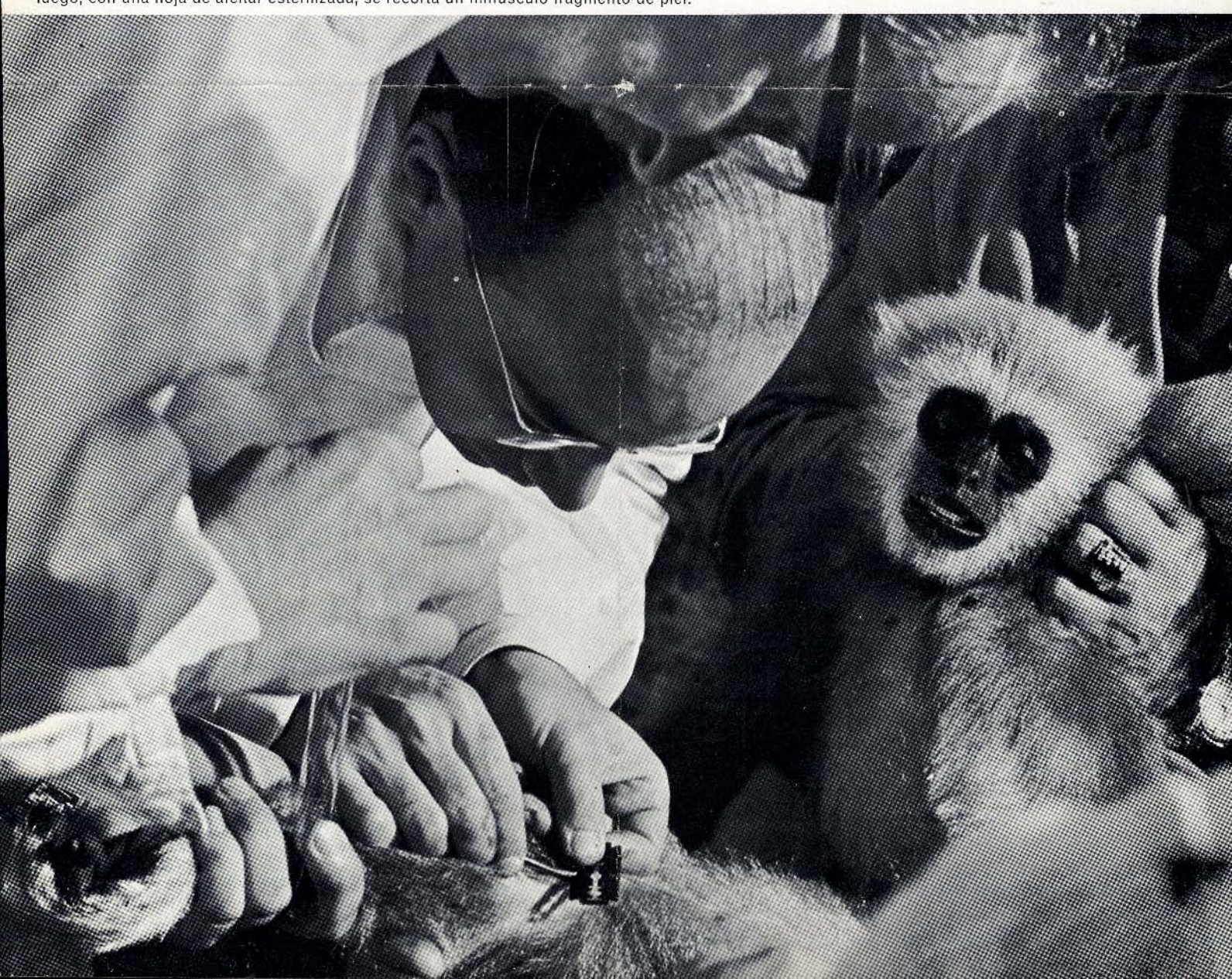
Introducida la aguja en la vena de un brazo del gibón, se comienza a aspirar sangre. Esta va por un tubo a un recipiente aséptico que contiene un anticoagulante. Una vez separados los glóbulos blancos de la sangre, se les cultiva para observar los cromosomas durante la mitosis.

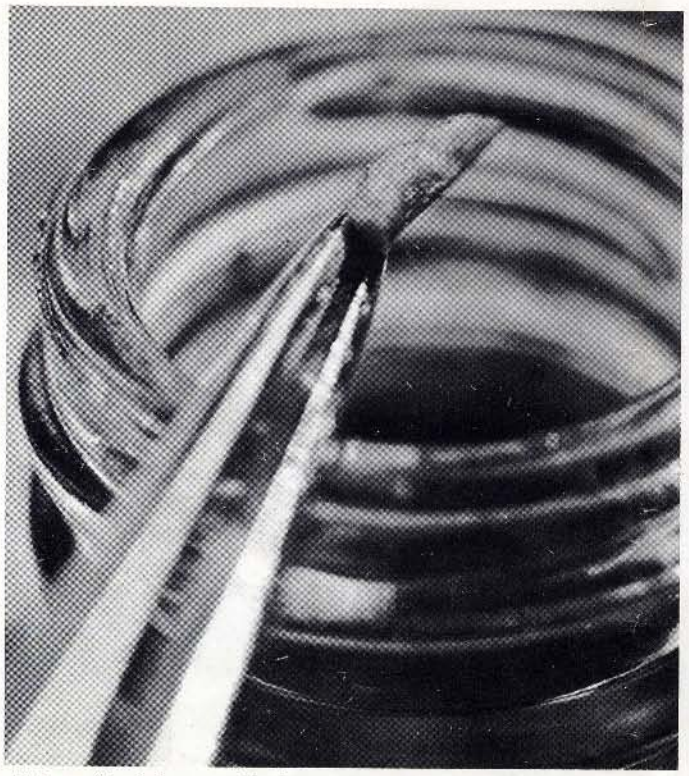
De otro lado, observaciones empíricas realizadas en animales cuyo parentesco filogenético es evidente, han revelado una sorprendente semejanza de sus cariotipos (cariotipo es la disposición de los cromosomas en la célula durante la metafase; véase la ilustración de la pág. 14).

Para estudiar, junto con J. L. HAMERTON, E. M. LANG y otros[2], los cromosomas del hombre y de los grandes monos (homínidos), hemos extraído sangre venosa y fragmentos de epidermis, en condiciones asépticas, para hacer cultivos de tejidos. Tan pronto como la división celular se manifiesta de manera activa, se añade colchicina al medio de cultivo para detener la mitosis en la metafase, etapa en la cual se distingue muy claramente la morfología de los cromosomas. Al agregar una solución salina hipotónica, el cultivo se hincha, con lo que se consigue una neta separación de los cromosomas que se fijan, extienden y secan en este estado. Después de teñir y fotografiar la preparación, se recortan y ordenan por pares según su tamaño y la situación del centrosoma. Para determinar qué cromosomas son morfológicamente homólogos es preciso estudiar numerosas células en cada animal y hacer muchas mediciones comparadas de las ramas de los cromosomas. Admitimos, como hipótesis de trabajo, que los animales que tienen un número mayor de cromosomas homólogos se hallan más estrechamente emparentados.

De nuestras observaciones resulta que, utilizando como único criterio la morfología de los cromosomas, el chimpancé del norte *(Pan troglodytes troglodytes)* es el que más cerca está del hombre. En segundo lugar colocaríamos al chimpancé enano *(Pan troglodytes paniscus)* que sólo se diferencia de su hermano mayor por el vigésimo segundo par de cromosomas. Detrás del chimpancé vendría el gorila *(Gorilla gorilla gorilla)* seguido, a cierta distancia, de un gran mono asiático, el orangután

Con el objeto de obtener células de otro tipo, a fines de comparación, se afeita y desinfecta una pequeña zona en la pierna del gibón y luego, con una hoja de afeitar esterilizada, se recorta un minúsculo fragmento de piel.





Fotografía del pequeño fragmento de piel. Conservadas en un recipiente que contiene solución isotónica fisiológica y antibióticos, las células se mantienen vivas hasta su traslado al medio de cultivo.

Los minúsculos fragmentos de tejido son introducidos en un frasco de cultivo y mantenidos en el fondo merced a una capa de plasma de gallina coagulado, sumergido todo ello en un líquido que contiene todos los elementos necesarios para el crecimiento celular.

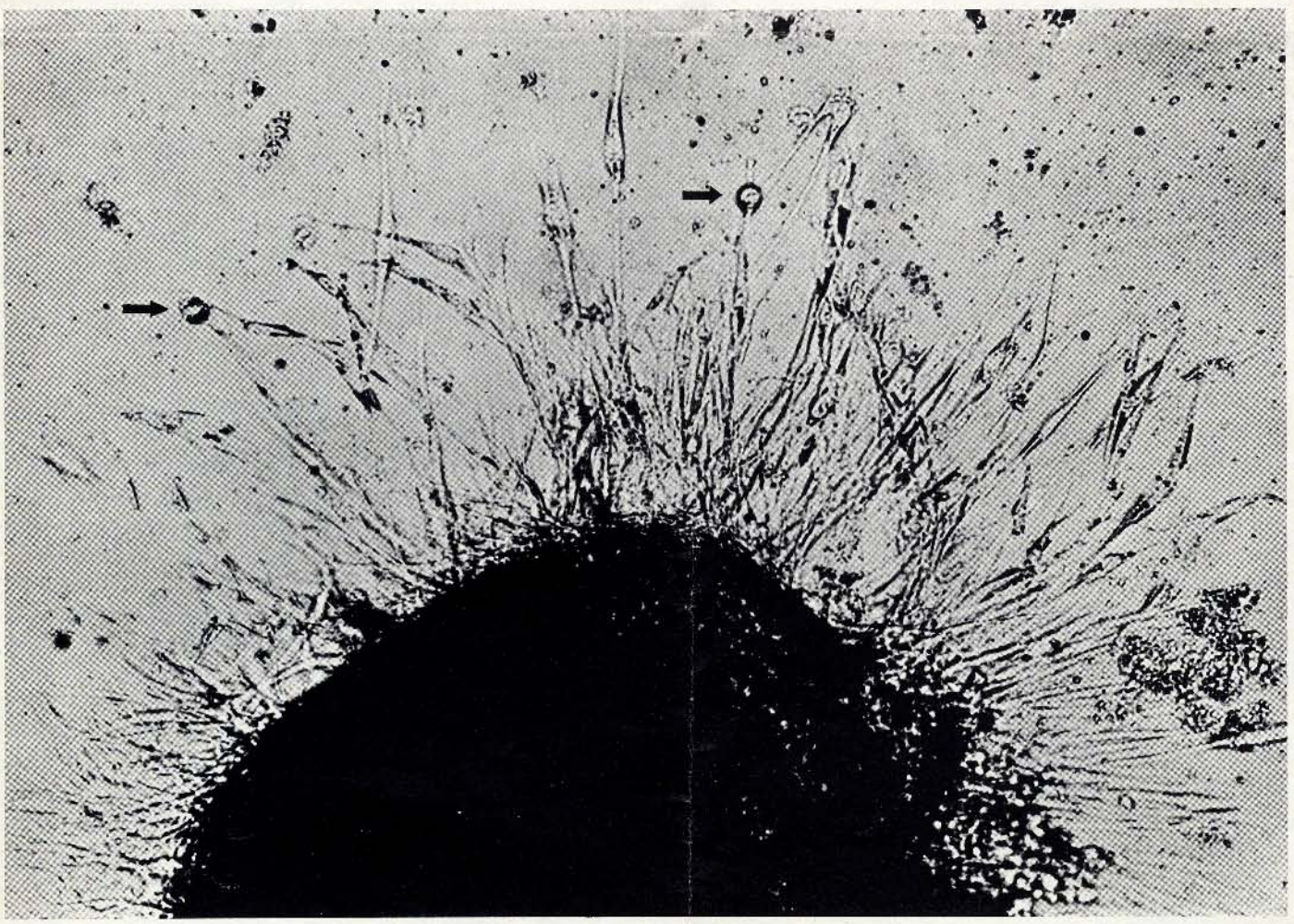
En el laboratorio se limpia cuidadosamente el pequeño trozo de tejido y se le divide en partículas muy pequeñas.

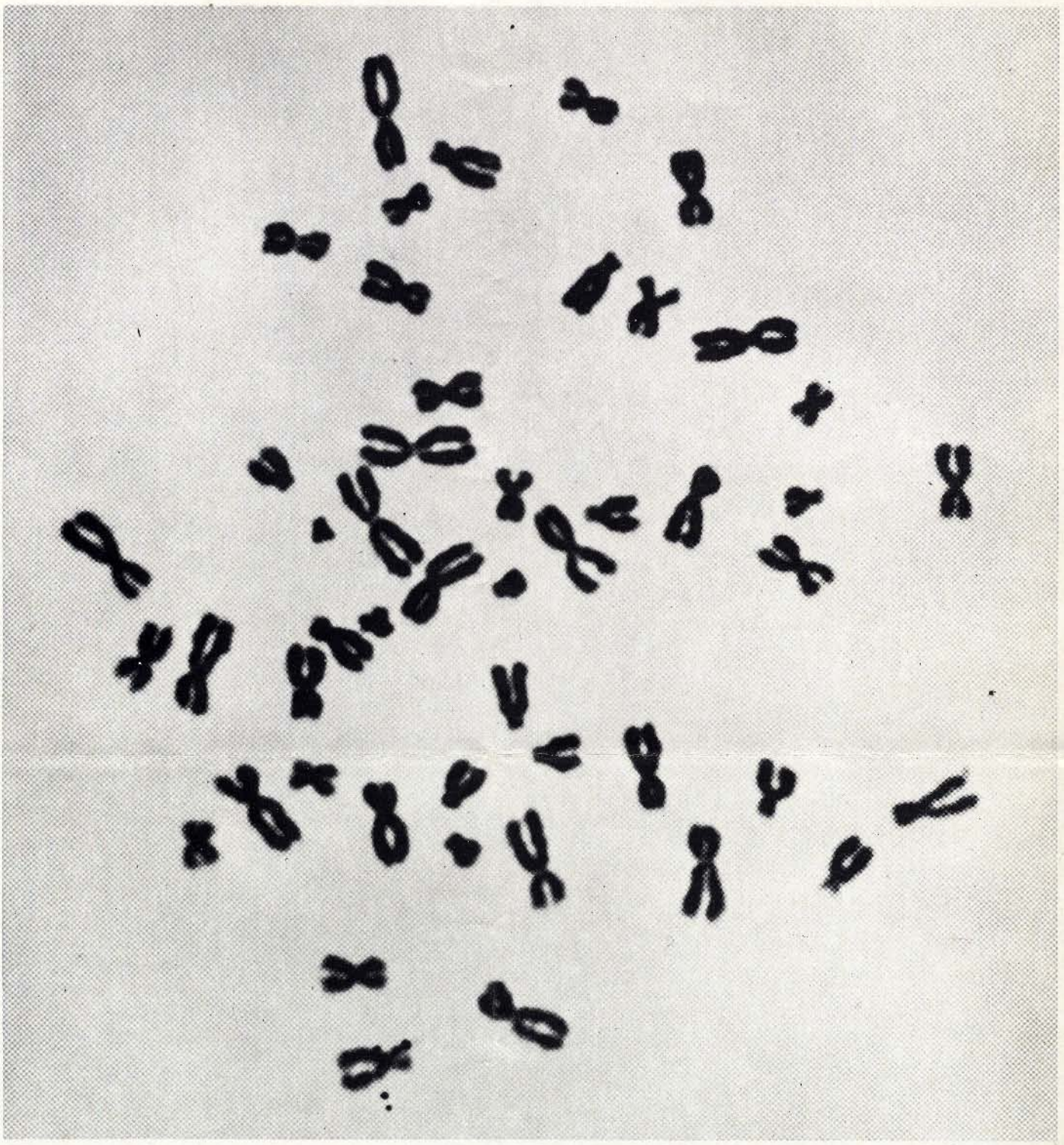
(Pongo pygmaeus). Todos estos grandes monos tienen 48 cromosomas, es decir dos más que el hombre. Los de otro animal asiático, el gibón (el que estudiamos era un *Hylobates lar*), que no pocos autores incluyen entre los grandes monos, difieren mucho de los de los demás miembros de este grupo. Son 44, y todos ellos, menos el minúsculo cromosoma sexual masculino en el que el centrosoma es acrocéntrico, presentan un centrosoma situado en el centro. A juzgar por las diferencias de orden numérico y morfológico que existen entre los cromosomas del gibón y los de los otros grandes monos, los hilobátidos no pertenecerían a la misma familia. Parecen haberse separado mucho antes

ESPECIE	2 n	M		A		X	Y
		grande	pequeño	grande	pequeño	cromosomas sexuales	
Homo sapiens	46	24	10	6	4	M	A
Pan troglodytes troglodytes	48	24	10	8	4	M	A
Pan troglodytes paniscus	48	24	12	8	2	M	A
Gorilla gorilla gorilla	48	24	6	12	4	M	M
Pongo pygmaeus	48	22	6	16	2	M	M
Hylobates lar	44	(34)	(8)			M	A

2 n = número de cromosomas diploides M = metacéntricos A = acrocéntricos ( ) = todavía indefinidos

Control microscópico de un fragmento de tejido que estuvo varios días en el medio de cultivo. Filamentos celulares, que recuerdan los fibroblastos, se han desarrollado en los bordes del tejido (× 400). Las células redondas (➡) van a dividirse en seguida. Una vez que se dispone de un número suficiente de células en mitosis, se hacen con ellas preparaciones de cromosomas.

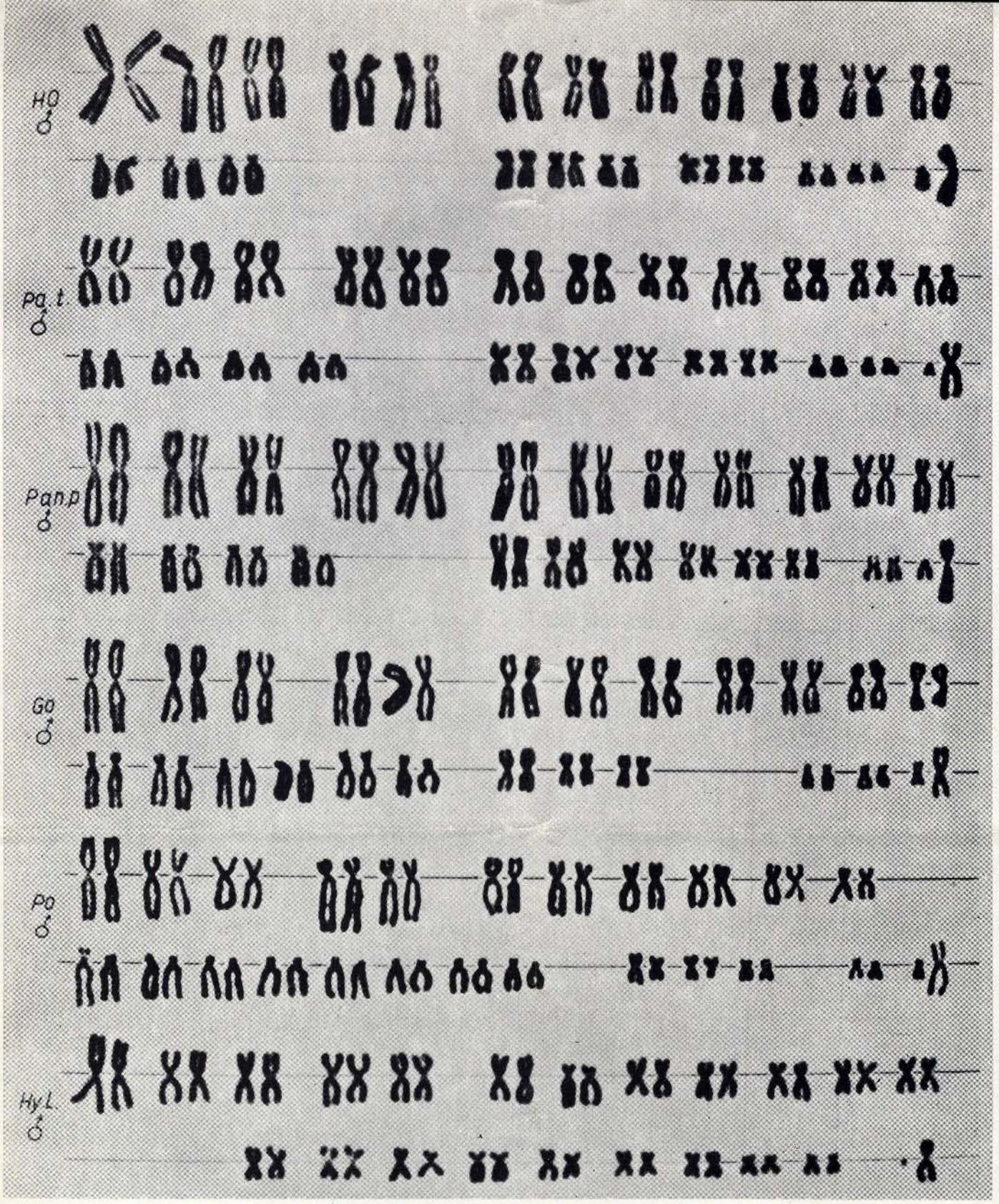




Cromosomas teñidos de una célula en metafase, procedente de la piel de un chimpancé macho. Han sido dispersados por un procedimiento especial y aparecen en la ilustración a gran aumento (aprox. × 4000). En la figura siguiente, los mismos cromosomas, recortados y alineados, representan el cariotipo del chimpancé.

que los otros grandes monos, del orden que llega hasta el hombre. Cosa que, por lo demás, confirman los exámenes electroforéticos de los prótidos séricos, efectuados por GOODMAN[3].

De todos modos, los resultados hasta hoy obtenidos no pueden considerarse definitivos. Quedan por examinar todavía muchas otras especies de primates, algunas de las cuales, por desgracia, se hallan en vías de extinción. Y aunque ello llegue a hacerse, mientras no se puedan estudiar los fósiles, seguirá abierta una gran laguna en nuestros conocimientos.



Cariotipos característicos de individuos masculinos: hombre, Homo sapiens (Ho); chimpancé del norte, Pan troglodytes troglodytes (Pa. t.); chimpancé enano, Pan troglodytes paniscus (Pan. p.); gorila, Gorilla gorilla gorilla (Go); orangután, Pongo pygmaeus (Po); y gibón, Hylobates lar (Hy. l.). Los cromosomas sexuales X e Y figuran en la segunda fila, al extremo derecho de cada cariotipo.

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