

International Journal of Neurology



ISSUE DEDICATED TO:

EPILEPSY

VOLUME I

DECEMBER 1959

NUMBER 1

INTERNATIONAL JOURNAL OF NEUROLOGY

CONTENTS OF VOLUME I, NUMBER I, DECEMBER 1959

EDITORIAL — Español	7
EDITORIAL — English	14
HISTORY OF FOCAL EPILEPSY	21
John F. Fulton.	
PHYSIOPATHOLOGY OF MYOCLONUS	34
M. Gozzano and R. Vizioli.	
MANIFESTATIONS CLINIQUES DE L'EPILEPSIE	45
P. Passouant.	
PSYCHIATRIC ASPECTS OF EPILEPSY	53
C. L. Cazzullo.	
MODERN CONCEPTS ON THE VALUE OF EEG IN EPILEPSY	66
Robert B. Aird.	
THE DRUG THERAPY OF CONVULSIVE SEIZURES	76
Melvin D. Yahr and H. Houston Merritt.	
INTRACRANIAL SURGERY IN THE TREATMENT OF EPILEPSY	83
Joseph Ransohoff and J. Lawrence Pool.	
PERSONALITY	89
NEWS	93
BOOKS REVIEW	93



The next issue will treat of: BRAIN VASCULAR DISEASES

Editorial

Se dice que los hombres tienen ideas. Yo diría más bien que las ideas buscan, poseen y dominan a los hombres.

Ellas los necesitan para pasar de lo abstracto a lo material, de lo intangible a lo real. Todo lo que es posible busca el camino de su ejecución. El dicho latino "Mens agitat molens" significa la idea conmoviendo a la materia para objetivarse en una realidad.

Ya en 1957 durante el Congreso Internacional de Neurología realizado en Bruselas, hablando con nuestro amigo el Prof. Melvin Yahr, de la Columbia University acerca de nuestro proyecto, él se mostró entusiasta y agregó: "Es una idea como para llenar toda una vida, Víctor".

Y cuando la idea se convierte en ideal entonces tiene el combustible necesario para marchar hacia adelante.

Y hoy que ofrecemos a los lectores el primer número de la "Revista Internacional de Neurología" puedo afirmar que el servir a esta idea ha sido fuente de muchas satisfacciones.

Las primeras derivaron cuando en nuestra gira por distintos países de Europa y América, realizada en 1958 tomé contacto con distinguidas personalidades de nuestra especialidad, encontré el más caluroso apoyo y un espíritu de amplia colaboración de aquellos maestros que hoy honran el Comité Consultante de esta Revista.

Lo mismo puedo decir de aquellos distinguidos especialistas que comparten con nosotros la tarea de editarla y a cuyas sugerencias se deben muchos de los aciertos que puedan encontrarse en la misma. Esta publicación tiene un propósito humano y científico a la vez. Pretendo establecer vínculos de cooperación y amistad entre senes que en las distintas latitudes del mundo tienen el mismo objetivo, avanzar en el conocimiento de las ciencias neurológicas.

Desde los tiempos antiguos, los sabios sentían la necesidad de visitar otras fuentes de los conocimientos y emprendían con tal propósito riesgosos viajes. Desde entonces hasta nuestros días esta necesidad de intercambio intelectual e información acerca de lo que ocurre en otros lares, ha permanecido incambiada.

Los congresos, publicaciones y viajes de estudios, tratan de amalgamar el esfuerzo de los hombres en la conquista del conocimiento.

Sin embargo creemos que la creación de una Revista Internacional de Neurología, llenaría en forma eficaz y certera este permanente anhelo de información actual, de un modo coherente, evitando en nuestra publicación los artículos heterogéneos, dándole a cada número un tema único tratado por destacados especialistas de diversas partes del mundo, quienes honrarán nuestras páginas colaborando por invitación.

Cada número tiene el significado de una gira de estudios, podría decirse que asistimos a la formación de una Universidad de carácter internacional.

Al recorrer sus páginas el lector viajará en primer lugar hacia New Haven; allí está el célebre Prof. Fulton dictando una clase sobre Historia de la Epilepsia Focal; de su valiosa colección de la Biblioteca de Historia de la Medicina, ha extraído las hermosas ilustraciones que adornan su muy interesante disertación.

Después visitaremos Roma; allí un maestro, el Prof. Mario Gozzano y el Dr. Vizioli desarrollarán una clase sobre Fisiopatología del Mioclonus. En ella expondrán ideas originales acerca de esta manifestación neurológica. Luego nos transportamos a Montpellier, donde un brillante neurólogo e investigador el Prof. Passouant hablará sobre Manifestaciones Clínicas de la Epilepsia.

Terminada la cual volveremos a Italia, esta vez en Milán para escuchar los conceptos que sobre Aspectos Psiquiátricos de la Epilepsia verterá el talentoso catedrático de Neurología y Psiquiatría de Milán Prof. Carlo Cazzullo.

Luego nos trasladamos a Norteamérica; en ésta nos dirigimos a San Francisco para asistir a una conferencia que sobre Electroencefalografía en la Epilepsia va a pronunciar el eminente neurólogo Prof. Robert Aird.

De allí nos transportamos a New York donde asistiremos a la brillante disertación que los distinguidos neurólogos americanos el Prof. Melvin Yahr y el Prof. H. Houston Merritt (el famoso descubridor de la Dilantina) realizarán sobre un tópico muy de su especialidad, Tratamiento Médico de la Epilepsia. Y sin salir del Medical Center, escucharemos a los muy destacados neurocirujanos Dr. Joseph Ransohoff y Prof. Lawrence Pool quienes expondrán sus conceptos sobre Tratamiento Quirúrgico de la Epilepsia. He aquí que merced a la gentileza de estos distinguidos neurólogos podemos brindar a los lectores un panorama de actualidad acerca de la situación presente en el mundo del problema de la Epilepsia, tratado con maestría por expertos sobre esta materia.

Esta Revista de carácter Internacional por sus Comités, por los autores que desde las distintas latitudes del mundo nos envían su invaluable cooperación, espera ser Internacional también por la masa de lectores a quienes pretende servir en este esfuerzo por brindar la información al día de los problemas neurológicos abarcando uno de ellos en cada número. El próximo tema de esta Universidad Internacional, es ENFERMEDADES VASCULARES DEL CEREBRO, y desde ya confiamos que será un número valioso por las figuras de renombre mundial que en él colaboran.

Los conocimientos deben actualizarse en estos días en que la ciencia diversifica cada vez más su radio de acción, de una manera ágil, de acuerdo con el ritmo acelerado de nuestras vidas.

Difundir el conocimiento es la mejor manera de mantenerlo fresco si nos atenemos al dicho de Alfred North Whitehead: "Knowledge does not keep any better than fish".

El sistema nervioso nos enseña que evolución significa una mayor complejidad en el proceso de integración.

En el campo de las relaciones humanas, evolución significa también cooperación, superación de una etapa de movimientos anárquicos y aislados para entrar en una función coherente en la conquista del conocimiento y de una mejor humanidad.

La competencia, y los conflictos humanos con su coadyuvante de frustración y agresividad, señalan una etapa inferior que hay que superar en pro de una mejor comprensión de sí mismo y de los demás.

El hombre no ha sido creado para vivir aislado, aún aquellos que voluntariamente se recluyen como los monjes en sus celdas, declaran que "Ningún hombre es una isla". (No man is an island, Merton.)

En el campo de las ciencias es donde se hace más necesario el espíritu de cooperación. Cuesta mucho trabajo juntar las moneditas de luz de los conocimientos, y si ellas no se capitalizaran en un fondo común para beneficio de todos, sería muy exiguo nuestro caudal científico.

Es por eso que el "International Journal of Neurology" desea fervientemente convertirse en un vínculo de amistad y colaboración que enlace los continentes, que acerque no sólo la obra sino también al hombre que tras ella se oculta.

En nuestra página dedicada a figuras representativas de la medicina, expondremos en cada número, una de las personalidades médicas de la neurología contemporánea, trascendiendo los límites meramente científicos para trabar conocimiento con el hombre, que ha hecho de la búsqueda del conocimiento motivo de su existir.

Hay en toda publicación un ser anónimo pero importante, al cual van dedicados todos nuestros esfuerzos, es nuestro crítico y nuestro aliado, ese ser que en la sombra es sólo para nosotros una silueta que se inclina ávida sobre las páginas impresas, es el Lector.

Puede ser un Profesor, que refresca sus conocimientos antes de dictar su clase, un médico práctico, consultando las nuevas terapias o el enfoque moderno de una afección enunciados por especialistas de reconocida versación sobre el tema, o bien el estudiante ambicioso deseoso de ampliar sus conocimientos por un medio moderno, sintético, y más económico que el que podría adquirir a través de libros cada día más costosos. También el lector tendrá su página, a través de ella podrá escribir sus impresiones acerca de los artículos publicados, sugerir temas que quisiera ver tratados en esta Revista, pedir datos ampliatorios o aclaratorios a los autores acerca de sus escritos.

En el siglo XVI escribía Montaigne que él raramente se encontraba con un hombre de cincuenta años.

En nuestros días la vida no sólo se ha prolongado sino que se ha vuelto más intensa.

El hombre puede desplazarse con mayor rapidez y pasar de un continente a otro en el curso de unas horas, la distancia ha sido prácticamente suprimida por la velocidad.

El mensaje que el indio arrancaba a los tambores y que retrasmittía a través de la selva ha sido suplantado por el repiqueteo del telegrafista mandando a través del éter el pensamiento transformado en pulso eléctrico. La paloma mensajera que hasta mediados del siglo XVI fuera el correo aéreo más eficaz ha sido en mucho superado por la ciencia moderna, no sólo se pueden enviar millares de mensajes que de hacerlo por el antiguo medio eclipsarían al sol con el aletear de millones de palomas mensajeras sino que se puede hablar a distancias intercontinentales, con meramente alzar el tubo del teléfono.

Las comunicaciones tienen en sí el fundamento de la existencia del hombre. El dicho de Descartes "Cogito ergo sum", es un estado subjetivo. Pero no es sólo para nosotros que existimos. Otros también deben saber que pensamos que existimos, y de ahí la necesidad de comunicarnos, de transmitir, compartir y recibir el caudal emocional e intelectual de los demás a través de la palabra oral o escrita, de las obras de arte, de una sinfonía o de una conquista científica. La experiencia ajena se hace propia y enriquece nuestras vidas.

A través de la información y difusión del conocimiento, con cada hombre que avanza da un paso hacia adelante toda la humanidad.

Si pudiéramos visualizar el pensamiento en acción recibiendo y transmitiendo ideas tendríamos una concepción fantástica del hombre. Lo veríamos unido con el pasado dialogando con seres que le precedieron en muchas centurias, intercambiando impresiones y pareceres con cada individuo con quien se encuentra durante el día, comunicándose por intermedio de cartas con aquellos que están a la distancia. Perpetuamente en movimiento extendiendo sus tentáculos para apresar el alimento intelectual. El cerebro se nutre de ideas y el conocimiento de la verdad es para él, el manjar más apetecible.

El hombre vive sumergido en el cosmos, sus sentidos envían al cerebro el material con el cual se elaboran sus reacciones.

Aún el ser más aislado de sus congéneres, aquel cuyas "Puertas de percepción" ("Doors of Perceptions") como denominó Huxley a los sentidos, estén en su mayoría herméticamente cerradas, si como Helen Keller puede desarrollar un medio de comunicación con sus semejantes, por precario que éste sea, su existencia como ser humano está salvada.

Así ocurre con las personas y así también con los pueblos.

El imperativo conócete, no se refiere únicamente a un estudio introspectivo sino también a aquel que dimana de nuestra vida de relación.

Conocer, apreciar a los demás en su justo valor, aprender a vivir y compartir el mundo como una gran familia con un interés común, es conocerse e identificarse con el género humano.

Todos somos fragmentos de un gran cerebro universal que está tratando de organizarse de una manera coherente. El ser aislado que pretenda imponerse o imponer a su grupo por encima del interés general

es un foco epiléptico que perturba el desarrollo armónico de ese gigantesco organismo que se llama humanidad.

Esto se puede aplicar a la ciencia, a la política o al comercio. Todos ellos tienen que ver con el desarrollo de la existencia humana.

Desde la antigüedad la práctica de la Medicina gira fundamentalmente alrededor del vínculo entre el médico y el enfermo. El interrogatorio, el examen clínico, son los elementos básicos de nuestra profesión que no pueden ser reemplazados por ningún método moderno, sino que éstos deben ser utilizados para contribuir a ampliar la visión y comprensión del médico enfrente de su paciente.

Ya en el entrenamiento de los futuros médicos aconsejó Sir William Osler ejercitar el arte de una observación ajustada "Teach him how to observe, and the lessons will come out of the facts themselves". "The whole art of medicine is in observation, as the old motto goes, but to educate the eye to see, the ear to hear, and the finger to feel takes time, and to make a beginning, to start a man on the right path, is all that we can do".

Compartimos el criterio de este gran maestro de la Medicina y consideramos el estudio clínico y anátomo patológico, como el núcleo básico de la práctica médica. Su estudio será parte fundamental en todos los capítulos que se traten en esta Revista. Pero indudablemente hoy esto no es todo.

En los últimos decenios se han hecho importantes contribuciones al estudio del enfermo con las nuevas técnicas de exploración, arteriografías, neumoencefalografías, radioisótopos y electroencefalografía.

La neuroquímica se ha incorporado trayendo nuevos enfoques fisiológicos y terapéuticos a viejos problemas neurológicos y psiquiátricos.

El desarrollo de la neurocirugía además de constituir un poderoso recurso terapéutico, permite exploraciones de corteza y profundidad encefálica; a esto se agrega su nueva adquisición, la cirugía esterotáxica.

Un nuevo enfoque terapéutico que pretende en nuestros días sustituir en parte a la neurocirugía lo constituyen las intervenciones por medio del bisturí atómico realizando tratamiento de tumores a cráneo cerrado y las destrucciones de zonas profundas del encéfalo por el ultra sonido.

Todo sin olvidar que el sistema nervioso forma unidad indivisible con todo el organismo humano, y por lo tanto el estudio neurológico debe integrarse en la medicina interna.

Ciertas afecciones tienen mucho en común con la psiquiatría, otras están en estrecha relación con la endocrinología, la ortopedia, etc.

Cuando el tema lo requiera estos aspectos han de ser contemplados en nuestra Revista a fin de abarcar todos los aspectos del problema de una manera coordinada y moderna.

Las investigaciones de laboratorio experimental de vanguardia que tengan conexión con el capítulo neurológico a tratar, serán difundidas en esta publicación siempre que contribuyan con datos que sirvan para

iluminar el mecanismo de los síntomas y síndromes, especialmente si sus aportes no sólo satisfacen el ansia natural por el conocimiento del hecho científico, sino que también ayuden a resolver en la práctica el problema clínico o contengan nuevos enfoques terapéuticos.

El primer número de la Revista Internacional de Neurología versará sobre un tema que desde hace siglos constituye uno de los enigmas más apasionantes de la Medicina. De antiguo llamada la "Enfermedad Sagrada", y en nuestros días "Epilepsia", esta palabra significa en griego sorpresa, siendo ésta una de las más dramáticas características de su ataque.

Una de las más reconfortantes recompensas que el investigador clínico y el experimental encuentran en su infatigable búsqueda de los factores desencadenantes de la Epilepsia son las luces que ellos arrojan sobre problemas igualmente enigmáticos para filósofos, fisiólogos y psicólogos, acerca de la función nerviosa y los problemas de la conciencia y de la mente.

De una y otra manera el hombre se va acercando hasta las márgenes de los grandes misterios que encierra la vida. No hay investigación por altamente especializada que parezca que no vaya a integrar con su contribución una mejor comprensión de otros sectores de la ciencia.

La Epilepsia, como bien lo afirma Hughlings Jackson, si bien traduce una súbita y excesiva descarga transitoria de alguna parte del cerebro, en ella están englobadas una vasta variedad de formas, cada una de las cuales entraña para el clínico un problema distintivo, en su aura, ictus y estado post ictal.

La ciencia añade día a día nuevas armas para su arsenal de investigación en pos de datos que aclaren los misterios del cerebro en su función normal y patológica. Entre estos medios de exploración que auxilian y completan el estudio clínico del epiléptico, destacamos la electroencefalografía y la neuroradiología como importantes factores que contribuyen en la pesquisa diagnóstica.

Con finalidad científica y práctica a la vez actualmente con los nuevos aportes de la neuroquímica, vuelve al tapete de la discusión el papel de los iones, potasio, sodio, calcio, magnesio; el de los mediadores químicos, adrenalina, noradrenalina, acetilcolina; últimamente hay conclusiones a la serotonina y a los inhibidores de la monoaminooxidasa.

Antes de terminar estas líneas deseamos enviar un saludo a toda la Prensa Médica del mundo que tan gentilmente ha anunciado la aparición de "Revista Internacional de Neurología", especialmente a aquellas publicaciones dedicadas a las Ciencias Neurológicas.

Queremos agradecer a todos los que con su valiosa contribución han hecho posible el que brindemos a nuestros lectores un número de la jerarquía científica de éste dedicado a "EPILEPSIAS".

Sabemos cuán difícil y engorroso es poner todo el caudal de experiencia, seleccionando lo más importante, en las diez páginas escritas a máquina a que deben ceñirse nuestros colaboradores. Ya Pascal, ese

gran filósofo francés así lo manifiesta, cuando excusándose por el largo de uno de sus escritos dice: "Yo no tuve tiempo de hacerlo más corto".

Por último saludamos a los lectores, esperando que nuestro esfuerzo para presentar los conocimientos de última hora en forma condensada y tratados por altas personalidades científicas, les sea de real utilidad.

Nuestro próximo número sobre ENFERMEDADES VASCULARES DEL CEREBRO, seguirá la misma directriz que le hemos impreso al presente, el cual manteniendo el alto nivel científico estará a cargo de destacados hombres de ciencia de Europa y América.

Queremos dejar constancia de nuestro agradecimiento al Dr. Enrique Blum y a las numerosas personas que colaboraron en la preparación de esta Revista.

Estamos también muy reconocidos a la "Imprenta Letras" por la dedicación y empeño que han puesto en la solución de los innumerables detalles concernientes a la realización del primer número de la "Revista Internacional de Neurología".

VICTOR SORIANO

Editorial

It is said that men have ideas. I rather would say, that ideas seek, take hold of and dominate men.

They need them to pass from that which is abstract to that which is concrete, from the intangible to that which is material. All that is possible looks for a way to fulfill itself. The Latin saying of "Mens agitat molens" means the idea stirring up matter to become a reality.

In 1957 during the International Congress of Neurology held at Brussels, while conversing with our friend, Prof. Melvin Yahr of Columbia University about our project, he was most enthusiastic and added: "It is an idea that would take up a life-time, Victor".

And when the idea is converted into an ideal, it has the necessary fuel to go forward.

Today as we offer our readers the first number of the "International Journal of Neurology" I can say for sure that it has been a source of many satisfactions to carry out this idea.

The first ones came during a trip we made to different countries of Europe and America in 1958 when I contacted distinguished individuals in our specialty and found enthusiastic support and a warm spirit of cooperation from those eminent authorities who today honor with their presence the Advisory Board of this Journal.

I can say the same of all the prominent specialists who share with us the task of editing this periodical. Many of the good things you find in it are there thanks to their suggestions.

It is our purpose to establish ties of friendship and cooperation among people who in all parts of the world have the same objective to extend the frontiers of knowledge in the neurological sciences.

Since ancient times, scholars have felt the need to put themselves in contact with other sources of knowledge and thus set off on perilous voyages. From then till now this necessity for intellectual interchange and information about occurrences in far off places has remained unchanged.

We believe that the creation of an International periodical like ours is the best answer to this ever present need for current information on neurology.

To avoid heterogeneity and to present these data in coherent form, each number shall feature a single topic discussed by eminent specialists from all over the world who will collaborate by invitation.

Each issue will be like a study trip or it may even be said that we are attending the formation of a University with a definite International flavor.

As he reads away the reader first travels to New Haven where the renowned Professor Fulton is giving a class on the History of Focal Epilepsy. From his valuable collection in the Medical History Library he has brought beautiful illustrations that make his lecture even more interesting.

Then on to Rome where an authority, Professor Mario Gozzano and Dr. R. Vizioli are lecturing on "Physiopathology of Myoclonus". They expound on their original ideas concerning this neurologic manifestation.

Afterwards we move on to Montpellier where a brilliant neurologist and investigator Professor Passouant will speak on "Clinical manifestations of Epilepsy".

Then we return to Italy, this time to Milan to listen to concepts about "Psychiatric Aspects of Epilepsy" uttered by Milan's talented Professor of Neurology and Psychiatry Dr. Carlo Cazzullo.

Then 5000 miles west to San Francisco to attend a lecture on "Electroencephalography in Epilepsy" given by the prominent neurologist Prof. Robert Aird. From there to New York to hear a brilliant talk by those two distinguished American neurologists Prof. Melvin Yahr and Prof. H. Houston Merritt, famed discoverer of Dilantin, on a topic right down their alley, "Medical treatment of Epilepsy". And without leaving the Medical Center we listen to the very outstanding neurosurgeons Dr. Joseph Ransohoff and Prof. Lawrence Pool who will explain their concepts on "Surgical treatment for Epilepsy".

Thus thanks to the graciousness of these eminent neurologists we are able to present to our readers a broad view of what is going on in the world today concerning the problem of epilepsy.

This quarterly which is international due to the make up of its Boards and to its authors who from all corners of the world send in their valuable contributions, hopes also to be international in respect to the many readers from many nations it wishes to serve by offering up-to-date information on neurological problems.

"BRAIN VASCULAR DISEASES" will be the next subject given by this International University and already we are confident it will be a worthwhile number due to the world renowned figures who will collaborate on it. In the fast moving world of today it becomes ever more difficult for knowledge to keep pace with the ever increasing amount of truths revealed by science.

Difusing knowledge is the best way to keep fresh if we heed the saying of Alfred North Whitehead: "Knowledge doesn't keep any better than fish".

The nervous system teaches us that evolution signifies a greater complexity in the process of integration. In the field of human relations, evolution also means cooperation, progressing from a stage of isolated and sporadic movements to one of coherent efforts in the attaining of knowledge and a better humanity.

Competition, human conflicts with their collateral consequences of frustration and aggressivity are but stepping stones to a better understanding of oneself and of others.

Man was not created to live in isolation. Even those who are voluntary recluses as monks in their cells declare that "No man is an island", like Thomas Merton who used it as a book title.

It's in the field of sciences where the spirit of cooperation is even more necessary. To gather together the innumerable bits of knowledge represents much toil, but if they hadn't been put into a common fund for the benefit of all men's wealth of knowledge the result would be very meager.

That is why the "International Journal of Neurology" fervently wishes to become a bond of friendship and collaboration linking the continents and thus bringing together not only the achievements but also the men behind them.

In every number there will be a special article on a contemporary representative figure from the world of neurology. It will go beyond the merely scientific to give an accurate idea of the whole man who has made the search for knowledge the reason for his existence.

There is every publication an anonymous person who for us is very important. He is our critic and our ally. That individual who in the distance is for us only a silhouette who eagerly pores over the printed pages, is our Reader.

He could be a professor who refreshes his memory before giving a class, a practicing doctor looking up the newest therapies or the modern approach to an affection as described by specialists of renowned fame in the field, or just as well an ambitious student desirous of broadening his knowledge in a modern and all inclusive way. Besides the reader will have his page by means of which he will be able to write his impressions about the published articles, to suggest subjects he would like discussed in this Journal or to ask the authors to clarify or develop more fully certain points.

In the 16th century Montaigne wrote that he seldom met a man of 50. Nowadays lives are not only longer but more intense.

Man can move around ever faster and go from one continent to another in a matter of hours. Distance has been practically done away with by speed. The message that the Indian beat out on his drum resounding through the jungle has been supplanted by the clicking of the telegraph operator sending through the ether thought transformed into electric pulses. The carrier pigeon who until the middle of the 16th century was the most efficient air mail has been surpassed by

modern science. Not only can millions of messages be sent which by the old way would eclipse the sun with the countless pigeon wings, but by merely lifting the 'phone receiver the human voice has spanned the continents.

Communications hold in themselves the basis for man's existence. Descartes's saying "Cogito ergo sum" is strictly subjective. But it is not just for ourselves that we exist. Others also should know that we think we exist and thus the need to communicate, transmit, share and receive the emotional and intellectual experience from others, through the oral and written word, works of art, a symphony or a scientific conquest. Thus we make it ours and it enriches our lives.

With this vast diffusion of knowledge every time an individual takes a step forward all of humanity progresses.

If we could visualize the mind receiving and sending our ideas we would have a fantastic conception of man. We would see him linked to the past in conversation with persons who preceded him by many centuries, exchanging opinions and impressions with everyone he encounters during the day and communicating by letters with those at a distance.

In perpetual motion grasping everywhere for his intellectual sustenance. The brain feeds on ideas and for it knowledge of the truth is the most appetizing tidbit.

Man lives submerged in the cosmos, his senses supplying his brain with the raw material with which are shaped his reactions.

Even the human being most removed from his fellow man, that one whose "Doors of Perception" as Huxley called the senses, are practically hermetically sealed, like Helen Keller, develops, some means of contact with his neighbors, and precarious as these may be, his existence as a human being is assured.

As it happens to people, so too does it happen to nations. The command to Know Thyself not only refers to an introspective study but also to what is the propelling force in our relations with others.

To know to appreciate the true value of others, to learn to live and share the world as a great family with a common goal is to know oneself and to feel a part of the human race.

We are all fragments of a gigantic universal mind which is trying to organize itself into a manageable whole. The solitary individual who attempts to impose himself or his will on the group passing over the general welfare is like an epileptic focus which hinders the harmonious development of this mammoth organism which is mankind.

This may be applied to science, politics or commerce. All these are activities of man's existence.

Since it began the practice of medicine has revolved around the doctor-patient relationship. The questioning, the clinical examination of the patient are basic to our profession and they can't be replaced by any modern method. These have to be employed to broaden the doctor's vision and comprehension of his patient.

As soon as a future doctor begins to study, he should start to practice the art of observation, is the advice of Sir William Osler. "Teach him how to observe, and the lessons will come out of the facts themselves". "The whole art of medicine is in observation, as the old motto goes, but to educate the eye to see, the ear to hear, and the finger to feel takes time, and to make a beginning, to start a man on the right path, is all that we can do".

We share the criterion of this great teacher of Medicine and consider the clinical study and the pathological anatomy as the corner stone of the practice of medicine. Its study will be a fundamental part of all the chapters of this periodical. Undoubtedly this doesn't constitute all.

In recent decades important contributions have been made to the study of the patient using the new exploratory techniques such as neuro-radiology, radioisotopes and electroencephalography.

The neurochemistry has incorporated new physiological and therapeutic approaches applying them to neurological and psychiatric problems.

The development of neurosurgery besides being a powerful therapeutic resort permits explorations on the brain. Added to this is a new acquisition, stereotaxic surgery.

A new therapeutic approach which aspires at present to replace in part neurosurgery is to operate by means of atomic bistoury and in this way treat tumors without opening the skull and destroy deep zones of encephalon by the ultrasound.

All this without forgetting that the nervous system is part of an indivisible unit which is the human body and therefore neurological studies should be integrated with those of internal medicine.

Certain maladies have much in common with psychiatry, others a close relation with endocrinology, orthopedics, etc.

When the subject calls for it, these aspects have to be contemplated in this Journal so that every factor is considered in a modern and coordinated way.

The results of research carried on by foremost experimental laboratories that are related to the chapter on neurology, to be considered, will be given in this publication, provided they supply data that shed light on the mechanism of symptoms and syndromes, especially if the information not only satisfies the natural eagerness to know scientific facts but also aids to solve the clinical problem or give new therapeutic approaches.

The International Journal of Neurology in its first number will feature a subject which for centuries has been one of the most intriguing enigmas of Medicine. In the dim past it was known as the

"Sacred Illness" and in our days Epilepsy, which word means "surprise" in Greek, being this one of the most dramatic characteristics of a seizure.

One of the most appreciated rewards which the clinical or experimental investigator finds in his untiring search for the factors involved in Epilepsy is the light which they shed on problems equally enigmatic for philosophers, physiologists and psychologists concerning the nervous functions and the problems of consciousness.

One way or the other man is closing in on the last barriers which separate him from the mysteries enclosed in life.

There is no investigation regardless of how highly specialized it seems, that won't contribute something toward a better understanding of other sectors of science.

Epilepsy as Hughlings Jackson affirms is a condition in which there is a sudden and excessive discharge from some part of the brain and in it is enclosed a vast variety of forms each one of which entails a distinct problem in its aura, ictus and post-ictal state for the observer.

Day by day science adds new weapons to its arsenal of investigation in search of data which would clear up the mysteries of the brain both in its normal and pathological workings. Among the exploratory methods that aid and supplement the clinical study of the epileptic we stress electroencephalography and neuroradiology as important factors in the diagnostic inquiry.

With both scientific and practical aims in view we turn to the latest developments in neurochemistry and discuss the role of the potassium, sodium, calcium and magnesium ions and also of the chemical mediators adrenalin, noradrenalin and acetylcholine; lately there have been allusions to serotonin and to the inhibitors of monoamine oxidase.

Before concluding these lines we would like to send our kindest regards to the medical press all over the world who have so graciously announced the debut of the "International Journal of Neurology" especially to those publications dedicated to Neurological sciences.

We would like to thank all those who by their valuable contributions have made it possible for us to offer to our readers an issue of high scientific calibre as is this one dedicated to "Epilepsy".

We know what a painstaking job it is to pack into all the wealth of one's experience, selecting the most important into 10 typewritten

pages as our collaborators had to do. As Pascal, that great French philosopher, once put it as an excuse for the length of one of his writings, "I didn't have time to make it shorter".

And last but not least we send a hearty greeting to our readers with the hope that our efforts to present the latest developments in condensed form and via the pens of outstanding scientific authorities, will be of real usefulness.

Our next number featuring Brain Vascular Diseases will follow the same formula as the first one. With prominent men of science from both Europe and America at the helm it shall be of the same high scientific character.

We are greatly indebted to Dr. Enrique Blum and the numerous persons who have collaborated in launching this Journal.

We want to express our warmest thanks to "Imprenta Letras" who has given special attention and care to the countless details involved in putting together the first issue of "The International Journal of Neurology".

VICTOR SORIANO

History of Focal Epilepsy*

by JOHN F. FULTON, M. D.

Department of the History of Medicine. Yale University

Head injuries and the focal seizures that often follow in their wake assume a prominent rôle in the history of neurology, indeed knowledge of the subject antedates the dawn of recorded history. When, therefore, Professor Soriano did me the great honour of inviting me to contribute an historical paper to the first number of his projected *Revista Internacional de Neurología*, I accepted immediately and I did so with particular pleasure since it makes possible participation in the launching of a new and much needed journal in the broad field of neurology. It also affords me the opportunity of extending to the *Journal* a cordial welcome from the Editors of *Journal of Neurophysiology*.

Dr. Soriano had originally requested me to write on the history of epilepsy itself,

but since that subject has already been so fully covered by Professor Owsei Temkin in his great monograph *The Falling Sickness*(14), there would be little new to be said. However, having long been interested in the history of focal epilepsy, it was obvious that this would be a more limited theme and, therefore, undoubtedly more appropriate. Moreover, as far as I am aware, this particular subject has not previously been traced in detail.

Primitive man knew that blows on the head might cause suspension of consciousness, and this brought with it a tacit recognition on the part of many writers of antiquity such as Hippocrates, Aristotle and Galen, of the brain as the organ of the mind(15). In every age injuries of the head have been distressingly common among those peoples who have attempted to settle their differences through resort to combat. Among the skulls of some of the more belligerent tribes of the ancient Incas**, in addition to evidences of successful trepanation (Fig. 1), frequent examples have been found of sharply localized depressed fractures, many of them healed (Fig. 2), but in some the depressed bony spicules are so situated that they must have caused neurological symptoms in the form of paresthesias, motor pareses and paralyses, and since bony spicules are notoriously irritating, focal seizures must have been observed (Fig. 3). Some of these points have been brought out by Cyril B. Courville and Kenneth H. Abbot in the memoir "Cranial Injuries of the Pre-Columbian Incas. With comments on their mechanism, effect and lethality"(4). Their well selected illustrations are those to which reference is made above. Courville and Abbot studied the

*) Contributed by invitation to the first number of *Revista Internacional de Neurología*, September 1959.

**) Although much has been written on trepanation among the Incas, it is sometimes forgotten that the practice was common among neolithic peoples of Europe and North America as well as among the pre-Columbian Indians of Peru. The first disclosure was made by the French anthropologist, Prunière, in 1873 at Lozères. Similar skulls were found successively in other parts of France, Switzerland, Great Britain, Denmark, Germany, Sweden, Austria, Poland, Italy, Russia, also in Spain and Portugal (Walker 15). The character of the European trepaning differed from that encountered from one place to another, some being large "T" shaped openings, others small holes, and still other types were found in South America. The first example of prehistoric trepanation in America was depicted in 1839 but was not recognized as such. — See S. G. Morton, 1839 (11), Broca (3), and Squier (12) were the first to publicize the trephined skulls of the Incas.

instruments used by the prehistoric Inca surgeons in their trepanations (Fig. 4) and fracture repair. The implements of war used by Inca fighters have likewise been analyzed in relation to their wounding potential; as such, their study represents the only one with which I am familiar of prehistoric "wound ballistics". Some injuries were the result of blunt clubs, others obviously of large stones hurled, no doubt, by the effective sling-shots of people of an ancient civilization having no metallic weapons.

The literature of Greco-Roman neurology is too vast to touch upon here and has been well summarized by A. Earl Walker (15) and more recently by H. W. Magoun (10), but the structure of the brain itself was nowhere accurately portrayed. It therefore remained for the anatomists of the Renaissance to make the first study of ce-

rebral structure although there had been many earlier portrayals of an idealized brain having three schematized cerebral ventricles having little or no relation to anything now recognized as of normal structure (2,10). The earliest published illustrations of the brain based on actual dissection are those of Mondino de'Luzzi, John Dryander and Andreas Vesalius; but the specimens from which they drew were evidently collapsed and soft owing to the difficulty of removing the brain with sufficient rapidity to prevent deterioration especially in hot countries. It is therefore not surprising that the first adequate representation of the brain came from the more northern countries of Europe.

But before discussing these points, there is an important little-known case of sensory attacks described in Spain in 1563. This is the celebrated case of Prince Don Carlos

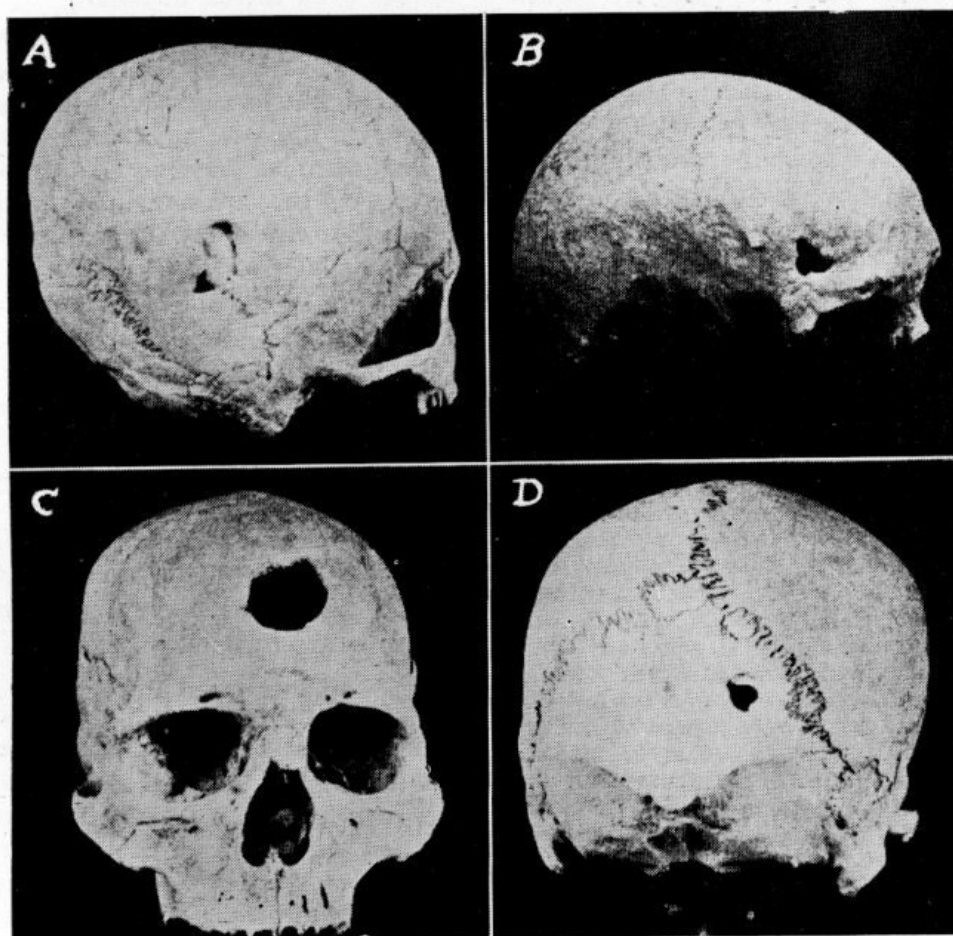


Fig. 1. — Moderate-sized cranial defects. A, B and D are obvious old lesions. In D note occurrence of wormian bones ("Inca bones") in parieto-occipital suture lines.

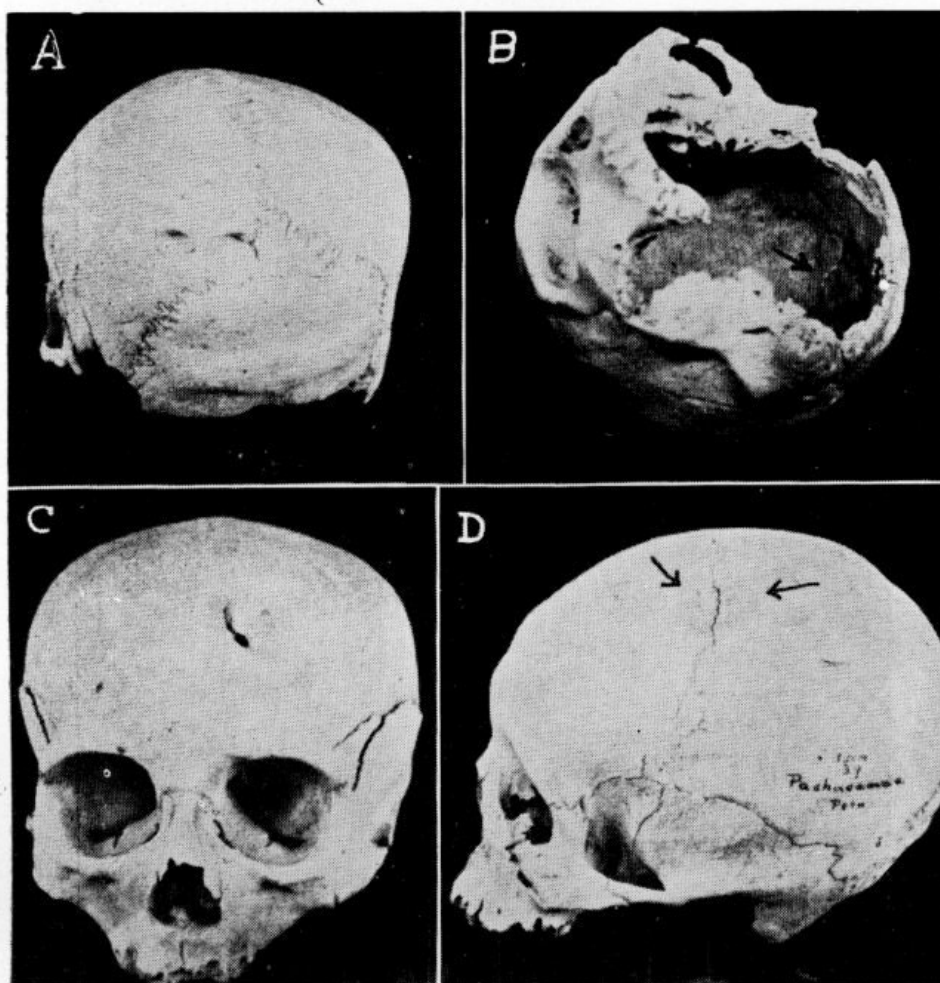


Fig. 2. — Focal depressed fractures of the skull. A and B. old double depressed fracture which may be due to mace injury. C. old depressed fracture in frontal region. D. old depressed fracture over left coronal suture. Depressions in C and D are very likely the result of sling shot wounds.

of Spain known in history for his alleged romantic attachment to his step-mother, Elizabeth de Valois, wife of Felipe II. Don Carlos had suffered an unrecognized accidental depressed fracture (from a fall on a stone stairway) and was seen in consultation by the great anatomist Andreas Vesalius and the Spanish physician, Dionisio Daza Chacón. The case is described in the celebrated but excessively rare booklet, *Relación verdadera de la herida de la cabeza*

*) Dr. Guerra is the fortunate possessor of the only known copy of the first edition of this booklet; he also possesses the second edition as does Professor Charles Donald O'Malley of the University of California Medical Center, Los Angeles 24, California.

del Serenísimo Principe Don Carlos, nuestro señor, de gloriosa memoria, la cual se acabó al fin de julio del año 1563, Madrid (9). My associate at Yale University, Dr. Francisco Guerra, eminent bibliographer and authority on early Spanish medicine, who has long been interested in the case of Don Carlos, has generously provided me with the following abstract of his clinical history*.

The Clinical case of Prince Don Carlos, according to Dr. Daza Chacón

When he was seventeen Prince Don Carlos fell down the stairs at Alcalá de Henares on 19 April 1562. As a result of the accident, he suffered a wound in the left

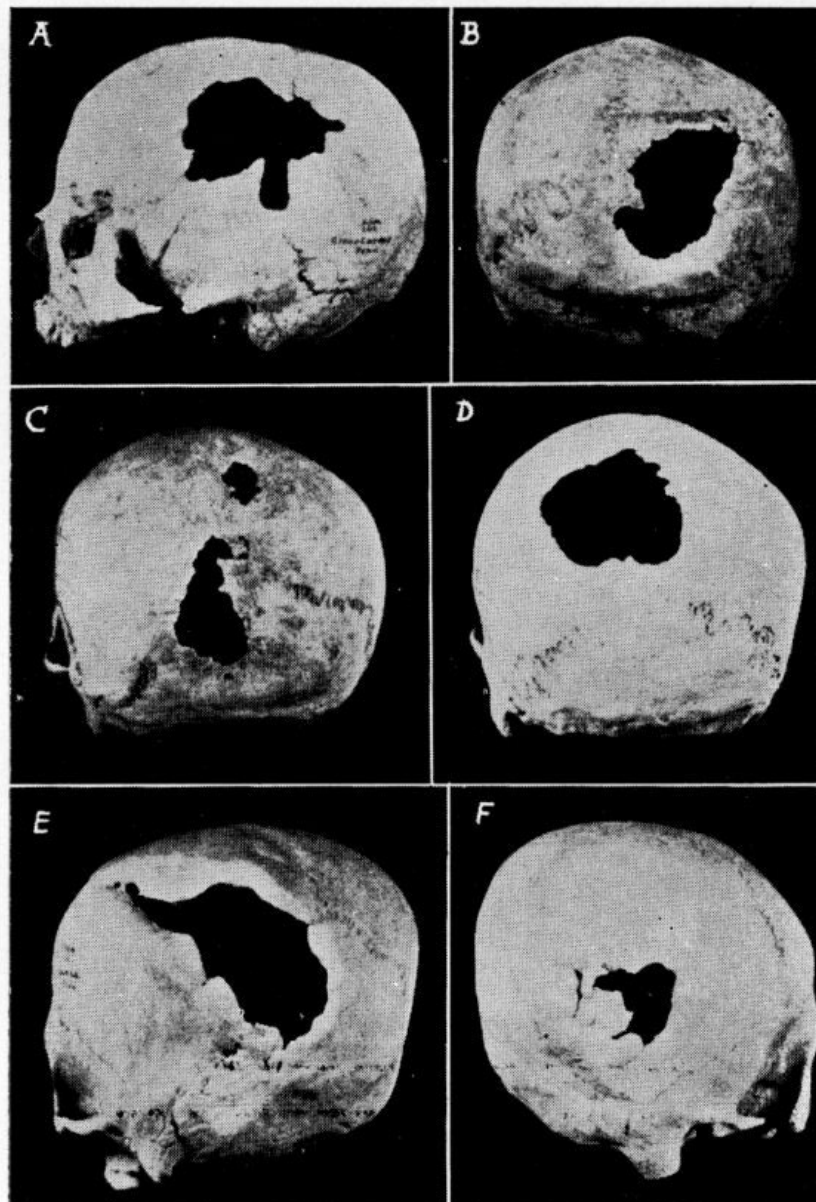


Fig. 3. — Gross cranial defects consequent to compound comminuted fractures. These large defects all show evidence of healing but variable degrees of brain damage must have occurred with the original injury perhaps with a mace, an axe or a war club.

parietal area of the skull near the lambdoid suture, a depressed fracture as it turned out with exposure or loss of bone. On the fourth day the patient experienced paresthesia of his right leg "entumecimiento", which subsequently disappeared. However, the paresthesia recurred on the 12th. day. A periosteotomy was performed, and 44 days after the accident, part of the parietal

bone, now protruding, was removed surgically. On 14 June, 1562, the Prince started walking again, and afterwards recovered normally.

The case-history was written up by Daza Chacón from the daily letters which he sent to the Princess Juana de Portugal, who was insistent that she have daily progress reports. Daza Chacón had agreed to do so,

but he made the condition that the letters be returned to him after Don Carlos' recovery.

Dr. Guerra in commenting on the case-history adds, "This accident of Prince Don Carlos revealed one of the weak points in the so-called 'black legend' against Philip II of Spain. Some historians have asserted that Philip II had intended that his son be killed because the boy was in love with his stepmother. The accident caused some unrest among the population, but this case-history, which was published by Daza Chacón after Prince Don Carlos' recovery, greatly contributed to clearing Philip II of any imputed blame. As an aside, it is interesting to note Daza Chacón's assessment of the

"doctísimo Vesalio" in some other books. He said that although Vesalius performed some astonishing anatomical dissections, he was a slow and not-very-efficient surgeon. Though Vesalius was consulted during the illness of Prince Don Carlos, he did not perform the periosteotomy."

Following the accident, Prince Carlos, whose fracture had affected the brain under the left lambdoid suture, had thus suffered attacks of paresthesia in the right leg. Vesalius insisted that the paresthesias resulted directly from brain injury caused by the depressed fracture, and advised operation, whereas Daza Chacón at first thought the symptoms due to malaria from which the Prince was also suffering and deemed ope-

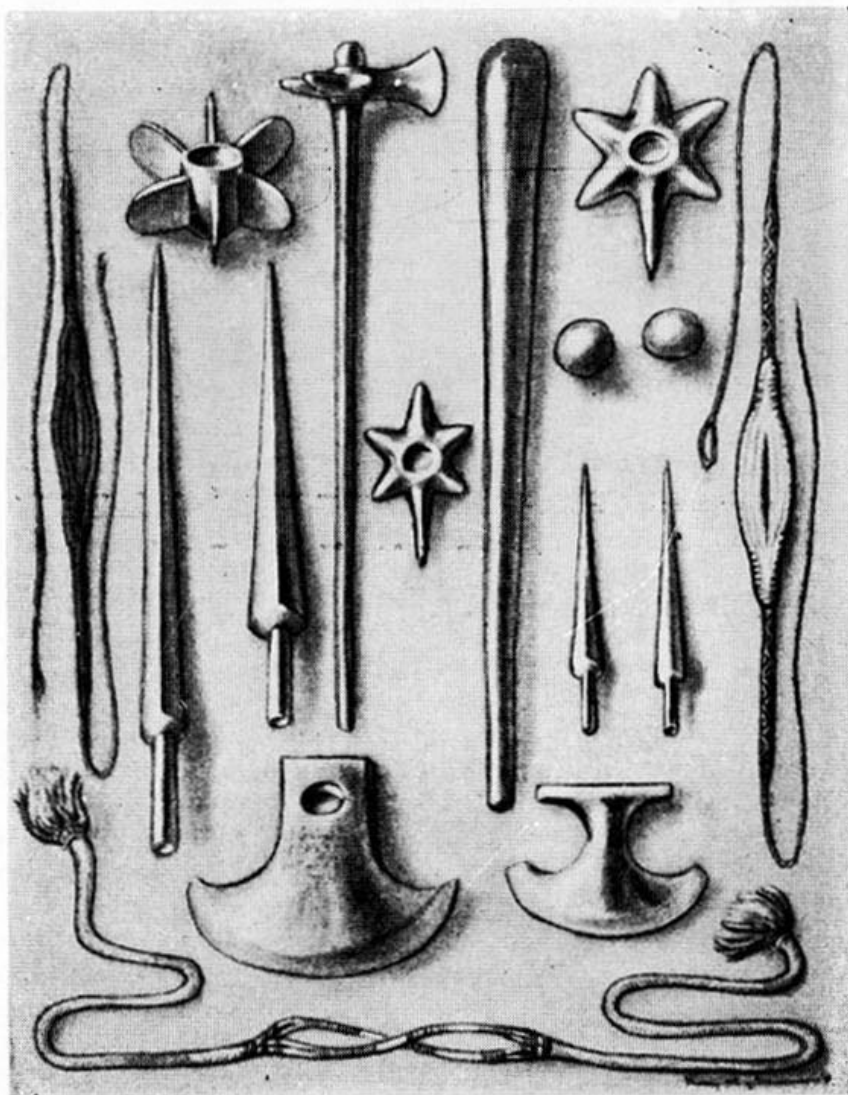


Fig. 4. — The more common weapons of war used by the pre-Colombian Incas.

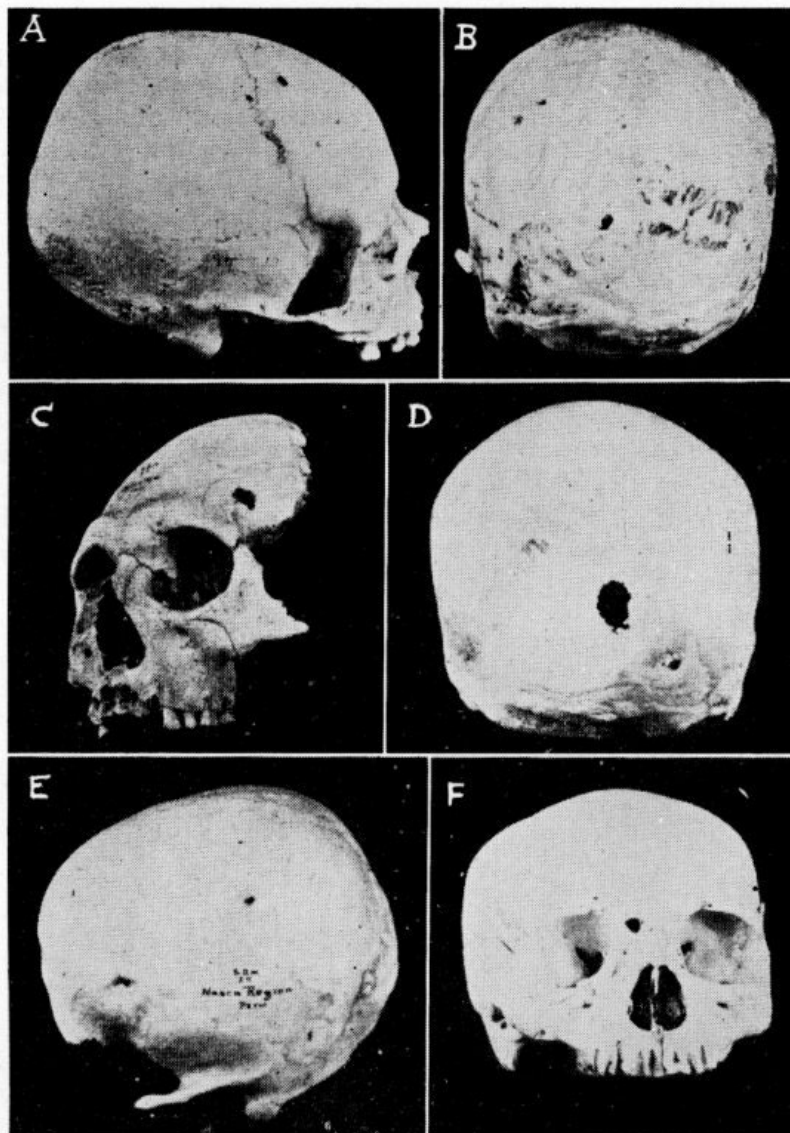


Fig. 5. — Small round perforations possibly due to arrows.

ration too hazardous, no doubt fearing rupture of the longitudinal sinus. Apart from its interest to historians of the Spanish Court and Royal House the case of Don Carlos is important scientifically because it stands as the first well-documented case of opposite sided sensory 'fits' resulting from a precisely localized lesion of the brain.

More detailed studies of brain structure came almost simultaneously from an Englishman and a Dane—Thomas Willis in his *Cerebri Anatome*, London 1664, and Nicolaus Stensen (Steno) in his *Anatome du Cerveau*, Paris 1669, anatomists of two northern countries. Here one finds the sur-

face marking of the brain exquisitely drawn and in Willis's book, the celebrated plate of the base of the brain was probably drawn by the architect, Sir Christopher Wren, showing the vascular circle still referred to as the circle of Willis. In Stensen's book, which is much rarer and rather less well known, there are four finely executed plates that are remarkable for their depiction of the detailed structure of the base of the brain, the so-called suprasellar region above the pituitary and including the walls of the third ventricle, now designated the hypothalamus. Although both Willis and Stensen were interested in translating physiological facts into anatomical language

whenever the opportunity presented itself, and although Stensen seemed to have a prescient forboding of motor control of the extremities by the nerve pathways emerging from the cerebral hemispheres, there is no record of his having devised experiments to test his hypothesis.

Only a few years later, however, the Honorable Robert Boyle, he of Boyle's Gas Laws, and honorary doctor of medicine from Oxford, made an observation that might well have led to the discovery of the motor area. The account occurs in a case report given in *Experimenta et Observations Physicae* (1691, pp. 67-73), an English book with a Latin title. It concerns a

young knight of Boyle's acquaintance who had been thrown from his horse and suffered a well-circumscribed depressed fracture near the vertex of his skull which was followed by a "dead palsy" of one side of his body, a state of affairs that we should now refer to as a flaccid paralysis. The young knight continued in this semi-paralytic state for 24 weeks and until a surgeon was persuaded to lift a spicule of bone pressing on the dura mater. Within five minutes the man could move his little finger and shortly thereafter he regained both motion and sensation of the entire paralytic side of the body, this for the first time in eight months.



Fig. 6. — Veracruz, Alphonsum a. Phisica, Speculatio. Excudebat Ioan Paulus Brissensis. 4,380 y 12 f., 32 cms. Mexici, 1557.

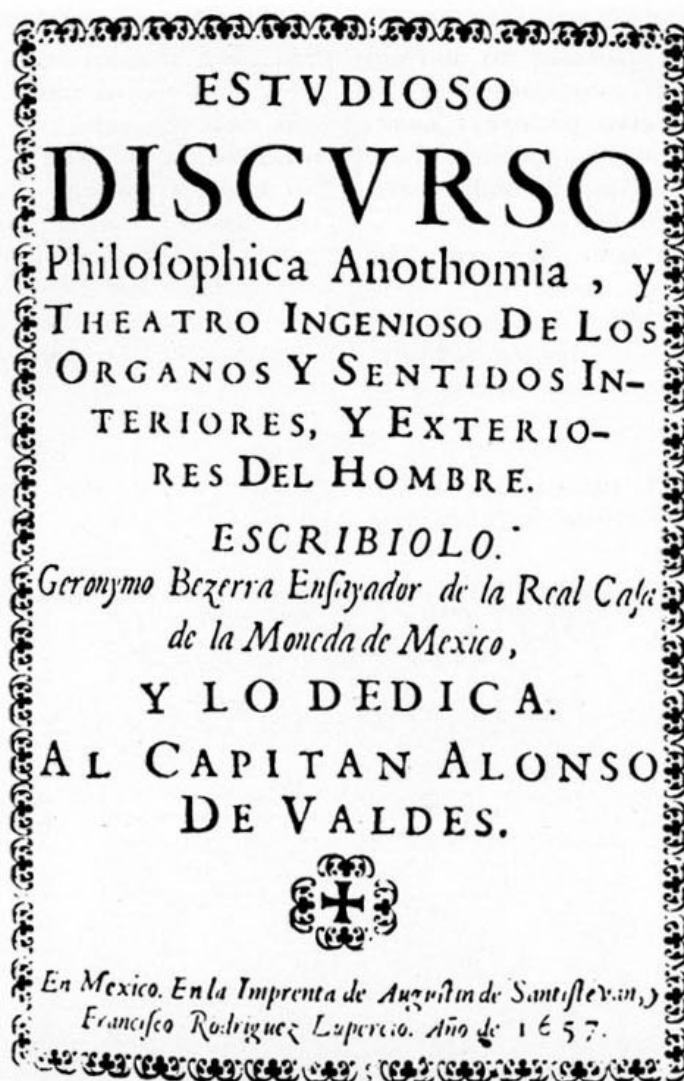


Fig. 7. — Bezerra, Geronymo. *Estudioso discurso Philosophica Anatomia*. Imp. Augustin de Santistevan y Francisco Rodriguez Lupercio. 4 y 26 h., 21 cms. México, 1657.

In early Latin-American literature neurological conditions are also described in some detail. Thus in *Phisica Speculatio* Alfonso de la Veracruz (Guerra 1, Fig. 6), the first book published in Mexico (1557), there is a full section on neurology, and they are also dealt with from a more functional standpoint in the first Interamerican textbook of Physiology published a hundred years after Veracruz, also in Mexico, i.e. Geronymo Bezerra's *Estudioso Discvrsio Philosophica Anatomia* (1657, Guerra 97, Fig. 7). The earliest separate monograph on epilepsy to be written in the New World (Puebla, Mexico) is Pedro de Horta's *In-*

forme Médico Moral sobre la epilepsia, published at Madrid in 1763, which deals, among other things, with periodic fits occurring among nuns. The attacks, some actually of *grand mal*, were thought to have been hysterical in origin (Guerra 836, Fig. 8), since they usually occurred in 'epidemic' form in given nunneries just prior to the six-monthly bleeding to which traditionally they were subjected as a rite of their Order.

The great British neurologist Hughlings Jackson once remarked, "Differentiation in structure means differentiation of function", and it turned out that following the

precise description of the surface markings of the brain by Willis and Stensen, the next important step in the direction of establishing functional localization within the cerebrum was a disclosure concerning the fine structure of the occipital lobe, an area of the brain known to be associated with vision. Irritation of the occipital pole by tumour or local fracture causes visual seizures, e.g. sparks, bright lights and sometimes well-formed hallucinations of objects and scenes drawn from past experience.

The observation was made by a 26 year-old Italian medical student, a pupil of Michele Girardi of Parma, Francisco Gennari, who stated in a book published in 1782 (p. 72) that on 2 February 1775 he saw for the first time on cutting the brain of a frozen cadaver a distinct line "interposed between two layers of white matter" (fig. 10), this being in the occipital lobe(8). Professor William C. Gibson, in his attractive book *Young Endeavour, Contributions*

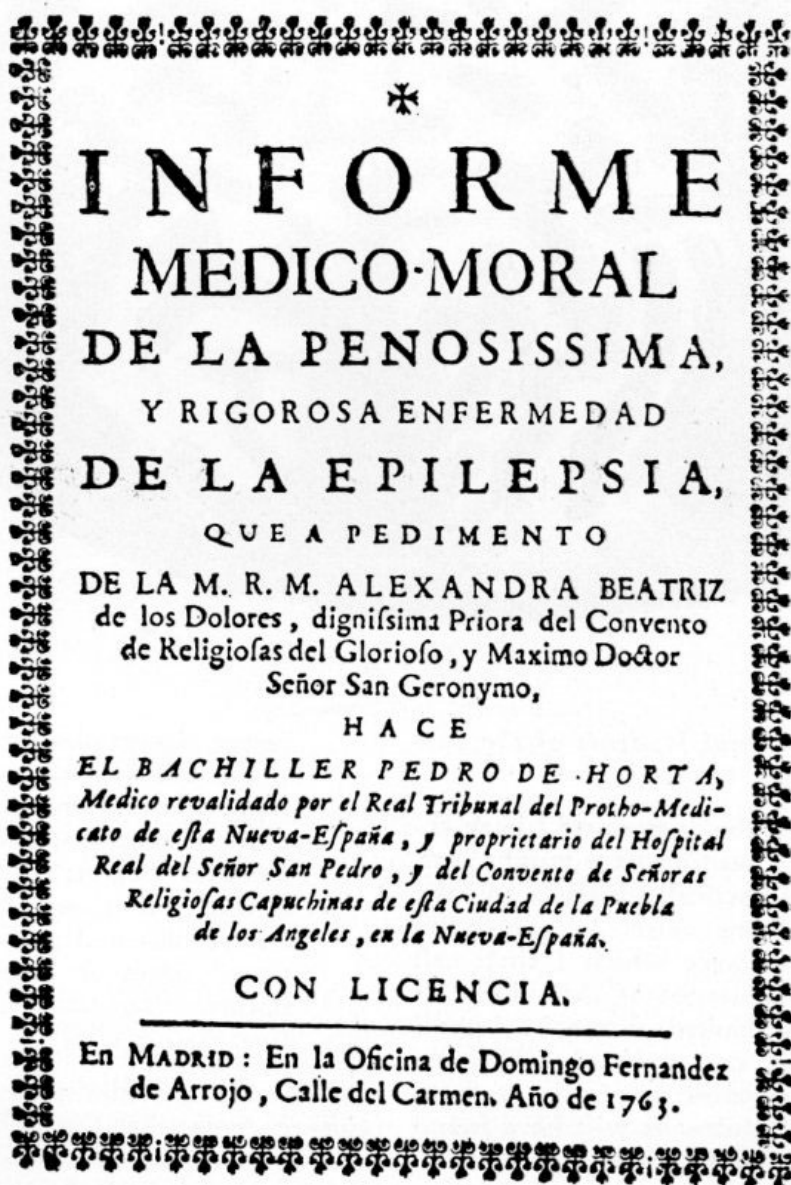


Fig. 8. — Horta, Pedro dc. Informe Médico Moral sobre la Epilepsia. Oficina de Domingo Fernández Arrojo. 7 h., 284 p., 1 grab. 21 cms. Madrid. 1763.

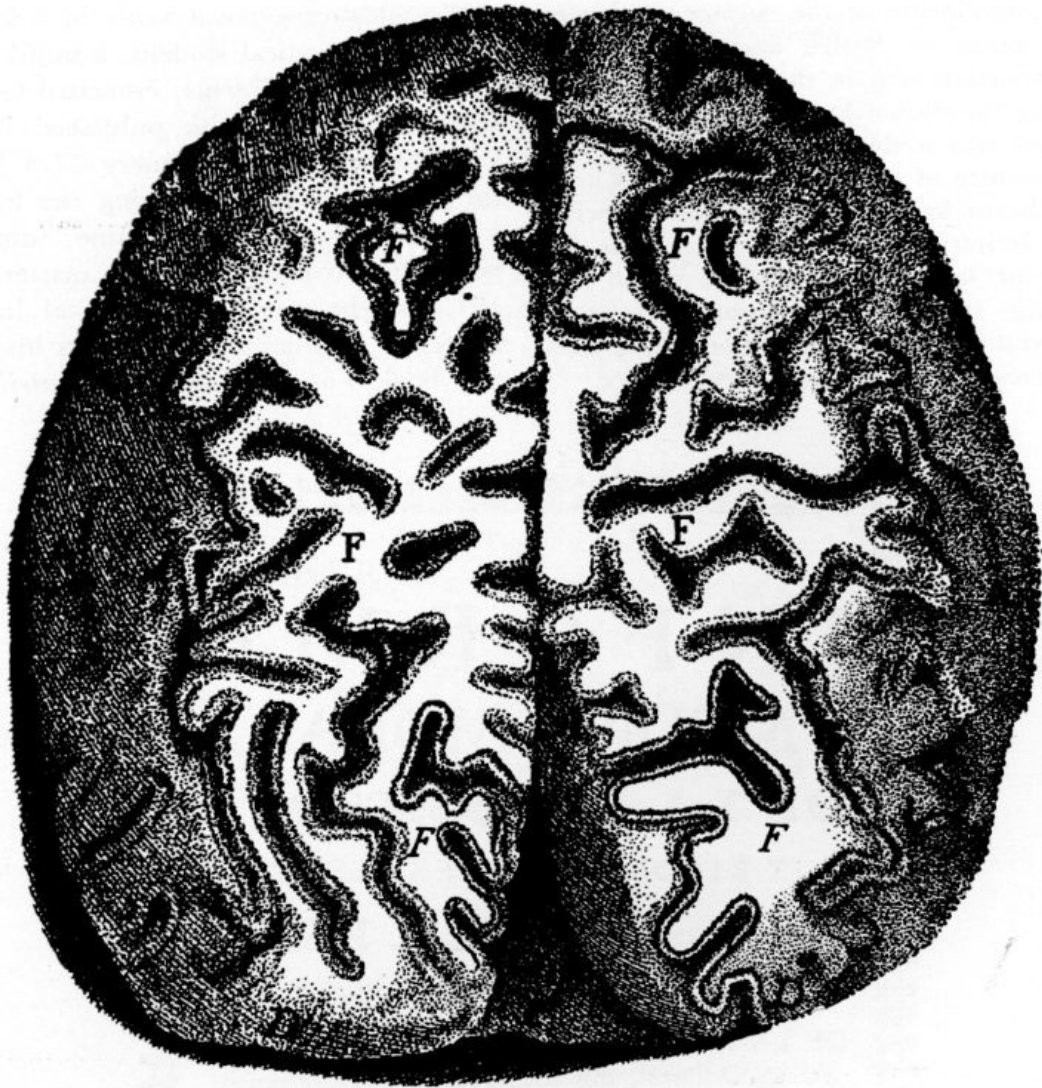


Fig. 9

to Science by Medical Students of the past four Centuries (p. 185).

"None of the anatomists I have come upon in reading have taught that, besides the cortical substance and the medulla, there exists in the brain another substance which I shall call the third substance of this viscus. If anyone has looked at the horizontal strata of the cortex of a brain dissected at the point where it conjoins with the medulla, he will have found a certain whitish substance ('subalbida'). This does not always present itself in exactly the same spot, appearing a little farther from or a little nearer to the medulla; it is ho-

wever always observed with the same extension, with the same color, sometimes more abundant and sometimes more obscure; sometimes subtle, sometimes clearer; at points, difficult, at others it is easy to demonstrate... I have observed such variations, as if many times it reappeared in such points, *afterwards with a duplicate line* (Italics ours)."

We owe to Gibson another recent disclosure from the French literature, of a medical student *Thèse de Paris* by L. F. Bravais entitled *Recherches sur les symptômes et le traitement de l'épilepsie hémiplegique*. Here, for the first time, a patient is described that had convulsions lo-

FRANCISCI GENNARI

P A R M E N S I S

MEDICINAE DOCTORIS COLLEGIATI

DE PECULIARI

STRUCTURA CEREBRI

NONNULLISQUE EJUS MOREIS .

PAUCAE ALIAE ANATOM. OBSERVAT.

A C C E D U N T .



P A R M A E

EX REGIO TYPOGRAPHICO

M. DCC. LXXXII

CUM APPROBATIONE .

Fig. 10.

calized to an isolated part of the body, this account of a unilateral focal seizure antedating by 40 years Hughlings Jackson's classical account, hence the current French term "crise Bravais-Jacksonienne". Similarly, Marc Dax, in a Montpellier essay presented for graduation in 1836, gave the first description of the syndrome of hemiplegia, hemiconvulsion and residual epilepsy in children, a condition now under stu-

dy in nearly every child neurology clinic throughout the world. Professor Soriano mentions similar studies in his forthcoming monograph in Neurology. Dax, also in 1836, wrote a remarkable paper on left hemisphere lesions and aphasia in right-handed patients, emphasizing that aphasia is never associated with similar lesions of the right cerebrum. This clinical account makes him an important forerunner of his

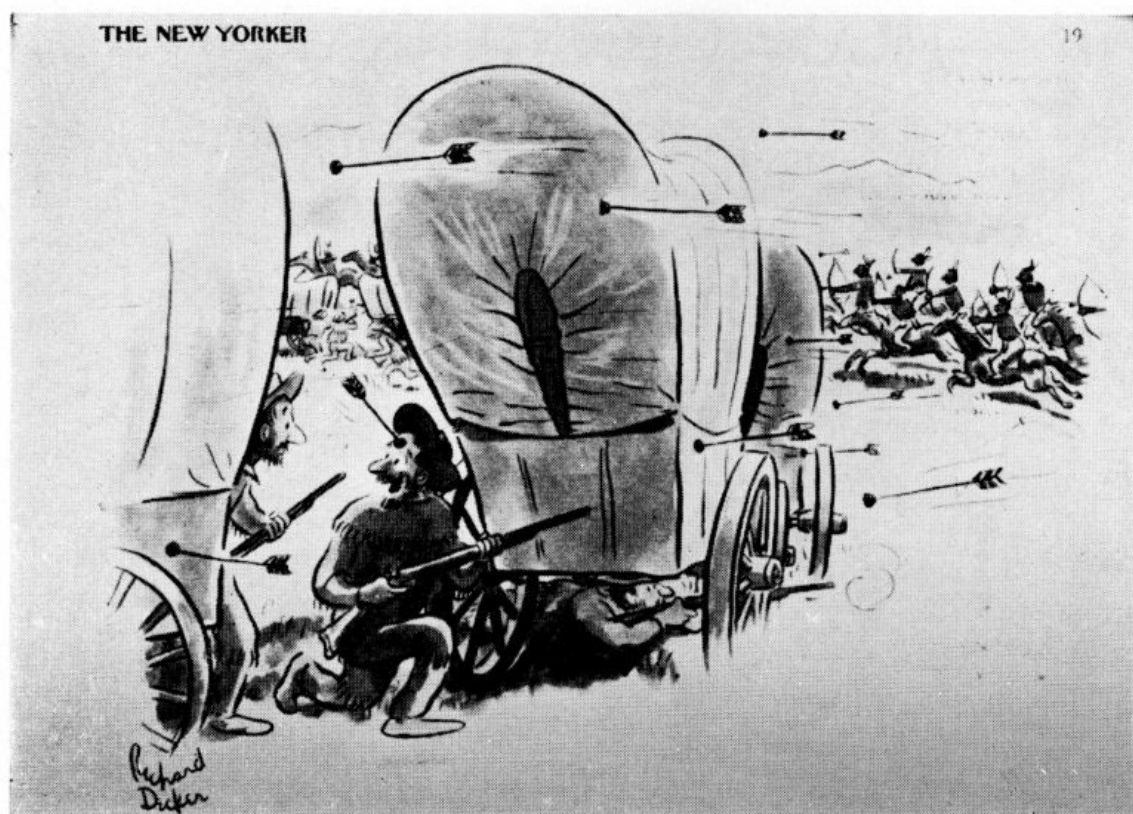


Fig. 11. — *Thank God! They're friendly*

countryman, Paul Broca — "with a firm grasp on the truth concerning hemiplegia" (Gibson, p. 187).

The men, however, who may be said to have laid the solid neuro-physiological foundation for our knowledge of the focal epilepsies were the two German students Fritsch and Hitzig, who worked simultaneously (but quite independently) of that shrewd clinical observer John Hughlings Jackson, founder of British clinical neurology.

EPILOGUE

In reviewing the most recent literature, I have noted a paper on bilateral Jacksonian seizures in the Czech journal *Ceskoslovenska Neurologie*(1) from the Neurological Clinic of the late Professor Marinescu of Bucarest.

The existence of bilateral Jacksonian epileptic seizures has long been recognized, but few cases have been described in

detail. Botez and Brosteanu report some cases illustrating two types of bilateral seizures, the first beginning in one-half of the face which may spread concurrently but less intensely to the other half, which the second type consists of convulsions affecting both sides of the body in succession. They have made EEG studies of patients in the second group illustrating the spread of EEG waves from one side to the other, thus securing an accurate record of the timing of the bilateral events. They note that such bilateral seizures are usually seen in patients with a previous history of encephalitis who have given symptoms similar to those of an expanding brain tumor and put forward the hypothesis that the residual inflammatory lesion of the encephalitis irritates the inhibitory fibers of the corpus callosum, in that way facilitating the irradiation of seizure from one-half of the body to the other. Botez and Brosteanu's report is well documented.

Physiopathology of Myoclonus

M. GOZZANO and R. VIZIOLI

Institute of Neurology and Psychiatry. University of Rome.

Director: Prof. Mario Gozzano

We have been led to take into consideration the problem of the neurophysiological basis of myoclonus in order to ascertain whether and how far the myoclonic manifestations may be approached from an unitarian standpoint, that is whether, apart from causative factors, a common final mechanism might be postulated on the basis of current clinical and experimental information. The aim of this report, therefore, is not to supply a new classification for myoclonus but to describe in current terms the involved physiopathology.

We cannot, nevertheless, omit mentioning, though briefly, previous attempts on this subject carried out from the clinical standpoint, and evaluating the limitations and uncertainty of a purely symptomatologic approach.

Only a small number of other clinical manifestations may claim such a high number of different definitions: again and again the various authors have given themselves great trouble for individuating and defining new myoclonic manifestations, different from those previously described.

Unfortunately all this has resulted in a noticeable loss of synthesis, associated with a more and more detailed analysis of the symptomatologic aspect which, though likely to gratify some author's desire for refinement in descriptive medicine, has not been of much help in the attempt to find a unitarian approach of the problem.

The history of myoclonus shows some similarity with that of the Babinski sign: in fact several authors have described the same phenomenon of the extension of the first toe, but in their descriptions only the evoking procedure was different.

According to Krebs, who is the most authoritative researcher in the clinical field, the clinical differentiation of myoclonus is admittedly difficult at times, even though "the clinical differentiation is mandatory since both precision and accuracy of semeiology, so dear to neurologists, rely upon it".

Further on the author recognizes that "a movement may be difficult to catch and to explain even with the aid of cinema and electromyography".

The Author suggests the following definition for myoclonus: "A sudden, sharp, spontaneous jerk of a muscle, similar to that resulting from muscle faradization: the typical myoclonus involves one muscle, as isolated from connected structures, affects the whole muscular mass and does not produce motor effects".

Krebs differentiates myoclonus, as above specified, from clonus which is characterized by "coordinated jerking (saccadés) movements which set to work synergically acting muscles and cause the displacement of head, of one limb or of a segment in a well-defined direction".

Paramyoclonus multiplex should be considered one of the most typical example of the first group; its nosological specificity has been supported by Krebs in contrast with most authors, particularly those of the Anglo-Saxon school (Clark, Bradshaw Hassen and Kepner, Penfield and Jasper), who classify it as a myoclonic epilepsy variant, though acknowledging the infrequent occurrence of a form of hysterical paramyoclonus. The rare reported instances of possible symptomatic nature showed clearcut signs of brain stem involvement.

PHYSIOPATHOLOGY OF MYOCLONUS

The absence of specific electroencephalographic patterns does not exclude the epileptic nature of this manifestation. Gastaut and Remond, Vizioli and Sinisi actually reported some cases of degenerative myoclonic epilepsy, in which the electroencephalographic pattern did not show any specific alteration. The authors interpreted this finding as the result of the changes of cortical electrical activity. Thus paramyoclonus might be essentially considered as a progressive myoclonic epilepsy without grand mal attacks, as already suggested by Clark in 1919 on the basis of some demonstrative cases and later supported by Hassin and Kepner in 1945.

The first classification group after Krebs might also include, besides the paramyoclonus multiplex, the partial paramyoclonus, including Kny fibrillary chorea and Schultze myokymia with reference to which Krebs mentions fibrillations, fasciculations and undulations, failing to exert motor effects. As the reciprocal identity of the above mentioned clinical pictures has been established and undoubtedly associated with acrodynia, which is an encephalomyelitis, the inclusion of these clinical entities in the myoclonus classification is currently considered obsolete. The myoclonic jerks associated with petit mal, as well as all occasional myoclonic manifestations occurring during the intervals between seizures, can be considered a typical example of synergic clonus.

Occasional interseizure myoclonic jerks occurs in 65 % of cases according to Muskens and in 75 % according to Russell Reynolds. Indeed, only myoclonic jerks of petit mal are truly synergic and symmetrical, while the interseizure clonus of idiopathic epilepsy is mostly limited to a few muscular groups (generally fingers, unfrequently head or thighs).

As for myoclonic manifestations of degenerative epilepsy, they occur in the form of volleys and are extremely irregular. As there is only a difference in intensity between interseizure epileptic myoclonus, known to be more accentuated just before the seizure, and the intermittent myoclonic of Rabot-Lundborg, the differential diagnosis may at times be difficult.

All the above described clonic manifestations are very easily elicited by external stimulations (sensory-clonic and psychoclonic effects of Muskens) by variations of the level of vigilance, by different physiologic conditions (catamenia, etc.), by variations of the muscular tonus (facilitated by relaxation).

Moreover, there are the myoclonic manifestations of the so-called Gibbs petit-mal variant, which may occur in two different forms: a dropping of head, occasionally of minor degree, or a violent dropping of head, trunk and limbs often accompanied by a shout. Attacks of this kind are not modified by sensitive-sensorial stimuli nor by spontaneous changes of tonic innervation and vigilance oscillations. The same can be stated for the pseudorhythmical clonus of the subacute sclerosing leuco-encephalitis, which are even lower than those associated with the petit mal variant.

Brief mention should also be made of the myoclonic manifestations of the jacksonian epilepsy and of the Kojewnikoff type; the former need not to be discussed in the present study and as for the latter, its localization in the so-called aerothalamic sectors of Von Bonin is admitted.

The same manifestations may result from the lesion either of the cortical or of the thalamic pole (ventro-lateral nucleus) of the above mentioned sectors. There are in addition the rhythmical clonic jerks of epidemic encephalitis and the clonic jerks of velum, palate and larynx, associated with the lesion either of the central tegmental tract, or of the olivary body in the medulla oblongata, or of the dentate nucleus.

Summarizing, therefore, on the basis of exclusively semeiologic criteria, Krebs classifies myoclonic manifestations as follows:

- a) asynchronous, arrhythmical, asymmetrical and asynergic myoclonic jerks (paramyoclonus multiplex and partial paramyoclonus);
- b) rhythmical or arrhythmical clonus (associated with degenerative epilepsy, essential epilepsy and that of the Kojewnikoff type);
- c) rhythmical clonus (epidemic encephalitis and velumpalatolaryngeal clonic jerks).

In a somewhat cloudy classification and as only member of the group, christened by the author "rhythmical or arrhythmical clonic jerks with normally synergic muscular activity", Krebs locates the Bergeron-Henoch electric chorea, the very existence of which, as specific entity, is disputed by a number of researchers.

We would suggest for all myoclonic manifestations, irrespective of intensity and distribution, occurrence or lack of synergy, synchronism and rhythmicity, a definition that takes into account the epileptic nature of the phenomenon, regardless of the presence or absence of a concomitant specific electroencephalographic pattern, which, as already mentioned, may fail at times to appear. It is therefore our opinion that one should consider as myoclonic any sudden contraction of a muscle, either rhythmic, synergical, synchronous or not, having or failing to have a motor effect and associated at least with one of the elements proving its right of inclusion in the motorial symptomatology of epilepsy, such as a specific electroencephalographic pattern, a loss of consciousness, though transient, or the associated occurrence of major epileptic manifestations. Obviously by this criterion, individual symptomatologic variants are scarcely taken into account, thus preventing the excess of analysis which has led to the present confusion and to the identification of nosographic entities which indeed do exist only for the authors who have described them. It is hardly necessary to point out that, having accepted the epileptic nature of the phenomenon, one should exclude all other hyperkinetic muscular manifestations connected with peripheral neuron involvement which, according to Krebs, should be included in the partial paramyoclonus but is in most cases related with acro-dynia.

Let us now approach the physiopathological problem upon which we wish to focus the reader's attention. It is our intent to discuss briefly three different aspects of the physiopathology of myoclonus, i.e.: a) influence of the cortex on the genesis of myoclonic manifestations; b) relations between myoclonic jerks and major epileptic

manifestations; c) role of inhibitory mechanism in suppressing the myoclonic phenomenon.

As for the first item, that is the possible influence of the cortex on the genesis of myoclonus, this would appear to be quite negligible according to most researchers, even though a few contrasting opinions do exist as well as clinical indications which do not support such an exclusive standpoint on the role played by the cortex in the genesis of myoclonus.

According to Moruzzi, epileptic myoclonus may be physiologically interpreted as the convulsive enhancement of the tonic effect normally exerted by the reticular formation of the brain stem on the spinal activity.

It is well known that the activating influence of the descending reticular formation on the spinal motor neurones can be elicited by the stimulation of a long tract of the same formation, while the inhibitory activity is evoked only by the stimulation of the inhibitory center of Magoun in the medulla oblongata.

The view of the purely subcortical genesis of myoclonus is supported by the knowledge that myoclonic manifestations can be evoked also in the rhombencephalic animal. However Gastaut and Remond also admit that when E.E.G. records cortical discharges, as in some cases of unilateral myoclonic jerks observed by them, it supplies the evidence of the cortical genesis of some forms of partial myoclonus, thus confirming the opinion of Kojewnikoff.

As for those cases where unilateral myoclonus is not accompanied by cortical discharges, it is necessary, according to Gastaut, to take into consideration the concept of the areothalamic sector of Von Bonin, that is to admit that similar clinical manifestations may result from the involvement either of the cortical pole (positive E.E.G.) or of the thalamic pole (negative E.E.G.) of the same sector. Also the myoclonic jerks type B of Gastaut and Remond which show a characteristic E.E.G. pattern (spike-and-wave Gibbs variant) and clinical features corresponding to those once described as "bowing tic or saalam convulsions", indicate the presence of "gros dom-

mages cérébraux décelables par la radiologie et l'examen neuropsychiatrique" (Gastaut and Remond).

Type A myoclonus, according to the French classification is widely different from the B type; the former shows exacerbations in the evening or in the morning and is subject to hormonal changes (the myoclonic manifestations are characteristically exacerbated during the menstrual cycle), to alcohol excess, to emotional stress, to sudden sensorial stimulations (sensory-clonic reaction of Lundborg and Muskens), while type B myoclonus is in no way affected by the above mentioned factors.

Despite the recognition that type B myoclonus is associated with gross brain damage, Gastaut states that bilateral myoclonus may be also evoked in the absence of the motor cortex. This might be supported by the fact that an exact relationship between myoclonus and the E.E.G. may fail to exist as they may be reciprocally independent; polyspikes-and-waves may in fact occur in the absence of myoclonus while, on the other hand, myoclonic jerks may be observed in the absence of specific E.E.G. patterns.

The participation of cortex in bilateral myoclonus would be quite occasional as this should originate only in the reticular formation.

Penfield and Jasper also favour the hypothesis of the lack of active participation of cortex in epileptic myoclonus. Their statements are supported mostly by the finding that in many cases of "epilepsia partialis continua" electroencephalographic changes are not observed.

However the authors admit that, though their attempts to elicit myoclonic response in man by cortical stimulation have been unsuccessful, in animals the stimulation of the motor cortex evokes movements similar to myoclonic jerks.

The concept that, as for myoclonic discharge, the cortex would behave in a completely passive way is contested by the observations of Lorentz de Hass, Lombroso and Merlis.

These authors object that wide interest resulting from the recognized importance of the midline structures has caused the

possible role of cortex on the effector mechanism of clonus to be neglected. On the basis of accurate experimental research, they have proved that the motor cortex, although not essential for the elicitation of the reflex myoclonic response, may markedly influence this response in the acoustic—Metrazol and photic—Metrazol preparations. They observed that in the nembutalized or curarized cat, injections of subconvulsant doses of Metrazol evoke myoclonic response to the click stimulus or to the single photic stimulus and that after the unilateral ablation of the motor cortex the myoclonic response becomes asymmetrical, being completely or partially abolished on the side opposite ablation.

With bilateral ablation of the motor cortex, the myoclonic response is suppressed, but it can be restored bilaterally by increasing the dosage of Metrazol. The responses are not affected by the ablation of the specific sensory cortex (visual or acoustic) of one or both sides nor by the removal of all cortex which only causes the Metrazol threshold to be markedly increased.

The studies of the American researchers, while supporting the assumption that the motor cortex is not essential for the genesis of the myoclonic phenomenon, on the other hand indicate that, when functioning, it greatly facilitates the elicitation of the reflex myoclonic response.

Whether this facilitation is exerted on subcortical motor mechanisms or is a direct discharge to the spinal motor neurones is a problem which, according to the authors, has not yet found a definite answer.

Summarizing and attempting to solve our first problem concerning the degree of cortical influence on myoclonic manifestations of epilepsy in man, we would suggest that the clinical role of cortex ought to be reviewed, particularly if we wish to take into account the fact that, should even the exclusive brain stem origin of the petit mal myoclonus and of the sporadic myoclonic jerks of epilepsy be admitted, there are also myoclonic manifestations, such as those associated with the E.E.G. pattern of the petit mal variant where there is "evidence of organic brain damage" (Gibbs).

Upon which neurophysiological basis should the assumption of the role of the cortex in certain myoclonic manifestations be supported?

Clearly we must refer to the correlation between the cortex and the reticular system, admitting therefore that the reticular activating system is the final common pathway of symmetrical myoclonus, despite that Merlis and Misray were able to show, both in cats and in monkeys, that the section of the pyramidal tract in the medulla oblongata, near the trapezoid body, depresses the myoclonic response.

(The authors concluded that the corticospinal tracts are directly involved in the genesis of myoclonus rather than indirectly through the activating effect of brain stem.) It is well known that cortico-reticular connections begin from the sensorimotor cortex, the oculomotor frontal areas, the gyrus cinguli, the orbital surface of the frontal lobe, the upper temporal gyrus, the paraoccipital area, and the entorhinal cortex. It is therefore obvious that neocortical and paleocortical effects are exerted directly on the brain stem through which they also affect the various mechanisms cephalad and caudad. The stimulation of these cortical areas evokes electrocortical and behavioral arousal reactions in animals with indwelling electrodes. Stronger stimulation of the same areas evokes reactions showing features associated with fear, terror, etc. Behavioral responses are in agreement with these features. All this indicated that the mechanisms controlling the modulation of the input to the brain, as well as the motorial control have a definite underlying subcortical layer.

As regards the possible type of influence exerted by the cortex on the genesis of myoclonic manifestations, either of the two following assumptions must be admitted: that it might enhance the activating capacity of the descending reticular formation, *or that a cortical lesion might suppress the influence exerted by a number of inhibitory fibres directed to the reticular formation in the medulla oblongata, thus altering the balanced activity of the activating and inhibitory reticular formation, in behalf of the former.*

As several areas connected with the reticular system belong to the category admittedly exerting an inhibitory activity, we do not consider too bold to acknowledge that several cortical damages may indirectly evoke myoclonic manifestations by suppressing the inhibitory fugal discharges (Sollini and Vizioli). The myoclonic jerks accompanying the Gibbs petit mal variant, where evidence of gross cerebral lesions exists, are those less affected by sensitive-sensory or psychical stimuli (sensoriclonic and psychoclonic effects).

This seems to support the validity in man of the interpretation of Lorentz de Hass, Lombroso and Merlis on the influence of cortex in the elicitation of the reflex myoclonic response.

A further corroboration of the soundness of such an integration between clinical and experimental data is that the myoclonic manifestations, where the cortex is assumed to be intact, are the most responsive to the reflex triggering (myoclonic petit mal, sporadic myoclonic jerks of essential epilepsy).

Let us now discuss briefly the second item of the problem we selected for our analysis, i.e. correlations between myoclonus and grand mal epilepsy.

These correlations have been considered very close since in 1926 Muskens supposed that the basis of every epileptic manifestation was myoclonus which he therefore defined as the epileptic unit.

Thus the grand mal attack would only be a sum of myoclonic jerks. This hypothesis was supported by the occurrence of sporadic myoclonic jerks in epileptic subject. This, according to Russell Reynolds, is observed in 75 % of cases and according to Muskens in 60 %, even though Hoskins and Zakowled have reported different rates of the phenomenon, ranging, after various authors, from 15 % to 70 %.

In this connection the data reported by Gastaut and Remond are of great value: of 371 epileptic patients seen in their clinics, the clinical diagnosis of epilepsy with intermittent myoclonic manifestations had been made only in 37, while the myoclonic discharge were shown in the E.E.G. pattern of some 314 patients. Thence the authors concluded that myoclonic manifestations

are much more frequently observed by the electroencephalologist than by the clinician.

Lecasble was able to find evidence of myoclonus in 113 out of 138 patients, i.e. in 90 % of cases. In studying the chronological correlations between myoclonus and other epileptic manifestations, he found out that in 40 % of cases, myoclonic jerks occurred only as a premonitory element of the seizures, in 20 % they were both preictal and inter-seizure, while in the remaining 40 % they were chronologically quite independent of the major attacks.

As regards the E.E.G., Lecasble points out that myoclonic discharges do not gradually combine in order to give rise to the tonic-clonic discharge of grand mal but on the contrary they cease, to be replaced, after a short interval, by the latter.

More than once we have been impressed by the fact that it is possible to elicit a true myoclonic epileptic status by the intermittent photic stimulation without provoking a grand mal seizure. In a recently observed case (Vani, Vizioli and Macagnani) of a girl suffering from an extremely severe photogenic epilepsy, which could be triggered even by a weak artificial light and which compelled the patient to live in darkness or wearing ungraduated lenses (black opaque glasses), the exposure to light elicited an endless succession of myoclonic jerks never resulting in a major seizure.

This aspect of the problem, i.e. the relations between myoclonic manifestations and grand mal attacks is closely connected with the third item of our analysis, viz. the possible role of an inhibitory system in myoclonic epilepsy.

Gastaut has postulated for the cessation of the attack the influence of a rhythmic inhibitory system, on the basis of the phylactic theory held by G. Walter and of the "Bremswelle" theory of Jung. He is of the opinion that the caudate nucleus is the center of this system, as also supported by the findings of Drooglever Fortuyn who has described a caudate relay in the diffuse projection system to the cortex from the intralaminary nuclei.

According to Gastaut, clear-cut analogies exist between the discharge in lapses and

that in myoclonus both of which employ the same subcortical mechanisms.

The polyspikes-and-waves would represent a transition between the polyspike and the spike-and-wave of petit mal. Also according to Gastaut, in myoclonus associated with polyspikes-and-waves the muscular jerk is less violent when the spikes are less in evidence and the slow wave more prominent. He believes therefore that the slow wave is nothing but the electroencephalographic manifestation of an inhibitory process in the epileptic discharge.

This mechanism would operate most effectively in petit mal where each spike evokes a slow wave.

Gastaut's interpretation of the problem of inhibition is so much more admirable as one considers that it is founded exclusively on the integration between clinical and electroencephalographic data.

It is our opinion that we can presently make a somewhat more detailed study in order to grasp more clearly this complex suppressive mechanism. We refer to the studies by Terzuolo, who showed that it is possible to inhibit completely the tetanoid convulsions induced by strychnine in the curarized cat by means of electrical stimulation of the inhibitory center of Magoun in the medulla oblongata or of the inhibitory area of the anterior lobe of the cerebellum. He was likewise able to give evidence that these inhibitory supraspinal structures maintain a restraining activity also in the course of epilepsy due to strychnine, as supported by the fact that a marked increase of frequency in the tetanoid rhythm results from the cooling of the cerebellum.

The spinal tetanoid rhythm is at each instant slowed down by the restraining effect of supraspinal mechanisms, not affected by the convulsant activity of strychnine but consistently maintaining their responsiveness.

Bremer and Gernandt believe that the cerebellum exerts its modifying activity through a back-acting mechanism by negative feed-back. In fact, every spinal discharge results in a powerful discharge of afferent impulses to the cerebellar areas with spinal projection and particularly to

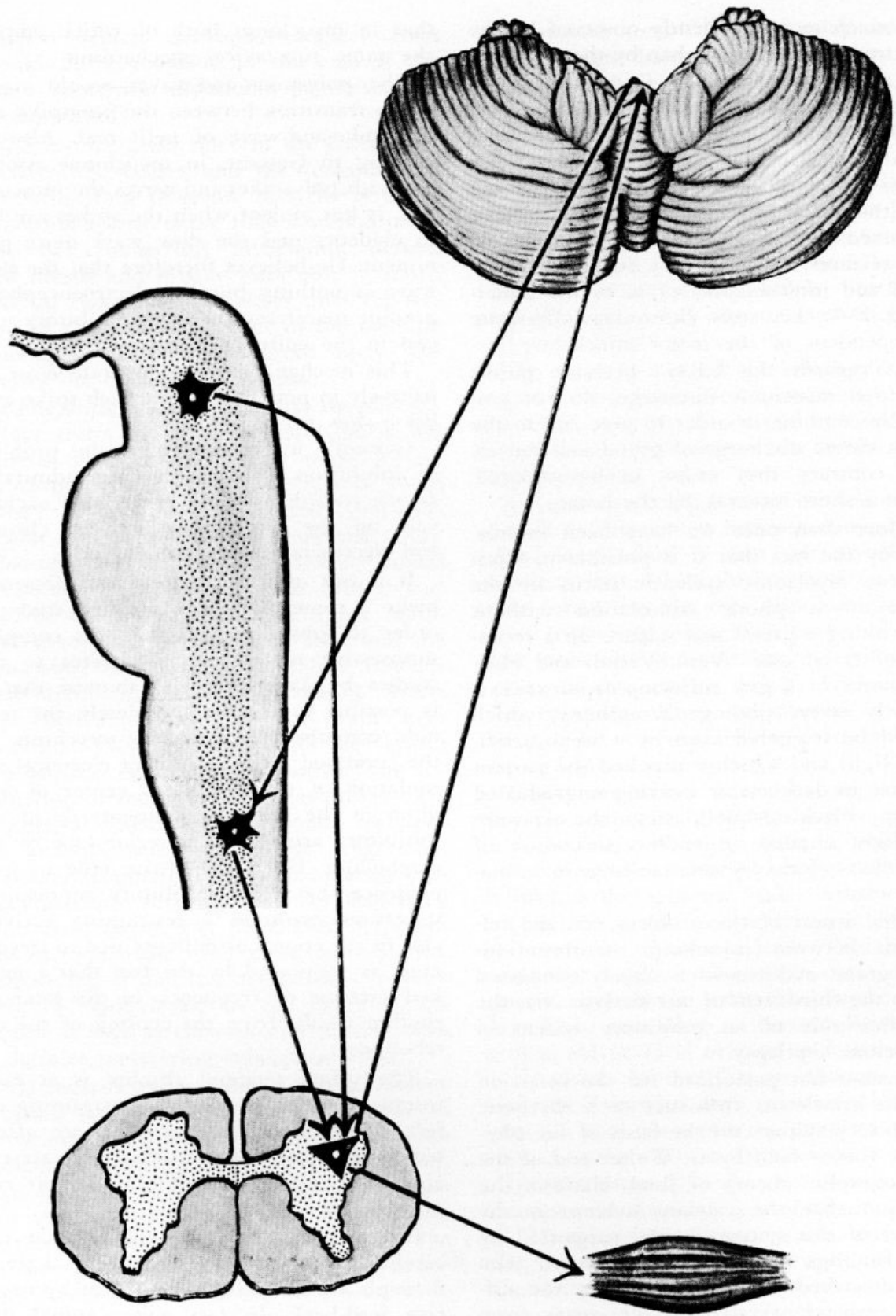


Fig. 1. — A reticulo - spino - cerebello - reticulo - spinal circuit controls the genesis and cessation of myoclonic jerks.

the inhibitory area of the anterior cerebellum. Each of these spinocerebellar afferent discharges is followed by a discharge of impulses with features similar to those of the Purkinje cells afferent discharges.

Considering that the anterior lobe of the cerebellum projects on the inhibitory reticular formation (Snider, McCulloch and Magoun, Moruzzi, Mollica and Naquet) our hypothesis appears to be logical and well supported by the experimental data, viz. that a powerful inhibitory system takes a part in the cessation of the myoclonic jerk. This system is set to work by the same discharge of the spinal motor neurones which would participate in its interruption through spino-cerebellar, cerebello-reticular and reticular-spinal discharges. (Fig. 1.)

We think it therefore justified to assume the existence of a reticulo-spino-cerebello-reticulo-spinal circuit controlling the genesis and the cessation of myoclonic jerks without the necessity of postulating the intervention of the caudate nucleus, as suggested by Gastaut.

Concluding our brief survey of the present status of the myoclonus problem, we think it logical to state that:

- a) a number of experimental and clinical data are available that lead to the conclusion that the cortex may play a role, if not essential at least of great importance, in the genesis of myoclonus, possibly through a decrease of cortico-reticular inhibitory discharges with alteration of the balanced effects of activating and inhibitory reticular formation in behalf of the former.
- b) the correlations between myoclonus and major seizures are not such that myoclonus may be considered as the epileptic unit, as suggested by Muskens.
- c) experimental evidence is available supporting, at least on an analogical basis, the assumption that in the cessation of myoclonic jerks an inhibitory system intervenes which is localized in the anterior lobe of cerebellum. This system is set to work by the same discharge of spinal motor neurones that would also take a part in its cessation, through the spino-cerebellar and cerebello-reticulo-spinal pathways.

SUMMARY

The neurophysiological basis of myoclonus are reconsidered by the Authors in order to see whether it is not possible to propose a final common mechanism.

Clinical classifications of myoclonus are criticized because extreme analysis of the symptom myoclonus has not been of help until now in its correct interpretation.

A definition of myoclonus is proposed that takes into account its pertinence to epileptic phenomena independently from its intensity, symmetry, synergy. So called paramyoclonus parcellaris should not belong to the group of myoclonus, but to the group of muscular hyperkinesias of peripheral origin.

Three main points are stressed by the Authors: a) importance of cortex in the genesis of myoclonus; b) relations between myoclonus and major convulsive seizures, and c) participation of inhibitory mechanisms in the arrest of myoclonus.

As to the first point, the participation of cortex is stressed on the basis of the experimental research of Lorentz de Haas, Lombroso and Merlis on the reduction of reflex myoclonus after ablation of motor cortex. Cortico-reticular relays might be the basis for a cortical participation in myoclonus: the normal balance between reticular facilitatory system and reticular inhibitory sys-

tem might be altered by cortical lesion of inhibitory cortical areas.

The relation between myoclonus and grand mal are not such to justify the hypothesis of Muskens that myoclonus is the "epileptic unit". The possibility to provoke by SLI a myoclonus status without grand mal is stressed on the basis of some personal cases.

The participation of an inhibitory system in the arrest of myoclonus is considered

and the hypothesis that such inhibition is provoked by spinal discharges to anterior lobe of cerebellum and by cerebellar discharges from the anterior lobe to bulbar inhibitory system is advanced; it is based on experimental research by Germandt and Bremer who have shown that each spinal discharge is accompanied by a volley of impulses toward cerebellar areas of inhibition.

RESUMEN

Los autores reconsideran las bases neurofisiológicas del mioclonus a fin de establecer si es o no posible proponer finalmente un mecanismo común.

Se critican las clasificaciones clínicas del mioclonus, pues el análisis profundo del síntoma no ha sido útil hasta el presente para llegar a una interpretación correcta.

Se propone una definición del mioclonus que tiene en cuenta su pertinencia al fenómeno epiléptico, independientemente de su intensidad, simetría, sinergia. El llamado "*Paramioclonus parcellaris*" no debe ser considerado como perteneciente al grupo del mioclonus, sino al de las hiperquinias de origen periférico.

Los autores insisten sobre tres puntos principales: a) la importancia de la corteza en la génesis del mioclonus; b) la relación entre el mioclonus y los ataques convulsivos mayores; c) la participación de mecanismos inhibidores en la detención del mioclonus.

En lo que concierne al primer punto la participación de la corteza está confirmada por las investigaciones experimentales de Lorentz de Haas, Lombroso y Merlis, sobre

la reducción del mioclonus reflejo después de la ablación de la corteza motora.

Las conexiones córtico-reticulares pueden estar en la base de una participación cortical en el mioclonus: el equilibrio normal entre el sistema reticular de facilitación y el sistema reticular de inhibición podría estar alterado por la lesión de las áreas corticales de inhibición.

Las relaciones entre el mioclonus y el gran mal no justifican la hipótesis de Muskens de que el mioclonus es la "unidad epiléptica". Ciertos casos personales sirven para establecer la posibilidad de provocar por SLI un estado de mioclonus sin gran mal.

Se considera la participación de un sistema de inhibición en la detención del mioclonus; se emite la hipótesis que esta inhibición está provocada por descargas espinales al lóbulo anterior del cerebelo y por descargas del lóbulo anterior del cerebelo hacia el sistema bulbar inhibitor; lo que se basa sobre la investigación experimental de Germandt y Bremer que mostraron que cada descarga espinal se acompaña de una salva de impulsos hacia las superficies de inhibición del cerebelo.

RESUME

Les auteurs reconsidèrent les bases neurophysiologiques du myoclonus afin d'établir s'il est possible ou non de proposer finalement un mécanisme commun.

On critique les classifications cliniques

du myoclonus car l'analyse approfondie du symptôme n'a pas été utile, jusqu'à présent, pour arriver à une interprétation correcte.

On propose une définition du myoclo-

nus qui tient compte de son appartenance au phénomène épileptique, indépendamment de son intensité, symétrie, synergie. Le nomme "Paramyoclonus Parcellaris" ne doit pas être considéré comme appartenant au groupe du myoclonus, sinon à celui des hyperkinésies d'origine périphérique.

Les auteurs insistent sur trois points principaux: a) l'importance de l'écorce dans la genèse du myoclonus; b) la relation entre le myoclonus et les attaques convulsifs majeurs; c) la participation de mécanismes inhibiteurs dans l'arrêt du myoclonus.

En ce qui concerne le premier point, la participation de l'écorce est confirmée par les investigations expérimentales de Lorentz de Haas, Lombroso et Merlis, sur la réduction du myoclonus réflexe après l'ablation de l'écorce motrice.

Les connections cortico-réticulaires peuvent être à la base d'une participation corticale dans le myoclonus: l'équilibre nor-

mal entre le système réticulaire de facilitation et le système réticulaire d'inhibition pourrait être altéré par la lésion des aires corticales d'inhibition.

Les relations entre le myoclonus et le grand mal ne justifient pas l'hypothèse de Muskens de que le myoclonus est "l'unité épileptique". Certains cas personnels servent à établir la possibilité de provoquer par SLI un état de myoclonus sans grand mal.

On considère la participation d'un système d'inhibition dans l'arrêt du myoclonus; on émet l'hypothèse que cette inhibition est provoquée par des décharges spinales au lobe antérieur du cervelet, et par des décharges du lobe antérieur du cervelet vers le système bulbaire inhibiteur; ce qui se base sur l'investigation expérimentale de Germandt et Bremer qui ont montré que chaque décharge spinale s'accompagne d'une salve d'impulsions vers les surfaces d'inhibition du cervelet.

ZUSAMMENFASSUNG

Die Autoren unterziehen die neurophysiologischen Grundlagen des Myoklonus einer Kritischen Betrachtung, um festzustellen, ob es endlich moeglich ist, einen gemeinsamen Mechanismus vorzuschlagen.

Es werden die klinischen Klassifizierungen kritisiert, weil eine gruendliche Analyse des Systems bis jetzt von keinem Nutzen war, um zu einer korrekten Auslegung zu gelangen.

Man proponiert eine Definition des Myoklonus, wobei man seine Zugehoerigkeit zum epileptischen Formenkreis in Betracht zieht, ganz unabhængig von seiner Intensitaet, Symmetrie und Synergismus. Der sogenannte Paramyoklonus Parcellaris darf nicht in die Gruppe der Myoklonien einbezogen werden, sondern in die der Hyperkinesien peripherischen Ursprungs. Die Autoren legen auf drei Hauptpunkte Nachdruck: a) Die Wichtigkeit der Hirnrinde fuer die Entstehung des Myoklonus; b) die Beziehungen zwischen Myoklonus und

grossen Krampfanfaellen; c) die Teilnahme der Hemmungsmechanismen bei der Bremsung des Myoklonus.

Beueglich des ersten Punktes ist die Teilnahme der Hirnrinde durch die experimentellen Studien von Lorentz Haas, Lombroso und Merlis ueber die Verminderung des Myoklonusreflexes nach der Abtragung der motorischen Hirnrinde bestaetigt worden.

Die cortico-reticulaeren Verbindungen koennen die Grundlage einer kortikalen Beteiligung des Myoklonus sein. Das normale Gleichgewicht zwischen dem retikulaeren Bahnungssystem und dem retikulaeren Hemmungssystem, koennte durch die Erkrankung der kortikalen Hemmungszonen gestoert sein.

Die Beziehungen zwischen Myoklonus und Grand Mal berechtigen nicht zu der Annahme von Muskens dass der Myoklonus die "Epileptische Einheit" sei. Einige eigene Faelle dienen dazu, an die Moeglich-

keit, durch SLI einen Status Myoclonicus ohne Grand Mal hervorzurufen, zu denken.

Man betrachtet die Teilnahme eines Hemmungssystems bei der Bremsung des Myoklonus und man stellt eine Hypothese auf, dass solche Hemmung durch spinale Entladungen nach dem Vorderlappen des Kleinhirns und zerebelläre Entladungen

des Vorderlappens nach dem bulbaeren Hemmungssystem hervorgerufen sei. Diese basiert auf die experimentellen Forschungen von Germandt und Bremer, welche zeigten, dass jede spinale Entladung von einer Salve von Impulsen in Richtung nach den zerebellaeren Hemmungszentren begleitet ist.

REFERENCES

BREMER F. Les processus d'excitation et d'inhibition dans le phénomènes épileptiques in "*Bases physiologiques et aspects cliniques de l'épilepsie*", Masson et C. Paris, 1958.

BRADSHAW J. P. P. A study of myoclonus. *Brain* 77:138, 1954.

GASTAUT H. et REMOND A. Étude EEGraphique des myoclonies. *Rev. Neurol.* 86:596, 1952.

CLARK L. P. A critical discussion of the nature of essential myoclonia. *J. Nerv. Ment. Dis.* 50:17, 1919.

HASSIN G. B. and KEPNER R. D. Paramyoclonus multiplex. *J. Neuropath. exper. Neurol.* 4:123, 1945.

KREBS E. Les myoclonies (étude semeiologique). *Rev. Neurol.* 86:549, 1952.

LECASPLE R. Les myoclonies épileptiques in "*Bases physiologiques et aspects cliniques de l'épilepsie*". Masson et C. Paris, 1958.

LORENTZ DE HAAS, A. M., LOMBROSO C. and MERLIS J. K. Participation of the cortex in experimental reflex myoclonus. *EEG Clin. Neurophysiol.* 5:177, 1953.

MUSKENS L. J. J. L'épilepsie. Maloine, Paris, 1928.

PENFIELD W. and JASPER H. H. Epilepsy and the functional anatomy of brain. *Little Brown Comp.* 1954.

VANNI V., VIZIOLI R. and MACCAGNANI F. *In press.*

VIZIOLI R. and SOLLINI A. *In press.*

Manifestations Cliniques de L'Épilepsie

P. PASSOUANT

Professeur à la Faculté de Médecine. Montpellier.

Les manifestations cliniques de l'épilepsie sont très diverses et leur classification malgré l'apport considérable de l'électroencéphalographie et de la neurophysiologie reste difficile.

Les aspects de l'épilepsie ont longtemps été envisagés sous trois types: le *Grand-Mal* forme majeure ou épilepsie généralisée précédée ou non d'aura, le *Petit-Mal* forme mineure correspondant à des brefs obscurcissements de la conscience et non accompagnés de chute, les *Equivalents* groupant des manifestations diverses parmi lesquelles les troubles psychiques et les automatismes. Deux caractères cliniques, communs à la plupart de ces accidents: l'allure paroxysmique avec début et terminaison brusque, l'amnésie secondaire, orientaient le diagnostic qui était facilité par l'apparition de la crise généralisée.

L'électroencéphalographie en donnant à l'épilepsie un critère objectif a bouleversé cette ancienne classification clinique. L'épilepsie est devenue un symptôme électro-clinique traduisant la brusque décharge d'un groupe de neurones et dont l'expression clinique est fonction de la localisation de la décharge initiale et de sa propagation secondaire.

Ainsi la notion jacksonienne de foyer épileptique était précisée et étendue, par la suite, à la plupart des épilepsies psychomotrices par l'identification de décharges temporales. Les stimulations de l'écorce cérébrale faites chez l'homme, au cours d'interventions neuro-chirurgicales allaient permettre de reproduire les diverses épilepsies focales et d'établir, grâce à Penfield, une véritable carte des foyers corticaux.

L'électroencéphalographie a par ailleurs révélé l'existence de décharges bila-

térales ou généralisées au cours des épilepsies qui se traduisent par une perte de conscience immédiate. Ces anomalies ont été rapportées, d'après les données expérimentales, aux formations non spécifiques du tronc cérébral et ces épilepsies correspondant au Petit-Mal et au Grand-Mal ont été groupées sous le nom de "centrencéphaliques". A ces épilepsies sous corticales, Penfield a rattaché les myoclonies rapportées à une décharge localisée dans la partie basse du centrencéphale.

Ainsi une classification topographique en épilepsie localisée corticale et en épilepsie généralisée sous corticale ressort du nombre considérable de travaux consacrés à cette question. Cette classification qui situe le symptôme épileptique en fonction des diverses structures spécifiques et non spécifiques de l'encéphale a un intérêt non seulement physiopathologique, mais aussi étiologique: l'épilepsie focale étant symptomatique, l'épilepsie centrencéphalique dans le sens de Penfield étant idiopathique.

D'après cette classification, les épilepsies généralisées, avec la crise Grand-Mal, les épilepsies toniques, les myoclonies, le Petit-Mal, les épilepsies localisées avec les épilepsies partielles (sensitivo-motrices), et l'épilepsie psychomotrice seront successivement envisagées.

LA CRISE CONVULSIVE GENERALISEE

Cet accident majeur de épilepsie évolue en trois périodes: tonique, clonique et stertoreuse dont les caractères cliniques sont bien connus. Il correspond soit à une épilepsie primitivement centrencéphalique ou idiopathique, soit à la généralisation d'une épilepsie localisée et symptomatique.

Dans le premier cas le début est brutal, les signes neurologiques pré ou post critiques sont absents. Des manifestations psychiques sont toutefois possibles. Elles sont de courte durée (quelques heures au maximum) se produisent avant la crise, plus rarement après et correspondent à un état de confusion.

Dans le second cas, la crise Grand-Mal est précédée de manifestations neurologiques ou psychiques, dont certaines ou *prodromes* se produisent de quelques heures à quelques jours avant l'attaque et dont d'autres ou *aura* correspondent en fait à son début. D'autre part la crise peut être suivie de séquelles neurologiques: hémiplegie, monoplegie, troubles sensitifs, sensoriels ou de séquelles psychiques qui ne sauraient être considérées comme un phénomène banal d'épuisement, mais traduisent une souffrance cérébrale et ont ainsi une réelle valeur localisatrice. Ces divers signes associés neurologiques et psychiques indiquent une localisation et seront envisagés avec les épilepsies partielles et psychomotrices.

LES CRISES TONIQUES ET LES MYOCLONIES

Ces expressions de l'épilepsie méritent d'être rapprochées de l'épilepsie Grand-Mal et par leurs caractères cliniques et leur mécanisme.

Les crises toniques. — Ces crises se traduisent par une brusque contraction des muscles axiaux avec extension ou flexion de la nuque et du tronc et intéressent moins nettement les membres. Elles sont en général accompagnées d'une perte de conscience, sont d'une durée très brève (quelques secondes), et facilement provoquées par les stimulations sensorielles et nociceptives. Fréquentes chez les enfants, elles peuvent être observées chez les nourrissons et correspondent alors aux *spasmes en flexion* qui accompagnent l'hypsarythmie.

Les "cerebellar fits" de Jackson avec brusque contraction en opisthotonos, mais sans perte de connaissance sont liées à une souffrance de la partie basse du tronc cérébral.

Les crises toniques correspondent à des

crises Grand Mal écourtées et le tracé E.E.G. avec pointes rapides généralisées est comparable à la phase tonique de la crise Grand Mal. Ces crises, dénommées mésencéphaliques par Penfield, peuvent être reproduites expérimentalement par stimulation de la portion mésencéphalique de la formation réticulée. Associées aux crises Grand-Mal et aux absences Petit-Mal elles peuvent être considérées comme une forme intermédiaire de ces épilepsies généralisées.

Les myoclonies. — Caractérisées par de brusques contractions musculaires, localisées, ou généralisées, elles sont très fréquentes chez les épileptiques. Elles peuvent être isolées ou associées à des crises généralisées en particulier au cours de l'épilepsie idiopathique.

Localisées aux membres inférieurs, les myoclonies entraînent un brusque dérobage des jambes et une chute. Il est probable que de tels accidents correspondent aux attaques statiques de Ramsay Hunt.

Les myoclonies sont fréquentes au cours des lésions du mésencéphale. C'est le cas d'affections dégénératives familiales correspondant à l'épilepsie myoclonique progressive d'Unverricht-Lundborg et à la dyssynergie cérébello-myoclonique de Ramsay-Hunt. C'est aussi le cas de diverses affections acquises: séquelles d'encéphalite, leucoencéphalite de Van Bogaert, tumeurs du III^e ventricule, traumatisme crânien, intoxication par le bromure d'éthyle.

PETIT-MAL

Traduit par une perte brève de conscience (quelques secondes), le Petit-Mal est précisé par le paroxysme électrique de Pointes-Ondes à 3 c/s.

Epilepsie de l'enfance, apparaissant entre 3 et 12 ans, le Petit-Mal devient plus rare après la puberté pouvant toutefois se prolonger à l'âge adulte sous une forme en général dégradée.

La perte de conscience est en général complète et suivie d'amnésie. Elle peut être partielle avec conservation de certaines perceptions.

Les signes d'accompagnement se limitent, dans les formes pures, à des clonies palpébrales qui suivent la fréquence de 3

par seconde. Ils peuvent correspondre à des myoclonies en général globales dans la forme myoclonique et plus rarement à de brusques pertes du tonus posturale dans la forme akinétique. Ils peuvent enfin se traduire par des automatismes moteurs et rendent alors le diagnostic difficile avec les "fausses absences temporales".

Les absences sont en général fréquentes, de 10 à 100 dans la même journée (pycnolepsie). Elles se groupent par périodes, sont facilitées par l'inattention, diminuées par les stimulations d'éveil.

Considéré comme une expression de l'épilepsie idiopathique de l'enfant, le Petit-Mal peut aussi être symptomatique. Plusieurs étiologies ont été indiquées (encéphalite, tumeur, hématome), avec le plus souvent une localisation anatomique frontale.

Modalité d'expression de l'épilepsie centrencéphalique, le Petit-Mal est intimement lié au Grand-Mal. Des associations Petit-Mal-Grand-Mal sont possibles durant l'enfance, mais les crises Grand-Mal sont fréquentes après la puberté, aussi le Petit-Mal de l'enfant a-t-il été considéré comme le Grand-Mal de l'adulte.

LES EPILEPSIES PARTIELLES

Traductions d'un foyer épileptique, leur expression clinique est fonction de la localisation de ce dernier.

Les crises jacksoniennes motrices intéressent le plus fréquemment le membre supérieur et sont faciles à reconnaître grâce à leur côté spectaculaire.

L'épilepsie faciale est plus difficile à préciser: les clonies sont souvent limitées aux paupières ou à la commissure des lèvres. D'autre part, ce type d'épilepsie est souvent accompagné d'obnubilation qui peut aller jusqu'à l'absence.

L'épilepsie crurale est rare et correspond à des clonies des orteils qui gagnent secondairement la jambe et la cuisse.

Les crises jacksoniennes peuvent survenir à intervalle rapproché et être associées à des décharges myocloniques qui se produisent entre les crises. C'est le cas de l'épilepsie partielle continue de Kojenikoff,

syndrome rare, dépendant d'une double lésion corticale et sous-corticale.

Les crises adversives se traduisent par une déviation soutenue des yeux et de la tête, parfois suivie d'une rotation du tronc ou plus rarement d'une véritable giration. Ce type de réaction, surtout celui limité à la déviation de la tête et des yeux, est très banal. Il dépend d'une irritation de la région frontale basse et peut être observé soit au cours de foyers frontaux associés à une perte de conscience immédiate et à une généralisation des convulsions, soit au cours de foyers temporaux antérieurs avec conservation partielle de la conscience. Les crises adversives avec giration ont généralement une origine sous-corticale.

Les crises sensibles sont souvent associées à une crise jacksonienne motrice et lorsqu'elles sont isolées, elles peuvent passer inaperçues. Elles se traduisent par des sensations banales de fourmillement, d'engourdissement, de gêne ou de tension en général peu douloureuses. Leur début brusque, leur extension progressive de type jacksonien, certaines localisations précises commissure buccale et main (type cheiro-oral) aident le diagnostic.

Les crises sensorielles visuelles, auditives, olfactives entrent dans le cadre de l'épilepsie psychomotrice et seront envisagées avec cette dernière.

L'EPILEPSIE PSYCHOMOTRICE

Cette épilepsie, la plus fréquente des formes de l'épilepsie, est caractérisée par des manifestations très diverses ayant comme point commun une perturbation mentale associée ou non à des troubles végétatifs et à des automatismes. Ce vaste groupe, mal limité, a été précisé par l'identification de décharges localisées à la région temporale du scalp et ainsi a été isolée une "épilepsie temporale" dont on a fait le synonyme de l'épilepsie psycho-motrice.

La constatation première faite par Jackson d'une relation de certaines manifestations psycho-motrices correspondant à un état de rêve et à des hallucinations olfactives avec une lésion de l'uncus a été non seulement confirmée mais largement

amplifiée par l'étude systématique des formations rhinencéphaliques de la face interne du lobe temporal.

La crise psychomotrice se traduit par une série de symptômes variables selon les sujets et variables d'une crise à l'autre.

La dissolution psychique intéresse la conscience, la mémoire et l'affectivité. *L'état de conscience* est toujours altéré soit dans le sens d'une brusque exacerbation associée à une agitation motrice, soit, le plus souvent, dans le sens d'une diminution et tous les intermédiaires sont possibles depuis l'obnubilation de la conscience jusqu'à l'absence.

La mémoire est parfois facilitée et il s'ensuit de brusques réminiscences de souvenirs oubliés, de fausses reconnaissances avec impression de "déjà vu" ou de "déjà fait" entraînant un sentiment de familiarité. Le défilé des images est rapide, et comparable à celui d'un rêve. Il peut intéresser des images souvenirs parfois très anciennes et correspondre à une vision panoramique du passé. A d'autres moments, une image isolée, suite d'un défilé brusquement interrompu ou produite spontanément, vient se fixer dans le champ de la conscience. Certains phénomènes idéatifs à type de fuite des idées ou au contraire à type de pensée forcée indiquent eux aussi cette ambivalence d'expression: soit déroulement rapide soit au contraire fixité.

La mémoire peut être diminuée et c'est la non reconnaissance de tout ce qui entoure le sujet entraînant alors un sentiment d'étrangeté.

L'état affectif est toujours perturbé et correspond soit à un état de malaise indéfinissable avec peur, tristesse, parfois réaction de colère, soit au contraire à une impression de bien être qui peut aller jusqu'à l'extase.

A cette modification du psychisme, s'associent diverses manifestations sensibles, sensorielles, végétatives et motrices.

Les manifestations sensitivo-sensorielles élémentaires correspondent à des sensations olfactives, gustatives, auditives (sifflements, sons de cloche), visuelles, vertigineuses ou somesthésiques. Elles traduisent l'irritation des zones de projection sensitivo-sensorielles et apparaissent au début de la crise.

Les troubles psycho-sensoriels se traduisent soit par des déformations de perceptions: visuelles (macropsie, micropsie), auditives (hyper ou hypoacousie), modification du schéma corporel (impression d'augmentation ou de diminution de volume d'un membre) ou par des hallucinations complexes. Ces hallucinations surtout auditives et visuelles sont souvent combinées et rappellent un état de rêve, dont bien souvent le contenu ne peut être décrit, par suite de l'altération de la conscience.

Les symptômes végétatifs sont assez communs avant la crise et peuvent dans certains cas en résumer l'expression. Ils se traduisent par diverses sensations viscérales: gêne épigastrique parfois ascendante et suivie d'oppression thoracique, douleurs abdominales, génitales, précordiales, sensations nasales, oesophagiennes, buccopharyngées. Ils correspondent aussi à des manifestations viscérales motrices avec besoin d'uriner, selle impérieuse, éructation, borborygme. Ils s'expriment parfois par de brusques sensations de faim ou de soif, de brusques troubles vasomoteurs, par des troubles respiratoires qui par leur allure critique qui peuvent en imposer pour une crise d'asthme.

Les automatismes correspondent à un groupe non homogène de manifestations motrices. Ils peuvent être élémentaires et correspondre à une "crise masticatrice" avec mâchonnements, salivation, déglutition, à des gestes d'habillage ou de deshhabillage, à une réaction de grattage, à des bredouillements (épilepsie marmotante), à un accès de rire non motivé ou à une fugue élémentaire du type procursif.

Les automatismes peuvent être complexes et représenter une série d'actes coordonnés eupraxiques difficiles à différencier d'une activité volontaire consciente. Certains automatismes correspondant à un acte professionnel et les fugues de longue durée avec automatisme ambulateur entrent dans ce groupe.

Les automatismes ne doivent pas être confondus avec des réactions motrices réactionnelles aux troubles psychosensoriels, et qui peuvent correspondre à des gestes simples (main portée à l'abdomen lors d'une aura épigastrique), ou à des phénomènes

complexes: réaction de peur ou de fuite, agitation motrice et colère. D'autre part, ces automatismes sont à séparer de ceux qui se produisent après la crise Grand-Mal, et qui sont liés à l'obnubilation post-critique.

Ces différents symptômes peuvent être associés de façon très diverse et plusieurs types cliniques méritent d'être isolés. Les uns sont brefs et les autres de longue durée.

Parmi les *épisodes brefs*:

— la crise psycho-sensorielle ou attaque illusionnelle avec état onirique, illusions ou hallucinations variées.

— l'absence temporaire avec perte de conscience complète d'une durée de plusieurs minutes associée à des automatismes gestuels ou oraux (mâchonnements, déglutition), ou traduite par un état de stupeur avec attitude figée.

— les crises aphasiques pouvant correspondre à tous les types d'aphasie, mais difficiles à préciser par suite de leur brièveté.

— les crises abdominales d'origine intestinale avec aura épigastrique, douleurs périombilicales irradiant dans le quadrant droit de l'abdomen et associées à des nausées, des vomissements et plus rarement à de la diarrhée.

Parmi les *épisodes de longue durée*, on peut retenir:

— des épisodes psychiques prenant l'allure d'états confusionnels accompagnés ou non de manifestations délirantes, de type soit hallucinatoire soit paranoïde. Certains de ces épisodes se traduisent par un état de dépression avec anxiété, et sans grosses modifications de la conscience. Leur durée varie de quelques jours à quelques semaines. Leur début est en général brusque.

— des états hypocondriaques. L'intrication de l'anxiété et des désordres végétatifs entraîne un état hypocondriaque avec des manifestations viscérales, qui localisées sur tel ou tel organe peuvent en imposer pour une affection organique du type: ulcère de l'estomac, cholécystite, affection urinaire, trouble coronarien.

— des automatismes de longue durée correspondant aux fugues et aux automatismes ambulatoires.

Cette analyse schématique souligne l'aspect polymorphe des crises psychomotri-

ces dont l'expression va du trouble mental à l'affection somatique.

Ces crises ne seront jamais semblables. Un même malade peut présenter des "absences", des troubles sensoriels, des phénomènes complexes avec impression de déjà vu, des troubles psychiques de longue durée ou des manifestations hypocondriaques.

Ces différents troubles sont associés à un déficit ou une facilitation de la conscience et de la mémoire et cette ambivalence est à mettre en parallèle avec les réactions de bien être ou de malaise. Les manifestations sensitivo-sensorielles ainsi que les manifestations motrices correspondent soit à des troubles élémentaires (sensations diverses, automatisme), ou à des phénomènes complexes (illusion ou hallucination).

Les manifestations convulsives se limitent en général à quelques clonies faciales, buccales ou palpébrales qui accompagnent la crise. Elles peuvent se traduire par des crises Grand-Mal, en général nocturnes. Il est à remarquer que des crises hystériques sont possibles et leur apparition ne peut qu'égarer un diagnostic déjà difficile.

L'ÉTAT INTERCRITIQUE

Les manifestations intercritiques de l'épilepsie sont propres à l'épilepsie psychomotrice et méritent d'être envisagées avec cette dernière. Rarement traduites par un déficit neurologique, elles correspondent soit à des troubles du comportement avec instabilité caractérielle, impulsion et adhésivité affective, soit à des manifestations hypocondriaques de types très variés. L'épileptique perd rapidement l'intérêt qu'il peut porter à ce qui l'entoure, il cherche à s'éloigner de son milieu familial et professionnel, ce désir de changement correspondant à une instabilité qui trouve sa solution dans une réaction de fuite. Aux réactions négatives s'opposent des accès caractériels et des impulsions qui soulignent encore l'instabilité de fond de l'épileptique.



L'aspect clinique de l'épilepsie, envisagé d'après une classification topographi-

que, peut être influencé par de multiples facteurs parmi lesquels: la répétition fréquente des crises pouvant entraîner un état de mal, la maturation cérébrale qui marque l'épilepsie de l'enfant, méritent d'être envisagées.

Répétition des crises et états de mal. — Les états de mal correspondent à une succession de crises généralisées ou localisées, avec perte de conscience entre les crises et désordre végétatif. La prolongation de la crise pendant plusieurs jours peut se produire au cours d'autres formes de l'épilepsie: le Petit-Mal (status Petit-Mal), l'épilepsie psycho-motrice. Ces crises prolongées se traduisent par de longues périodes de confusion mais ne s'accompagnent pas des perturbations végétatives propres à l'état de mal.

Si le rôle de certaines structures à seuil convulsif très bas, telles les formations rhinencéphaliques, peut être retenu dans la production de certains états de mal psycho-moteur, par contre le mécanisme de l'état de mal proprement dit, lié au mécanisme intime de la crise d'épilepsie, est inconnu.

Epilepsie et maturation cérébrale. — Les données topographiques qui ont guidé la description clinique permettent de comprendre les variations d'expression de l'épilepsie selon l'âge. La traduction de la décharge varie avec le développement des structures cérébrales et de leurs interactions. Bien que l'ontogénèse du système nerveux soit peu connue, et que l'étude expérimentale

de variations de la décharge avec l'âge soit encore à ses débuts, certaines expressions cliniques liées à l'âge méritent d'être isolées.

Le nouveau-né fait des crises mal organisées, traduites par des contractions toniques prédominant sur l'axe du corps et par des convulsions souvent très localisées. Si les crises sont incomplètes, elles ont une tendance à se répéter, entraînant alors un état de mal. Elles correspondent du point de vue E.E.G. à des crises focales et seraient entretenues, d'après certaines données expérimentales, par les formations sous-corticales (hippocampe et rétículo mésentéphalique), alors que l'écorce et le thalamus sont encore immatures.

Le début de corticalisation qui se produit autour du sixième mois est accompagné d'un début d'organisation de crises tonico-cliniques. C'est à ce moment que se produisent les myoclonies lentes du nourrisson et les spasmes en flexion associés ou non à l'hypsarythmie.

Entre 3 et 5 ans apparaît le Petit-Mal, qui d'après de nombreuses données cliniques, électriques et résultats expérimentaux paraît être lié à un stade de maturation des relations cortico-thalamiques.

A la puberté, un important remaniement se fait: l'épilepsie focale se précise, l'expression clinique s'enrichit en particulier celle de l'épilepsie psycho-motrice, le Petit-Mal s'atténue ou disparaît.

RÉSUMÉ

Les aspects cliniques de l'épilepsie sont classés d'après la notion jacksonienne de foyer et d'après les données électroencéphalographiques en épilepsies généralisées et en épilepsies localisées.

Parmi les épilepsies généralisées, la crise Grand-Mal primitive ou secondaire, est l'accident majeur qui est au centre de toutes les manifestations épileptiques et qui peut être l'aboutissant de toutes les formes. De la crise Grand-Mal, sont rapprochées les crises toniques, fréquentes chez l'enfant et correspondant à une crise Grand-

Mal écourtée et les épilepsies myocloniques. D'autre part, le Petit-Mal, souvent associé au Grand-Mal, peut être l'expression d'une épilepsie idiopathique ou symptomatique.

Parmi les épilepsies focales, l'épilepsie psycho-motrice ou temporale, type le plus commun de toutes les épilepsies, mérite une place à part. Après une étude des nombreux symptômes propres à ce type, certaines formes particulières soit de courte durée, soit de longue durée, sont envisagées. L'accent est mis sur l'ambivalence (facilitation ou inhibition), des diverses modifi-

cations mentales et sur le double aspect élémentaire ou élaboré des manifestations psycho-sensorielles et des automatismes.

En complément des données topographiques, l'aspect clinique de l'épilepsie peut être influencé par de multiples facteurs

parmi lesquels la répétition des crises et la maturation cérébrale sont retenus. Le premier concerne la question des états de mal. Le second est en rapport avec les types particuliers de l'épilepsie de l'enfant et des remaniements en fonction de l'âge.

SUMMARY

The clinical aspects of Epilepsy are classified according to the Jacksonian notion of focus and the Electroencephalographic data, in generalized epilepsy and localized epilepsy.

Among the generalized epilepsy, the primitive or secondary grand mal seizure it is the major accident, which is in the center of all epileptic manifestation, and moreover it can be the culmination of the different types of epilepsy. Closely related with the grand mal seizure are the tonic crisis frequent during the infancy and correspondig to an abbreviated grand mal seizure and mioclonic epilepsy.

On the other hand, the petit mal so frequently associated with grand mal can be the expression of an idiopathic or symptomatic epilepsy.

Among the focal epilepsy, the temporal or psicomotor, which is the most frequent

of all types of epilepsies deserves an special place.

After studying the numerous symptoms that are characteristic of this type, are considered, certain brief or prolonged form. Emphasis has been put on the ambivalence (facilitation or inhibition) of the different mental modifications and upon the double aspect elemental or elaborated of the psychosensorial manifestations and of the automatism.

Complementary to the topographic findings, the clinical aspects of epilepsy can be influenced by numerous factors among which are prominent the repetition of the seizures and the cerebral maturity. The first one is related with the status epilepticus.

The second is concerned with the special types of epilepsy of the children and the mutations related with age.

RESUMEN

Los aspectos clínicos de la epilepsia son clasificados de acuerdo con la noción jacksoniana de foco y según los datos electroencefalográficos, en epilepsias generalizadas y en epilepsias localizadas.

Entre las epilepsias generalizadas la crisis de gran-mal primitivo o secundario, es el accidente mayor, que está en el centro de todas las manifestaciones epilépticas y que puede ser la culminación de todas las formas. A la crisis de gran-mal se aproximan las crisis tónicas, frecuentes durante la infancia y correspondientes a una crisis de gran-mal abreviada y las epilepsias mioclónicas.

Por otra parte el Pequeño-mal, frecuen-

temente asociado al Gran-mal, puede ser la expresión de una epilepsia idiopática o sintomática.

Entre las epilepsias focales, la epilepsia psicomotriz o temporal, que es el tipo más frecuente de todas las epilepsias, merece un lugar aparte.

Después de un estudio de numerosos síntomas propios de este tipo se consideran ciertas formas de corta o de larga duración.

Se ha puesto énfasis sobre la ambivalencia (facilitación o inhibición) de las diversas modificaciones mentales y sobre el doble aspecto elemental o elaborado de las manifestaciones psicosenoriales y de los automatismos.

En complemento de los datos topográficos, el aspecto clínico de la epilepsia puede ser influenciado por múltiples factores entre los cuales se destacan la repetición de las crisis y la maduración cerebral.

El primero concierne a la cuestión de los estados de mal.

El segundo está en relación con los tipos particulares de la epilepsia del niño y de las mutaciones en función de la edad.

ZUSAMMENFASSUNG

Die klinischen Bilder der Epilepsie werden gemaess der Jacksonschen Herdauffassung und gemaess den durch das EEG vermittelten Daten in generalisierte und lokalisierte Epilepsien eingeteilt.

Unter den generalisierten Epilepsien ist die bedeutendste Manifestierung der primitive oder sekundaere Anfall von grand mal.

Dieser steht im Mittelpunkt aller epileptischen Manifestationen und kann der Gipfelpunkt aller Formen sein. Dem grossen epileptischen Anfall aehnelt sehr die tonischen Krisen, die in der Kindheit haeufig sind und einem abgekuerzten grossen epileptischen Anfall und den myoklonischen Epilepsien entsprechen. Andererseits kann der kleine Anfall, der den Grossen Anfall oft begleitet, der Ausdruck einer idiopathischen oder symptomatischen Epilepsie sein.

Unter den Herdepilepsien verdient die

psychomotorische oder temporale Epilepsie einen besonderen Platz. Nachdem zahlreiche Symptome dieser Epilepsieform studiert worden sind, werden gewisse kurz- oder langdauernde Formen betrachtet. Man hat besonderen Nachdruck auf die Ambivalenz (Bahnung und Hemmung) der verschiedenen mentalen Veraenderungen und auf das doppelte elementale oder verarbeitete Bild der psychomotorischen Manifestationen und Automatismen gelegt. Ausser den topographischen Daten kann das klinische bild der Epilepsie durch zahlreiche Faktoren beeinflusst werden, unter welchen die Wiederholung der Anfaelle und die Reifung des Gehirns besonders wichtig sind.

Jenes betrifft das Problem des Status Epilepticus; dieses bezieht sich auf die besonderen Formen der Epilepsie beim Kinde und ihre Mutationen in Zusammenhang mit dem Lebensalter.

BIBLIOGRAPHIE

- GIBBS, F. A. and GIBBS, E. L.: Changes in generalized and focal seizure activity with age in Proc. of the 1st int. Cong. of Neurological Sciences. 1959. Vol. III, 501-503. Pergamon Press. London.
- MARCHAND, L., AJURIAGUERRA, J. de: Epilepsies. Leurs formes cliniques, leurs traitements. 1948. Desclée de Brouwer. Paris. 721 p.
- PASSOUANT, P., CADILHAC, J., RIBSTEIN, M. avec la collaboration de PASSOUANT-FONTAINE, Th. et MIHAILOVIC, L.: Epi-

lepsie et maturation cérébrale. XVII^e Congrès de l'Association des Pédiatres de Langue Française. 1959, vol. II. 67-148. Dehan, édit., Montpellier.

PENFIELD, W.: Epileptic automatism and the centrencephalic integrating system. Res. Publ. Ass. nerv. ment. Dis. 1950, 30, 513-528.

PENFIELD, W. and JASPER, H. H.: Epilepsy and the functional anatomy of the human Brain. 1953. Boston. Little Brown Co. 896 p.

Psychiatric Aspects of Epilepsy

C. L. CAZZULLO

Professor of Neurology and Psychiatry, Head of the Department of Psychiatry at the Milan University, Medical School

INTRODUCTION

The many clinical aspects of "epilepsy" are linked not only to the large number of etiological factors, but also to the variety of pathogenic mechanisms essentially related to the topography of the structures involved in the epileptogenic focus.

An attempt to distinguish the single entity underlying the epileptic syndrome in its psychic and somatic aspects can be made only through analysis of the physiopathological changes responsible for the preparation of the background to the epileptic dysrhythmia, as well as to the ictal episode, the whole infracritical symptoms.

The effects of these changes on the psychic activity of the epileptic patients are peculiar: in fact, it is enough to recall that the convulsive attack permits observation—in almost experimental conditions—of a whole series of *changing states in the structure of the consciousness*, ranging from complete loss in generalized seizures, to partial "diminutio" in twilight states and conscious automatism.

Thus, clinical studies on epileptics should not merely be directed at determining the etiological factors for the disease, and the site and extent of cerebral involvement, but also at analysing the psychopathological aspects accompanying the various stages of the epileptic syndrome.

The aim of the present work is to review the psychic phenomena properly observed at the ictal phase—the psychopathological sequelae of chronic epilepsy until epileptic dementia intervenes.

The main object of our study will be however, careful analysis of the psychiatric as-

pects of the *infra-ictal* phase in adults. Special attention should be paid to the fact that a large amount of information regarding the abnormal behaviour of epileptic patients during and outside the attack is available, while we know very little about the motivation of the behavioural pattern and the psychic changes of deep individual personality structure.

For this reason we have studied the actual and residual pathology of epileptic patients, using a research method allowing objective estimation of the widest possible series of pathological elements in either the noematic and affective sphere, and permits to appreciate particularly the underlying psychopathological phenomena.

In fact, the original contributions of this review relate to the possibilities that some projective tests realized in revealing special "ways of being" of the epileptic with regard to his disease or his environment, and his capacity of adaptation to the pathological situation which has arisen.

A) Ictal psychopathological aspects

Clinical and bio-electric observations have by now confirmed a certain specificity of relationship between some types of generalized attacks and some psychopathological pictures of epilepsy.

The most complicated aspect of the problem is the attempt to reveal more or less *specific* psychopathological traits of the ictal phase of the "epileptic's convulsiveness" in his thinking and behaviour when free from attack.

Furthermore, it is worth noticing if the manifestations of the psychopathological

pattern evolve in more or less close correlation with the neuropathological lesions responsible for the convulsive attacks.

Penfield and Jasper's anatomic-clinical classification of epilepsy is most suitable for establishing the physiopathological elements in relation to the psychopathological ones proper to the ictal phase.

Thus, we can distinguish between:

- a) *the focal cerebral seizures*
- b) *the centrencephalic seizures*
- c) *the widespread cerebral seizures*

As regards the first group, the *motor seizures* where the suspension of the consciousness may be missing (Jacksonian seizures), or where the subject may remain conscious only during the first stage (adversive seizures), are of slight interest for the psychic ictal manifestations.

Nevertheless, the pre-and post-ictal psychic phenomenon mentioned later on may be observed in this type of paroxysmal episode.

Sensory seizures, which also form part of focal cerebral attacks, are clinically characterized by an experience lived in one or the other sensorial sphere and which abruptly takes hold of the subject's attention. The psychopathologic element is represented by perception without object, which is often lived in the conviction of reality, and only later criticised. Changes in the somatognosic function may induce changes in total or partial auto-consciousness.

The origin of *viscerovegetative* attacks in the frontotemporal and temporoparietal cortex renders the psychopathological aspects similar to those of temporal seizures where, precisely for the involvement of the limbic lobe and insula (Penfield), besides the thalamohypocampal connections (GASTAUT) —structures which may be included in the terms "Gastaut's enlarged rhinocephalon" or "Fulton's viscere brain" — there is predominance of alterations in behaviour and in oral, furious (aggressive) and timorous attitudes (flight) associated with manifestations of anxiety, surprise and bewilderment.

Psychical seizures obviously show more impressive psychopathological phenomena;

they include Jackson's "dreamy state" and the sensation of "jamais vu", "déjà vu" and "déjà entendu" described by French investigators.

These ictal episodes are often accompanied by thymic disturbances such as anguish, anxiety and, less frequently, euphoria or depression.

Paroxysmal behaviour changes with tendency to aggressiveness, impulsiveness and impropriety of conduct, belong to this group.

Episodes of increased irritability and explosive aggressiveness can be associated with some depressive traits and also with episodic alcoholism (dipsomania). Other psychiatric changes are reported as attacks of mental dullness: the patients lose their initiative, and their thoughts and actions are slowed down, although they remain conscious and well oriented.

Episodic manifestations (hallucinations, ideas of reference and greatness etc.) resembling those of affective and schizophrenic psychoses with KLEIST, before the appearance of electroencephalography, described as episodic psychoses, have quite recently been related to psychomotor epilepsy by GASTAUT.

Twilight states are characterized by pathological changes in the states of consciousness which is totally involved, as the quality of the phenomena is concerned. In fact, there is disturbance of temporal spatial and auto-consciousness, but as far the quantity of the pathological phenomena is concerned automatic or stereotyped activity is still possible.

Particular behaviour changes are represented by "fugue" which must be considered as ictal manifestations of abnormal behaviour with temporal alteration of consciousness.

Twilight states are often, but not necessarily, associated with fugue, during which the patient may commit improper acts such as theft, aggressions, etc.

Such behaviour anomalies occur during twilight states, as there is deflection of awareness which, during the infra-ictal period, works actively on an identical background. Actually it is possible to distinguish —even

in infra-ictal phases— aggressive tendencies similar to these which, in twilight states, transform their fundamental expressive charge into an open act.

The psychic attacks cause deep structural modifications in consciousness, so that the subject's consciousness tends to more or less intensely change into a sense of de-personalization which places him in an irresolute position between an onlooker "Ego" and an active "Ego" seen in an autoscopic manner.

The patient may live this experience in a state of restlessness, anxiety, and panic-anxiety, or else with a sensation of marvelous intoxication, as if he were in an extraordinary, incomparable and almost ineffable situation.

Consciousness appears to be mainly qualitatively altered in the above-mentioned ictal psychic phenomena, while the psychomotor *automatism*, forming part of the large group of centro-encephalic epilepsy states, involves destructure of the consciousness, constraining the subject to a low activity level. In this case there is a fall (quantitative) in the consciousness level or, according to PENFIELD, a psychoparalytic attack.

The other types of centre-encephalic seizures (petit mal, myoclonic petit mal, attacks of amnesia and subcortical grand mal), like the third group in JASPER's and PENFIELD's classification, *i. e.*, *widespread cerebral seizures*, do not display particularly interesting ictal phenomena from the psychopathological point of view, as they are distinguished by abrupt and complete loss of consciousness lasting for varying periods.

B) Pre-and post-ictal psychopathological aspects

Aggressiveness, quarrelsomeness, brady-psychia and perseveration may appear as warning signs of a seizure.

Convulsive attacks may be preceded by psychomotor automatism similar to ictal or post-ictal type, but lasting only a few seconds. It mainly occurs as professional automatism generally associated with a con-

fusional state and hallucinations such as to stimulate paranoic delusions (PARDO).

These short-lasting warning signs are a feature of a seizure in which the consciousness level is not abruptly and immediately reduced. Likewise, post-ictal psychic phenomena appear when return to consciousness is slow and progressive. The intermediate stages of degradation of the consciousness which the subject goes through after a seizure can continue for a period long enough to permit the onset of a psychotic state.

In fact, some twilight, confusional or delusional states may be considered as common post-ictal features. Confusional symptoms when persistent, should, in our opinion, be considered the expression of organic brain damage (adult post-traumatic epilepsy, vascular brain disease with convulsions). The patient is either calm or excited; his excitement may be accompanied by hallucinations, paranoid ideas. Especially after temporal lobe seizures, one may observe automatic behaviour resembling that of the ictal phase.

Post-ictal automatism may be the clinical expression of post-paroxysmal paralysis of certain parts of the brain stem, similar to the cortical paralysis seen after local motor seizures (STRAUSS). Some patients become easily suggestionable during this period, so that they may write important and compromising documents under dictation. In rarer cases, after rapidly succeeding convulsive seizure, the psychic manifestations are so serious as to resemble catatonic syndrome (BARUK and LAGACHE), melancholic state (GRIESINGER) or maniac-like state.

C) Psychopathological aspects of the sequelae

The clinical polymorphism of epilepsy, which is present from the very onset of the disease, also lost during later course of it.

This does not depend on etiologic factors alone, but also on the brain lesion and the action of the repeated seizures on the cerebral tissue.

Several suggestions have been made regarding the more or less capacity of some types of attacks to induce psychic modifications. It appears to be statistically pro-

ved that greatest mental deterioration is observed in grand mal, seizures when the attack appear abruptly, and in "psychic seizures".

Alternation of attacks of grand mal with periodic episodes of psychomotor automatism and more or less protracted confusional states, induces the most serious changes in the psychic sphere.

During the infra-ictal phase, these patients reduce their activity to the immediate requirements of daily life; their intellectual capacity is slowed down and obtuse. That is, the mental pattern defined as "deterioration" by Anglo-Saxon investigators, is set up. This symptomatic pattern may, nevertheless, be also seen in epileptics in whom the attacks maintain a certain constancy with regard to their nature and frequency, which may even sometimes be diminished. This confirms the evolutive variability of epilepsy.

According to our experience, the above occurs in post-traumatic epilepsy in adults, as a result of the wounding effect of "concussion" or "cerebral contusion". The disease expresses itself, in this case, either with convulsive symptoms or with parenchyma, cortical or periventricular atrophy (post-traumatic hydrocephalus), in both cases strictly linked to the evolution of the disease (encephalopathy or encephalosis) and the consequent "psychic deterioration". The latter generally precedes the seizures and is more serious than the convulsive episodes.

The gradual metamorphosis of the epileptic's personality structure starts from the impulsiveness, impetuosity and emotional instability, and later includes multiple manifestations of intransigent egoism.

Attachment of life assumes morbid proportions and is revealed by hypochondriac preoccupations.

The affective and moral perversion is associated with intellectual deterioration which, through various stages, may even reach dementia.

Grades of mental deterioration comparable with those reached by epilepsy in its severest forms can only be found among hebephrenic patients.

A clinical peculiarity of epileptic dementia is the frequent appearance of agitation and of delusional ideas during the pre-dementia phase.

The onset of chronic delirium is obviously facilitated by the critical weakening and affective perversion proper to the habitual epileptic. The commonest form of paranoid delusional ideas is that of persecution, often accompanied by hallucinations which especially affect the sense of smell, of taste and of hearing.

Chronic ideas of greatness sometimes arise. These delusional states display flare-ups and remission and evolve in relation to the course of intellectual deterioration.

Differential diagnosis of these psychopathological patterns which are proper to, but not merely specific, for the epileptic sequelae, should be made between general paralysis and schizophrenia in its various forms (hebephrenia, catatonia and paranoia).

D) Infra-ictal psychopathological aspects

The onset of ictal symptoms, whatever their etiology, in such a dramatic behaviour abnormality as to condition an instinctive defence reaction in the subject and to often determine the appearance of conflicting elements with regard to family and social environment.

In drawing up the symptomatic pattern of the epileptic subject, whether physis or neurological, it is of determinant importance to discover the date of first appearance of the episodic phenomena, the manner in which the attacks occur, the frequency of the paroxysmal episodes, and the duration of the disease.

Correlation of these anamnestic data with anatomico-clinical observations permits us adequate estimation of the psychopathological problem of each single case, bearing in mind the subject's personality structure before the onset of the convulsive phenomena. If the latter have already appeared, it is just as important to recognize the residues of the primary structure and the ways by which these adapt, insert or organize

themselves when faced with the traumatizing pathogenic event.

Special emphasis must be laid on the time of appearance of the first attack, with relation to the psychological structuration of the personality at the level corresponding to said time.

Two psychiatric aspects of epilepsy must be considered; the first concerns the psychopathology *directly* produced by the lesion constituting the epileptogenic focus, and by its organic and bioelectric evolution; the second conforms with the psychic effects produced in the subject by knowledge of the attack undergone.

Peculiar psychic manifestations may be observed in a relatively low percentage of cases during the convulsive seizure (for instance, in temporal epilepsy of deep focus, in centrencephalic epilepsy), while the motor phenomena of grand mal often do not supply any specific elements of psychiatric interest.

By contrast, during the *infra-ictal* period we may obtain important information regarding the type of seizures and the site of the focus, and particularly the evolution of the epilepsy, if we study the catamnestic elements supplied by the patients and the results given by some mental tests.

With this method, it is often possible to gather the *basic* psychiatric alterations and the *collateral* neurotic reactions determined in the subject by the onset of seizures.

Analysis of our case list of subjects hospitalized for varying periods allows us to pay special attention to the neomatic and thymic aspects of epileptic psychism.

1° Intelligence

Analysis of the data obtained from application of psychometric tests (Progressive matrices 38, Wechsler-Bellevue intelligence scale, form I) to a group of epileptic patients compared with normal subjects of the same age and belonging to similar social and cultural levels, has disclosed a slight deficit of intellectual capacity in the first.

It must be pointed out that these cases had displayed the first convulsive attack after puberty. The intellectual defect was

obvious and especially marked in those subjects with sequelae of cerebropathy occurring in early infancy or childhood, or suffering from particularly frequent seizures. Contrary to the observations of LENNOX, FETTERMAN, and BARNES; SULLIVAN and GANAGAN; ARIEFF and YACORZYNSKI; WINFELD and PICHOT, PERSE, LAMPERIERE, we never noted any worthwhile difference between the intellectual levels of subjects affected with cryptogenic epilepsy and those of subjects ranging from 30 to 60 years of age with grand mal type post-traumatic epilepsy of recent appearance.

Values of uncertain pathological significance were obtained on determining the deterioration index with Wechsler's method and the regression formula proposed by Gozzano *et al.*

In our opinion, one aspect worth mentioning is the influence of the subject's social and cultural environment. The subject's degree of affective frustration unfavourably conditions the acquisition of those cultural elements normally widening his knowledge which, in turn, generally favours, by reflex, the development of higher intellectual efficiency.

Still regarding the extent of knowledge, another unfavourable element is the hospitalization of the epileptic in unsuitable surroundings which increase the sense of "psycho-social" inferiority that inevitably occurs at the onset of the episodic symptoms. "Return illiteracy" phenomena have been observed in young epileptics, during studies performed in some institutes for chronic cases.

This verbal deficiency on the epileptic's part, caused by frustration of the "Ego", which has been estimated by means of Rosenzweig's P. F. test, involves both symptomatic and idiopathic states of epilepsy.

Qualitative analysis of our case list confirms the observation already reported by other investigators (SHEPS, GASTAUT) regarding reduction of the intellectual capacity, sector by sector, rather than global weakening. If this deficit is carefully examined, it is discovered that it may be classified as dementia, *i. e.*, there is a true and proper loss of engrams explaining the res-

triction of the sphere of interest and impoverishment of the verbal patrimony.

One of the most important components of the psychic deterioration is the loss of memory, which is often very marked. Because of the general psychic slowing down, in epileptics understanding is torpid and delayed, leading to fixation difficulties. Furthermore, the viscosity, perseveration and "difficult succession of representations" (KLEIST) leads to difficulty in revocation of the engrams. Thus, the global reduction of the memory is explained by slower capacity of understanding, restriction of the circles of interest, ideative perseveration and changes in affectivity.

Furthermore, it should be recalled that all epileptics display some lack of memory corresponding to the attacks. These gaps in the memory are covered by false remembrance in some subjects, thus giving rise to chattering.

2° Ideation

Bradypsychism almost certainly occurs in epileptics. The ideation is polarized on the subject himself with consequent egocentrism. Because of the bradypsychism and the very marked difficulty in passing from one representation to another, we have states of meticulousness, pedantry and tendency to perseveration. Many authors have used the term "viscosity" when speaking of this pattern. MAUZ has suggested the term "enekesis".

Ideative perseveration is the most typical character of epilepsy infra-ictal clinical manifestation. The ideomotor activity also shows the same characteristics in some objects, so that motor perseveration occurs first, *i. e.*, the patient performs an action in a given manner and can no longer adapt himself the various contingent needs of the situation.

On comparing the behaviour of our patients during clinical observation and psychodiagnostic tests, we observed, along with altered capacity of organizing idea, also behaviour manifestations expressing thymic lability, poor adaptation and manifest and underlying anxiety.

In Murray's Thematic Apperception Test

(T.A.T.), slowing of the ideative process is accompanied by prolixity and there is also repetition of the same word in different sentences, with increase in the number of sentences necessary to express a given idea and tendency to tautology and to the use of more appropriate words. The use of adjectives, more frequently observed in males, appears to express a greater tendency to rationalization of the intimate conflict by males rather than by females. The intensity of the perseveration phenomena seems to be proportional to the frequency of seizures and to the seriousness of the clinical symptoms.

Those subjects displaying best preserved thought processes, often possess acute and very vigorous judgement, particularly moral, in view of the meticulousness of ideation and the intense affectivity. The above sharp judgement is proved also by the quick indignation of an epileptic with respect to a wrong.

3° Affectivity

Epileptics have an intense and lively, even if slightly expansive, affectivity. Their personality is highly accentuated, with distinct, precise and sharp outlines, in comparison with the schizoid, where all is "flou", deadened, indistinct.

Restlessness, inquietude, irritability and impulsiveness are often seen. The noematic reduction often leads to an affectivity concentrated on the subject himself and thus to egoism. This egoism, pedantry, and lack of vivacious spirit explain why the epileptic often tends to stubbornly protest for even futile reasons.

The viscosity is also displayed in the field of affection, which is limited to a few objects, these being clung to with persistence and marked intensity.

Irritability and instability, the abrupt change in the emotional mood, the impulsiveness which suddenly even violently appears, and alteration of the moral sense shown by egoism, indifference and the absence of remorse, are frequently described as belonging to the thymism of epileptic subjects.

The studies by STEKEL, FREUD, CLARK,

REICH, etc., must be examined in order to extend our knowledge of the affective structure in epileptics and analyse the relationships between it and the patient's instinctive-affective life.

Unhappily, the polymorphism of the unconscious affective manifestations in the presence of the ictal phase, contrasts with the psychiatrist's hopes to include these vital expressions in a sharply defined class. Although the interpretation of the episodic attack as "liberation from an archaic affective pressure" may be acceptable in some cases and the studies by Clark and Reich on the libidic significance of the attack and by KARDINER on the epileptic "need for rebirth" are extremely interesting, we feel that better knowledge of the epileptic character structure and wider understanding of the somatopsychic integration of the unconscious need in neuronal discharge, as suggested by KRAPF, are richer in practical prospects.

Although related to the study of the epileptic's affective sphere, we consider it useless to insist on the importance of Rorschach's psychodiagnostic test. However, since it is impossible to establish a specific psychogram, and as the types of intimate resonance greatly vary (*Erlebnistypus*, *Experience typus*) in the epileptic, it appears logical to learn by means of the projective test more about a series of elements which may confirm the diagnosis and better define the prognosis.

In fact, while estimation of epileptic behaviour through direct observation belongs to clinical medicine, the expressive mode of the impulsiveness can be fully explored by psychological study of the contents of the consciousness which are at the base of epileptic character alterations.

We have thus been able to observe that compelled subjects display good capacity of social adaptation without disclosing disturbances in character, while the extroverts, by contrast, are socially ill and display manifestations of explosiveness and impulsiveness which sometimes reach physical violence.

We also noted that the subject's behaviour during the test is strictly analogous to that of patients with organic brain dis-

ease and also to some initial forms of schizophrenia. The quality of the imaginative production unleashed by the unusual stimulus represented by the spot is relatively low and there is a weakness of the creativity and imaginative capacity followed by frequently perseverative stereotype phenomena characterized by poor knowledge of one's own inadequacy to the test. Character modifications linked to the etiology, duration and localization of the focus, which determine the subject's degree of adaptation, overlay a basic epileptic personality. While grand mal epilepsy reveals restriction of the emotional reactivity with fair capacity for social adaptation, temporal lobe epilepsy displays social inadaptation linked to impulsive and explosive type character disturbances. More or less structured neurotic elements frequently overlap the former, expressing the subject's reaction to the disease, thus creating a much more complicated pattern that is generally seen in other syndromes of an epileptic nature.

The most typical aspects of the psychology of epileptics are especially disclosed by two mental tests which have been particularly developed in our Institute: the tree test (*Baumtest*, Kock) and the coloured pyramids tests (*Farbpyramidentest*).

The first proved to be the most suitable for identifying the noematic and sphere of interest alterations; the *Farbpyramidentest*, instead, emphasizes thymic modifications.

The epileptic's psyche, all concentrated on the "Ego", is expressed by a tree design in which the main element is the trunk; a trunk often contorted, expressed with abrupt, acute, harsh lines. The same characters are seen in the branches, whether these—extremely developed and ending in sharp forms—show the attempt to impose themselves on the external environment, or—softened by the presence of leaves—reveal the desire of better environmental relations, which are always difficult because of the epileptic's instability and impulsiveness.

In the *Farbpyramidentest*, the intellectual deficit is expressed by the infrequency of evolved forms, but this test mainly reveals the genesis of the irritability and of the introvert affectivity.

The epileptic is very sensitive to stimuli

from the exterior world (increase in this test of green and of the extension figures) but does not succeed in conveniently elaborating and normally discharging them (reduction of red and of the stimulation syndrome). This is the reason for the restlessness, "l'irritation intérieure" (marked utilization of violet) and impulsive discharges.

The perseveration and viscosity are also confirmed by this test and are expressed by a constant choice and a constant refusal with respect to a given color (high "extremes" of the receptivity formula).

4° Instincts and compulsions

The epileptic's erotic manifestations are often described as excessive and exuberant. Even the expressions of erotism often display that impulsive and absolute character forming the psychic substrate of such subjects. It is worth noticing that the erotic excesses or tendency to same appear in some patients only whenever the attacks are controlled by medical treatment. When marked intellectual deficit is present, the erotic manifestations often have the character of perversions.

Compulsional analysis has been performed in function of the type of affective charge and its direction, particularly by means of the Thematic Apperception Test. As regards study of this dynamic element innate to the affective structure of epileptics, various types of aggressiveness can be distinguished:

A type of verbal aggressiveness in which (even if the sentiment is expressed in words) we see the HERO become agitated or hate someone, take part in a quarrel or discussion, criticize, hold someone up to ridicule, shout at someone, or excite persons against an individual or social group.

A type of physical, social aggressiveness, in which the HERO fights or kills in defence of himself or a loved one, repays an unprovoked criminal insult, or fights for his own or a friendly country.

A type of antisocial physical aggressiveness in which the HERO attacks someone with criminal intent, abuses, kills a person, starts a quarrel without any reason, repays an insult with cruelty, fights against au-

thority (parents, heads, government), betrays, behaves sadically.

A type of aggressiveness tending to the killing or attacking of an animal, to the crushing, breakage or destruction of an object.

These types of aggressiveness may be directed either in a self-punishing sense, or towards the familiar and social environment, or even towards animals or objects.

The predominance of dependent type oral responses, according to the classification by ROY SCHAFER observed in 25 cases of temporal lobe epilepsy with an average normal intellectual level, compared with homogeneous groups of epileptics suffering from grand mal, and normal subjects, might signify more extensive regression to archaic levels; this observation is confirmed by the fact that said dependent behaviour prevails even more when the bioelectric anomalies involve both temporal lobes. Although Rorschach's test permits extremely interesting and significant data to be obtained with regard to the personality structure, it does not allow us to estimate the direction tendency of the affective impulses. Rorschach's psychodiagnostic test only quantitatively estimates the affective charge, while the T.A.T. offers the possibility of *qualitative* analysis.

If the symbolic value of the responses to the Rorschach test expressing the temporal lobe epileptic's psychological behaviour is interpreted in a psychoanalytical sense, it reveals suggestive correlation with both the clinical manifestations of the ictal phase and the behaviour of animals stimulated in the habenular region. (HESS, GASTAUT).

The temporal lobe epileptic appears to select only those impressions which do not contrast with his deep personality structure and tends to give complex responses of oral type, mainly of dependent nature but also, and rather frequently, aggressive. The significance of the epileptic's character behaviour is linked to the relationships between the stories related and the means by which the subjects set forth and solve their conflicting situations. In this way, it will be possible to determine the patient's needs and instincts. Analysis of the patient's way

of solving the conflict will allow us to reduce his index of social adaptability. In our case list, comprising a group of 30 adult epileptics suffering from grand mal, the self-punishing and traumatizing compulsions are more frequently found in the female than in the male.

Furthermore, the male tends, to a greater extent, to satisfy his emotional impulses and to entrust the solution of the affective conflict evoked in the story to the future. The aggressive compulsive charge of the Hero which, in the female, is generally directed at herself in either a verbal or physical sense, or else towards the familiar environment, in the male is mainly directed, in a physical sense, at the social and work environment.

The directional interpretation of the aggressive compulsion observed with the T. A.T. is confirmed by means of Rosenweig's frustration test.

E) Social aspects

The feeling of being an object of special interest in which are associated elements of fright and human solidarity accompanied by a sense of pity, produces in the epileptic an ambivalent reaction with regard to the social environment where the seizure occurs. Incomplete structuration of consciousness, as occurs on awakening from the attack, facilitates the onset of an anxious symptomatology comparable with the Freudian "trieb angst" which painfully incides on the experiences lived by the subject.

During the intercritical phase, when the acknowledgement of the problems of existence reaches adequate critical levels, the epileptic estimates the seriousness of his affection and knows that other attacks will presumably lead to his exclusion from work. The hope or conviction that the seizures will not return is born and takes root in the epileptic; this sense of reactive safety is followed by behaviour which mirrors the will to carry out increasingly difficult tasks, both qualitatively and quantitatively, at work. Later when the attacks return, the construction rich in dreams and illusions crashes down and is often accompanied by true and proper depressive states.

In our opinion, the strong emotional charge which immediately follows the attack and the other which is the result of the anxiety of awaiting during the infra-ictal period, appear to condition the onset of types of abnormal reactions rather than the pathogenic noxa in the strict sense of the word. Analysis of the expressive mode of the seizure, correlated with the factors — time of onset, duration frequency of the seizures, and duration of the disease— explains the different epileptic character reactivity.

For the purpose of an improvement of social adaptability on the part of the epileptic, the most interesting element appears to be deeper knowledge of the epileptic's personality structure, directed, above all, at estimating his capacities of controlling the emotive compulsion.

SUMMARY

Thus, our observations on the psychiatric aspects of epilepsy can be summarized in the following points:

- 1) Confusional states with obnubilation of the consciousness are frequent in the pre- and, above all, post-ictal phase.

- 2) Twilight states composed of more or less extensive disintegration of the consciousness may precede the motor attack, or very often, represent the whole episode.

In this case, verbal productivity, postural attitudes and behaviour dynamics increase

the compulsion, affective alterations and the personality anomalies to a great extent. During the infra-critical period the latter can be shown up by some suitably integrated mental tests.

Epileptic fugues may be associated with twilight states, but in our experiences, the fugue quite frequently occurs in a state of temporal restriction of the consciousness, composed of strict limits in which, however, attention, perception and understanding are efficiently applied.

True twilight states have been observed in subjects with centrencephalic and temporal lobe epilepsy.

As regards fugues, we observed that they appeared as ictal phenomena in isolated forms, from one to three times in the same individual, and were then intermingled with various behaviour anomalies (theft, desertion, etc.) where the grip of environmental consciousness and auto-consciousness were much more active than in the fugue attack.

Fugues have been observed, particularly in subjects undergoing cranial trauma during childhood.

The mild electroencephalographic anomalies often accentuated only by cardiazol activation, are constant elements.

Their site may be uni-temporal, but more often it is unsynchronous bitemporal or temporoparietal.

The psychic patterns of the subjects are represented by a high or very high I. Q., and marked emotionability with frequent shifting of mood from anxiety to depression.

3) We consider the infra-ictal period the most fertile for studying the psychiatric aspects of epilepsy.

4) Anxiety and, more often, dysphoric-anxiety states, with difficulty in reasoning with regard to the emotional alteration, are frequently seen in the infra-ictal period and are revealed early by the tests. The depression is hidden much more by the anxiety and forms the basis of two types of neurotic reactions — auto-negativism or hetero-aggression.

5) Psychotic states are observed in cases where global psychic deterioration makes utilization of the residual defence psychism difficult or impossible.

6) In our opinion the terms psychosis or epileptic neurosis may not be properly used; for all we said, they are both psychic reactions to an event degrading the personality — reactions which appear according to the efficacy of the organic background (cerebral parenchyma), and therefore directly related to the degree, site and age of the focus with respect to the subject's age.

RESUMEN

De este modo nuestras observaciones sobre los aspectos psiquiátricos de las Epilepsias pueden resumirse en la siguiente forma:

1) Estados confusionales con obnubilación de la conciencia son frecuentes en las fases pre y sobre todo post ictales.

2) Estados crepusculares realizados por una desintegración más o menos profunda de la conciencia pueden preceder el ataque motor, o muy a menudo, representar todo el episodio.

En este caso, la productividad verbal, actitudes posturales y dinámica de la conducta aumentan las compulsiones, alteraciones afectivas y anomalías de la personalidad en alto grado. Durante el período infracrítico, las últimas pueden ser demostradas por algunos "tests" mentales adecuadamente integrados.

Fugas epilépticas pueden estar asociadas con estados crepusculares, pero en nuestras experiencias la fuga con mucha frecuencia

ocurre en un estado de restricción temporal de la conciencia dentro de ciertos límites, en el cual no obstante, la atención, la percepción y la comprensión son aplicados eficientemente.

Verdaderos estados crepusculares han sido observados en sujetos con epilepsia centroecefálica y temporal.

En lo que se refiere a las fugas, observamos que ellas aparecieron como fenómenos ictales en formas aisladas, de una a tres veces en el mismo individuo, y estaban entonces entremezcladas con varias anomalías de la conducta (hurto, desertión, etc.) donde el compromiso de la conciencia era mucho mayor que en el ataque de fuga.

Fugas han sido observadas particularmente en sujetos que sufrieron trauma de cráneo durante la infancia.

Son constantes leves anomalías electroencefalográficas a menudo acentuadas sólo por la activación cardiazólica.

Su asiento puede ser uni-temporal, pero más a menudo es bitemporal asincrónica o *temporo parietal*.

Las características psíquicas de los sujetos están representadas por un cociente intelectual alto o muy alto y marcada emocionalidad con frecuentes pasajes de la ansiedad a la depresión.

3) Consideramos el período infraictal como el más fértil para estudiar los aspectos psiquiátricos de la epilepsia.

4) Ansiedad y más a menudo estados disfórico-ansiosos, con dificultad en el razonamiento con respecto a la alteración emocional, son vistos frecuentemente en el período infraictal y son revelados temprano por los tests. La depresión está oculta

mucho más por la ansiedad y forma la base de dos tipos de reacción neurótica, auto-negativismo o *hétero-agresión*.

5) Estados psicóticos se observan en casos donde la deterioración psíquica hace difícil o imposible la utilización del *psiquismo residual de defensa*.

6) En nuestra opinión los términos *psicosis* o *neurosis epiléptica*, pueden no ser usados en forma apropiada, por todo lo dicho por nosotros. Ambos son reacciones psíquicas a un acontecimiento que degrada la personalidad, reacciones que aparecen de acuerdo a la eficacia del fondo orgánico (*parénquima cerebral*) y de este modo directamente relacionado al grado, sitio y edad del foco con respecto a la edad del sujeto.

R E S U M E

En conséquence nos observations sur les aspects psychiatriques de l'épilepsie permettent faire une synthèse en la forme suivante:

1) Etats confusionnels avec obnubilation de la conscience sont fréquents dans les états pré et surtout post ictals.

2) Etats crépusculaires produits par une désintégration plus ou moins profonde de la conscience peuvent précéder l'attaque motrice et très souvent représenter tout l'épisode.

En ce cas la productivité verbale, attitudes posturales et dynamiques de la conduite augmentent les compulsions, altérations affectives et anomalies de la personnalité dans un haut degré.

Pendant la période infracritique ces anomalies peuvent être mises en évidence par quelques "tests" mentaux proprement intégrés.

Les fugues épileptiques peuvent être associées avec états crépusculaires mais en nos expériences la fugue assez fréquemment se produit dans un état de restriction temporelle de la conscience en certains limites dans lesquels, la perception, la compréhension sont appliquées efficacement. Vraies états crépusculaires ont été observés en sujets avec épilepsie centroencéphalique et temporelle.

En rapport avec les fugues nous avons observé qu'elles apparaissent comme phénomène ictal en forme isolée d'une à trois fois dans le même individu et alors elles se montraient mélangées avec diverses anomalies de la conduite (*vols, désertion, etc.*) ou le compromis de la conscience était beaucoup plus grand que pendant l'attaque de fugue.

Particulièrement les fugues ont été observées en sujets qui ont souffert pendant l'enfance un traumatisme du crâne.

Légères anomalies électroencéphalographiques souvent accentuées seulement par l'activation cardiazolique sont constantes.

Leur place peut être unitemporale mais plus souvent elle est bitemporale asynchrone ou *temporo parietale*.

Les caractéristiques psychiques des sujets sont représentées par un quotient intellectuel très élevé et marquée émotivité avec fréquents passages de l'anxiété à la dépression.

Nous considérons la période infraictal comme le plus utile pour étudier les aspects psychiatriques de l'épilepsie.

4) Anxiétés et plus fréquemment états *disphoriques- anxieux* avec difficulté pour interpréter son altération émotionale sont fréquents dans la période infraictal et sont mises en relief précocement par les "tests".

La dépression est cachée beaucoup plus

par l'anxiété et forme la base de deux types de réaction névrotique, autonégativisme et hétéroagression.

5) États psychotiques sont observés en cas où la détérioration psychique rend difficile ou impossible l'utilisation du psychisme résiduel de défense.

En notre opinion les termes psychose ou névrose épileptiques peuvent n'être pas ap-

pliqués en forme appropriée par tout ce qu'on a dit. Les deux sont réactions psychiques envers un événement qui dégrade la personnalité, réactions qui apparaissent d'accord avec l'intégrité organique du cerveau et de cette façon directement en rapport avec le degré, situation et antiquité du foyer en rapport avec l'âge du sujet.

ZUSAMMENFASSUNG

So koennen unsere Beobachtungen ueber die psychischen Aspekte der Epilepsie in folgenden Punkten zusammengefasst werden:

1) Die Verwirrungszustaeude mit Truebung des Bewusstseins sind haeufig in der pre-iktalen und, vor allem, post-iktalen Phase.

2) Daemmerzustaeude, die aus einen mehr oder weniger ausgedehnten Abbau des Bewusstseins bestehen, koennen dem motorischen Anfall vorausgehen oder sehr oft die ganze Episode darstellen.

Die verbale Produktivitaet, die Koerperhaltungen und die Dynamik des Benehmens verstaerken in diesem Falle weitgehend die Zwangshandlungen, affektiven Stoerungen und Abnormalitaeten der Persoenlichkeit. Waehrend der inter-iktalen Stadien koennen letztere durch einige passend zusammengestellte psychologische Tests nachgewiesen werden.

Das epileptische Fluchtverhalten kann mit Daemmerzustaeuden vergehellschaftet sein, jedoch nach unserer Erfahrung kommt das Fluchtverhalten sehr haeufig in Zustaeuden voruebergelender Bewusstseinsbeschraenkung innerhalb strikter Grenzen vor, wobei jedoch die Aufmerksamkeit, Perzeption und das Verstaendnis erfolgreich angewandt werden.

Wirkliche Daemmerzustaeude sind bei Patienten mit zentroenzephalischer und Schlaefenlappenepilepsie beobachtet worden.

Bezueglich des Fluchtverhaltens, haben wir beobachtet, dass es als epileptisches Phaenomen isoliert vorkommen kann, und

zwar ein bis drei mal in demselben Patienten, und dann vermengt mit verschiedenen Verhaltensstoerungen (Diebstahl, Fahnenflucht usw.), wobei die Bewusstseinstoerung staerker war als in den Fluchtattacken.

Das Fluchtverhalten wurde besonders bei Patienten, die in ihrer Kindheit ein Kopftrauma erlitten hatten, beobachtet.

Leichte elektroenzephalographische Veraenderungen, die oft nur durch die Cardiazolaktivierung verstaerkt werden, sind bestaendige Befunde. Ihr Sitz mag unitemporal sein, aber oft ist dieser asynchrone bitemporal oder temporoparietal. Die psychischen Charakteristika dieser Patienten sind ein hoher oder sehr hoher Intelligenzquotient, wie auch ausgesprochene Gemuetsschwankungen mit haeufigem Wechsel der Stimmung von Zustaeuden aengstlicher Spannung bis zur Depression.

3) Wir betrachten die inter-iktale Periode als die fruchtbarste fuer das Studien der psychiatrischen Aspekte der Epilepsie.

4) Die Zustaeude aengstlicher Spannung und noch haeufiger Dysphorische Zustaeude aengstlicher Spannung mit Erschwerung des logischen Denkens in Hinblick auf die Gemuetstoerungen werden haeufig in der inter-iktalen Periode beobachtet und fruehzeitig durch die Tests entdeckt. Die Depression ist viel mehr durch die Zustaeude aengstlicher Spannung verborgen und bildet die Grundlage fuer zwei Typen von neurotischen Reaktionen, dem Autonegativismus und der Heteroaggression.

5) Psychotische Zustaeude beobachtet man in den Faellen, in denen die globale

PSYCHIATRIC ASPECTS OF EPILEPSY

psychische Verschlechterung die Inanspruchnahme des verbleibenden Verteidigungs-psychismus erschwert oder unmöglich macht.

6) Unserer Meinung nach koennen die termini "psychische" oder "epileptische Neurosis" nicht fuer alles, was wir hier gesagt haben, genau angewandt werden. Bei-

de sind psychische Reaktionen auf eine Affektion, die die Persoenlichkeit degradiert —Reaktionen, die je nach der Wirksamkeit des organischen Substrates (des cerebralen Parenchyms) auftreten und deshalb direkt von Groesse, Sitz und Alter des Herdes in Hinblick auf das Alter des Patienten abhaengen.

BIBLIOGRAPHIE

- ARIEFF A. J., YACORZYNSKI G. K. — Deterioration in epilepsy - Chicago Neurol. Society, 16 January, 1941.
- BARUK H., LAGACHE D. — Catalepsie et épilepsie - Ann. Méd. psych. 68, 203, 1933.
- CLARK P. — A further contribution to the psychology and essential epilepsy - J. of Nerv. and Ment. Disease 63, 24, 1926.
- COLLINS L. — Epileptic intelligence - J. Consult. Psychiat. 15, 392, 1951.
- ERMENTINI A., GUARESCHI A. — Le risposte orali al test di Rorschach negli epilettici temporali - Medicina Psicosomatica fasc. V. supp. 1959.
- EY H. — "Épilepsie" in Études psychiatriques - III vol., Desclée de Brouwer and Cie., Paris, 1954.
- FERRARI D., MONTANINI R. — Applicazioni cliniche del test delle piramidi a colori - Riv. pat. Nerv. e Ment. 80, 1083, 1959.
- FETTERMAN J. L., BARNES H. — Serial studies on the intelligence of patients with epilepsy. - Arch. Neurol. and Psychiat. 32, 797, 1934.
- FREUD S. — Dostoiowski und die Vertötung. - Almanach der Psychoanalyse, Gesamtschriften, vol. XII, 1930.
- GASTAUT H. — Les épilepsies - Enc. Méd. Chir., Neurologie, 1, ed. Paris, 1951.
- GASTAUT H. — La maladie de Vincent van Gogh envisagée à la lumière des conceptions nouvelles sur l'épilepsie psychomotrice - Coueslant, Cahors, 1956.
- GIBBS F. A., STAMPS F. W. — Epilepsy Handbook - Blackwell Scientific Publications, Oxford, 1958.
- GOZZANO M., REDA G. C., RICCIO D., NENCINI R. — Studio del deterioramento intellettuale attraverso il rapporto "Vocabolario" - "Progressive matrici" - Medicina Psicosomatica, 1, 138, 1956.
- GRIESINGER W. — La pathologie mentale au point de vue de l'école somatique allemande - Ann. Méd. Psych. 5, 1, 1865.
- HESS W. R. — Il diencefalo - Ed. Martello, Milan, 1952.
- KARDINER A. — The Bioanalysis of the epileptic reaction - Psychoanalytic Quarterly 1, 375, 1932.
- KLEIST K. — Episodische Dämmerzustände - Thieme, Leipzig, 1926.
- KLEIST K. — Gehirnpathologie vornehmlich auf Grund der Kriegserfahrungen. Barth, Leipzig, 1934.
- KRAFF E. — Physiogénèse et psychogénèse des états convulsifs - Evol. Psych. 3, 607, 1953.
- LENNOX W. G. — Brain injury, drugs, environment as causes of mental decay in epilepsy - Amer. J. of Psych. 174, 1942.
- MARCHAND L., AJURIAGUERRA J. — Epilepsie - Desclée de Brouwer, Paris, 1958.
- MAUZ F. — Die Veranlagung zu Krampfanfällen - Thieme, Leipzig, 1937.
- PARDO G. — Episode paranoïque prodromique d'attaque épileptique - Rev. Psychol. Psychiat. Neuropath. 31 Mai, 1898.
- PENFIELD W., JASPER H. — Epilepsy and the functional Anatomy of the human Brain - Little and Brown, Boston, 1954.
- PICHOT P., PERSE J., LAMPERIERE T. — Rapport au XI Congrès de Psychotechnique - Rev. de Psychologie Appliquée, 3, 14, 1953.
- REICH W. — Ueber den Epileptischen Anfall - Inter. Zeitschr. Für Psychoanalyse 17, 263, 1931.
- SCHAFER R. — Psychoanalytic interpretation in Rorschach testing. Theory and Application. Grüne and Stratton, N.Y. 1954.
- SHEPS J. G. — Intelligence of male non institutionalized epileptics of military age - J. of Ment. Science 93, 82, 1947.
- STEKEL W. — Der epileptische Symptomenkomplex und seine Behandlung - Fortschrift. Sexualwiss. Psychoanal, 1, 17, 1924.
- STRAUSS H. — Epileptic disorders in American Handbook of Psychiatry - vol. II Basic Books, Inc. New York, 1959.
- SULLIVAN A. J., GAHAGAN H. — On intelligence of epileptic children - Genet Psychol. Monogr. 17, 309, 1935.
- WINFIELD D. L. — Intellectual performances of cryptogenic epileptics, symptomatic epileptics, and post-traumatic encephalopaths - J. Abnormal Soc. Psychol. 46, 336, 1951.

Modern Concepts on the Value of EEG in Epilepsy

ROBERT B. AIRD, M. D.

Professor and Chairman, Department of Neurology, University
of California School of Medicine

The value of EEG in epilepsy is inherent in the physiological nature of both EEG and the phenomenon of epilepsy which it records. Nevertheless, the value of EEG as a means of studying epilepsy has been limited in actual practice, and until the limitations of EEG are more fully understood, it would appear unlikely that the full potentialities of this physiologic technique would be realized.

It is now generally held that the great majority of convulsive disorders, if not all, are of focal origin. Correspondingly, the detection of focal discharge in epilepsy is of great importance, if the physiological mechanisms underlying the convulsive state in each individual are to be properly understood. This can be shown by means of EEG only in those instances in which the focus is at or near the surface of the convexities of the cerebral hemispheres that are sampled by this technique. To this spatial limitation of EEG should be added the effect of generalized dysrhythmias, which are associated with convulsive disorders in an high percentage of cases, and which frequently serve to obscure the presence of epileptic foci. Thus, the relationship of focal epileptic discharge to generalized dysrhythmic activity in the EEG and the importance of both to the clinical problem of epilepsy, is considerable. One object of the present report is to emphasize the potentialities of a modified technique of EEG recording which helps to clarify these relationships.

Another limitation of EEG in practice concerns the too prevalent dichotomy that

exists between the clinic and the EEG laboratory. Like all other diagnostic tools, the value of EEG may be impaired or lost if the clinician, in his study of convulsive disorders, is lacking in his understanding of the potentialities and limitations of this technique, or fails to closely integrate its use with his clinical study. The second purpose of the present report, therefore, is to emphasize the fact that when used properly EEG is of great value to the clinician in the study and management of convulsive disorders.

Other limitations of EEG concern (1) the differentiation between artefact and brain wave activity; (2) the temporal limitations of a sampling technique in recording transient phenomena, and (3) the limitations of interpreting physiological data in terms of possible underlying pathology. These are well known limitations and, except for the last, may be overcome by vigilance in the technical aspects of recording and care with respect to the duration of recording, or to recognizing the need for a repetition of the test.

Methods and Material

Because of the obvious importance of focal activity in the study of convulsive problems, the methods by which focal abnormality might be recognized in EEG were reviewed a number of years ago in our laboratory. Of first importance appeared to be the utilization of a sufficient number of electrodes to permit an adequate coverage of available scalp areas from which the re-

cording can be obtained. The precise arrangement of electrodes on the scalp and the exact routine of recording appeared to be of secondary importance. Correspondingly, a minimum of 16 electrodes for children and 18 electrodes for adults (including the ear electrodes) has been used routinely in our laboratory in the past 15 years.

Another factor which might aid in the recognition of focal abnormality was suggested by the principle of localization employed in the neurological examination. Bilateral comparison of homologous parts of the two sides of the body and comparison of the physiological responses of these homologous structures constitutes the basis of the neurological examination. That this same principle might be employed in EEG was suggested by the close symmetry found in the size, form, frequency, and pattern of the brain waves when recorded from homologous areas. The recognition of the normal degree of variation which can occur when the recording is done in this fashion, that is, under precise conditions of symmetrical electrode placement and of calibration for the EEG channels to be compared, is essential, of course, to the proper interpretation of the EEG so obtained. Suspected abnormal variations in the EEG recording can be detected more readily when the homologous tracings are used as a control. For a careful comparison of all the characteristics of homologous EEG tracings, it is essential that they be recorded both simultaneously and side by side in adjacent channels.

The careful utilization of such methods has resulted in an increased appreciation of focal EEG activity in our hands. Foci suspected by ordinary methods are ruled out or made obvious by the weight of the additional focal data provided. Furthermore, focal changes have been recognized or suspected in an additional 20 per cent of cases than were previously diagnosed by other routine techniques(1). For a more detailed exposition of the methods used and results obtained, the reader is referred to previous papers(2) (3).

One of the more interesting aspects of homologous EEG recording has centered about the bilateral or hemispheric synchrony

of brain waves when recorded simultaneously as described. The degree of synchrony of both the normal rhythms and of various abnormal rhythms has been studied in detail, utilizing when necessary for research purposes a dual-beam, cathode-ray oscilloscope with high speed photographic recording, capable of determining differences of synchrony as slight as 1-2 milliseconds.

The technique described has been used for purposes of diagnosis in over 20,000 EEGs and, with the development of activating procedures in more recent years, has been adapted to the study of physiological mechanisms of presumptive importance in patients with convulsive disorders as determined by an initial clinical study of each case.

Results

The results of our studies may be discussed to best advantage under two headings: (1) New developments in the diagnostic value of EEG in epilepsy; and (2) the value of EEG as a clinical, physiological tool in the study and management of patients with epilepsy.

New Developments in the Diagnostic Value of EEG in Epilepsy

The essential synchrony of homologous EEG activity has been confirmed for both normal alpha and beta rhythms and such abnormal rhythms as the generalized dysrhythmias usually associated with petit mal and grand mal (4) (5). Variations of synchrony up to 20 and more milliseconds were found in all the rhythms mentioned, but was less than one millisecond off perfect synchrony in from 21-55 % of the waves studied, regardless of their type, and showed a shifting of the leading side from one hemisphere to the other when continuous runs were studied serially. The degree of bilateral synchrony found far exceeded what might be anticipated if the cortical activity in the two hemispheres were functioning in a random and independent fashion. This has led us to postulate a common driving force, capable of influen-

cing the cortical activity of both cerebral hemispheres, which we have termed the cerebral "pacemaker" (6).

The importance of the cerebral "pacemaker" lies in the fact that by means of simultaneous, homologous EEG recording,

subject of study in our experimental laboratory.

A striking finding in our human EEG studies has been the observation that focal cortical and subcortical pathology is characterized by asynchronous activity when

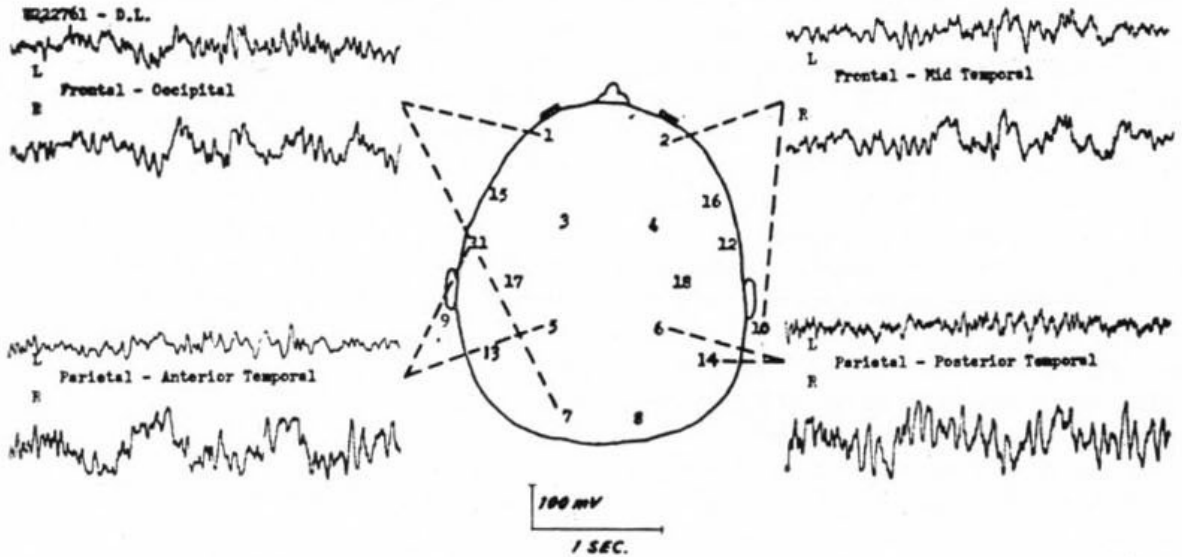


Fig. 1. — D. L., Female of 34 years. Left sided spastic paresis developed within one month 5 yrs. ago, most marked in left leg and foot. Two focal seizures, but no further spells on Dilantin and Phenobarbital, t.i.d. Sensory loss and increased reflexes were also found in the left lower extremity. — EEG showed irritative focus in the parietal and temporal regions on the right. PEG unsatisfactory and Arteriogram normal. Ventriculogram showed depression of posterior portion of right lateral ventricle. — Right temporoparietal craniotomy revealed intracerebral hematoma deep in the right parietal lobe. No evidence of tumor. Good post-operative recovery, except for some residual weakness of the left leg. — 5 years later awakened with tingling of left side, bad taste sensation and confusion, followed by generalized grand mal seizure. Had discontinued Dilantin in past year. No evidence of new bleeding. Lumbar puncture showed normal pressure and clear CSF. Anticonvulsive therapy started again. — EEG showed gross focal dysrhythmia in the right temporal region. Other adjacent areas on the right side were involved secondarily. The dysrhythmia was characterized by high voltages, slow waves, irregularity of form, and hemispheric asynchronism. A slight, generalized dysrhythmia appeared secondarily. — Note: the asynchronism of the anterior and posterior temporal recordings and the essential synchronism of the generalized dysrhythmias elsewhere.

we are enabled to study another phenomenon from the depths of the brain in addition to the cortical activity as ordinarily recorded by EEG. That the cerebral "pacemaker" represents a fundamental neurophysiological mechanism would appear evident from the fact already mentioned that it controls the synchrony of both the normal rhythms and the generalized dysrhythmias of the brain. The localization and nature of the "pacemaker" is at present the

recorded by means of homologous, simultaneous runs. The presumption has been made that the projection pathways between the "pacemaker" and cortex, underlying the points of asynchronous recording, have been interrupted by the pathological process. Empirically it has been demonstrated that this type of asynchronism constitutes a valid and valuable criterion for EEG localization (7). In a review of 500 EEG records showing gross focal dysrhythmias, 97

per cent were characterized by bilateral hemispheric asynchronism. In striking contrast to this, the generalized dysrhythmias, which were found in a high percentage of these same cases, were found to be synchronous in the homologous areas away from the focus (Fig. 1). That the generalized synchronous dysrhythmia was related to

observations must be checked under controlled experimental conditions, it would appear that, in addition to the effect of the "pacemaker" on the cortex, one must postulate an important pathophysiological effect of focal pathology upon the "pacemaker" mechanism. The evidence for this has been presented elsewhere(6). It would appear

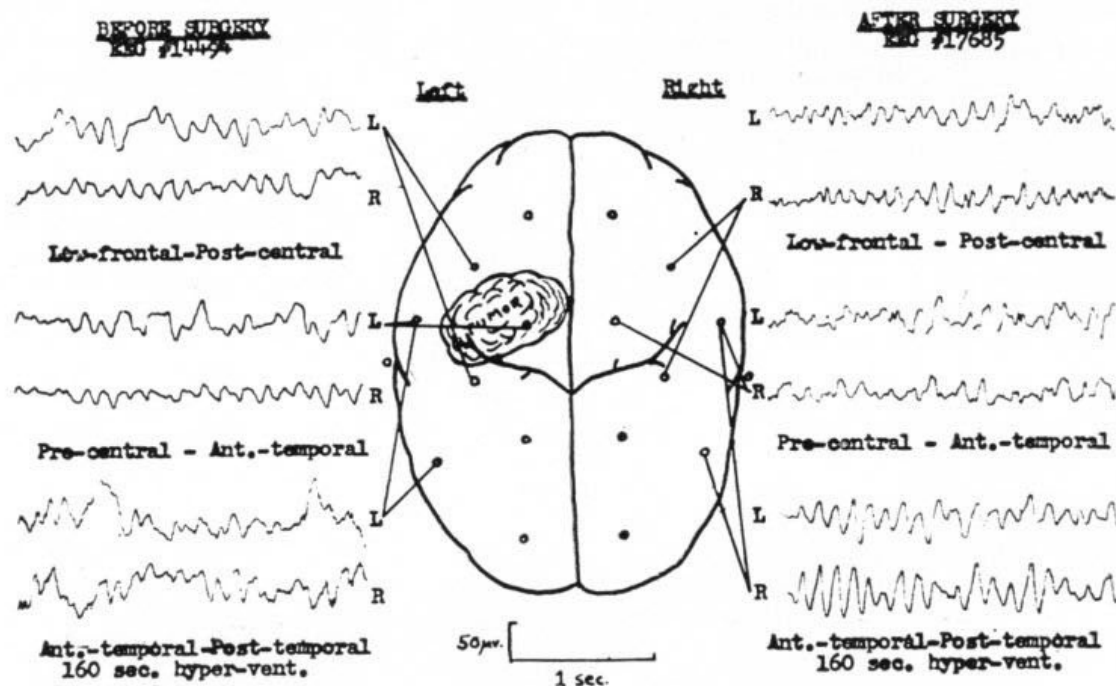


Fig. 2. — G. K., 30 year old female, who had a history of 2 nocturnal generalized convulsions within the past 10 days. — Findings: Physical examination was non-contributory. EEG showed evidence of gross irritative focus in the left anterior temporal region. A carotid arteriogram demonstrated a left frontoparietal tumor mass. — Pathology: Meningioma, parasagittal in left frontal lobe. (EEGs were obtained 8 days before surgery and 756 days after surgery).

the focal process has been shown by its variations of degree, which closely followed changes in the intensity of activity of the focal process. This can be studied to best advantage when the focal process is associated with epileptic discharge that varies widely in its intensity. With sustained bursts of focal dysrhythmic activity, a generalized dysrhythmia will appear if it has not been present previously, or a generalized dysrhythmia already present will become more marked. Again, such generalized dysrhythmias clear following the adequate surgical resection of focal pathology. (See, Fig. 2.)

Although the implications of such ob-

that this may constitute an important mechanism for the propagation of epileptic discharge. The study of such EEG findings and their correlation with the convulsive phenomena, as evidenced clinically in the history and neurological findings of patients, constitute a challenging and important new development in EEG.

The Value of EEG as a Clinical, Physiological Tool in the Study and Management of Patients with Epilepsy

Another aspect of EEG of particular importance in the study of epilepsy has arisen with the development of activating techniques that permit the assessment of phy-

siological mechanisms of potential importance because of their effect on the underlying convulsive susceptibility of patients. It should be emphasized from the start that the use of activating techniques as implied here does not primarily concern their value as diagnostic procedures, which serve to enhance the usefulness of EEG as a clinical, diagnostic tool; rather, the use referred to concerns their value in permitting an understanding of those physiological factors in each individual patient which

tating clinical spells and again in the efficacy of the ketogenic diet in such patients. If hyperventilation is done during EEG recording, the alteration in the brain wave tracing usually appears very quickly and as a rule either subclinical bursts, called "larval" episodes, appear or actual clinical spells are precipitated, in either case with a typical burst of 3 cps wave-and-spike activity. The EEG, therefore, is of value in evaluating this factor in patients with petit mal, as well as in differentiating petit mal

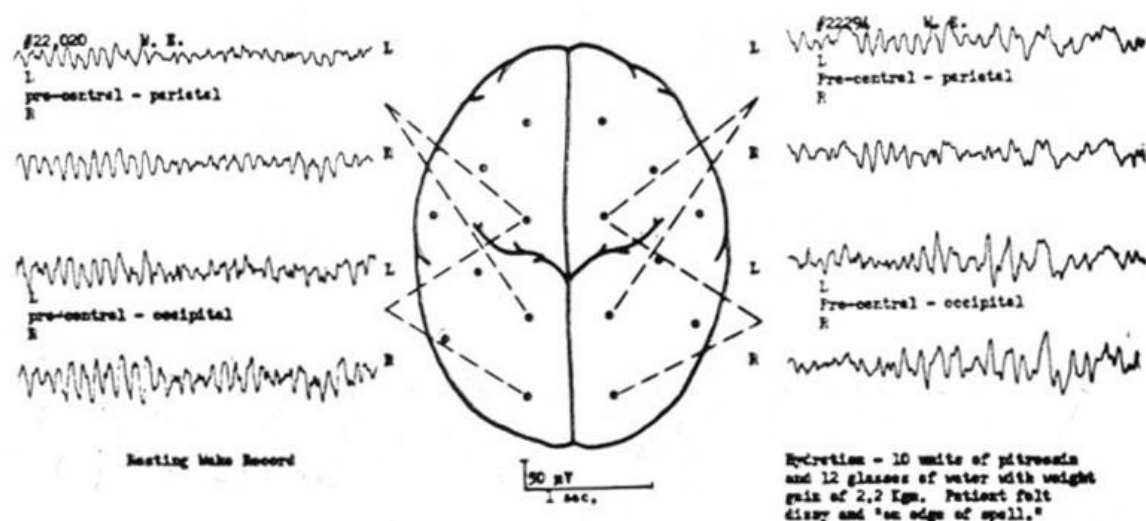


Fig. 3. — W. E., 27 year old female had dizzy spells for 11 months with epigastric auras. Nocturnal seizure occurred 8 months ago; grand mal seizure 5 months ago; sensitive to flashing lights. — Past History: Incurred a severe left-sided head injury in 1950. — Family History: Mother was sensitive to light. — The neurologic examination was normal. — EEG showed a borderline pattern activated by sleep, hyperventilation and photic stimulation. There was a left temporal focus which consisted of transient irritative activity associated with low voltages. — Diagnosis: Temporal Lobe Epilepsy with associated psychiatric symptoms. — Follow-up: 5 kgs. weight loss in 3 days on Diuril. Felt much better.

may be of importance in conditioning or influencing their underlying convulsive state. This represents an extension of the use of EEG as a clinical diagnostic aid into another sphere, which may be best referred to as clinical physiological studies of potential value in planning the management of patients with convulsive disorders(8).

To take one of the most obvious examples, in patients with petit mal it is well known that alterations of the acid-base balance are of considerable importance. This is shown by the effect of hyperventilation in precipi-

from minor attacks of the temporal lobe type.

Such information is of importance in the practical treatment of the more resistant cases of petit mal. In such difficult cases we have found that regulation of the acid-base balance is of great importance. Rather than utilizing the ketogenic diet in such patients, as was done in former years and as was shown to be effective so long as the patient could be induced to stay on this difficult diet, we have used an acid-ash diet and added either glutamic acid

or Diamox as necessary to regulate the acid-base balance.

The water balance is also a mechanism of primary importance in convulsive disorders. Acute hydration will precipitate spells in a very high percentage of patients, as was amply confirmed by the efficacy of the "water" or pitressin test used commonly in neurological practice years ago(9). Again, if in the individual case this me-

tolerance curve is run, this mechanism may be evaluated. In some patients we have used small doses of insulin as an activating mechanism to test this factor. Since cerebral function depends upon an adequate carbohydrate metabolism, the production of hypoglycemia represents a potent threat to normal cerebral physiology. In areas of cerebral pathology, inadequately supplied by blood vessels, or relatively isolated from

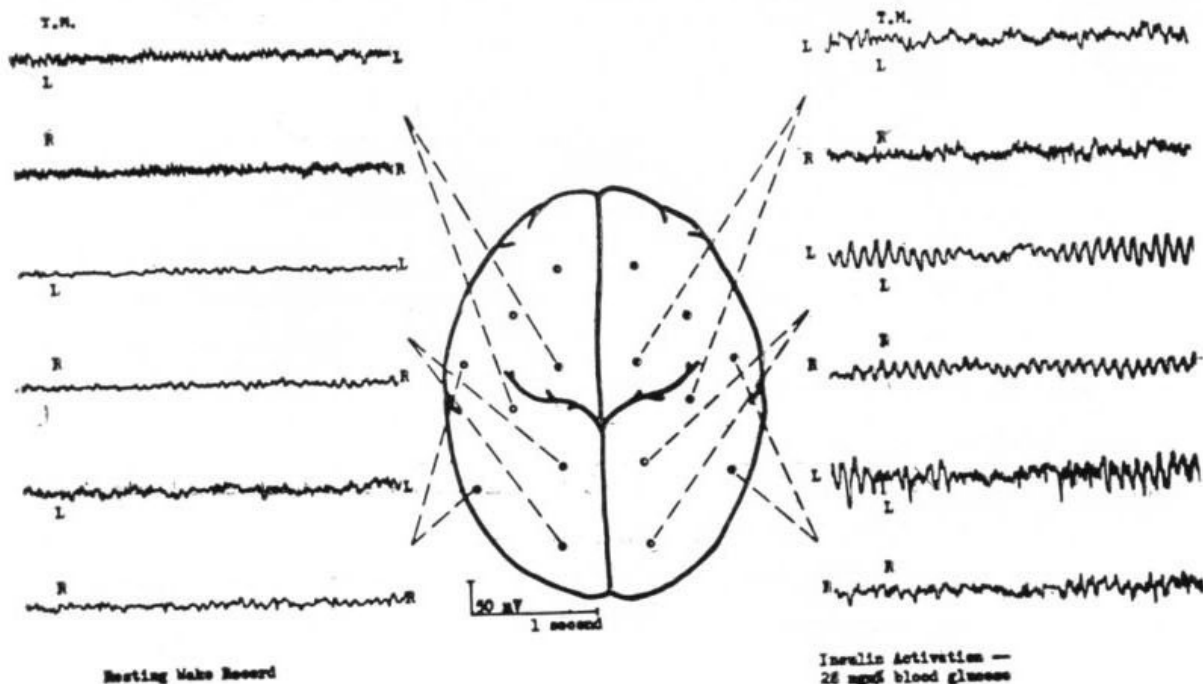


Fig. 4. — T. M., a 47 year old male with episodes of left facial pain of 10 years' duration following a head injury; also suffered "blackout" spells in the past 7 years, and had episodes of confusion and amnesia more recently. — The neurological examination was normal. — EEG resting wake record showed a borderline normal pattern. With insulin activation (10 units I. V. O.) higher voltages, irregularity, asynchronism and suggestive spikes appeared in the left temporal and post-central regions 1 + hour after injection, when the blood glucose was 28 mgm %. — Impression: Temporal Lobe Convulsive Disorder.

chanism appears to be important, it can be checked by EEG and this can be accomplished short of the point of actual precipitation of seizures as was required in the hydration test. (See Fig. 3).

In some patients we are concerned about the possibility of hypoglycemia, if their spells tend to come in the early hours of the morning before breakfast. Although the majority of such conditions are due to temporal lobe disturbance, occasional cases may be due to hypoglycemia. If an EEG is obtained at the same time that a glucose

a nutritional standpoint by gliosis or other pathology, increased degrees of susceptibility to hypoglycemia may be encountered. Under such conditions, hypoglycemia may embarrass the local abnormal physiology and thus produce an activation. (Fig. 4).

In an older age group we have been interested in the possibility of a relative insufficiency of the cerebrovascular supply as a contributing factor to their spells. Carotid compression in such cases may temporarily exaggerate the cerebrovascular insufficiency and show up both clinically and

in the EEG. (Fig. 5 illustrates this point). It is important to distinguish between the effects of carotid sinus stimulation and carotid compression, of course, but this can be done by running an electrocardiogram of the patient in one channel simultaneo-

conditioning or precipitating mechanisms in patients with convulsive states will be obvious from the examples already considered. The use of EEG for this purpose depends upon a careful initial clinical study of each patient. As different mechanisms

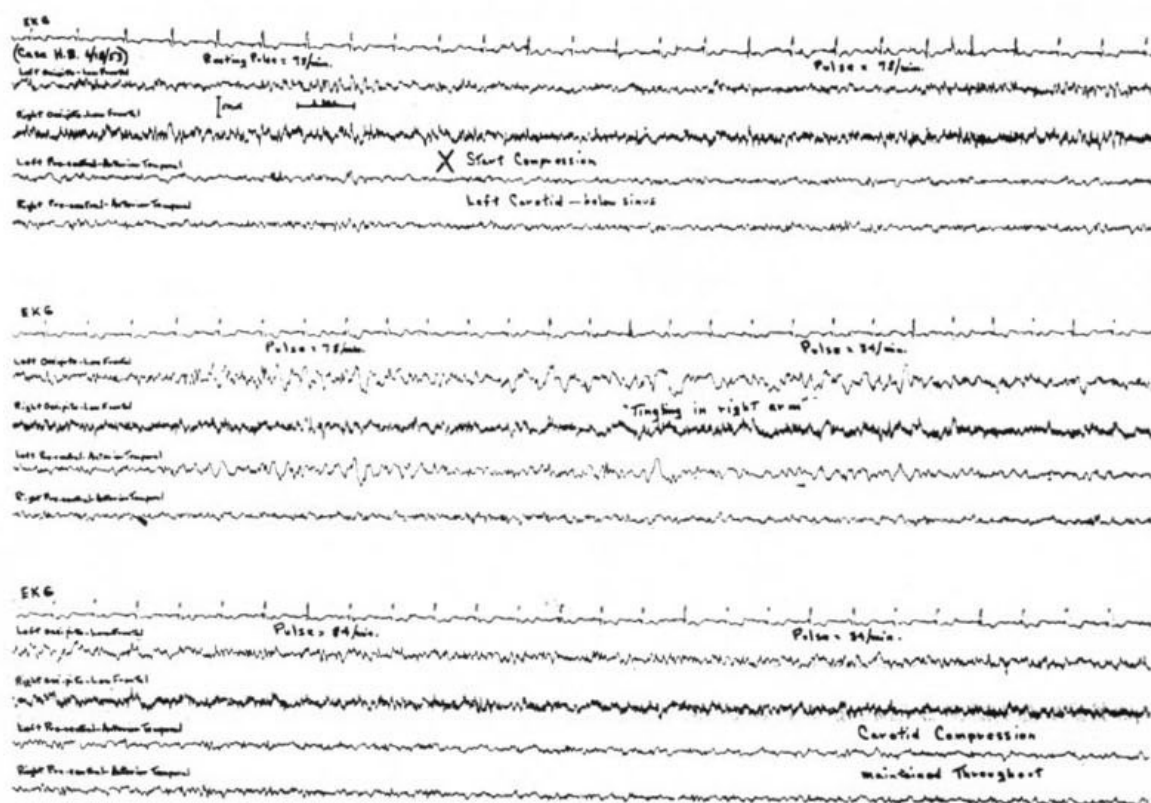


Fig. 5. — H. B. Continuous recording during digital compression of left, common carotid artery on a 52 year old, right-handed woman, who complained of brief spells of inability to talk over the past 4 years, and of short spells of numbness and weakness involving chiefly her right upper limb, associated with inability to speak, visual loss, and loss of contact with her environment in the past year. — Neurological findings were limited to underaction of the right lower face and slightly increased reflexes in the right upper limb. Spells could be reproduced by compression of the left internal carotid artery. — EEG showed generalized, paroxysmal dysrhythmia of nonspecific type and suggestive evidence of a focus in the left temporal and central regions. — Pneumoencephalography showed no definite abnormality, although early atrophic changes in the left cerebrum were suspected because of slight enlargement of the left lateral ventricle and central subarachnoid spaces. — Arteriography showed narrowing of the left internal carotid at an extracranial point. Surgical resection of adhesive bands across the carotid improved her condition.

usly with the EEG during carotid compression. Care must be exercised in the proper selection and management of patients for this test.

The application of EEG to the study of sleep, photic stimulation, alcohol, etc., as

are suggested as being of importance in each patient, they may then be evaluated by means of EEG and the activation techniques indicated. In the case of convulsive disorders, such physiological mechanisms may be important in conditioning the pa-

tient or in actually precipitating seizures. Since these mechanisms may be of great practical importance in patients who are refractory to drug therapy alone, they should be assessed and regulated as part of the treatment in such cases. It is essential that such mechanisms be assessed in each case, since their importance varies greatly in different patients and in the different types of convulsive states.

The use of EEG as a clinical physiological tool stands in striking contrast to its use as a diagnostic tool when such stimulants as metrazol are used. Although the activating effect of convulsive agents does possess considerable diagnostic value in a small percentage of epileptic patients, in the great majority of cases the same diagnostic end may be achieved by more moderate, physiological activating procedures. At the same time, providing that the physician has properly coordinated his EEG studies with his clinical studies, such physiological activating procedures afford the physician a better understanding of those underlying mechanisms which are of im-

portance to him in planning a comprehensive therapeutic regimen best suited to the individual needs of each patient.

The majority of the activating techniques mentioned are well known and widely used. Unfortunately, however, they are too frequently used in a haphazard fashion by electroencephalographers who are not clinically trained, or who do not know the clinical problems of the patient referred to the laboratory. Only as EEG is used as a clinical tool in close conjunction with the clinical study of individual patients can the best results be achieved and the best interests of the patient be served. If utilized in the manner indicated, EEG becomes more than a diagnostic technique in the limited and static fashion that it is now employed in most centers. It becomes an aid to therapy and an aid to the clinician in his over-all understanding of the management of each clinical problem. When properly used as an adjunct to the clinical study of neurological patients, EEG thus may achieve a more positive and wider use, which is at once of value to the physician and the patient.

SUMMARY

In addition to the usual study of the cortical potentials and rhythms of epilepsy by EEG, a method is described which permits an evaluation of the bilateral, hemispheric synchrony of brain waves. The significance of this phenomenon, in terms of a deeply lying neurophysiological mechanism of great importance in epilepsy, was discussed and the added insight it affords to our understanding of convulsive problems was emphasized.

The potentialities of EEG as a clinical physiological tool, rather than as a diag-

nostic aid, were also presented. The value of EEG, when used to increase our understanding of those physiological mechanisms which vary considerably in each epileptic patient, was stressed and the importance of obtaining such knowledge in planning a comprehensive regimen of management for each patient was indicated. It was concluded that EEG when employed in this fashion at once achieves a more positive and wider use, which greatly extends the usefulness of EEG to the physician in aiding his understanding and care of the patient.

RESUMEN

Además de los estudios habituales en la epilepsia de los ritmos y potenciales de la corteza por medio de EEG, se describe un método que permite la evaluación de los sincronismos bilaterales de las ondas de los hemisferios cerebrales.

Se ha discutido la significación de este fenómeno de gran importancia en la epilepsia, en términos de mecanismos neurofisiológicos y se ha insistido sobre nuevos puntos de vista, que aumentan la comprensión de los problemas de las convulsiones.

En este trabajo se ha señalado también las posibilidades de los EEG como instrumentos de investigación clínico-fisiológica más bien que como simple auxiliar del diagnóstico. Se insistió sobre el valor del EEG cuando es empleado para aumentar nuestra comprensión de los mecanismos fisiológicos que varían considerablemente en cada enfermo epiléptico, y se ha subra-

yado la importancia de obtener esta indicación para poder planificar un régimen racional de tratamiento para cada enfermo. Se concluyó que cuando se emplea el EEG de este modo, se llega a tener un uso más vasto y positivo, lo que aumenta mucho la utilidad del EEG para el médico, ayudándolo a comprender y a tratar al enfermo.

R É S U M É

En plus des études habituelles pour l'épilepsie des rythmes et potentiels de l'écorce au moyen de l'EEG, on décrit une méthode qui permet l'évaluation du synchronisme bilatéral des ondes des hémisphères cérébraux.

On a discuté la signification de ce phénomène, de grande importance dans l'épilepsie, en termes de mécanismes neurophysiologiques, et on a insisté sur des nouveaux points de vue, qui augmentent la compréhension des problèmes des convulsions.

Dans ce travail on a aussi signalé les possibilités de l'EEG comme instrument d'investigation clinico-physiologique, plu-

tôt que comme simple auxiliaire du diagnostic. On a insisté sur la valeur de l'EEG quand il est employé pour augmenter notre compréhension des mécanismes physiologiques qui varient considérablement chez chaque malade épileptique, et on a souligné l'importance d'obtenir cette indication pour pouvoir planifier un régime rationnel de traitement pour chaque malade.

On est arrivé à la conclusion que lorsque on emploie l'EEG de cette manière, on parvient à avoir un usage plus vaste et positif, ce qui augmente beaucoup l'utilité de l'EEG pour le médecin, en l'aidant à comprendre et à traiter le malade.

ZUSAMMENFASSUNG

Ausser den bei der Epilepsie gewöhnlichen Untersuchungen der Rhythmen und Potenziale der Hirnrinde mittels des EEG wird eine Methode beschrieben, die die Bewertung des bilateralen Synchronismus der Wellen der Hirnhemisphaeren erlaubt. Es wurde die Bedeutung dieses Phaenomens im Sinne von in der Tiefe gelegenen neurophysiologischen Mechanismen, die so grosse Wichtigkeit bei der Epilepsie haben, besprochen und die neuen Gesichtspunkte hervorgehoben, die das Verstaendnis des Problems der Konvulsionen vermehrt haben.

Die Moeglichkeiten der EEG als Instrument klinisch-physiologischer Forschung und nicht nur als einfaches diagnostisches

Hilfsmittel, wurden ebenfalls in dieser Arbeit hervorgehoben. Man betont den Wert des EEG wenn es benutzt wird, um das Verstaendnis fuer die physiologischen Mechanismen, die von einem zum andern Patienten erheblich variieren, zu vertiefen. Und man hob die Wichtigkeit hervor, solche Kenntnisse zu erreichen, um eine rationelle Behandlungsweise eines jeden Patienten planen zu koennen.

Man kam zum Schluss, dass wenn das EEG auf diese Weise benutzt wird, man eine erweiterte und positive Nuetzlichkeit erhaelt, was den Nutzen des EEG fuer den Arzt erheblich vermehrt, indem es ihm bei dem Verstaendnis und der Behandlung des Patienten unterstuetzt.

BIBLIOGRAPHIE

(1) AIRD, R. B., and BOWDITCH, S.: Cortical localization by electroencephalography; the value of a quantitative and statistical analysis of homologous recordings obtained simultaneously. - *J. Neurosurg.* 3:407-420 (Sept.) 1946.

(2) AIRD, R. B., and ZEALEAR, D. S.: The localizing value of asymmetrical electroencephalographic tracings obtained simultaneously by homologous recording; four hundred and six correlative studies of clinical, pathologic, pneumo-encephalographic and electroencephalographic data. - *EEG & Clin. Neurophysiol.*, 3:487-495 (Nov.) 1951.

(3) AIRD, R. B., and ADAMS, J. E.: The localizing value and significance of minor differences of homologous tracings as shown by serial electroencephalographic studies. *EEG & Clin. Neurophysiol.*, 4:45-60 (Feb.) 1951.

(3) GAROUTTE, B., and AIRD, R. B.: Studies on the cortical pacemaker; synchrony and asynchrony of bilaterally recorded alpha and beta activity. - *EEG & Clin. Neurophysiol.*, 10:259-268 (May) 1958.

(5) OGDEN, T. E.; AIRD, R. B., and GAROUTTE, B. C.: The nature of bilateral and synchronous cerebral spiking. - *Acta psychiat. et neurol., Scand.*, 31:273-284, 1956.

(6) AIRD, R. B., and GAROUTTE, B.: Studies on the "cerebral pacemaker". *Neurology*, 3:581-406 (Aug.) 1958.

(7) AIRD, R. B., and ZOBELL, D.: Homologous asynchronism as an electroencephalographic sign of focal pathology. 4th International EEG Congress, Brussels, Belgium, July 23, 1957. *Free Communications - EEG*, 4:45-46, 1957.

(8) AIRD, R. B.: Electroencephalographic Diagnosis. Chapter in: *Epileptic Seizures*, edited by John R. Green and Harry F. Steelman. Baltimore, Williams and Wilkins, 1956.

(9) MCQUARRIE, I., and PEELER, D. B.: The effects of sustained pituitary antidiuresis and forced water drinking in epileptic children; a diagnostic and etiologic study. *J. Clin. Invest.*, 10:915-940 (Oct.) 1931.

The Drug Therapy of Convulsive Seizures

by **MELVIN D. YAHR, M. D.** and
H. HOUSTON MERRIT, M. D.

The Department of Neurology. The Neurological Institute of New York

With few exceptions, patients suffering from recurrent convulsive phenomena will at one time or another require anticonvulsant medications. In a limited number, the finding and correction of a metabolic defect or the extirpation of a localized pathological process in the Central Nervous System (i.e. brain tumor, abscess, etc.) may obviate the necessity for continued use of such drugs. However it should be pointed out that even after removal of as benign a tumor as a meningioma, convulsive seizures may recur in as many as 50 % of patients. Were there an ideal anti-convulsant available, one which would effect all seizure types, have an established dosage, and produce no side effects, the drug therapy of seizures would be relatively simple. Lacking such a drug, it is essential that the clinician have a comprehensive understanding of the various medications available, as well as the technique by which they can be most successfully utilized.

The objective of all anticonvulsant therapy is to establish and maintain a reservoir of drug sufficient to control the seizures while producing a minimum of side-reaction. This is accomplished by choosing from the available drugs one or more of which is most effective for a particular seizure type or for a particular patient. If more than one seizure type exists, a combination of drugs is usually more effective than a single one. In fact, a combination of drugs will often be necessary even for patients with a single seizure type. The choice of drug must also be governed by

its ease of administration and its safety in regard to nonfatal and reversible toxic phenomena.

After choice of the most effective drug or drugs for a particular patient has been made, it must be remembered that anticonvulsants have no fixed dosage. Their administration should be started at what is assumed to be a minimum dose and gradually increased until either the seizures are controlled or toxic reactions to the drug develop. If the latter occurs without seizure control, the administration of drug is not discontinued but doses are reduced to a nontoxic level and a second drug is given following the same principle of increasing dosage. This system of pyramiding drug administration allows for the establishment of a reservoir of two or more anticonvulsants, the combined action of which is more effective than any one drug by itself. As many as three or four drugs can be combined in this fashion without producing toxic reactions. Frequent shifting of drugs is undesirable. When new drugs are introduced, previous medication should not be discontinued until an optimum level has been established for the new medicament.

Diligence and patience are necessary to find by this method of trial and error the best possible combination of drugs and the optimum dosage schedule for each individual patient. The patient's confidence and cooperation are essential for the success of a program of this sort. He must be indoctrinated in the mechanism of the process and enlisted to play an active role in keeping accurate records of his seizures, taking

THE DRUG THERAPY OF CONSULSIVE SEIZURES

prescribed doses, and reporting his reactions to the drug.

The antiepileptic drugs most commonly used are derivatives of the barbiturates, hydantoins, oxazolidines, bromides, and, to a

lesser extent, the phenylacetylureas, succinimides, and carbonic anhydrase inhibitors.

The following is a list (Table 1) of currently employed drugs that are commercially available under various trade names:

T A B L E 1

<i>Chemical Name</i>	<i>Common Name</i>
<i>Barbituric Acid Derivations</i>	
Phenylethyl Barbituric Acid	Phenobarbital Luminal Gardenal
Methylphenylethyl Barbituric Acid	Mebaral Isonal Prominal
Methyldiethyl Barbituric Acid	Gemonil
Phenylethylhexahydro Pyrimidine	Primidone Mysoline
<i>Hydantoins</i>	
Diphenyl Hydantoin Sodium	Dilantin Epanutin Epamin Alepsin Comitoina
Methylphenylethyl Hydantoin	Mesantoin Phenantoin Sedantoinal
Ethotoin	Peganone
<i>Oxazolidine - Diones</i>	
Trimethyl Oxazolidine Dione	Tridione Trimethadione Epidione Petilep
Dimethylethyl Oxazolidine Dione	Paradione Paramethadione
<i>Succinimides</i>	
Phensuximide	Milontin
Methsuximide	Celontin
<i>Phenylacetylurea</i>	
	Phenurone Phenacemide Fenilep Epiclase
<i>Acetazoleamide</i>	
	Diamox
<i>Bromides</i>	
	Sodium or Potassium Bromide

In a recent evaluation of therapy utilizing the above medications and principles of drug administration previously indica-

nefit from therapy. The results of treatment in psychomotor and minor seizures are not good. Though 65 per cent show a

TABLE 2

Results of therapy in various types of seizures				
Seizure Type	Nº	Controlled %	Improved %	Uncontrolled %
Grand Mal	290	59	22	19
Focal	45	52	33	15
Petit Mal	65	73	10	17
Psychomotor	85	20	42	38
Minor	58	24	39	36
Akinetic	25	5	16	79
Myoclonic	27	5	16	79

ted, the following results were obtained (Table 2). Grand mal and focal seizures behave similarly in response to drug therapy with slightly more than 50 % being completely controlled, another 30 % improved, leaving 15-20 % uncontrolled. Equally good results are obtained in petit mal: only 17 per cent of this seizure type fail to be-

positive effect, less than 25 per cent can be completely controlled. Akinetic and myoclonic seizures have proved to be highly resistant to drug therapy, with some 80 per cent uncontrolled.

Major seizures. On the basis of the sequence of drug administration previously outlined, the contribution of each of the

TABLE 3

Effectiveness of various drugs in major seizure types		
D R U G	% Seizures Controlled or Improved	Total Nº Each Seizure Type
Dilantin	17	
Dilantin + phenobarbital or Mebaral	35	
Dilantin + other anticonvulsants	16	
Other anticonvulsants		
Mesantoin	3	90
Mysoline	6	102
Phenurone	5	45
Peganone	1	57
Diamox	1	23
Experimental drugs (23 - Generically allied to above)	3	—
TOTAL	71	

THE DRUG THERAPY OF CONSULSIVE SEIZURES

agents used for the control or improvement of major seizure types was evaluated. (Table 3) The overall results for these seizure types indicate that 71 per cent benefited from therapy. The use of Dilantin alone accounts for 17 per cent, while the combination of Dilantin with phenobarbital or Mebaral yields 35 per cent. The addition of all the other drugs to Dilantin contributes another 16 per cent. In those

related with the amount of drug administered—we have previously reported an increase from 10 to 77 per cent for Dilantin when the dose is increased from 0.3 to 0.6 gm.—and in most instances can be alleviated by decreasing the amount of drug, the overall incidence is not of importance. What counts is the number of patients in whom the medication cannot be tolerated at all so that it must be discontinued. Re-

TABLE 4

Dosage ranges and toxicity of drugs used in major seizure types				
DRUG	DOSAGE RANGE	TOXICITY		
		gm.	Overall %	Mild % Serious %
Dilantin	0.1 - 1.0		37	3 1
Phenobarbital	0.03 - 0.3		25	2 1
Mebaral	0.1 - 0.5		25	2 1
Mysoline	0.250 - 2.0		40	20 1
Mesantoin	0.1 - 0.8		48	15 10
Phenurone	0.5 - 3.0		45	15 20
Peganone	0.5 - 4.0		40	20 1
Diamox	0.250 - 1.5		5	4 1

instances in which Dilantin could not be tolerated, other anticonvulsants, either alone or in combination, account for 3 per cent. This, of course, is not a comparative study of the anticonvulsant potency of these medications, for altering the order of administration might well reverse these values. As a matter of fact, some of the drugs have been reported to be as high as 80 per cent effective in a few of these seizure types. However, in terms of tolerable side effects and lack of serious toxicity, this order of drug administration seems most desirable at this time.

The dosage ranges necessary to achieve such results and the incidence of toxicity of the various drugs are indicated in table 4. The wide dosage ranges, as much as tenfold for most drugs, indicate the individualized problem with which the clinician is challenged in each treatment situation. The dosage levels here are above those normally recommended for use with each of the drugs. Since toxicity is intimately co-

actions which are not a threat to the patient's life are termed "mild"; those with more dire implications are classified as "serious". Only a small percentage of this group has had to discontinue the use of Dilantin, phenobarbital or Mebaral for either mild or serious toxicity. When this has happened, it has been because of skin rashes or generalized allergic manifestations. With Mysoline, the serious side effects are also minimal, but a fair percentage—some 20 per cent—are unable to tolerate even the smallest dose without developing severe vertigo or drowsiness. Though this, on occasion, disappears with continued use, many patients refuse further trial. Peganone has, thus far, shown no appreciable serious toxicity except for occasional leukopenia, but in this series of patients 20 per cent developed mild reactions, which could not be alleviated by adjustment of dosage. The two problem drugs have been Mesantoin and Phenurone. The side effects of these drugs are well

known. In our experience, the use of Mesantoin is limited by its soporific action and bone marrow suppression. With Phenurone, this group of patients had a high incidence of personality disturbances — some 15 per cent—. The rest of the serious

even a trial of all other anticonvulsant agents, with no material beneficial effect. We have not had the opportunity of trying glutamine or asparagin in these patients and cannot report on their value. The effectiveness of the various drugs used is

TABLE 5

Results of therapy in the petit mal triad				
Seizure Type	Total Cases	Controlled %	Improved %	Uncontrolled %
Petit Mal	65	73	10	17
Akinetic	25	5	16	79
Myoclonic	27	5	16	79

toxic reactions were neutropenias and hepatic dysfunction. Fortunately, no deaths from the administration of any of these agents were encountered in this series.

Petit mal seizures. The results of therapy in the petit mal group of seizure types is

therefore limited to petit mal itself (Table 6). Of these cases, 83 per cent benefited by therapy, including 62 per cent from the use of Tridione alone and another 11 per cent from Paradione, either by itself or combined with Tridione. Benefit in the

TABLE 6

Effectiveness of drugs in petit mal							
DRUG	TOTAL CASES	% Controlled	% Improved	Dosage Range in gm.		Toxicity Mild % Serious %	
Tridione	65	57	5	0.9	- 3.0	10	2
Paradione	31	8	3	0.9	- 2.4	5	2
Milontin	31	1	1	1.5	- 3.0	2	1
Celontin	15	—	1	0.9	- 2.4	1	—
Diamox	15	1	1	0.25	- 1.0	5	—
Dexedrine	5	1	—	0.005	- 0.02	—	—

indicated in table 5. The marked difference in responsiveness to drug treatment of petit mal and the two other members of this group makes one seriously doubt whether they should be continued in the same category. In this series, all three were initially subjected to trial on the so-called petit mal drugs. Since akinetic and myoclonic seizures did not respond, these cases were gi-

remaining 10 per cent comes from all other agents used. Though the toxicity of Paradione is less than that of Tridione in respect to mild reactions, we have had to contend with as many neutropenic responses. No irreversible hematological disturbances were encountered from either of these agents in this group of patients, though instances of such reactions have been re-

ported. In two patients receiving Tridione, nephrotic syndromes which developed in the course of therapy necessitated withdrawal of medication. Because of these toxic hazards, we have tended to prescribe newer agents as an initial choice of therapy in these patients. The succinimides, Milontin and Celontin have been reported as effective agents producing a minimum of toxic reaction. Unfortunately, in this series, their ability to control petit mal was

negligible. Of the 31 patients to whom Milontin was administered, 20 had had no previous treatment and only 4 derived any benefit. In the 17 failures, 9 were controlled with the use of either Tridione or Paradione. Eleven patients not controlled on Paradione or Tridione also failed on Milontin. Limited success has been derived from the use of Diamox in this series of patients.

SUMMARY

At the present time, anticonvulsant agents are capable of producing beneficial effects in 75 per cent of seizure patients. These results, however, are not uniform for all types of seizure. The best response is obtained with grand mal, focal and petit mal seizures; the psychomotor, minor, akinetic and myoclonic types respond poorly. To obtain these results, precise classification of the type of seizure is necessary as well as a proper choice of a combination

of drugs whose dosages must be individualized for each patient. Since all of the drugs are capable of producing toxic reactions, the choice should be largely governed by the type of adverse reaction and its tolerability. Though many new drugs have been added in recent years, they have not replaced existing drugs; however, they have proved valuable as adjunct medications.

RESUMEN

Actualmente los agentes anticonvulsivos pueden producir efectos benéficos en el 75 % de los pacientes con crisis. Sin embargo, estos resultados no son uniformes para todos los tipos de ataques.

Se obtienen los mejores resultados con los ataques de gran mal, mal focal y petit mal; los tipos psicomotores, menores, aquinéticos y mioclónicos reaccionan mal. Para obtener estos resultados se debe tener una clasificación precisa del tipo de ataques y se debe lograr una combinación adecuada

de medicamentos, que deben ser dosificados individualmente para cada paciente. Como todos estos medicamentos son capaces de provocar reacciones tóxicas, la elección de los medicamentos debe estar gobernada sobre todo por el tipo de reacción adversa y por la tolerancia. A pesar que se descubrieron muchos nuevos medicamentos durante estos últimos años, ellos no han reemplazado a los medicamentos anteriores. Sin embargo han demostrado ser útiles como medicación auxiliar.

R É S U M É

Actuellement les agents anticonvulsifs peuvent produire des effets bénéfiques chez 75 % des patients avec crises. Cependant ces résultats ne sont pas uniformes pour tous les types d'attaques. On obtient les meilleurs résultats avec les attaques de grand mal, mal focal, et petit mal; les

types psychomoteurs, mineurs, akinétiques et myocloniques réagissent mal. Pour obtenir ces résultats on doit avoir une classification précise du type d'attaques, et on doit choisir une combinaison adéquate des médicaments, qui doivent être dosés individuellement pour chaque patient. Comme

tous ces médicaments son capables de provoquer des réactions toxiques, le choix des médicaments doit être gouverné surtout par le type de réaction adverse, et par la tolérabilité. Malgré qu'on a découvert beau-

coup des nouveaux médicaments pendant ces dernières années, ils n'ont pas remplacé les médicaments antérieurs. Cependant ils ont démontré être utiles comme médication auxiliaire.

ZUSAMMENFASSUNG

Heute koennen die antiepileptischen Medikamente in 75 % der unter Anfaellen leidenden Patienten eine wohltuende Wirkung erzeugen.

Die Erfolge sind jedoch nicht gleichfoermig in allen Formen von Konvulsionen. Die besten Resultate hat man beim Grand Mal, den herdbedingten Anfaellen und dem Petit Mal erreicht. Die Resultate bei den psychomotorischen, akinetischen und myoklonischen Formen sind unbefriedigend. Um diese Ergebnisse zu erreichen, ist eine genaue Klassifizierung der Form der Anfaelle und eine geeignete

Auswahl der Medikamentenkombination notwendig, wobei die Dosifizierung fuer jeden Patienten besonders sein muss. Da alle Medikamente ihre toxische Reaktionen hervorrufen koennen, muss die Wahl weitgehend je nach den stoerenden Reaktionen und ihrer Vertraeglichkeit getroffen werden. Obwohl in den letzten Jahren viele neue Medikamente eingefuehrt worden sind, haben sie doch nicht die schon bestehenden verdraengt. Jedoch haben sie sich als beigeordnete Verordnungen von Medikamenten wertvoll gezeigt.

Intracranial Surgery in the Treatment of Epilepsy

JOSEPH RANSOHOFF, M. D. and
J. LAWRENCE POOL, M. D.

From the Service of Neurological Surgery, The Neurological Institute, New York

Intracranial surgery in the treatment of convulsive disorders is based on the concept that at least some, if not all, seizures arise from a focus of abnormal nerve cells. The neurons which make up such an epileptic focus differ from normal nerve cells in that they are subject to mass discharges in an abnormal fashion and degree(1), in contrast to normal cells which discharge in a more organized and synchronous fashion(1). When the magnitude of a discharge from an epileptic focus reaches threshold level, adjacent normal circuits may be activated, resulting in a clinical seizure.

In 1892, reporting on the origin of epileptic disturbances, Horsley(2) demonstrated experimentally that the impulses causing muscular contraction did not originate in the spinal cord but rather descended from the cerebral cortex. Several years prior to this, however, Horsley(3) in association with Jackson had begun to carry out craniotomies at the National Hospital, Queen Square, London, for the excision of epileptogenic foci in the cerebral cortex. Foerster(4) and Krause(5) both emphasized the need to reproduce the pattern of an attack by cortical stimulation rather than relying on charts or maps of the brain in planning this type of surgery. Stress on the need for clean subpial resection of foci by Penfield and the value of electrocorticography by Foerster, Jasper, and others finally set the stage for the modern technique of epileptic surgery.

Brain damage with secondary cicatrix formation leading to a seizure focus may occur as a result of trauma, infection, and vascular malformations, occlusion or ischemia. (For the purpose of this discussion epilepsy in conjunction with intracranial tumors will not be considered although its mechanism is essentially the same.) The end result of all these processes, however, is an area of damaged or destroyed brain which is electrically and physiologically inactive. Surrounding this region is a margin of damaged but still active brain and it is from this border area that the seizure activity arises (Fig. 1). Surgery's aim is to excise this irritative focus, leaving a less active scar whose discharges can be controlled if need be with reasonable doses of anticonvulsant medication. Surgery however can rarely offer the patient an existence completely free of medication, a fact which cannot be stressed too strongly to the subject and the family prior to operation.

A patient does not come under consideration for surgery however until medical therapy has been proven to have failed in controlling the seizures. The current armamentarium of anticonvulsant drugs is large and the skillful employment of these agents alone and in combination to toxic levels is a pursuit which requires great patience on the part of both the physician and patient. Particularly when seizures are infrequent, months to years may be required before it can be decided that medical therapy has failed.

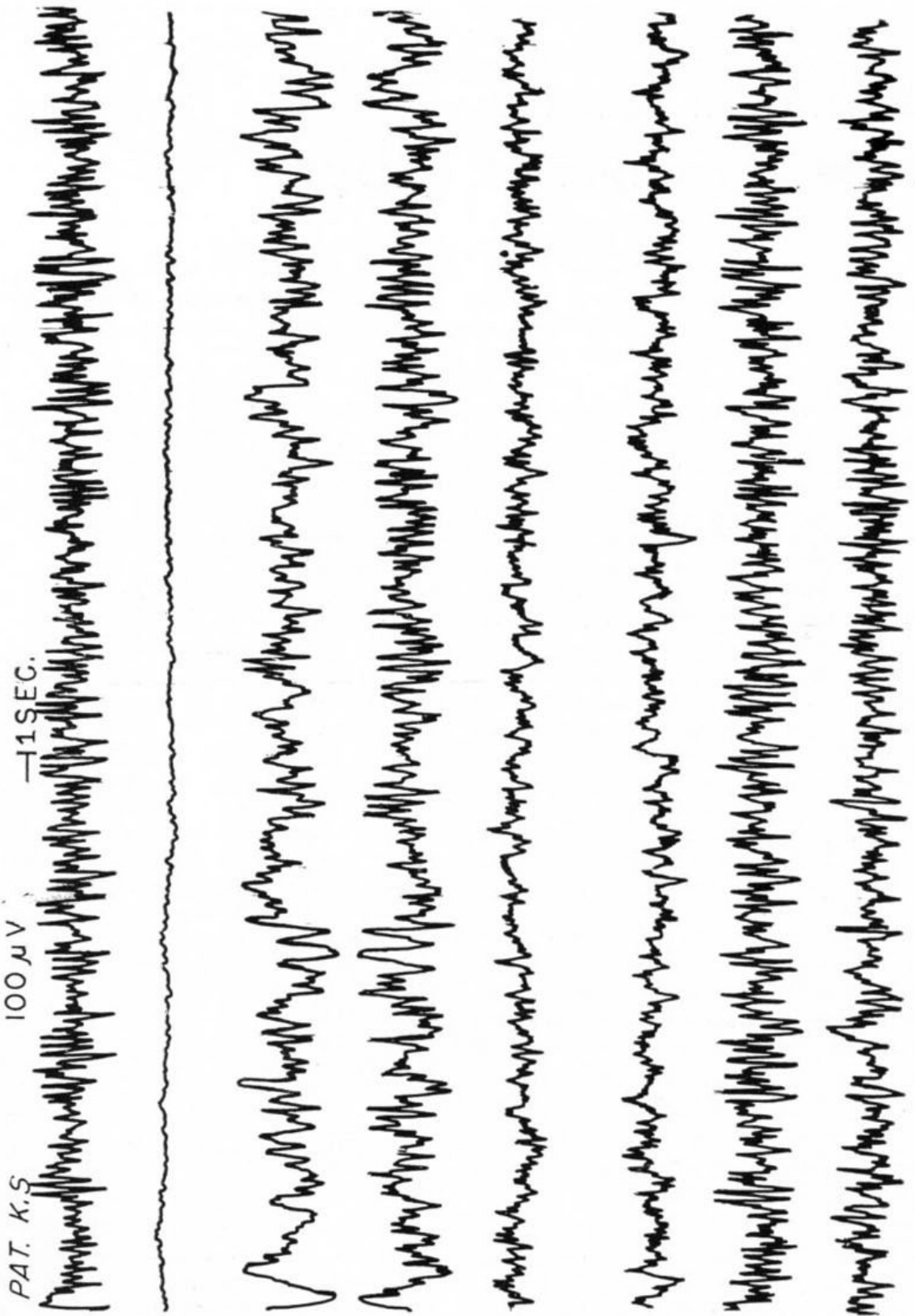


Figure 1. — Electroencephalogram Case II. Tracing demonstrates silent area recorded from center of diseased hemisphere with abnormal electrical activity coming from surrounding damaged tissue.

Once medical therapy has been judged a failure, the next consideration must be that of determining whether a focal site of origin of the seizures can be found that would make surgery worthwhile. Surgery for the relief of seizures is of course dependent on our ability to recognize the focal nature of the convulsive disorder and to localize its site of origin. A careful history of the type of attacks frequently supplies the clue as to the site of seizure origin. Neurological examination, x-rays of the skull, visual fields and careful, repeated electroencephalographic studies are of course necessary. Finally gas encephalography and/or angiography should be employed to delineate if possible the type and location of brain pathology. Most important of all, however, is the physician's ability to recognize the focal nature of the seizures, not only the relatively simple focal motor or Jacksonian type of seizure, but also the more complex symptoms which may indicate seizures of temporal or occipito-parietal lobe origin.

The final criterion for surgery is that the lesion be surgically accessible and in a non-vital area, the loss of which will not cripple the patient. Regions which meet these requirements are, for example, either frontal lobe with the exception of the motor cortex, the anterior 5-6 cm. of either temporal lobe, either occipital pole, and in some cases the non-dominant parietal and posterior temporal areas, or even the entire non-dominant hemisphere.

Three cases treated by surgery will be presented with the aim of illustrating the type of seizure problem which can be considered for this type of therapy.

CASE REPORTS

CASE 1 (T.B.) Post-traumatic leptomeningeal cyst with focal seizures

This five year old girl was admitted to the Neurological Institute of New York in July, 1953 with the complaint of a left parietal skull defect and right-sided seizures which were controlled only with great difficulty.

Past History: The patient fell three floors

at the age of eight months. She recovered with only a mild right hemiparesis, but began to have right-sided seizures 18 months after the accident.

X-rays of the skull revealed a skull defect in the left parietal region typical of a post-traumatic leptomeningeal cyst with skull erosion(6). Electroencephalogram revealed a slow wave focus in this area and air injected through the skull defect outlined a loculated, intracortical cyst. At craniotomy the damaged dura and underlying cortical cyst were excised and the dural defect repaired with a fascia lata graft.

Post-operatively the patient was neurologically intact. She was maintained on gradually decreased doses of dilantin sodium over a three year period. She has been off all anticonvulsant medication for 24 months and has remained seizure free.

CASE 2 (K. S.) Infantile hemiplegia with uncontrollable seizures and behavior disturbances(7)

This fifteen year old girl was admitted to the Neurological Institute of New York in June, 1953 with a history of almost uncontrollable seizures since the age of nine months. These followed soon after an illness characterized by a temperature of 107° and a right hemiplegia. The patient was of low normal intelligence, and had the typically underdeveloped right arm and leg which occurs following hemispheric damage in infants. She demonstrated violent antisocial behavior and had attempted suicide. Her seizures were generalized in nature and were impossible to control at this time.

X-rays of the skull and pneumoencephalography demonstrated an atrophic left hemisphere with a small hemispheric cavity and overdeveloped air sinuses on that side(8). Electroencephalography showed diffuse bilateral abnormality suggesting an effect on the uninvolved side from the electrical disturbance arising in the pathological diseased hemisphere.

At craniectomy the entire left hemisphere was removed. The patient's post-operative neurological examination was un-

changed as compared to her pre-operative status and her speech and gait were unaffected. Maintained on decreasing doses of dilantin sodium for 18 months, she has been off all anticonvulsant medication for three and one half years and has been seizure free. There has been a marked improvement in her personality with an apparent improvement in cerebration, although her I. Q. is unchanged.

CASE 3 (N. S.) Psychomotor seizures i. e. temporal lobe epilepsy

This nineteen year old girl had suffered from episodes of loss of consciousness of 30 to 40 seconds duration since the age of seven. For several years prior to admission to the Neurological Institute of New York in January, 1955, she had had temper tantrums, had assaulted her parents and at times required sedation and restraints. She had become sexually promiscuous and had begun to indulge excessively in alcoholic beverages.

Several previous electroencephalograms had shown a persistent left temporal lobe slow wave focus. Her seizures and other disturbances were not affected by anticonvulsant therapy. Skull x-rays and pneumoencephalography were normal.

In desperation, since institutionalization was otherwise indicated, the patient was submitted to surgery. The anterior six centimeters of her left temporal lobe was excised, this area having been grossly abnormal on electrocortical studies conducted at the time of the operative exposure.

The patient has been maintained on dilantin sodium during the four years since operation. She has an occasional momentary lapse of consciousness. Except for one violent outburst six months after operation, her personality has been markedly improved. She is now married, has one small child and carries out her duties as a mother and wife. There has been no recurrence of her alcoholism or sexual promiscuity.

SUMMARY

The three cases just presented illustrate the fact that surgery in the treatment of convulsive disorders must be reserved for the occasional patient who meets certain strict criteria, as follows:

- 1) The seizures must be of focal origin and be recognized as such, whether they be motor, sensory, psychomotor or visceral in nature.
- 2) Diligent attempts at medical control of these seizures carried out over a considerable period of time must have failed.
- 3) The site of the epileptogenic lesion must be such that its excision or partial excision will not produce a crippling neurological deficit.

The surgical therapy of convulsive phenomena can only be successfully carried out by a team of physicians who are work-

ing closely together. The recognition of the focal nature of the disease, the trial of medication, the accurate localization of the focus and its excision, and the objective evaluation of post-operative results require the services of experts in neurology, psychiatry, neuroroentgenology, electroencephalography, neurosurgery, in addition to numerous highly trained technicians.

In carefully selected individuals excision of damaged brain may render them seizure-free, sometimes without further need of anticonvulsant medication. While surgery has little to offer for the great majority of epileptics, continued study makes us progressively more aware of the focal nature of certain seizures that removes them from the so-called idiopathic group to a group which can be considered for surgical therapy.

RESUMEN

Los tres casos presentados ilustran el hecho de que el tratamiento quirúrgico de los desórdenes convulsivos debe ser reservado para emplearlo muy ocasionalmente y con un criterio estricto en aquellos pacientes cuyo caso justifique la intervención y tengan las características siguientes:

1) Los ataques deben ser de origen focal y ser reconocidos como tales, sean ellos de naturaleza motora, sensorial, psicomotora o visceral.

2) Deben haber fracasado las tentativas de controlar los ataques por medio de cuidadoso tratamiento médico realizado por un prolongado período de tiempo.

3) El sitio de la lesión epileptógena debe ser tal, que su excisión total o parcial no produzca un defecto neurológico invalidante.

El tratamiento quirúrgico de los fenómenos convulsivos puede ser realizado con éxito por un equipo de médicos que tra-

bajen en estrecha colaboración. El reconocimiento de la naturaleza focal de la enfermedad, el ensayo de medicación, la localización exacta del foco y su extirpación y la evaluación de los resultados postoperatorios, requieren los servicios de especialistas en neurología, psiquiatría, neuroradiología, electroencefalografía, neurocirugía, además de numerosos técnicos altamente preparados.

En individuos cuidadosamente seleccionados, la excisión de la parte lesionada del cerebro puede liberarlos de los ataques, a veces sin necesidad ulterior de medicación anticonvulsivante. Mientras que la cirugía tiene poco que ofrecer para la gran mayoría de los epilépticos, continuos estudios nos ponen progresivamente más conscientes de la naturaleza focal de ciertos ataques que los hace pasar del grupo llamado idiopático al grupo que puede ser considerado para terapéutica quirúrgica.

RÉSUMÉ

Les trois cas présentés illustrent le fait qu'on doit réserver le traitement chirurgical des désordres convulsifs, pour l'employer très rarement, et avec un critère strict, chez les patients dont le cas justifie l'opération, et qui possèdent les caractéristiques suivantes:

1) Les attaques doivent être d'origine focale et être reconnues comme telles, qu'elles soient d'origine motrice, sensorielle, psychomotrice ou viscérale.

2) Les essais de contrôler les attaques au moyen d'un traitement médical soigneux doivent avoir échoué pendant un laps de temps prolongé.

3) La localisation de la lésion épileptogène doit être telle, que l'extirpation totale ou partielle ne produise pas un défaut neurologique invalidant.

Le traitement chirurgical des phénomènes convulsifs peut être réalisé avec succès par une équipe de médecins trava-

illant en étroite collaboration. La connaissance de la nature focale de la maladie, l'emploi de médication, la localisation exacte du foyer et son extirpation, et l'évaluation des résultats post-opératoires, exigent les services de spécialistes en neurologie, psychiatrie, neuroradiologie, électroencéphalographie, neurochirurgie, en plus de nombreux techniciens bien préparés.

Chez certains individus bien sélectionnés, l'extirpation de la partie lésée du cerveau, peut libérer des attaques, parfois sans nécessité postérieure de médication anticonvulsive. La chirurgie a peu à offrir pour la majorité des épileptiques, mais des études constantes nous rendent chaque fois plus conscients de la nature focale de certaines attaques, qui les fait passer du groupe nommé idiopathique, au groupe qui peut être considéré comme apte pour la thérapeutique chirurgicale.

ZUSAMMENFASSUNG

Die drei vorgestellten Faelle illustrieren die Tatsache, dass die chirurgische Behandlung der epileptischen Stoerungen zurueckhaltend sein muss, um sie nur gelegentlich und mit strengem Kriterium bei jenen Patienten anzuwenden, bei denen die Operation berechtigt ist und die die folgenden Charaktere aufweisen:

1) Die Anfaelle muessen herdbedingt und als solche erkannt worden sein, ob sie nun motorischen, sensorialen, psychomotorischen oder visceralen Charakters sind.

2) Es muessen die Versuche, die Anfaelle mittels einer geeigneten medikamentoesen Behandlung waehrend laengerer Zeit zu unterdruecken, gescheitert sein.

3) Der Sitz der epileptogenen Lesion muss derart sein, dass seine totale oder teilweise Abtragung keinen neurologischen verkrueppelnden Ausfall erzeugt.

Die chirurgische Behandlung der epileptischen Phaenome kann nur mit Erfolg durch ein "team" von Aerzten durchgefuehrt werden, die in engster Zusammenarbeit wirken. Die Erkennung der Herd-

natur der Krankheit, der Versuch einer medikamentoesen Behandlung, die genaue Lokalisierung des Herdes und seine Abtragung und die objektive Bewertung der Resultate nach der Operation, erfordern die Mitarbeit erfahrener Spezialisten der Neurologie, Psychiatrie, Neuroradiologie, Enzephalographie, Neurochirurgie und darueberhinaus zahlreicher hochspezialisierter Techniker.

Bei sorgfaeltig ausgewaehlten Patienten kann die Abtragung der erkrankten Hirnrinde sie von den Anfaellen befreien, ohne Notwendigkeit einer nachfolgenden antiepileptischen medikamentoesen Behandlung. Waehrend die Chirurgie der grossen Mehrheit der Epileptiker wenig bieten kann, erlauben uns die fortwaehrenden Forschungen immer mehr ueber die herdbedingte Natur gewisser Anfaelle zu wissen, was sie von der sogenannten idiopathischen Gruppe absondert und sie einer Gruppe zufuehrt, die fuer die chirurgische Therapie in Betracht gezogen werden kann.

REFERENCES

- (1) WARD, A. A.: The surgical treatment of epilepsy. *Med. Clin. N. A.* 327-336, March 1958.
- (2) HORSLEY, V.: The origin and seat of epileptic disturbance. *Brit. M. J.* 1:693-696, 1892.
- (3) HORSLEY, V.: Brain surgery. *Brit. M. J.* 2:670-675, 1886.
- (4) FOERSTER, O.: Zur pathogeneese und chirurgischen behandlung der epilepsie. *Zentralbl f. Chir.* 52:531-549, 1925.
- (5) KRAUSE, F.: Surgery of the brain and spinal cord. New York. Rebman Co. (3 volumes) 1909-1912.
- (6) TAVERAS, J. M. and RANSOHOFF, J.: Leptomeningeal cysts of brain following trauma with erosion of skull; study of 7 cases treated by surgery. *J. Neurosurg.* 10: 233-241, 1953.
- (7) RANSOHOFF, J. and CARTER, S.: Hemispherectomy in the treatment of convulsive seizures associated with infantile hemiplegia. *Neurol. & Psych. in Childhood, Proceedings of the Assoc. for Res. in Nerv. & Ment. Dis.* Baltimore, The Williams & Wilkins Co., 34:176-195, 1956.
- (8) DYKE, C. G., DAVIDOFF, L. M. and MASSON, C. B.: Cerebral hemiatrophy with homolateral hypertrophy of the skull and sinuses. *Surg., Gynec. & Obst.* 57:588, 1933.

Personality

Prof. JOHN F. FULTON on his 60th. Birthday

The first of November was a gay day in Mill Rock. Friends from everywhere came to greet Prof. Fulton on his 60th birthday.

That was a great day for him. All Lucia's (Mrs. Fulton) family came down from Boston, including Martha and Grant Ingraham, Ann and Sam Orday, also Lucia's sister, Steve and David Weatland, Lucia's two brothers and their wives.

During the cocktail party, Prof. Fulton was presented, with a hush-hush gift, which came as a complete surprise, a volume

telling about the founding of the Yale Medical Library based on letters from Dr. Harvey Cushing, Dr. Arnold Klebs and Dr. John Fulton. It bears the title "The Making of a Library".

Everyone who has been a research fellow like us in Prof. Fulton's Laboratory, has become a close and affectionate friend of his and thus a member of a vast international family. I am sure that all of them will be very happy to learn that Prof. Fulton has reached his "saintly" 60th birthday in good health and with a youthful spirit.

Recently he has been in Buenos Aires attending the International Congress of Physiology. When the session was over, at noon or at night, you could see Prof.

Fulton walking very swiftly through the Buenos Aires streets. I remember once we needed almost to run to reach him. Puzzled we asked him, "Where are you going, Dr. Fulton?"

"Well, Victor, you know, somebody told me that there is a little place around here where they have wonderful books"...



Every one that visits the Yale Historical Library, can see many of the precious historical items that Prof. Fulton has gathered since his students days.

He is praised for his ability to spot real collector's gem at a surprising price.

He was regarded as extravagant by the English when, as an American student, he paid as much as ten shillings for some old physiological book.

Amongst his best bargains we can recall a copy of Robert Boyle's "The Sceptical Chemist" (1661): he paid \$ 20 dollars for it; now it is valued at 3.000. Like this one there are hundreds in John Fulton's collection: a copy of Ambroise Paré's "Anatomie Universale" bought in Paris in his youth for 30 dollars; a copy of the immortal work of Laennec's "De l'auscultation médiate"... of 1819 bought for \$ 25 dollars, and today could be prized possession of any collector. These and the many that Prof. Fulton have donated to the Historical Library, along with those of Dr. Harvey Cushing's and Arnold Klebbs's are sources of inspiration for the younger generations that year by year pass through the Historical Medical Library of Yale University. There they can see his collection and hear the wonderful lectures of the Sterling Professor of History of Medicine surrounded by a spirit of greatness of those whose immortal lives are preserved between the covers of ancient books.

Every one that loves books will understand what it is to become a book addict.

Let us quote here the lines from Clarence Day that Prof. Fulton includes in his Christmas letter:

*"The world of books is the most remarkable creation of man
Nothing else that he built ever lasts.
Monuments fall, Nations perish... but books... live on.
Still young, still fresh as the day they were written,
Still telling men's hearts of men centuries dead".*

A man with a great awareness, about everything interesting that was going on, Prof. Fulton couldn't limit himself to the narrow confines of a career, and his enthusiasm made him pack many lives into one.

This trait annoyed his teachers in his student's days. When he went to Oxford, the head of Magdalen College received a letter from Prof. Mark in which he mentioned the inquisitive mind and clear intelligence of young Fulton, but he regretted that he had the tendency to spread himself too thin and failed to concentrate on just one subject as he thought he ought to do.

But Prof. Fulton has succeeded in his attempts to develop several aspects of his intellectual personality. Everyone of them, could make any man feel proud of his achievement.

As a physiologist, bibliophile, medical historian, and author of numerous books, that have been translated to several languages, Dr. Fulton has proved to be gifted with the uncommon ability of not permitting one of his activities do dwarf the others.

This is due to his great capacity for work and his almost incredible energy. His fruitful life devoted to science has brought him numerous degrees and decorations which are eloquent testimonies that his greatness is recognized by his contemporaries from all parts of the world.

Amongst the Universities that have given him Honorary degrees, are Yale, Kenyon College, Birmingham, Oslo, Louvain, Boston, Emory, Upsala, Oxford. Recently the George Sarton Medal was awarded to him by the History of Science Society.

These, and also a Fellowship in the Royal College of Physicians of London, go to enlarge the collection of awards and decorations that from eighteen governments or associations have been given to him.

Now after such a remarkable record as a physiologist, author, bibliographer and historian Prof. Fulton maintains alertness and interest in everyone of his pursuits.

After leaving the Congress in Buenos Aires, he visited us in Montevideo. And also the laboratory of Neurophysiology which bears his name. After that he left to go to the States in a jet airliner.

A few days later we wrote him a letter that couldn't reach him because he was at that time in Barcelona...

As you can tell Prof. Fulton is once again in top shape and as eager as ever to be on the go.

Destiny has a strange way to help men to accomplish what they ought to be in the world.

John Fulton was born in Saint Paul, Minnesota, the day of All Saints, November 1, 1899.

His father, also John Fæcquard Fulton, wanted his son to study at the University of Minnesota and to become a general practitioner like him.

But that was not the idea that young Fulton had, instead he wanted to go to Harvard and to become an investigator. After having failed in the entrance examination he became involved in the turmoil of the First World War, and found himself submitted to heavy artillery training at Fortress Monroe.

Not for long, because a few days after receiving a commission the war ended and as a veteran he was admitted to Harvard University.

With his uncommon wit, Prof. Fulton remarked, "The artillery shot me into Harvard".

Greatness is something that nobody can share, give, borrow, or take away. It grows within human personality, permeates all aspects of life and transcends the limits of life and death. Like Sherrington and Osler, Prof. Fulton shows in everyday actions his spiritual kindness and his concern for others' welfare.

We want to emphasize this aspect of his life; because it is not so easy to find goodness and intelligence combined in one man, and sometimes, the lack of one mars the other, and when both meet we indeed find wisdom.

Prof. Fulton was for twenty years Sterling Professor of Physiology and now is Sterling Professor of History of Medicine, but the best praise about his person I ever heard was recently here in Montevideo, on the occasion of the visit to our country of our very good friend Prof. Donald Barron, also from Yale University. We were talking about Prof. Fulton and he said "I have never known a person who enjoys more other people's success than Prof. Fulton".

That quality contains a lot of meaning in human relations especially in the field of science where it is more needed.

It is with great satisfaction that we see Prof. Fulton adding more life to his years than years to his life, and we join our voices with the many that from different points of the world want to say "Many Happy Returns, Prof. Fulton".

VICTOR SORIANO.

• News

The American Epilepsy Federation

In September of 1959, the American Epilepsy Federation, a new organization of lay societies interested in promoting the welfare of persons with epilepsy, was founded in the United States. To date, some twenty-six local societies within the United States and Canada have joined, and co-operating membership has been extended to several other groups.

Coordination of the efforts of these geographically separated groups working on the lay level on behalf of epileptics is the first and primary goal. The program will include

public information services, public health education and social research, as well as active assistance both to existing groups and to those wishing to form new local societies. Each participating organization is represented on the Board of Directors by a State Representative.

Elected first president was Mrs. Ellen Grass. Offices are temporarily at 77 Reservoir Road, Quincy, Mass. The Federation will be most pleased to correspond with representatives of lay organizations abroad.

• Books Review

"Rehabilitation Medicine" by Howard A. Rusk. 572 pp. The C. V. Mosby Company. St. Louis, 1958.

The Editor Prof. Howard A. Rusk and his 36 collaborators have produced a very valuable book, which presents a general picture of the complex problem of rehabilitation.

The 27 chapters in which the subject matter is divided are easily followed. Every section shows us the hand of an expert. The text is ably supported by 172 useful illustrations.

The book begins emphasizing the philosophy and needs of rehabilitation, establishing that medical care is not complete until the patient has been trained to live and to work with what he has left.

Special care must be taken in the study of disturbances in the patient's personality as well as evaluating his physical deficit.

The tests of activities of daily living, psychologic examination, vocational evaluation, electrodiagnosis, are the main source of information for applying the proper therapeutic care.

From the third to the fifteenth chapters the principles concerning the use of instruments, the practice of exercises and tho-

se involving the problems that a physician must face dealing with disabled patients, are studied.

Subsequent chapters are devoted to specify the different techniques of rehabilitation according to the type of illness or group of diseases.

Undoubtedly predominance is given to those of neurological origin, and the ones affecting the locomotor system.

In this exhaustive study of rehabilitation, attention to illness of metabolic, cardiovascular, and blood origin, are also given.

The psychological aspect of the patient is in all of them of primary importance.

The patient is engaged in a struggle out of which can come changes, real change in his personality, attitudes, feelings, ways of thinking, awareness and perceptions and in the direction and goals of his life.

The numerous pictures and diagrams that illustrate this book are very well selected and have a didactic value. For example fig. N° 5 about myographic recording is even very clear for those not familiar with this technique.

The photographs illustrate very well about the use of materials and methods of splinting, gait training, and the use of crutches.

Due to its high scientific calibre, and

to this practical character, this book has a great intrinsic value.

It will be helpful to physicians of different specialties, because rehabilitation problems are easily found in every branch of Medicine, particularly in Neurology, where the physician must deal with so many crippling diseases.

This book is highly recommended.

"Trigeminal Neuralgia - Its History and Treatment" by Byron Stookey and Joseph Ransohoff. 366 pp. Charles C. Thomas. Springfield. Ill. 1959. \$ 10.75.

The authors have produced an excellent book which presents this complex problems in 18 chapters.

The first one refers to history of the trigeminal nerve and the trigeminal neuralgia.

Subsequent chapters are devoted to embryology and physiology, and from the fourth to the seventh to clinical aspects of the trigeminal neuralgia are discussed.

The rest of the book is dedicated to treatment, with the medical approach, alcoholization, followed by different types of surgical treatment.

This book is well organized, the chapter devoted to the history of the trigeminal nerve contains the most complete existing data.

Beginning with the first description of neuralgia given by the physician and philosopher John Locke in 1677, in which this famous doctor describes the crisis affecting English Ambassador's wife in France, at that time.

This book is enhanced by illustrations taken from early publications most of them of French origin related to the subject.

Very important conclusions have been reached in the chapters concerning surgical treatment.

Referring to the trigeminal tractotomy the authors made the following statement "the ends attained by trigeminal tractotomy do not justify the procedure in the surgical treatment of unilateral or bilateral trigeminal neuralgia".

They are not very enthusiastic about the results of decompression of the posterior trigeminal root and they agree with Cleveland (1957) that "he doubted whether any operation other than dorsal root section is going to hold up".

This book is an important contribution to the study of the trigeminal neuralgia and will be extremely useful for neurologists and neurosurgeons interested to know about the latest developments concerning the treatment of this cruel disease.

A handsome format, it is replete with excellent illustrations.

PISANTY, J.

*Departamento de Fisiología,
Facultad de Medicina
Monterrey, México.*

PSIQUIATRIA. Ensayo con Marsilid como anticonvulsivante; en enfermos epilépticos se redujo el número de crisis comicionales.

Algunos Efectos Curiosos de la Iproniazida

1º Efecto anticonvulsivante en epilepsias de tipo gran mal.

Medicina (Méx.), 39:141; 1959

- Ante unos hallazgos de laboratorio el autor se propuso indagar si el Marsilid tenía algún efecto sobre las convulsiones epilépticas.

- Para ello se ensayó en 32 enfermos con epilepsia (tipo gran mal), diagnosticada por neurólogos y comprobada por el electroencefalograma, 15 de ellos pudieron ser estudiados cuidadosamente. La edad de estos enfermos estaba comprendida entre los 9 y 52 años, durando la prueba 50 días.

- En todos los casos se anotó la frecuencia de crisis convulsivas durante 10 días de observación, administrándose a continuación el Marsilid a la dosis diaria de 2-3 mg/kg de peso, durante 30 días; solamente en 6 enfermos, en los que se prodigó el tratamiento por más de un mes, se disminuyó la dosis diaria a 0.7 mg/kg de peso. Excepto en algunos enfermos, la dosis se administró en una sola toma.

- En la mayor parte de los enfermos (23) el Marsilid fue el único medicamento que se administró, suspendiéndose 10 días antes cualquier otra medicación anticonvulsiva. En los 9 enfermos restantes, debido a la alta frecuencia de las convulsiones se continuó administrando anticonvulsivantes (barbitúricos + hidantoinatos) si bien a dosis menores.

- Para la valoración se tuvo en

cuenta la frecuencia de las convulsiones y el trazado electroencefalográfico. Considerando como del 100 % el número promedio de crisis convulsivas, antes de la administración del Marsilid, se observó que con él la frecuencia convulsiva descendió a 20 ó 30 %. Esta reducción de los ataques convulsivos, se observó también en el electroencefalograma.

- El efecto anticonvulsivante del Marsilid comenzó a observarse ya en los primeros días del tratamiento, alcanzando su máximo alrededor de la semana. En dos casos al sustituir el Marsilid por un placebo, reaparecieron las convulsiones.

- En algunos enfermos dementes, particularmente mujeres, aparecieron efectos secundarios, como excitación psicomotora no grave, agitación erótica y exageración de la sintomatología del área sexual que obligó a suspender la medicación.

- En dos niños, que pudieron observarse por un período de 6 meses, con el Marsilid los resultados fueron excelentes: desaparición total de las convulsiones con la particularidad —que también se apreció en los adultos— de que no hubo deterioro o disminución de la capacidad intelectual ni de los reflejos espinales, lo que indica una notable diferencia con las otras terapéuticas anticonvulsivantes.