accuracy of his statements regarding his recognition of test-letters.

For a description of additional devices which may be employed for the detection and measurement of hypermetropia, see *Optometry*.

The discovery of H is oftenest made through the recognition, by the patient, of an inability to use his eyes freely in near work, and if he happen further to discover that the reading glasses of some elderly person are of assistance to him, he may perhaps select for himself a pair of convex glasses sufficient for his present needs; and, having once experienced the aid afforded by these glasses in reading, he will be very likely, in replacing them, to choose glasses of greater power, until at length he arrives at an approximate correction of his Ht. In this self-treatment he will, however, be very likely to encounter opposition from the spectacle venders, owing to a still somewhat prevalent notion that convex glasses are injurious to the eyes of young persons, and that the stronger the glass the greater the injury. He is liable, therefore, either to be deterred from using glasses of the necessary strength, or to procure and wear such glasses as enable him to read with comfort, though under protest and in the dread of "wearing out his sight" through having recklessly forestalled the aid which he is told should be reserved exclusively for old age.

In early childhood H is seldom discovered except by the oculist, who is generally first consulted in consequence of some peculiarity in the manner of using the eyes, or because of the discovery of a tendency to strabismus. The child is noticed to scowl when looking intently at distant or near objects, or he is observed, in reading, to contract the opening of the eyelids, so as partially to cover the pupils, and at the same time to hold his book quite near to the eyes, in order to increase the size and intensity of the retinal images. In other cases he complains that he cannot distinguish the letters in his reading-book, or he miscalls certain words through imperfect recognition of individual letters. Possibly he tries on his mother's or grandmother's glasses, and, seeing much better through them, asks for them to aid him in his lessons, which he then learns more easily and with unwonted correctness. Not infrequently he learns to see distinctly with one eye by crossing the other whenever he is compelled to fix his attention closely upon any small object (periodic strabismus), and the family physician is perhaps consulted because the child is becoming cross-eyed. Of this suggestion he too often makes light, and puts off the parent by saying that "the eyes will probably come right of themselves," or that "the child is too young to be treated for cross-eye," or that "there is no help for cross-eye until it has become fully established, and then only by a surgical operation"; and so he advises waiting "until the child is old enough to decide for himself." "Teething," "indigestion," "worms," "mimicry" of a cross-eyed companion or nurse, "looking at the tip of the nose" or "at a lock of hair," and many other imaginary or, at most, only secondary causes are often invoked, with the result of encouraging mischievous delay through the neglect of the primary and essential factor in the case, namely, the hypermetropic conformation of the eyes. Unfortunately for the child, there is just enough of plausibility in some of these suggestions to lead a physician to give the worst possible advice in a matter which he does not understand, and to encourage a parent to accept bad advice when given by his trusted medical adviser.

The treatment of H is by supplementing the deficient refraction (*i.e.*, deficient relatively to the length of the axis of the eyeball) by means of neutralizing convex glasses, the effect of which is to advance the position of the principal focus of the eye to the actual position of the retina. The hypermetropic eye with its correcting glass forms a compound dioptric system, whose nodal point is farther from the retina than is the case when the same eye is focussed for distance by the exercise of its accommodation; the retinal image is, therefore, somewhat enlarged by the glass, and when the correcting glass is placed, as is usually the case in wearing spectacles, at or very near the anterior focus of the eye (about 15 mm. in front of the cornea) the size of the retinal image is found by calculation to be the same as in the emmetropic eye. With the exact correction of Ht the hypermetropic eye becomes, therefore, practically emmetropic, with normal region of accommodation; no part of the accommodation is expended in focussing parallel rays in distant vision, and A is rendered available in its entirety to meet the requirements of near vision. H *absoluta*, H *relativa*, and H *facultativa* being alike reduced to emmetropia, the conflict between accommodation and convergence ceases, and the patient is relieved of his asthenopia and of any pre-existing tendency to crossing of the eyes in the act of accommodation for distant or for near objects. The neutralizing convex glass required for the exact correction of Ht is that which, under complete relaxation of the accommodation, gives the maximum acuteness of vision at a distance.

The accurate correction of Ht is, therefore, the end to be kept constantly in mind in giving convex glasses to a hypermetrope; nevertheless, it is often better to reach this full correction by successive stages. Thus a young hypermetrope with large Hl may find it impossible to relax his accommodation fully on first using convex glasses, and may, therefore, reject neutralizing glasses as impairing distant vision and compelling him to read or work at an inconveniently or uncomfortably short distance. On the other hand, he will probably take very great satisfaction in somewhat weaker glasses which correct, or perhaps slightly overcorrect, his Hm. After wearing such partially correcting glasses for a few days or weeks a larger fraction of Ht will have been rendered manifest, and the glasses may then be changed for others of shorter focus, and these again for others, until the full correction of Ht is reached. Proceeding in this way, we may give the patient from the start all the help which he can receive from glasses, and at the same time spare him the inconvenience and possible disqualification for work attendant upon the production of complete artificial paralysis of the accommodation. If the previous condition of the patient has been that of H *absoluta*, the glasses first given will fully correct the manifest hypermetropia, and will enable him to see distinctly at a distance, and also to read unless he is also presbyopic; if of H *relativa*, they will relieve the accommodation both in distant vision and in reading, and will in a great measure do away with the necessity for excessive convergence in order to see distinctly; if of H *facultativa*, they will make it possible to use the eyes for finer work and for a longer time without fatigue. In proportion as Hl becomes merged in Hm, through the wearing of the weaker glasses, the change to stronger convex glasses renews the good effect of the former, until at length the full correction of Ht is accepted.

When, through uncorrected H *relativa*, accommodative insufficiency or periodic convergent squint has been developed, these symptomatic conditions usually disappear with the wearing of neutralizing glasses, and the eyes recover the power of working easily and harmoniously together in binocular vision. As the glasses afford needed aid to the accommodation, as well in distant as in near vision, they should, as a rule, be worn constantly; and to this end they should be mounted as spectacles rather than as a *pince nez*, and should be fitted with elastic bows curved behind the ears (see *Spectacles*).

If convergent strabismus has become already established, the effect of convex glasses is first of all to do away with the causes which incite to further development of the squint, and thus to arrest it in its actual stage. Secondly, they tend to diminish the existing grade of deviation, and in some cases, especially of recent squint, they may even suffice to bring back the optic axes almost immediately to their normal direction, and thus re-establish binocular vision. In other cases the full effect of the glasses requires a much longer time for its complete realization, which may be attained only after the lapse of many months or even of several years. Hence we should not hastily despair of finally curing

even a pretty high grade of strabismus, when associated with a high grade of H, by glasses, even though the immediate effect be conspicuously inadequate; in such a case the use of strong convex glasses will sooner or later

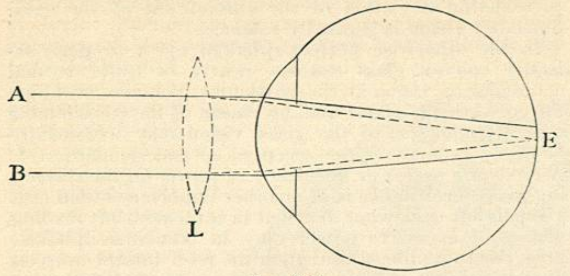

FIG. 2765.

become imperative, on account of the visual disabilities incident to a high grade of H, and if worn only after a full correction of the squint by tenotomy, they may easily determine divergence of the previously crossing eye. In the presence of a high grade of H resort should ordinarily be had to surgical procedures only after the complete correction of Ht, and after the lapse of sufficient time to develop the full effect of the optical correction.

The prompt correction of H by convex glasses is generally indicated on the first appearance of one or more of

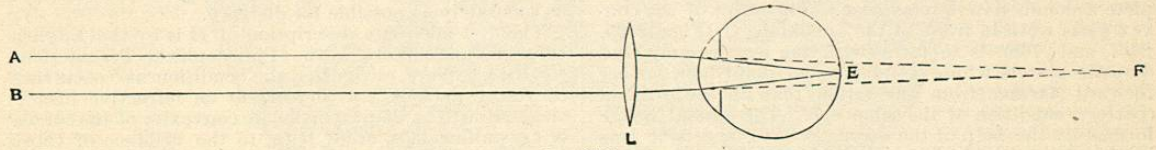

FIG. 2767.

its characteristic symptoms (asthenopia, incipient strabismus convergens, or impaired distinctness of vision). They should, as a rule, be worn constantly during the waking hours, and it should be made clear to the patient, or in the case of a child to the parents, that they will probably be needed throughout life, in order to make it possible to use the two eyes easily and effectively in near

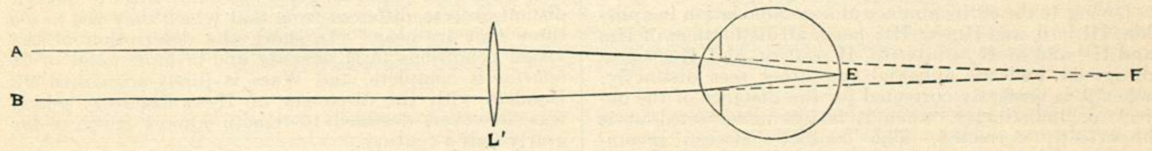

FIG. 2768.

work. Only in low grades of H, in which the rest afforded by weak convex glasses is not infrequently followed by a very marked amelioration of asthenopic symptoms, is it occasionally found practicable to lay them aside after this result has been attained (see also vol. i., pp. 583, 584, under *Asthenopia*).

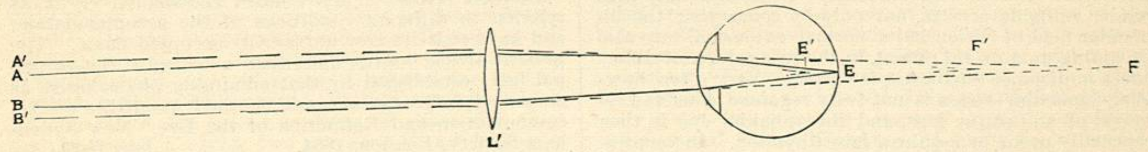

FIG. 2769.

APHAKIA.—Absence of the crystalline lens as a part of the dioptric system of the eye has been already noticed in this HANDBOOK (vol. i., p. 58). The deficiency in refractive power, as observed after the operation for cataract in an originally emmetropic eye, is so great as to necessitate the wearing of a convex glass of about 11 dioptries in order to raise vision to its maximum of acuteness at a distance, and a glass of 14 or 15 dioptries for reading. In the case of an eye previously myopic, a

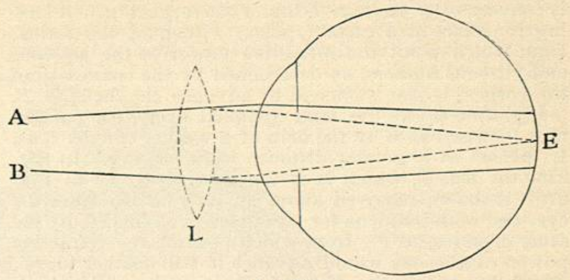

FIG. 2766.

lens of less power than 11 dioptries suffices for distance, and for an eye previously hypermetropic a stronger lens is required. It follows that an eye with a pre-existing myopia of very high grade may, after the loss of its crystalline lens, be found to be nearly or quite emmetropic, and cases are occasionally observed in which, after an operation for cataract, no glass is required to bring out the maximum of visual acuteness for distance, and in which a convex glass of only 3 or 4 dioptries is required for reading. On the other hand, a glass of as high power as 20 dioptries may be needed for distance in a case in which there has been a pre-existing H of high grade, and a still stronger glass, of 23 or 24 dioptries, will then be required for reading.

As a consequence of the very great diminution in refractive power due to the loss of its crystalline lens, the unaided aphakial eye is unfitted for the performance of its proper function as a camera obscura. Fig. 2765 illustrates the insufficiency of the refraction at the cornea, in the absence of the crystalline lens, to focus the pencil of parallel rays, *A, E, B*, except as it is first converted into a convergent pencil by means of the convex lens *L*. Fig. 2766 similarly shows a divergent pencil, such as reaches the eye from a near object, rendered convergent by a stronger convex lens, to be focussed upon the retina at *E*.

Besides the diminished refractive power in the aphakial eye, there is also entire loss of accommodation. Hence the necessity for a stronger glass for near than for distant vision. The distance of the correcting-glass from the eye is, however, a matter of very considerable importance. Fig. 2767 represents an aphakial eye corrected, by the strong convex lens *L*, for focussing the pencil of parallel rays, *A*, *E*, *B*, upon the retina at *E*; the parallel pencil is converted by the lens *L* into a convergent pencil having its focus at a certain point, *F*, behind the retina, from which point the refractive power of the aqueous and vitreous humors, as determined by the convexity of the cornea, is just sufficient to advance the focus to *E*.

Fig. 2768 shows the same aphakial eye, with parallel rays focussed at *E* by the help of a weaker convex lens, *L'*, placed at a greater distance from the eye. In Fig. 2769 the lens *L*, which is of the same power as in Fig. 2767, is shown removed about an inch farther from the eye, and with its focus for parallel rays advanced, by the same distance, to *F'*, from which position the refractive power of the eye would advance it still farther to *E'*, which lies within the distance of the retina. A pencil, *A*, *E*, *B*, diverging from the conjugate focus of the lens *L* is, however, focussed by the lens at the distance of *F*, and, through the further refraction at the cornea, at *E*. By thus removing the correcting glass farther from the eye, we increase the refractive power of the combined dioptric system, made up of the lens *L* and the aphakial eye, and so may provide, in some sort, a substitute for the lost accommodation.

The position of the (single) nodal point of the aphakial eye (at the centre of curvature of the anterior surface of the cornea) coincides very nearly with that of the (second) nodal point in the perfect eye when in a state of complete accommodative relaxation. The effect of the convex glass worn in front of the aphakial eye (Figs. 2765, 2767, and 2768) is to form (with the eye) a compound dioptric system whose (second) nodal point falls farther forward (farther from the retina) than in the original (perfect) condition of the same eye. The retinal image formed by the help of the strong convex spectacle lens is, therefore, notably larger than the image of the same object in a normal eye of the same dimensions and corneal curvature. In the case of an aphakial eye wearing a convex lens of 13 dioptries 15 mm. in front of the vertex of the cornea, the ratio of the size of the retinal image to that of the image in the perfect eye is about 1.32 : 1. In the case of a convex lens of half the strength (6.5 dioptries), mounted 105 mm. in front of the cornea, the ratio is about 2.64 : 1, which is nearly equal to the magnifying power of an ordinary opera-glass.

Owing to the entire absence of accommodation in aphakia, Hl = 0, and Hm = Ht; hence all distinctions of Hm and Ht, and of H *facultativa*, H *relativa*, and H *absoluta* disappear, and the aphakial eye either sees distinctly, when it is perfectly corrected for the distance of the object, or indistinctly, when it is left uncorrected or is imperfectly corrected. The conflict between accommodation and convergence, which in H gives rise to asthenopia or to strabismus, has therefore no existence, and if either of these symptomatic conditions is developed in a case of uniocular aphakia, the causes must be sought elsewhere than in the aphakial eye.

Notwithstanding its great refractive deficiency, and the consequent imperfect definition of its retinal image, an aphakial eye, though uncorrected, may continue to take part with its fellow in binocular vision, and may thus render valuable service, not only by conserving the binocular field of vision in its normal extension, but also by aiding, to a useful extent, in the recognition of differences in distance (stereoscopic vision). Very often, however, binocular vision is not fully regained after the removal of an opaque lens, and the aphakial eye is then especially prone to acquire a false direction. In the presence of H in the fellow-eye, an aphakial or otherwise materially defective eye may become crossed; on the other hand, the co-ordination of function of the recti interni muscles of the two eyes with each other, and with the accommodation in the eye which still retains this faculty, may become impaired, and the aphakial eye may then gradually assume a divergent direction, notwithstanding the presence of such a grade of H in the fellow-eye as would ordinarily give rise to marked convergence. In acquired binocular aphakia, following a double operation for senile cataract, the convergence ordinarily remains fully under control, and, in the absence of pre-existing deviation of the axis of one of the eyes, binocular vision is generally retained.

In the otherwise perfect aphakial eye a properly selected convex glass restores nearly or quite normal acuteness of vision at the particular distance for which the correction is given, and, by reason of the considerable magnifying effect of the glass, vision may occasionally be raised even above the accepted normal standard of $\frac{6}{6}$. A moderate excess or deficiency of power in the correcting glass for distance is of no other importance than that vision is left somewhat deficient in acuteness, but reading glasses of excessive power may, in binocular aphakia, give rise to undue strain upon the recti interni muscles by bringing the reading distance too near to the eyes.

In uniocular aphakia, so long as the fellow-eye retains normal or nearly normal acuteness of vision and is without notable refractive defect, it is a frequent practice to leave the aphakial eye uncorrected. In cases in which the condition of the other eye is such as to call for the wearing of a correcting glass, it is generally practicable, and often desirable, to prescribe also the proper correction for distance for the aphakial eye. A tendency to divergence of an aphakial eye, in a young person, may often be arrested by wearing for a time a concave glass, of from 1 dioptrie to 3 dioptries, before the emmetropic fellow-eye, at the same time correcting the aphakial eye as accurately as possible for distance.

The first adequate description of H is by the English surgeon James Ware, in the Philosophical Transactions for 1813. Ware recognized the condition as "occurring in young persons"; as dependent on refractive insufficiency due to "a disproportionate convexity of the cornea or crystalline lens, or of both, to the distance of those parts from the retina"; as not involving "the power by which the eyes are adapted to see at distances variously remote" (*i.e.*, the accommodation); as "requiring a glass of considerable convexity to enable [the person] to see distinctly, not only near objects, but also those that are distant"; as of such a nature that "the same glass will enable many such persons to see both near and distant objects"; and as differing from the condition existing after the loss of the crystalline lens, the subjects of which "always require a glass, to enable them to discern distant objects, different from that which they use to see those that are near." In short, the description of the visual conditions in H *absoluta* and in most cases of H *relativa* is complete, and Ware is justly accredited by Donders with the discovery of H—a discovery which was, however, destined to remain almost fruitless for nearly half a century.

Ruete (1853) proposed the very appropriate name *Uebersichtigkeit* for this condition, but his description falls short of that of Ware in clearness and accuracy.

Stellwag (1855) described H correctly, as a condition in which the principal focal length of the eye is greater than the actual distance of the retina; but, in proposing for it the name *hyperpresbyopia*, he failed to emphasize its independence of accommodative insufficiency.

Donders (1859–60) first studied H exhaustively in its relation to different conditions of the accommodation, and gave to it its now universally accepted name. The present article is little more than a *résumé* of the principal facts established by that admirable physiologist, as embodied in his great work on the "Anomalies of Accommodation and Refraction of the Eye," New Sydenham Society, London, 1864. *John Green.*

[For the convenience of the reader the following list of abbreviations used in this article is appended, following Donders, but with a few changes in form necessitated by the adoption of the modern metric notation.

H = Hypermetropia; Hm = H *manifesta*; Hl = H *latens*; Ht = H *totalis*; M = Myopia; A = Absolute range of accommodation; A_1 = Relative range of accommodation; A_2 = Binocular range of accommodation.]

HYPERNEPHROMA is a term suggested originally by Birch-Hirschfeld, and since adopted by other writers, to designate tumors that result from proliferation of adrenal tissue—it being immaterial whether the tumors arise in the adrenal itself or in regions where aberrant or misplaced (heterotopic) portions of adrenal tissue are known to occur. Though the terminology that suggests hypernephroma is not scientific, it finds justification in the peculiarities of structure of adrenal tumors and in the fact that the precise histogenetic position of the adrenal has not yet been determined. Lubarsch speaks of these tumors as hypernephroid tumors or tumors after the type of the adrenal with or without destructive characteristics.

During recent years considerable attention has been directed to the occurrence of *accessory adrenals* and to the great variety of displacements, in whole or in part, to which the adrenals are subject. Thus one or both adrenals may be absent; and the adrenal, if present, may be intimately adherent to the kidney and portions of its tissue may be displaced within the kidney. Accessory adrenals or portions of adrenal tissue have been found in the immediate vicinity of the normal situation of the adrenal, in the adjacent retroperitoneal connective tissue, in the kidney (usually directly beneath the capsule), about the renal blood-vessels, in the spermatic cord, between the testicle and the epididymis, in the inguinal canal, in the broad ligament (Marchand's adrenal), in the solar plexus, in the cœliac ganglion, in the liver, in the pancreas, etc. These accessory adrenals usually occur singly, though there may be more than one. They are yellowish in color, rather firm in consistence, and they vary in size. Usually they are about 2 to 3 mm. in diameter, but they may be so small as to be detected only by microscopical examination, and when the seat of hyperplasia or of tumor formation they may reach the size of a man's head. As a rule, they consist of one, two, or all three layers of the cortical substance; rarely medullary substance also is found. Schmorl states that they may be found in ninety-two per cent. of all bodies—a statement that has not found concurrence on the part of other observers. Presumably tumor formations may result from proliferation of any accessory adrenal; especial interest, however, attaches to the occurrence of adrenal tumors or hypernephromas in the kidney and in the broad ligament.

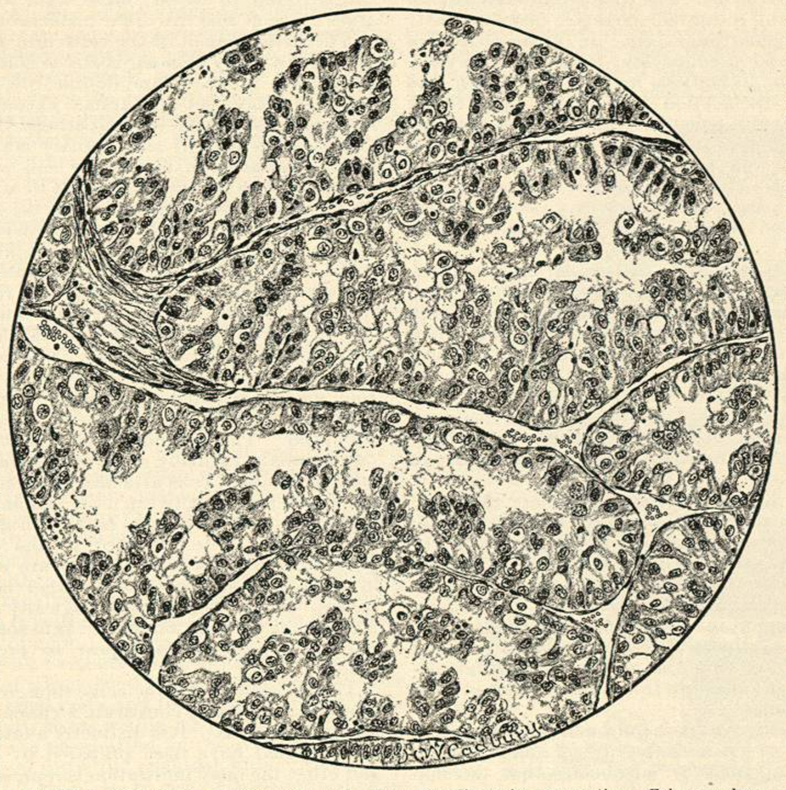

FIG. 2770.—Section of a Hypernephroma. Hæmatoxylin-eosin preparation. Zeiss apochrom, 8 mm., compens. oc. No. 4. For the most part the stroma consists of naked and intact capillaries that contain some blood corpuscles and that in some places are considerably dilated (more dilated than is usual). For the most part also the cells are attached directly to the endothelium of the capillaries, and they show marked fatty infiltration. In the section depicted the tumor presents large alveoli-like formations with central necrosis. In the upper right-hand region there are a number of high columnar cells.

In the kidney adrenal rests are found usually at the upper pole of the organ, in the cortex, and directly beneath the capsule. Sometimes they are themselves entirely encapsulated, being separated from the subjacent kidney tissue by a band of well-developed fibrous connective tissue. In some cases through openings in this connective-tissue capsule portions of adrenal tissue invade the kidney, and in other cases no connective tissue whatever separates one tissue from the other. The kidney tissue adjacent to the misplaced adrenal tissue may present no deviations from the normal, but what is of especial interest and importance is that in some cases cysts, evidently dilated uriniferous tubules, are present at the junction of the two tissues, and that in other cases (as illustrated by one of my own cases) areas of kidney tissue are entirely or almost entirely included within these misplaced adrenal rests.

It is scarcely pertinent in this connection to discuss the different tumors of the adrenal that in a strict sense may be included within the scope of the designation hypernephroma. It will suffice to describe that class of tumors variously designated lipomas, adenomas, carcinomas, sarcomas, adenosarcomas, angiosarcomas, endotheliomas, and peritheliomas of the kidney—tumors the true nature of which was first recognized, in 1883, by Grawitz, who referred them to proliferation of aberrant adrenal rests. The opinions of Grawitz have been abundantly confirmed by Wiefel, Hollen, Ambrosius, Chiari, Strübing, Löwenhardt, Beneke, Horn, Marchand, Ulrich, Lubarsch, Askanazy, McWeeney, Manasse, Gatti, Ricker, Warthin, Pick, myself, and others.

Hypernephromas of the kidney (as well as hypernephromas of the broad ligament and of other structures) may be small and benign or large and malignant. The small tumors usually are situated in the cortex of the kidney; they are well circumscribed, generally encapsulated, nodular, yellowish or yellowish-white, and moderately firm. The larger tumors, which may attain a great size, replace more or less the kidney structure, though even in the largest tumors a narrow layer of compressed and distorted kidney tissue usually limits the tumor below. Usually, though not always, the tumor is separated from the remaining kidney structure by a more or less complete and intact connective-tissue capsule. In many cases, however, the capsule has become invaded and penetrated by the growth, and careful search is necessary to detect even remnants of it. It is nevertheless one of the characteristic features of hypernephromas. The tu-