RAT DESTRUCTION BY TRAPS AND POISON.

Another thing which has tended to retard the due appreciation of the cat is the comparative success which has attended the efforts to remove rats by traps and poison. There are, however, many Hindus who object very strongly to the use of traps and poison, but even in the European quarter in Nagpur, where no such objection was met, it was found that, although rats could be cleared out by traps and poison, within a few weeks other rats would come in. It was only in those houses in which cats were kept that the rats could be kept permanently away. When plague began to spread in Nagpur we started what may be called the rat-hole inspection scheme. A number of inspectors were employed to go to each house, thoroughly inspect every nook and corner of the bungalows, and especially of the servants' houses, and to lay poison at the rat holes. After a few days the rat holes would be closed up, and if new holes were found poison would be laid again. As an emergency scheme this was very successful, but it is expensive.

PROFESSOR KOCH'S VIEWS.

Professor Koch has been for some years recommending the employment of cats for preventing plague, and in accordance with his suggestion the use of the cat is now being advocated by Kitasato in Japan. In the Public Health Reports of Japan (September, 1908), Kitasato gives a summary of Koch's views, and the following is an abbreviated extract from his report:

"The use of artificial methods like mechanical devices and poisonous drugs must prove laborious, expensive and at the same time comparatively inefficient; the limited powers of man are far inferior to the boundless resources of Nature. Examples: The *lantana*, a plant with pretty flowers, was introduced into the Hawaiian Islands, and after a few years caused great damage to agriculture. A small species of fly (*Agromyza*), which deposits its eggs within the seeds of the *lantana*, was introduced from Mexico, and in a few years the *lantana* showed signs of diminution. Second example: The sugar cane pest, a species of leaf hopper, in the Hawaiian Islands caused a loss amounting to several million dollars; an ant-like animal parasitic within the egg mass of the leaf hopper was introduced in 1904 and the sugar-cane pest was checked. Koch had experimented with the ichneumon of Egypt, the mongoose of India, and the common European ferret, but he found the cat most fitted for the task. The most useful things are often to be found among the most commonplace. An outline is given of a scheme for encouraging the keeping of cats, and attention is drawn to the necessity for providing holes, large enough to admit cats into rooms in which rats are likely to be found."

Professor Koch came to the conclusion that the cat is the best plague preventer in Africa, and his conclusion, taken with the fact that there is such a strong religious feeling, both among Mohammedans and Hindus, in favour of keeping cats, must surely strengthen very considerably the grounds for holding the view that the cat is the best plague preventer in India.

CATS IN MALAY PENINSULA.

Dr. Gimlette, in the *Journal of Hygiene* (April, 1909), refers to the fact that there has been very little plague in further India, and states that on this account considerable interest attaches to the small outbreaks which occur from time to time. "The keeping of cats," he says, "is a national convention which is common to other Mohammedan people, but in Malay the influence of folklore has an additional significance. The ancient superstitious faith of the Malays before their conversion to Mohammedanism seems to survive in the everyday treatment of their cats. In 1907 plague broke out among a gang of imported Javanese coolies who had been working on the Duff Development Concession. There happened to be no cats on the company's rubber estate, a fact which is interesting as giving negative support to Colonel Buchanan's hypothesis."

CATS IN OTHER COUNTRIES.

It would be interesting to know how far the failure of plague to get a hold in other countries could be accounted for by the presence of cats. Kitasato had a census of cats taken in various parts of Japan, and found that the percentage of cats to houses varied from 4 in Tokio to 49 in

the Yamanashi district, where cats are kept specially to protect the silk industry from rats. Now in Tokio, after 4½ million rats had been destroyed, it was found that rats were still numerous. At the Bombay Congress Professor Shiga informed me that plague could never get a hold at Yamanashi. I think, then, that inquiries conducted on these lines would afford valuable evidence as to why one country or part of a country should escape, while another suffers from repeated epidemics of plague. Since plague began, the medical inspection of ships coming from India is gradually developing into a sort of tyranny, and the sooner people come to realize that a good supply of cats at the port towns and a few cats on ships are all that is required for preventing the spread of plague at seaports, the sooner will the discomfort which arises from the present system of inspection be abolished.

CONCLUSION.

Some time ago I ventured to predict that "a few years hence we shall look on the neglect of the cat as one of the most extraordinary things in the whole history of our inquiries into plague and its prevention," and already there are indications that this prophecy is beginning to come true, for we frequently hear people saying something like this: "If plague is a disease of rats, it is only plain common sense to check it by keeping cats." There are, however, still many parts of India where the value of the cat is not fully understood, and there is a tendency among some to think that plague is dying out. One of two courses is now open—one to trust to luck and to soothe our minds with the idea that plague is dying out; the other to leave nothing to chance, but to endeavour by every means to reduce the number of rats, and to impress on the people that of all the methods that have been employed for killing rats, and for keeping them away, there is none that can be compared with the rat-destroyer which has been provided by Nature—namely, the cat.

VICIOUS CIRCLES ASSOCIATED WITH DISORDERS OF THE URINARY ORGANS.

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AMONGST the complications of disease with which the physician is called upon to deal, vicious circles play an important part. Chronic disease becomes more chronic in the presence of this complication, and acute disease more acute; while the territory over which morbid processes play havoc is apt to be indefinitely enlarged. Indeed, it is not too much to say that a lethal exitus is frequently accelerated by, if not wholly due to, the reciprocally acting factors that have been called into action.

Although vicious circles are of such consequence in determining the duration as well as the issue of an illness, they have almost wholly escaped attention. No lexicographer appears to have defined what is meant by a "vicious circle" in medicine, and yet the complication meets us at every turn, and has to be taken into account in prognosis as well as in treatment.

Among the great systems of the body, the urinary system is of special interest, owing to the number and variety of circles met with. Illustrations of the mechanical, neurotic, chemical, organic, and symptomatic forms may be found in abundance, many of them possessing great importance.

The following topographical classification will be found convenient, although it cannot always be strictly adhered to:

- I. Circles associated with the bladder and prostate.
- II. Circles associated with the kidneys.
- III. Circles associated with the ureters and urethra.

I.—Circles Associated with the Bladder and Prostate.

A striking example is presented by retention of urine caused by prostatic hypertrophy. The venous plexuses surrounding the prostate are always of ample size and undergo further dilatation in elderly men. This explains how it is that when, from some cause or other, congestion

of the prostate takes place, very considerable swelling of the gland results, sufficient in many cases to cause complete retention of urine. The accumulated urine in turn aggravates the venous engorgement, these two factors thus acting reciprocally on each other.

Desnos and Minet thus describe the mechanism of retention due to prostatic congestion:

On comprend dès lors comment la rétention s'opère: le volume des lobes latéraux augmentant brusquement les amène au contact; toute la glande elle-même est comprimée par les plexus périprostatiques: enfin et surtout la muqueuse congestionnée et oedématisée vient faire un bourrelet qui obstrue le col de la vessie; la muqueuse, plus friable, saigne au moindre contact d'une sonde. Pendant ce temps, l'urine s'accumule en arrière de ce bourrelet, distend la vessie. La pression du liquide dans ce réservoir augmente encore la stase veineuse, et l'oblitération cervicale devient invincible.¹

Another circle may be caused by the retention in the bladder of residual urine occupying the region of the trigone. This residual urine often sets up vesical irritation and congestion, which aggravate each other. Thus Mansell Moullin writes:

The presence of residual urine and the straining and effort caused by the disadvantage at which the muscular coat of the bladder is placed do not allow the congestion to subside. A vicious circle is established, the irritability causing increased frequency, and the increased frequency making the congestion and irritability worse.²

Again, the muscular wall of the trigone is apt gradually to yield under the continual pressure, giving rise to a thin-walled post-prostatic pouch. When once formed, this pouch leads to further retention of urine, and this in turn to further bulging. Occasionally the pouch has attained such dimensions as to reach the perineum. In women a cystocele may be formed in much the same way.

In some forms of prostatic hypertrophy the enlarged lobe takes the shape of a valve which falls over and closes the vesical orifice as soon as the bladder begins to contract. The more vigorous the contraction the more tightly is the orifice closed; the tighter the closure the greater the contraction.

Sir Henry Thompson draws attention to a circle that is frequently present when catheterism, although imperatively demanded by an incapable and inflamed bladder, aggravates the inflammation.

The cystitis on the one hand, and the catheterism on the other, exercise mutually inimical influences, and the patient becomes the victim of a vicious circle of actions, in which an absolutely indispensable remedy, the catheter, aggravates the inflammation of the bladder, which therefore, in its turn, demands the instrument with increasing frequency.³

Where retention of urine has led to atony of the bladder, another reciprocal condition is set up, as pointed out in Keen and Da Costa's *Surgery*:

Prolonged or repeated retention, with overstretching of the organ, from any cause whatever, results in weakening of the detrusor muscles, reducing their contractibility and producing the condition called atony; while, on the other hand, atony itself contributes to further retention by reason of the inability of the weakened muscles to expel the urine. Thus is established a vicious circle that forms the intimate relation between the two conditions.⁴

Guyon draws attention to correlations that were common in earlier days when lithotripsy was prolonged over several sittings. The cystitis called for lithotripsy, while the resulting fragments of crushed stone increased the cystitis.

Autrefois lorsqu'on avait recours aux séances courtes et multiples sans chloroforme, . . . on abandonnait dans la vessie les débris de la pierre qu'on avait broyée. Ces débris plus ou moins anguleux étaient parfois d'un volume assez considérable. Aussi, à l'irritation que provoquaient directement les manœuvres et que n'atténuait aucune tentative d'anesthésie, s'ajoutait bientôt celle du contact de ces fragments, contact beaucoup plus offensif on le conçoit, que ne l'était auparavant celui du calcul tout entier. Ainsi se produisaient des poussées de cystite d'autant plus difficiles à prévenir et à combattre qu'elles étaient précisément provoquées par le véritable traitement curateur, et que ce traitement exigeait toujours un nombre plus ou moins considérable de séances. On était donc inévitablement condamné à tourner dans un cercle vicieux.⁵

Fürbringer describes a vicious circle present in acute prostatitis, the abdominal straining to pass water increasing the pressure on the urinary tract, and thus leading to a greater obstruction and straining.

Die in Folge der Dysurie angestrengte Bauchpresse übt einen unheilvollen Druck auf die entzündete Drüse, die ihrerseits die

Harnröhre nur noch mehr comprimirt und die Qualen der Strangurie erhöht. Es können durch diesen Circulus vitiosus die Patienten . . . der Verzweiflung nahe gebracht werden.⁶

Some interesting reciprocal relations are established during the growth of a vesical calculus, whether such calculus descended from the kidney or was primarily formed in the bladder. If a small nucleus slips into a healthy bladder, provided that no infection occurs, just enough irritation may be provoked to surround the calculus with an envelope of mucus in which successive layers of crystals are deposited. The growth of the stone then proceeds in an acid medium, the film of colloid being ever ready to attract fresh crystals of uric acid or other substance out of the urine by molecular coalescence, while the enlarging stone keeps up the irritation and causes more and more mucus to be secreted.

Sooner or later, however, bacterial infection generally takes place, leading to cystitis and the precipitation of phosphates. Then the film of mucus becomes a nidus for the deposit of phosphatic accretions, and the growth of the calculus proceeds in an alkaline medium. The growing calculus increases the irritation, while the irritation leads to further deposits of phosphates and adds to the size of the concretion. A very similar vicious cycle of events is present when the concretion is *ab origine* a vesical one resulting from the deposition of phosphates.

Where bacterial infection supervenes in connexion with a calculus or otherwise a further circle is established, since the micro-organisms provoke ammoniacal fermentation and increased cystitis. Fresh pabulum is thus supplied to the invaders, adding to their powers of multiplication. Moreover, the alkaline salts formed during cystitis constitute a further source of irritation, as Skene points out:

The irritant effect of these salts, really deposits of foreign bodies, on the inflamed mucous membrane completes the vicious circle, the effect now aiding the original cause.⁷

A neurotic circle is occasionally met with in which impaired tone results from and also produces an irritable bladder. Reginald Harrison speaks of persons who, in view of an imaginary inconvenience they may be temporarily exposed to during a long railway journey, go on for days previously micturating every few minutes. They thus acquire a habit which becomes established.⁸

A somewhat similar neurosis due to exaggerated reflex irritability is met with in nocturnal enuresis. Some temporary derangement sets up nocturnal incontinence, and this, if frequently repeated, may so act on the impressionable nervous system of a child as to form a habit which may persist even after the removal of the exciting cause. Many such habit circles are met with in medicine.

II.—Circles Associated with the Kidneys.

The reciprocal correlations existing between the kidney and its fellow organs are so intimate that it is no wonder that vicious circles are readily established when disease attacks the system. A few examples will serve as illustrations.

When the blood is unduly charged with deleterious matters it impairs the nutrition and efficiency of the renal epithelium. Impaired nutrition and efficiency in turn keep the blood impure and so complete the circle. Adami describes the condition:

Functional inadequacy of the kidneys is not without its effect upon the composition of the blood. The quantity of water eliminated may deviate considerably from the normal, and waste products may be retained instead of excreted. The quality of the blood is thus depreciated, and, being laden with toxic substances, it in turn exerts an irritating and deteriorating effect upon the kidneys. In this way a vicious circle is set up, as a result of which the condition of the patient goes rapidly from bad to worse.⁹

Similar correlations involve the nervous, the digestive, and the vascular systems. Thus, the retention of toxic matters that should be eliminated by the kidneys injuriously affects the nervous system, and such disorder in turn increases the renal inadequacy. Or a lowered activity of the nervous system may be the primary factor, and induce a sluggish condition of the kidneys and other excretory organs, with a further reaction on the nervous condition. The digestive system may be affected in much the same way.

Again, in cardiac disease the kidneys may be gravely involved, and "the conditions form a vicious circle," as Brunton points out:

The disordered circulation disturbs the functions of other organs, and these in turn make the circulation worse. . . . The disordered circulation interferes with the functions of the lungs, liver, stomach, intestines, and kidneys. On account of the difficulty of breathing, exercise becomes impossible, and thus all the accessory aids to circulation given by the muscles and fasciae during movement are done away with. Appetite becomes lessened and flatulence increases; the elimination of waste products by the kidneys is interfered with, and distension of the abdomen either by flatulence alone or by flatulence with ascites, presses the diaphragm up, encroaches upon the breathing space in the lungs, and tilts the heart up, thus still further increasing its difficulties.¹⁰

Chronic renal disease associated with arterio-sclerosis is frequently complicated by a circle, although the exact part played by the kidneys cannot as yet be accurately defined. Modern pathologists regard arterio-sclerosis as a widespread process affecting both the renal organs and the arterio-capillary system generally, causing increased resistance to the flow of blood through the capillaries, and compensatory hypertrophy of the left ventricle followed by increased arterio-sclerosis.

Mott thus describes the process:

Arterio sclerosis affecting a number of vessels must lead to an increase of arterial pressure, which, reacting on the heart, causes hypertrophy; the two are progressively reciprocal, and although the cardiac hypertrophy is a necessary physiological compensation to overcome the increasing peripheral resistance, yet the high arterial pressure which it engenders leads to an increasing strain upon the walls of the aorta and arterio-capillary system generally. The arterial tension may then be both the cause and effect of the hypertension.¹¹

As Oliver expresses it: "It is not improbable that, in the manner of a vicious circle, a persistent rise of the arterial pressure may perpetuate itself."¹²

A bio-chemical view has recently been suggested—namely, that destructive changes in the renal epithelium cause an excess of an internal secretion from the kidneys (renin) to be cast into circulation and in turn to damage the renal tissues. Chauffard and Laederich write as follows:

Quoi qu'il en soit, il n'est pas douteux que les altérations des cellules rénales peuvent être l'origine de substances toxiques, qui vont contribuer à entretenir ces altérations et créer à proprement parler un cercle vicieux, dont la résultante sera une prolongation plus ou moins indéfinie de la néphrite.¹³

A similar condition has been suggested as a possible cause of uraemia. Thus Garrod, in discussing the theories of that disease, says:

It has been suggested that the tendency to chronicity in renal diseases is due to the establishment of a vicious circle, and that the nephrolitis formed as a result of the renal lesions aggravate the morbid condition in the kidneys.¹⁴

Both hydronephrosis and pyonephrosis may be complicated by reciprocally progressive conditions. An example occurs where undue mobility of the kidney is accompanied by twisting or kinking of the ureter, causing some obstruction to the escape of urine. As the renal pelvis and calyces become distended the whole kidney increases in size and weight and descends further in the abdomen, thereby aggravating the kink or twist and completing the circle.

Again, the insertion of the ureter into the hilum may

be so high as to leave a pouch lying below the point of insertion and always full of urine. Cases are on record in which such pouch compressed the ureter, causing further distension and further compression. Valvular folds and other abnormalities may also at times lead to reciprocal conditions.

Shattock describes a circle in which hydronephrosis and polyuria are associated with idiopathic dilatation of the bladder, the obstruction arising not from organic changes but from disordered innervation. After discussing alternative theories he says:

Far more probably the polyuria results from the hydronephrosis, and there being a persistent obstruction a vicious circle arises, in which the hydronephrosis brings about polyuria and the resulting polyuria brings about a further increase in the hydronephrosis.¹⁵

In neurasthenic women a vicious circle is often established by a movable or floating kidney. The oversensitive nervous system renders the sufferer unduly conscious of the abnormal mobility, while the persistent ache keeps the nervous system weak and sensitive and further weakens it.¹⁶ Osler thus expresses the idea:

"It is well never to tell a patient that a kidney is movable; the symptoms may date from a knowledge of the existence of the condition."

Similar reciprocal conditions may be established in connexion with renal as with vesical calculi. The renal calculus is believed to originate with the deposition in the urinary passages of some colloid or albuminous matter such as mucus, pus, blood, or albumen. Within

the meshes of this organic framework uric acid (or other substance) is entangled, and agglutinated into a nucleus. Such a nucleus, when once formed, provokes irritation. The irritation leads to further exudation of the colloid sub-

stance, and this in turn attracts fresh deposits and causes fresh irritation. Secondary renal calculi, on the other hand, result from an infective process in the kidney, generally associated with stagnation of the urine. Under such conditions phosphates are readily precipitated, the resulting concretion forming the nucleus of a calculus. This nucleus in turn causes irritation of the mucous membrane and the exudation of mucus, and this readily gathers about itself fresh phosphates. Renal infection often leads to a primary renal calculus at a later stage being incrustated with phosphates.

An accumulation of urine in the bladder, if at all considerable, may affect the renal secretion, as a result partly of reflex action, partly of mechanical tension. The accumulation of urine increases the renal secretion, which increase in turn aggravates the accumulation.

In severe cases of ascites a mechanical circle is sometimes formed. The pressure of the ascitic fluid in the kidneys and renal vessels diminishes the secretion of urine. This diminution in its turn aggravates the ascites.

III.—Circles Associated with the Ureters and Urethra.

The ureters and urethra have already been referred to more than once as co-operating with the bladder and kidneys in the formation of circles. But there are times when the ureters or urethra play the principal part.

The Ureters.

For example, the opening of the ureter into the bladder may be abnormally small, impeding the flow of urine, and

Diagrams showing how vicious circles may be resolved into their constituent factors.

giving rise to a saccoform dilatation. This dilatation may in turn further diminish the opening, and thus complete the circle.

Again, a renal calculus in its progress towards the bladder may lodge in and block the ureter, leading to inflammation and ulceration of the mucous membrane. This may aggravate the obstruction, and, owing to stagnation of urine, cause an increase in the size of the stone.

Matthews Duncan draws attention to a curious condition in which obstruction of the ureters due to polyuria provokes frequent micturition, and this in its turn increases the obstruction.

Frequent urination, he says, leads to obstruction of the ureters at their vesical orifices, and partial obstruction of the ureters leads to excessive secretion; the excessive secretion requires frequent emptying; the frequent emptying produces obstruction of the ureters; and the obstruction of the ureters leads to excessive secretion, and so on.¹⁸

The Urethra.

The obstetrician at times meets with a circle caused by a retroverted gravid uterus pressing on the urethra, and thus leading to retention of urine and increased retroversion. At other times the retention of urine is the primary and the retroversion the secondary factor. Pouliot thus describes the circle:

La rétroversion, une fois constituée, apporte un obstacle à l'émission de l'urine si bien que dans la majeure partie des cas un cercle vicieux se trouve formé. La vessie en ne se vidant point, projette l'utérus en arrière; celui-ci se prolant dans le cul-de-sac de Douglas s'oppose à la miction et seule une évacuation artificielle de la vessie peut mettre un terme aux accidents.¹⁹

In acute gonorrhoea the urethral mucous membrane may be so inflamed as to lead to retention of urine. Such retention in turn aggravates the congestion of the lower urinary tract and increases the urethral obstruction. The more prolonged the retention the greater the swelling of the mucous membrane, and vice versa. The severe straining associated with tight strictures and with retention sets up a similar hyperaemic condition of the urethra and aggravates the stricture.

Again, with congenital or other strictures of the urethra it is not uncommon to find extensive retro-strictural dilatations. These dilatations contain decomposing urine, and sometimes a calculus, and may be so situated as to further press on the strictured urethra, or to provoke dysuria. Thus the dysuria is both cause and result of the dilatation.

The accompanying illustrations show how vicious circles may be represented diagrammatically, the number of factors varying with the complexity of the condition.

CONCLUSION.

It is interesting to note that many circles arise from a failure of those beneficent powers with which the body is provided for the purpose of counteracting disease.

Thus in cases of chronic prostatic obstruction the walls of the bladder undergo considerable hypertrophy with the obvious intention of overcoming the obstruction. Such hypertrophy is compensatory and beneficent. But if the demands are excessive, the limit of compensation is reached and the hypertrophy is replaced by degeneration and atrophy. In this case the advantage becomes disadvantage and a vicious circle is established.

In cases of cystitis associated with the presence of a calculus the formation of ropy mucus and the deposit of phosphates is probably a conservative process intended to encase the irritating calculus and thus to shield the vesical walls from injury. But the opposite effect often follows, since the deposited colloids and phosphates lead to the growth of the calculus and thus increase, instead of lessening, irritation.

Where a heavy hydronephrotic kidney takes up a lower position in the abdomen, the constant ache that resulted from the dragging on the ligaments may be relieved and the movements become less irritating. But if such descent leads at the same time to kinking of the urethra, the benefit vanishes, since the displacement causes the hydronephrotic kidneys to increase in size and to cause more and more disturbance.

Lastly, where in cases of obstruction to the passage of urine renal secretion is increased, owing to reflex action, the increased flow is probably intended to wash away the obstacle, much as a foreign body lodged in the

cornea calls forth increased lacrymation. But if the increased flow of urine fails to remove the obstacle, its effect is but to increase the accumulation of urine and thus intensify the mischief.

Although the list of vicious circles is far from exhausted, sufficient illustrations have been given to show the importance of being on the *qui vive* for this possible complication, and of breaking the circle by any means whatsoever. The appropriate treatment will be found in every textbook, but as a general rule vigorous measures are called for, in view of the increased gravity of disease when complicated by a vicious circle.

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TREATMENT OF SMALL-POX IN RED LIGHT AND IN THE DARK:

SOME PRACTICAL REMARKS.

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FINSSEN in his pioneering works from 1893^{1 2} lays down his method for the treatment of small-pox by exclusion of the chemical rays of daylight, and in January and February, 1894, a slight small-pox epidemic gave Feilberg³ the opportunity of using it in my country. The method has later been used in the Øresundshospital on every occasion.

As is known, one tries to carry through the method generally by arranging a red room. This is done either by covering all windows with several layers of red stuff (bookbinder-shirting, flannel, blankets, and the like) or by furnishing the windows with red glass or by combining both proceedings. If the stuff is closely woven, the layers not too few, and if the hangings fit closely to all sides, all demands will be fulfilled; but in this case little light passes, and in consequence the room will be rather dark. The strongly subdued light is, however, more often a comfort to the patients at the beginning of the illness, nor is one justified in objecting that the dark or the red light interferes with the examination of the patients, because the physician must get used to judging the eruption by the peculiarities in appearance which are due to the light.

Red panes set in loose frames may be hung outside—or, having regard to the durability of the colour, preferably inside; these panes have the advantage that for the greater part of the day there is sufficient light in the room to allow the patient to read. But the panes of glass present in themselves a danger. Red glass in strong sunshine does not always exclude the green rays, and only glass which on spectroscopic examination has been proved to be faultless in every way should be employed; to choose glass whose colour is as intensive and as dark as possible, will give little or no guarantee that it is satisfactory. Spectroscopic examination is absolutely necessary. It must also be noted that red glass which at one time was correct fades when kept, even if it has been used only for a comparatively short time and has been kept in a rather dark store-room, with the single frames placed close together. This is not surprising, since there is only a very thin layer of colour on common glass. Durability would be increased if glass through which the colour is diffused were used, but the price is so much higher that in practice it is necessary to make use of the cheaper ware. I cannot say how long the latter retains its good qualities, as there is no date on the hospital panes of an earlier period showing when they were procured. After having examined the whole stock of panes—which, for the moment, consists of 45, and of which some were in use—I found only 24 faultless. Of the remainder, 8 allowed a very small quantity of green rays to pass, but this,