The dosage used in the present trial was twice that recommended by the manufacturers: it was also twice the dose used by Moore, though his patients received chymotrypsin for four days after operation, whereas in the present series treatment was restricted to two days.

In view of the previous findings, why are the results of the present series of 56 patients so disappointing? There are three possible answers.

Firstly, the assessment of the amount of swelling and bruising after operation in any individual patient is a purely subjective valuation based on experience of the type of operation performed, and for this reason a control series is essential. Because assessment is subjective (and cannot be measured objectively), clinical trials should be of the double-blind type. Only in this way is it possible to eliminate conscious or unconscious bias in the observer when a new preparation beneficial to the patient (and surgery) is being evaluated (Truelove, 1959). In none of the papers quoted was the trial "blind," nor apparently were controls included for comparison.

Secondly, bias may also be introduced through the pre-selection of the cases treated: hence the necessity for randomization at the planning stage. In the published reports selection could have contributed materially towards a favourable impression of the preparation.

Finally, a controlled clinical trial, properly conducted, tests not only the preparation under consideration but also its formulation. Hence, in spite of the favourable *experimental* results with chymotrypsin, the unfavourable *clinical* results with lyophilized chymotrypsin could be explained by the altered formulation of the preparation.

Conclusions and Summary

A double-blind controlled clinical trial was carried out on 56 patients undergoing plastic surgery.

Half the patients received chymar (10,000 units intramuscularly one hour before operation, and on each of the next two days) and half received a dummy preparation.

Chymar appeared to have no effect on the degree or incidence of post-operative oedema or bruising in such patients.

We are grateful to the Armour Pharmaceutical Company, who kindly supplied the ampoules of chymar, dummy preparation, and solvent; to the surgeons who allowed their patients to enter the trial; to Sister Sanderson and Sister Downes, who supervised the administration of the preparations; to Mr. W. Trillwood and the dispensary staff, who allocated the patients and maintained the day-to-day supplies; and to Dr. P. Armitage, of the Statistical Research Unit, for providing additional data on the sequential analysis.

REFERENCES

- Armitage, P. (1957). *Biometrika*, **44**, 9.
 Crawford, R. A. D. (1959). *Brit. med. J.*, **2**, 503.
 Fullgrabe, E. A. (1957). *Ann. N.Y. Acad. Sci.*, **68**, 192.
 Hill, D. W. (1959). *Brit. med. J.*, **2**, 365.
 Hill, R. G., and Bastian, J. W. (1956). *Fed. Proc.*, **15**, 438.
 Jenkins, B. H. (1956). *J. med. Ass. Ga*, **45**, 431.
 Kunitz, M., and Northrop, J. H. (1935). *J. gen. Physiol.*, **18**, 433.
 Miechowski, W. L., and Ercoli, N. (1956). *J. Pharmacol. exp. Ther.*, **116**, 43.
 Moore, F. T. (1959). *Brit. J. plast. Surg.*, **11**, 335.
 Salmony, D. (1959). *Brit. J. Ophthalm.*, **43**, 321.
 Tagnon, H. J., Weinglass, A. R., and Goodpastor, W. E. (1945). *Amer. J. Physiol.*, **143**, 644.
 Truelove, S. C. (1959). In *Medical Surveys and Clinical Trials*, edited by L. J. Witts. Oxford Univ. Press, London.

STRESS INCONTINENCE OF URINE

A SURVEY OF 34 CASES TREATED BY THE MILLIN SLING OPERATION*

BY

CLIFFORD KENNEDY, M.B., F.R.C.S.Ed.
F.R.C.O.G.

*Consultant in Obstetrics and Gynaecology,
Royal Infirmary, Edinburgh*

This communication is a survey of 34 cases treated by the Millin sling operation, which was first described by Millin and Read in 1948. Let me say right at the start that there is little place for this operation unless the patient has undergone a previous attempt to cure the incontinence by the vaginal route. This series of 34 cases would suggest, therefore, that my plastic repair results show a considerable number of failures, so far at least as a cure of incontinence is concerned. That, I hasten to say, is not necessarily so, for in the cases reported I have been partly or wholly responsible for the plastic repair operations on 13 cases only. The other 21 were previously treated, over the years, in all three units of the Edinburgh Royal Infirmary, in neighbouring city hospitals, and some, indeed, much further afield. So the fault, if there be one, in plastic repair operations is fairly general.

It is essential, in the first place, that there should be no confusion between the terms "stress" and "urge" incontinence. With the former there is the unconscious escape of urine on straining, laughing, coughing, sneezing, getting in or out of a car or bus, walking, running, and—because of the action peculiar to the game, bending and throwing, and because of the age-group of the women involved—curling. This leak may amount to a few drops only; on the other hand, a mere cough will project—and this can be demonstrated on the examination couch—an appreciable stream several yards across the room. I have seen this on several occasions. There is no associated history of frequency or dysuria in these cases.

With urge incontinence the picture is entirely different. Here there is a low-grade infection, there is often frequency, and there may be dysuria. The patient has the sudden desire to void urine, and if this cannot be done promptly there is a leakage, of which the woman is fully aware. And so there should be no mistake, on careful questioning, about which condition presents, and yet in the hospital out-patient departments one constantly finds a clinical confusion in the history and a faulty diagnosis as a result.

Incidence.—While Gainey (1943) has estimated that approximately 5% of all adult women suffer some degree of stress incontinence, the figure for the frequency of this symptom in association with utero-vaginal prolapse has been put by Bailey (1954) at 39% in 424 cases and at 50% by Read (1950). In a follow-up of plastic repair operations Stallworthy (cited by Read, 1950) estimated the persistence of this symptom at 16%, and both Kennedy and TeLinde (cited by Read, 1950) at 5%–10%. Millin and Read (1948) agree that this figure increases with time, and Counseller (1943) believes it to be as high at 30%. Bailey (1954) found that in a series of 84 patients who had prolapse and stress incontinence

*Paper read to the Edinburgh Obstetrical Society on February 10, 1960.

tinence, only 38.5% were cured of their incontinence by the Manchester operation after two years.

Types of Stress Incontinence

The two main varieties are: (1) congenital; (2) acquired—(a) post-partum, (b) post-menopausal, and (c) post-operative.

Congenital.—This form is extremely rare, though it so happens that I have had several such cases under observation fairly recently.

Acquired.—(a) *Post-partum*: This is by far the commonest acquired type, the causal factor being trauma associated with childbirth—the prolonged second stage, the difficult forceps extraction through malposition or disproportion, each playing its part in damaging the bladder-sphincter mechanism. (b) *Post-menopausal*: It is not uncommon for a stress incontinence to show for the first time at this stage. Presumably the atrophy which occurs in the musculo-fascial supports is responsible, and this is almost certainly the cause where incontinence troubles the nullipara. It is important, incidentally, to realize that this symptom, though usually associated with urethrocele, cystocele, or prolapse, may occur where no evidence exists of any such lesion. (c) *Post-operative*: It is a disconcerting fact that incontinence may present for the first time, fortunately rarely, after a plastic repair operation. Where no incontinence is present it is a great mistake to carry the repair of the cystocele too near the urethra and its immediate surround. No purpose is to be gained by such a procedure, and indeed only harm can be done.

Diagnosis of Stress Incontinence

With a careful history and vaginal examination there is usually little doubt that the condition is one of stress incontinence. There is the typical picture of pelvic-floor laxity with cystocele or urethrocele formation, and when the patient is asked to strain the tell-tale leak is evident. In cases of doubt the urethral elevation test described by Bonney (1942) can be used. Two fingers, one on each side of the midline, are applied with some pressure well up on the anterior vaginal wall. In this way the bladder-neck area is raised, and if there is now effective bladder control on straining the diagnosis is confirmed and the success of raising the bladder base by operation may be estimated. Less often it may not be so easy. The patient may be nulliparous and no laxity is apparent. Here it is important to remember that a basal cystitis may produce an urge incontinence; that neurological lesions—tabes dorsalis, disseminated sclerosis, and cord injury—may be responsible; and that congenital bladder abnormalities, calculi, and tumours may be the primary fault. It is essential in such cases to have a neurological investigation and cystoscopic examination carried out.

The Control Mechanism

Much has been written about this and we still do not know the answer. John C. Ullery (1953), of Philadelphia, wrote: "The first early anatomic treatises dealing with the musculature of the urethra and the vaginal wall were made by Galen in which he described the urinary bladder as being composed of longitudinal, transverse, and oblique fibres with the sphincter in the region of the internal meatus and controlling the escape of urine." Since those days this point of view has been supported and it has been denied. My own belief has always been

that the main control, and indeed almost the only control, is at the bladder-neck, and it would seem to be a matter of academic importance only regarding the make-up of this particular mechanism. Testut (1894) has described it as consisting of "circular fibres at the vesical neck." Zangemeister (1908) wrote of the smooth-muscle mass at the internal urethral meatus area consisting of bundles traversing obliquely into the bladder to form the "sphincter trigonalis." Ludinghausen (1939) believed that the sphincter—he called it the lissosphincter—consisted of two horseshoe-shaped loops of muscle at the bladder-neck area—one pulling anteriorly and one posteriorly, so shutting the urethra placed between.

The point I would make is that those writers—and these views are just one or two chosen at random—believe in a bladder-neck sphincter or sphincter-like mechanism. There are, no doubt, what might be called "secondary" sphincters—the pubo-coccygeus muscle (the most medial fibres of the levator ani), the urogenital diaphragm consisting mainly of the sphincter urethrae and deep transverse perineal muscle, and, nearer the surface, the bulbo-cavernosus and ischio-cavernosus muscles. Now it has been shown that if half or even more of the urethra is removed—and with it must obviously go the more intimate connexions from those "secondary" sphincters—the patient can still be continent. What better argument for the bladder-neck "sphincter" being the main and only control?

Cause of Stress Incontinence

Much investigation has been carried out in the last twelve years by radiographic study to show how the bladder empties normally and to explain why sometimes there is stress incontinence. Millin and Read (1948), Muellner (1949), Ball (1950), and Jeffcoate and Roberts (1952a, 1952b) have all described a descent of the bladder-neck or loss of the posterior urethro-vesical angle in women exhibiting this symptom when intra-abdominal pressure is increased. Read went so far as to say that "the degree of descent in most cases varies with the degree of incontinence." With this last opinion I would most strongly disagree. For descent to occur most of us believe there must be weakening of the pubo-cervical fascia and possibly of the pubo-coccygeus muscle. Now if there were this weakening, there would also be cystocele, and so, in the same way, it might be said "the bigger the cystocele the greater the incontinence." But this is not so. Indeed, how often is the reverse true?

It is argued further that this descent is important, not because of the accompanying cystocele, but because this downward and backward movement of the bladder-neck is associated with loss of the posterior urethro-vesical angle and the so-called funnelling of the exit, as happens in normal micturition. I have never subscribed to this idea and Simmons (1955) has denied such changes during micturition, and certainly the post-operative x-ray findings in this series support his view. Of nine patients chosen at random to be x-rayed, seven had complete control and two had occasional stress leakage. Of the seven, the angle was preserved in five and lost in two during micturition. Of the other two where there was a leak from time to time, the angle was well preserved in both, and so I would say that there is little or nothing in this theory of funnelling and loss of posterior urethro-vesical angle. A patient may be continent with no angle,

and the reverse may hold equally. It is my contention, therefore, that bladder control depends almost entirely on the efficiency of the internal sphincter mechanism situated in the bladder-neck. This efficiency can be upset by stretching or loss of tone resulting from parity, menopausal atrophy, or some general systemic disease. Indeed, it is even possible that no other factor is involved. It may well be as simple as that.

Prophylactic Treatment

Prophylaxis is all-important and consists in the most careful supervision and management of labour. Obviously the second stage and actual delivery are of greatest significance. In a primigravida, the second stage should not be allowed to exceed three hours—indeed, it may be cut short before that under certain circumstances—and the bladder must always be kept empty. Once the cervix is fully dilated, the bladder is displaced forward by descent of the foetal head, and it is then that the internal sphincter mechanism may be damaged. This is especially likely to occur if the musculature is already over-stretched. A delivery associated by more than average traction with resulting excessive trauma will also play its full part in stress aetiology. And so, therefore, correction of any malposition and adequate episiotomy, in those cases where there is obvious difficulty, are essential before an attempt at delivery is made.

For the puerperal patient, where there is often a slight and fortunately temporary tendency to incontinence, appropriate exercises to tone up the perineal musculature may be practised, sometimes with complete benefit. For this purpose the perineometer of Kegel (1948) may be used. Here the levator ani muscles are contracted, and a dial attached to this instrument, which has been placed in the vagina, registers the force of the contraction. The aim of the patient is to increase this force and so strengthen her pelvic musculature.

This may have been tried and proved unsuccessful, or, on the other hand, the incontinence may be marked from the beginning. In such cases some form of plastic vaginal operation is called for, particularly where utero-vaginal prolapse is also present and the patient is finished with child-bearing. Let it be said again that an attempt at cure should almost always be made by the vaginal route in the first place.

It is quite impossible, where the previous repair operations have been done by others, to find out the exact technique employed, but it is fair to surmise that three main methods were used: (1) the Manchester operation; (2) anterior and posterior repair without amputation of the cervix; and (3) anterior repair only in younger women where, from the viewpoint of future child-bearing, it is inadvisable to tighten the pelvic floor unduly.

Of these three procedures there can be little doubt that the Manchester operation, or our own version of it, is the most popular. But is this enough where incontinence is present? As already stated, Bailey (1954) found a cure in only 38.5% two years after this treatment. And therefore some modification is necessary if this procedure is to be effective. So it is that we find special techniques devised by Kelly *et al.* (1928), Kennedy (1941), Pacey (1949), and TeLinde (1951), to mention but a few. Of these, the "Kelly stitch," as it is commonly called, is possibly most practised. It is a simple procedure and has proved successful, according

to some writers, in 85% of cases so treated. Here the bladder-neck area, after being freed from the vaginal wall, is raised and supported by several mattress sutures. The suture material used depends on the operator, but Kelly used fine silk. TeLinde's operation was a little more extensive in that mattress sutures were employed along the whole length of the urethra in addition to those placed in relation to the bladder-neck.

Kennedy and Pacey went further and included not only plication of the pubo-cervical fascia but approximation of the levator ani muscles, where they were attached to the vaginal walls, with silver wire, or approximation of the pubo-coccygeus muscles with interrupted chromic-catgut sutures. Most of us have tried one or other of those manœuvres, and no doubt we are quite smug about our results. But just when we are most smug, along comes a patient and her story is humbling, for she is still incontinent. Now, it is fair to say that the indifferent surgeon has his successes; the human frame is tough and is often responsive to what amounts to suggestion only, for in many cases the technique employed is likely to be quite inadequate. What is equally true to say is that the good surgeon occasionally has his failures. And this may not be the fault of the surgeon, for there is no doubt that much must depend on the patient's own tissues. Bad material, no matter how good the tailor, falls out of shape quite soon, and exactly the same rule applies in the case of a plastic repair. And so, therefore, for one reason or another there are patients where one or more vaginal operations have failed to cure the incontinence. The prolapse has gone completely, the pelvic floor and vaginal walls are tight, but the patient is still uncomfortably wet on exertion. Further operative treatment is essential, and for this type of case many operative procedures have been devised.

Treatment of Stress Incontinence after Plastic Repair Operations

Those procedures may be divided into the following groups: (1) fascial slings placed under the urethra or bladder-neck area, (2) fixation of the bladder and urethra to the symphysis pubis, and (3) separation of the bladder and urethra from the symphysis pubis.

Other operations have been described, one of the more recent being advocated by Louros (1959). His technique is based on the belief that incontinence depends on abnormal curving of the urethra and sagging of the bladder-neck. Ventrofixation is first performed to correct any associated retroversion. The vesico-uterine fold, unopened, is raised from the depth of the vesico-uterine space and sutured to the posterior uterine wall to remedy retroflexion. As a result of this the bladder fundus is drawn backward, the bladder-neck is elevated, and the urethra is straightened. Any laxity of the vaginal wall is dealt with, before the laparotomy, by a plastic repair. The success of this procedure is given as 93%.

1. In the first group the Aldridge (1942) operation, later modified by Studdiford (1946), consists in carrying out a Kennedy plastic repair and in bringing down through the retropubic space, lateral to the bladder and under the urethra, two transverse fascial strips of external oblique aponeurosis. A sling is formed in this way. This operation has both an abdominal and a vaginal approach, and it was argued that the latter might predispose to an infection. A cure rate of 82% was reported after an interval of two years: Millin and Read (1948) described a sling operation,

the Millin I operation, where through a curved transverse lower abdominal incision the retropubic space is opened into. Two strips of aponeurotic fascia, one pedicled on the right and the other on the left at the level of the anterior superior spines, are passed through the rectus muscles and underneath the bladder-neck. The two strips are stitched to one another with nylon and the degree of elevation of the bladder-neck can be very finely judged by this method. In 1950, using a 20-cm. strip of fascia lata, Millin adopted a further technique, the Millin II procedure, which might almost be described as the Aldridge operation in reverse. Here the fascial strip is placed under the urethra and the ends are forced up behind the pubis, rather than brought down, and fixed to the rectus sheath through an abdominal incision. Again there was in this method the double approach and the same chance of infection.

2. Of operations designed to fix the bladder and urethra to the posterior surface of the pubis, the Marshall, Marchetti, and Krantz (1949) is the most popular in this country to-day. With an abdominal approach the urethra and bladder-neck are fixed to the periosteum by a series of chromic-catgut sutures. The bladder is also sutured to the posterior aspect of the rectus muscles. Here the cure rate has been placed around 74% and the improved rate at 92%.

3. Mulvany (1951) described how, through a transverse suprapubic incision, he freed digitally the bladder-neck and urethra from the pubic arch. His belief was that the bladder-neck so freed was able to contract and retract more efficiently. A cure rate of 88% was reported after four years. It has been said by Stabler (1952) and others that this procedure is effective not so much because adhesions are broken down, but rather because more form as a result of what has been done. In other words, this is merely another method of raising and fixing the bladder to the pubis.

The Millin I operation has not become tremendously popular, for two simple reasons: it is technically, on occasion, very difficult to place the fascial strips under the bladder-neck and there is a high incidence rate of injury to the bladder or urethra. I would not agree, however, that it is difficult to estimate the tension of the sling. On the contrary, I would claim that it is possible to do just this with great accuracy, and the ease with which this is done constitutes one of the main advantages of the technique. The technical difficulty arises from the dense scar tissue and adhesion formation between urethra and vaginal wall, the result of previous plastic repairs, and it is through this tissue that a tunnel has to be forced for the strips. I have had the Millin forceps modified—it has been lengthened by 2 to 3 in. (5 to 7.5 cm.) and the points have been sharpened. Placing the strips has become easier, less force is necessary, and injury may lessen. But, if injury should occur and there is suprapubic leakage of urine, continuous bladder drainage by a self-retaining catheter and drainage of the retropubic space should ensure healing of the bladder within ten days or so, sometimes sooner. No sling in this series has had to be undone, or divided, and on no occasion has the sling, through being too tight, cut through the urethra.

Analysis of the Series

And now, very briefly, a word or two regarding several points which were analysed in this present series of 34 cases.

Table I shows a lack of relationship between the duration of symptoms and the degree of parity. The four longest periods of incontinence, from 20 to 30 years in fact, were in no case associated with a parity greater than two. And so it can be said that the mother of the large family is not necessarily the one to have a long-

TABLE I.—Duration of Symptom in Relation to Parity

Duration	Parity
30 years	2
25 "	2
20 "	1
20 "	0

standing symptom history. In three cases the duration of incontinence in the case record was stated as "many years," and in these a period of 10 years was allowed. The average duration of the incontinence was 8.7 years.

TABLE II.—Influence of Parity

Parity No.	0	1	2	3	4	5	6	7	8	9	10	11
No.	6	5	11	2	5	2	0	1	0	0	1	1

Parity varied from 0 to 11 (Table II). It is significant that the biggest group of cases, 11 in number, are associated with a parity of 2. The present-day tendency to the small family may to some extent explain this finding, but it is not the whole explanation. There are only two cases in the para-3 and five cases in the para-4 groups. Incontinence was present in six nulliparae. The average parity was 2.6.

TABLE III.—Age Incidence

Age-group No.	21-30	31-40	41-50	51-60	61-70	71-80
No.	0	2	16	9	5	2

Table III shows that the age-groups most commonly involved were those of 41-50 and 51-60. This is exactly as it should be, in that the bladder-sphincter mechanism, already weakened by the trauma of labour, is further weakened by menopausal atrophy.

There were six nulliparae in the series, three married and three unmarried—an operation rate in this type of case of 17.6%. Three of the six had had a previous plastic repair and a fourth developed incontinence after extensive cauterization of a urethral caruncle some years before.

Twenty-five patients had had one previous plastic repair, four had two attempts at vaginal cure, and two patients had three. That makes a total of 31 cases. The remaining three had had no previous repair, and in those a sling operation was the first method of treatment—a frequency rate of 8.8%.

Where several vaginal operations had been performed the longest interval between the first of those and the subsequent sling was 32 years. Where only a single repair had been carried out the longest interval was 20 years and the shortest six months. Various figures have been quoted regarding the cure rate of stress incontinence by vaginal repair, and, though it is true that most failures show up after several years, some are obvious when the patient pays her post-operative reporting visit in a month or two.

In nulliparous patients particularly, and where no obvious laxity was apparent, it was the custom to have a cystoscopic examination carried out. This was done in eight patients, and in only one was abnormality found in the form of a basal cystitis.

The average stay in hospital after operation was 26.5 days, the shortest period being 15 and the longest 43.

Eighteen cases showed infection of the urinary tract, and the same number experienced bladder trauma at

operation—a percentage rate of 52.9. This, as has been said already, is one of the reasons why this particular method is not so popular as it might be.

Five cases showed wound infection. The reason for a rather prolonged convalescent period in certain patients is thus apparent.

In 1950 there were two deaths, and neither was directly related to the particular type of operation employed. The first was due to a massive pulmonary embolism on the seventeenth day, when all seemed well. The other occurred two days after operation. Here necropsy showed a liver necrosis, and it is fair to assume that this was not unrelated to the bromethol anaesthesia which had been employed.

And now for the really important point—the result of the operation. Regarding the term “complete control” there can be no dubiety. “Almost complete control” means simply a very occasional and slight leak when the bladder is full and the patient is making some special physical effort.

I think it is proper to include both groups under the term “cure”—a rate of 87.5%. This compares very favourably with the results of other types of sling operation. Two cases showed improvement and there were two absolute failures.

Conclusions

To conclude, I would say just this. In the parous patient with laxity of the vaginal wall and stress incontinence, an attempt at cure should always be made in the first place by a vaginal plastic repair operation. If this has been done and a stress incontinence still exists without laxity, then there is a place, and a most important place, for some form of sling operation. I would go further. There is also indication, on occasion, for this latter operation in the nullipara; for here, too, there is often no apparent laxity and nothing can be done by a routine repair procedure. Such cases, however, should always have the bladder and nervous system investigated before operation is undertaken.

The analysis of this series was carried out simply because I wished to ascertain just where the Millin I sling operation stood, so far as the results were concerned, with operations of a similar type. There can be no doubt that the comparison is very favourable. And so, though this operation may sometimes be technically difficult, though there is a high percentage of temporary bladder trauma, and though the immediate post-operative nursing is exacting and the convalescence a little prolonged, I would suggest that this procedure might be practised more often with advantage.

Summary

In this survey the clinical picture in “urge” and “stress” incontinence is described. The incidence of stress incontinence in association with utero-vaginal prolapse and the cure rate of this symptom by the standard plastic repair operations are discussed. Reference is also made to the diagnosis and differential diagnosis of stress incontinence.

In relation to the control mechanism of the bladder, the anatomical views of certain writers are quoted. It is thought that the loss of the posterior urethro-vesical angle plays little or no part in aetiology—this is supported by x-ray findings—and that the sole cause lies in weakening of the sphincter mechanism in the bladder-neck area.

The various plastic procedures for treating stress incontinence are described, and where those fail the more popular types of sling and fixation operation, which must then be considered, are mentioned. The cure rate of the different operations is contrasted.

Finally, the results of 34 cases treated by the Millin I operation are fully discussed. Thirty-one patients had had one or more previous plastic repair procedures carried out; in three the Millin operation was the first method of treatment. The cure rate in this series is 87.5%, a figure which compares more than favourably with comparable methods of treatment.

My thanks go to Miss West and to Sister Isdale for helping with the cystograms, and to Sister Robertson and Sister Michie, who helped with the nursing of the patients and made a very real contribution to any success there may have been.

REFERENCES

- Aldridge, A. H. (1942). *Amer. J. Obstet. Gynec.*, **44**, 398.
 Bailey, K. V. (1954). *J. Obstet. Gynaec. Brit. Emp.*, **61**, 291.
 Ball, T. L. (1950). *Amer. J. Obstet. Gynec.*, **59**, 1243.
 Bonney, V. (1942). *A Textbook of Gynaecological Surgery*, 4th ed. Cassell, London.
 Counseller, V. S. (1943). *Amer. J. Obstet. Gynec.*, **45**, 479.
 Gaaney, H. L. (1943). *Ibid.*, **45**, 457.
 Galen. Cited in T. Lauth's *Histoire de L'Anatomie*. Strasbourg, 1815.
 Jeffcoate, T. N. A., and Roberts, H. (1952a). *Ibid.*, **64**, 732.
 ——— (1952b). *J. Obstet. Gynaec. Brit. Emp.*, **59**, 685.
 Kegel, A. H. (1948). *Amer. J. Obstet. Gynec.*, **56**, 238.
 Kelly, H. A., and collaborators (1928). *Gynecology*. Appleton, New York.
 Kennedy, W. T. (1941). *Amer. J. Obstet. Gynec.*, **41**, 16.
 Louros, N. C. (1959). *Zbl. Gynäk.*, **81**, 225.
 Ludinghausen, M. (1939). *Gynecological Operations and their Topographic Anatomy*. DeBour.
 Marshall, V. F., Marchetti, A. A., and Krantz, K. E. (1949). *Surg. Gynec. Obstet.*, **88**, 509.
 Millin, T. (1950). *Proc. roy. Soc. Med.*, **43**, 258.
 ——— and Read, C. D. (1948). *Postgrad. med. J.*, **24**, 51.
 Muellner, S. R. (1949). *Surg. Gynec. Obstet.*, **88**, 237.
 Mulvany, J. H. (1951). *J. Obstet. Gynaec. Brit. Emp.*, **58**, 449.
 Pacey, K. (1949). *Ibid.*, **56**, 1.
 Read, C. D. (1950). In J. V. Meigs and S. Sturgis's *Progress in Gynecology*, 2nd ed., p. 690. Heinemann, London.
 Simmons, C. A. (1955). Cited in T. L. T. Lewis's *Progress in Clinical Obstetrics and Gynaecology*, p. 362. Churchill, London.
 Stabler, F. (1952). *J. Obstet. Gynaec. Brit. Emp.*, **59**, 708.
 Studdiford, W. E. (1946). *Surg. Gynec. Obstet.*, **83**, 742.
 TeLinde, R. (1951). *Operative Gynecology*. Lippincott, Philadelphia.
 Testut, L. (1894). *Traité d'Anatomie Humaine*, 2nd ed. Doin, Paris.
 Ullery, J. C. (1953). *Stress Incontinence in the Female*. Grune and Stratton, New York.
 Zangemeister (1908). *Z. gynäk. Urol.*, **1**, 1, 79.

Dr. R. K. CALLOW and Miss NORAH C. JOHNSTON, of the National Institute for Medical Research, Mill Hill, have succeeded in identifying and synthesizing “queen substance,” the hitherto unknown chemical substance which controls reproduction in honeybee colonies. (It is not the substance known as royal jelly.) Its constitution is that of 9-oxodec-2-enoic acid, $\text{CH}_3\text{CO}[\text{CH}_2]_5\text{CH}:\text{CH}.\text{COOH}$. In recent years it has been demonstrated that the queen bee produces a substance in her mandibular glands which her worker bees obtain in the process of caring for her. This substance becomes distributed throughout the colony, and prevents the workers from raising any new queens. It also prevents the development of the ovaries of worker bees. It is possible that it may have some allied effect in other animals, including man, and other pharmacological properties. (*Bee World*, Bee Research Association, June, 1960.)