MYTHOLOGICAL, profane and sacred literature abound in incident, fact and fancy, showing that from the dawn of history man has sought to assuage grief and pain by some means of dulling consciousness.

Both the Bible and Talmud contain references to the ancient practice of inducing sleep by artificial means. In these attempts many methods and diverse agents have been employed. The inhalation of fumes from various substances, weird incantations, the external and internal application of drugs and many strange concoctions, pressure upon important nerves and blood vessels; mesmerism, hypnotism, etc., have all played their part in the evolution of anaesthesia. But modern anaesthesia was not known to the world after the successful public demonstration of ether by Morton in 1846.

One of the first uses to which it was put was to modify the pains of childbirth. Sir J. Y. Simpson of Edinburgh, was the first to use ether in obstetrical cases, but not entirely satisfied, sought a substitute, and to him we are indebted for the second most universally used agent for general anaesthesia—chloroform. Common sense prevailed over the opposition of clergy and laity of his day, "to avoid one part of the primeval curse on women," and chloroform and ether are now used almost universally for special cases and in certain stages of labour. However, where expense is not considered, nitrous oxide and oxygen have supplanted the use of these agents.

In 1880, Klikowitch of St. Petersburgh, recommended an
80 per cent. mixture of nitrous oxide and oxygen for obstetrical purposes, and this is about the admixture that is used to-day for analgesic purposes. Guedel of Indianapolis was one of the first to endorse strongly this combination in normal labour in the United States (1911), and it is now quite generally employed.

Spinal analgesia has been used with success—as have also local analgetics to the cervix, the perineum and the rectum, but these methods have but few followers to-day.

Schneiderlin, in 1899, recommended the use of morphin and scopolamin for surgical anaesthesia, but Steinbuchel first recommended its use in labour in 1902. Kronig and Gauss of Freiburg are responsible for its introduction into the United States, reporting 3,000 cases in a paper read in Chicago in 1913. Kronig and Gauss use narcophin, a proprietary narcotin—morphin meconate. There is a good reason for using this combination, and those who do not have no right to condemn or criticise "twilight sleep." Sollman states (p. 260), "Narcotin has a considerable potentiating action on morphin. With hypodermic injection 5 mg. of morphin produced no measurable analgesic effect, with 10 mg. the analgesia was marked in two subjects, the third responded by hyperaesthesia. With narcotin 8 mg. was ineffective, 20 to 40 mg. produced first some hyperexcitability, then slight analgesia.

With a mixture of equal parts of morphin and narcotin containing 3—1/3 mg.—the analgesia was almost as great as with 10 mg. of morphin alone. This combination was also effective on the subject who resisted morphin." (p. 267.) "Morphin probably tends to delay the progress of labour by its psychic sedative action, largely by preventing the reinforcement of labour pains by the contraction of the abdominal muscles."

This system has been in turn praised and condemned; to-day it is practically abandoned except by Kronig and Gauss and a few specially equipped sanataria. Sollman further states, "the use of scopolamin-morphin anaesthesia is justified (if at all) only in specially equipped institutions and not in private practice, or even in ordinary hospitals." It is applicable only in about 30 per cent. of labour cases.
All of the above agents and methods require either a specialized technique, unusual equipment or trained personnel. Numerous inquiries from many sources indicate that none of these methods are satisfactory to the majority of physicians.

The development of painless labour by synergistic methods was undertaken from a purely scientific and altruistic viewpoint. It was decided that the method should be so simple that it could be used either in the home or hospital, and by any physician, in an entirely empirical manner. The ideal sought was a state of relaxation and analgesia with consciousness but little if at all impaired, so that full co-operation might be had at all times. The methods by which this condition was to be obtained were outlined to the chief and attending obstetricians of the N.Y. Lying-in Hospital, Asa B. Davis and George W. Kosmak, and were as follows:

1. To start with a minimum dose at which time no definite results were expected and to gradually increase the dose until definite results were obtained.
2. To stop at any time in the development of the technique if either mother or child appeared to be in danger.
3. To publish the results whether favourable or unfavourable.

With this understanding work was commenced on the 10th of February. The first four cases showed practically 75 per cent. failure. To-day the first chapter of painless labour by synergistic methods is completed when we can secure over 75 per cent. success. By "success" is meant the amelioration of pain to such an extent that patients state that they were "helped"—only a few of the 75 per cent. had a comparatively painless labour. By "failure" is meant whenever the patient obtained no relief from the method. At no time was the mother's condition imperilled in the slightest degree. Only in one instance did the infant seem to be affected. Whether or not this was from the medication cannot be stated positively, but it seemingly was. In the first series of drugs used there was not only failure but delay. This delay was in a measure corrected by placing 10 grains of quinine hydrochloride in the mixture. Sollman states that "satisfactory
results have been reported from its use in all stages of labour. This drug stimulates the contractions and increases the tone of the uterus.” Since this addition in only one or two cases has there been any delay, and in these exceptional cases exhausted nature was more powerful than the drug.

There also seemed at one time to be an increase in the nausea and vomiting. This was corrected in a very great measure by eliminating urethan and paraldehyde, thus also making the final mixture simpler. The other drugs considered fundamental to the scheme are magnesium sulphate, urea, ether and morphin. Two to four drachms of the magnesium salts is the maximum dose used in our investigations of painless labour, although the writer has used two ounces of the salts per rectum in other cases without deleterious effect. The magnesium sulphate must be chemically pure (the usual commercial product may cost fivepence per pound, the chemically pure four shillings per pound).

Weston and Howard have injected 2 cc. or more of a 50 per cent. solution of magnesium sulphate subcutaneously or intramuscularly more than a thousand times with no local pain or sloughing. They state the sedative action occurs in 15 to 30 minutes and lasts from five to seven hours, and is found to be a very good substitute for morphin and hyoscin. In a few instances the patient became quiet but did not sleep. In 82.7 per cent. it was effective. In 6 per cent. the dose was repeated before sedation occurred. In 11 per cent. no effect even after three or more doses.

Rector has used magnesium sulphate colonically in doses of two drachms in over 300 cases. The Presbyterian Hospital used the salts over 200 times by hypodermoclysis in four drachm doses with good results. In both instances other drugs or agents were added to complete the analgesia or anaesthesia.

Magnesium sulphate used in two to four drachms doses by rectum leaves a margin of safety amply sufficient to satisfy the most critical and is, next to urea, probably the safest drug in the combination.

In a personal communication, Alma J. Neill, Professor of Physiology, University of Oklahoma, states: “I have found that the rate of diffusion of the magnesium sulphate with urea
was rather constant; that is, the range was between 30.9 and 32.1 per cent., with the exception of a 6 per cent. solution of the magnesium sulphate and a 1 per cent. solution of the urea which diffused very much faster, it having diffused 48.1 per cent. in the same time. The whole range of percentages were used both with the magnesium sulphate and the urea. Each time the 6 per cent. solution of the magnesium sulphate and the 1 per cent. solution of the urea diffused practically 50 per cent. faster than any combination or any other substance which I tried."

Hewlatt7 has given 25 grams of urea every hour until 12 m. (100 grams in all) with no untoward results. Cushney8 states: "It is rapidly absorbed from the intestine and is practically devoid of action in the tissues even in the larger doses." The amount used, 1 per cent. of a 4 ounce mixture, is therefore negligible as far as danger is concerned. It is use with the idea that it increases the absorbability of the magnesium sulphate. The exact relation between "diffusion" and "absorbability" is not definitely known, nor can we state at this time how much the efficiency of the method is due to the urea.

"Ether9 is the anaesthetic of choice if the patient is suffering from any form of toxaemia or requires stimulation or is suffering from shock." The amount used in our mixture, two to four drams to a maximum of one and a half ounces, needs no extended comment. (Four to six ounces of ether is the amount used in colonic anaesthesia.)

Ten years after its introduction for general surgery oil-ether was first systematically treated in 100 obstetrical cases by Thaler and Hübel.*

The mixture was 90 grams (3 ounces) of ether and 120 grams (4 ounces) of olive oil. The amount used at one injection was 100 cc. (3 ounces) introduced very slowly. In a typical case, a few minutes after injection, the eyelids close and a general relaxation sets in. The condition is suggestive of twilight sleep, but if there is no marked effect after ten minutes a second injection of 50 cc. (1 1/2 ounces) is given. In only one case was the method entirely impractical. With this

* Zentralblatt für Gynäkologie, Leipzig, 47, 337-384 (March 3, 1923).
one exception there was no complaint of pain or irritation of intestine.

In 16 cases this injection (50 cc.) was repeated once.

25 times.
20 times.
15 times.
12 times.
4 times.
2 times.
1 time.

In one case the maximum total amounted to 767 cc., of which 270 cc. were lost. No rectal irritation.

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15 times.
12 times.
4 times.
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1 time.

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In 88 cases the results were satisfactory.

4 cases there was absolute failure.
80 cases normal or very strong labour contractions.
20 cases labour was reduced or retarded. In these cases quinine or pituitary extract was added.

In some cases the labour seemed to be improved by the oil-ether mixture.

In 73 primiparas average duration of birth 20½ hours.

27 multiparas 10½ hours.

No anomalies of the after-birth period were observed. No change in foetal heart beat. Usually born pink.

In 84 children condition normal—cried immediately.

14 cases apneic—breathed normally in five mins. without resuscitation.
2 cases typical asphyxia, one revived and second—forceps—was not resuscitated.

In the majority of cases during the intervals between labour contractions, the patients lay as if asleep, during labour contractions slightly restless and groaned occasionally.

The time of rectal instillation:

In 24 cases the os was dilated 1—4 fingers

27 fingers.
9 fingers.
3 fingers.
more than 4 fingers.
No morphin or alkaloids were used. In no case was there excitement. Vomiting in five cases. Strong thirst in seven cases. After delivery a deep sleep. Upon awakening do not recall any incidents. Of 99 born alive, one child died on fifth day, after third day intestinal inflammation and subsequently pneumonia. Some children were sleezy during the first one or two days. Ether by inhalation in comparison with this method affects the brain too much.

The disadvantage might be the impossibility of exact dosage on account of loss, but according to the writers the difference of individual reactions makes exact dosage irrelevant. The method is impractical in private homes.

To revert to the synergistic method again the next drug to consider is Alcohol. The ounce of alcohol was used principally as a vehicle for the ether; it also increases the absorbability of the mixture. Alcohol is below ether in analgesic qualities. Three-eighths of a grain of morphin per rectum (in our opinion) is the limit for this drug. The hyoscin is used to accentuate the value or to synergise the morphin.

"The exaggeration of the effects of small doses of morphia which results from its combination with scopolamin is of great practical importance. This synergism may be experimentally demonstrated in various species of animals, especially in those species in which scopolamin alone, even when given in large amounts, produces no narcotic effects. The combined administration of small doses of morphin and small doses of scopolamin, which by themselves produce hardly any effects, results essentially in an exaggeration of the effects of morphin. (Burghi, Madelung.) Morphin and the hypnotics of the alcohol group when administered simultaneously also act synergistically, with a resulting exaggeration of each other's pharmacological actions." (Burghi, Fuhner.)

THE METHOD.

It is the exceptional patient who is so unfortunate as not to have received instructions, among other things, to keep the lower bowel clean, especially in the last stages of labour. The rule at the Lying-in Hospital is to examine and give a cleansing enema when admitted to the hospital. The patient
is then sent to the floor where delivery takes place. The patient is therefore already prepared for the colonic administration of the drugs used, and this is the method adopted. A six ounce mixture seemed preferable, but was too frequently expelled, therefore a four ounce mixture is the final choice.

**TIME.**

In selecting the time for the rectal instillation we seemed to follow naturally the Freiburg method, which is as follows: "After labour is well on its way, when the pains are four or five minutes apart and lasting thirty or more seconds, the first injection (hypodermic) is made." It is at this time that the rectal instillation is given whether in a four ounce mixture or in divided dosage of two ounces. The effect is noticeable about the same time as a hypodermic would be and is not as painful. Analgesia is present in from thirty minutes to one hour after the administration, even in those cases in which a delayed action occurs.

**SUITABLE CASES.**

In the development of this method great care is being taken in rejecting cases that would in any way obscure the issue. For instance, if the uterus is dilating evenly and the contractions occur regularly, but with little pain, no medication is given; an even and sometimes painless delivery is then assured; or, when the cervix is fully dilated (four fingers or more) medication is withheld. Again, if the foetal heart sounds are irregular or bad, or malpositions occur, or if there is any question about the condition of the child, medication is withheld. After starting this method a patient with indistinct foetal heart sounds was admitted to the hospital. Medication was withheld and the child delivered, but died within forty-eight hours. If the method had been tried in this case it would have properly come under suspicion. The cases selected were those not too far advanced and where there was a possibility of helping them. The selection or rejection of these cases necessarily fell upon the house surgeon of the Lying-in Hospital to whom full credit is herewith given in exercising unusually good judgment.
RESULTS.

The results have varied, but in the majority of cases the patients have been "helped," the "pains were lessened," and in a few a comparatively painless delivery has occurred. Others were not helped in the slightest, whilst one or two stated that the pains were "intensified." This last statement can only be accounted for by taking into consideration the mentality of the patient who possibly expected very great help and received but little.

FORMULAÆ USED.

In the evolution of this method the various formulaæ used and the results, together with Donovan's notes on the cases, are herewith given:—

No. 1. February 10th, 1923.

Morph. Sulph. gr. $\frac{1}{2}$
Hyoscin Hydrobrom. gr. $\frac{1}{200}$
Sol. Mag. Sulph. 50% C.P. 1 ounce
Aqua Destill. $\frac{1}{2}$ ounce
Alcohol q.s. 2 ounces

Used on four patients. Dose repeated in one case and no relief. One case with one dose had a practically painless labour. Three cases had no relief.

No. 2. February 10th, 1923.

Glucose 4 drams
Morph. Sulph. gr. $\frac{1}{2}$
Hyoscin Hydrobrom. gr. $\frac{1}{200}$
Sol. Mag. Sulph. 50% C.P. 4 drams
Egg 1
Alcohol 1 ounce
Pept. Milk q.s. 4 ounces

Used on three patients. One with one dose said pains were worse. Two cases each had two doses with no apparent relief.

Impression: Effect somewhat better than No. 1, but not marked.

No. 2 with ether added (2 drams) used on three patients. All stated that pains were relieved somewhat.
British Journal of Anaesthesia

No. 3. February 19th, 1923.

Morph. Sulph. gr. ½
Hyoscin gr. 1/200
Sol. Mag. Sulph. 50% C.P. 4 drams
Alcohol 4 drams
Pept. Milk 2 ounces

Given at 110° Fahrenheit.

No. 2.

Alcohol 4 drams
Ether ½ ounce
Yolk of egg 1
Pept. Milk q.s.

Used on eight patients. Four cases the pains were lessened, but all had long second stage. One baby was resuscitated with great difficulty. Condition appeared to be morphin anaæsia. Four cases had no evident relief. Two delivered by forceps. Impression: Fairly good in four cases, but all had long second stage.

No. 4. February 26th, 1923.

Morph. Sulph. gr. ½
Hyoscin gr. 1/200
Mag. Sulph. C.P. 3 drams
Glucose 2 grams
Pept. Milk q.s.ad. 2 ounces

Given at 110° Fahrenheit.

No. 2. Given forty minutes later.

Ether 1½ ounces
O. Olive 2½ ounces

Used on five cases. Three had no relief. One expelled part of the second dose. One case was “helped” a little. One case had great relief but a long labour.

No. 5. March 1st, 1923.

Morphin Sulph. gr. ½
Hyoscin Hydrobrom. gr. 1/200
Mag. Sulph. C.P. 4 drams
Glucose 4 drams
Aqua Destill. 4 ounces

Given at 110°. Used on three patients with no relief. To one bottle, paraldehyde 3 drams were added. Patient slept all during labour. Had good progress, but vomited.
No. 6. March 8th, 1923.

Urea 1%
Mag. Sulph. C.P. 6%
Morphin Sulph. gr. 1/4
Hyoscin Hydrobrom. gr. 1/200
Paraldehyde 2 drams
Ether 2 drams
Pept. Milk 6 ounces

Used on four patients. Two cases helped considerably. Two others noticeably. All vomited and had prolonged second stage. Did not retain six ounces so well.

No. 7. March 13th, 1923.

Urea 1%
Mag. Sulph. C.P. 6%
Morphin Sulph. gr. 1/100
Hyoscin Hydrobrom gr. 5
Urethane gr. 1/4
Ext. Cannabis Indica 4 ounces
Water q.s.

Used on six patients. No noticeable effect on three. Pains of one were lessened; two considerably relieved.


Urea 1%
Mag. Sulph. C.P. 6%
Morphin Sulph. gr. 1/100
Hyoscin Hydrobrom. gr. 1/100
Paraldehyde 2 drams
Ether 2 drams
Urethane gr. 5
Pept. Milk 4 ounces

Used on two cases. Both were nauseated but rested and pains were lessened.

No. 9. March 20th, 1923.

Urea 1%
Morphin Sulph. gr. 1/4
Hyoscin Hydrobrom. gr. 1/100
Mag. Sulph. C.P. 6%
Ether 2 drams
Paraldehyde 2 drams
Urethane gr. 5
Quinine H.C.L. gr. 10
Alcohol 1 ounce
Water q.s. 4 ounces

Used on four patients. No apparent effect from first two.
British Journal of Anaesthesia

Alcohol added to last two; labour was prompt and pains eased a little.

No. 10. Same as above except Morphin gr. \( \frac{3}{4} \). No paraldehyde.

Used on four patients. Three of these were helped decidedly. Other case could not be helped with anything.

No. 11. Same as No. 10.

Used additionally upon three surgical cases. All of them had only small amount of inhalation anaesthetic. One case expelled nearly all of the mixture, pains not diminished. One case slept all night after medicine; pains next day were weak and she had a long labour, but the medication gave a much needed rest. Two cases in active labour—one said pains were eased. One case pains were better for about six hours but labour was prolonged, and patient finally was delivered with forceps. Two cases both said pains were eased.

No. 12.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>1%</td>
</tr>
<tr>
<td>Mag. Sulph. C.P.</td>
<td>2 to 4 drams</td>
</tr>
<tr>
<td>Morph. Sulph.</td>
<td>gr. ( \frac{1}{4} )</td>
</tr>
<tr>
<td>Hyoscin Hydrobrom.</td>
<td>gr. ( \frac{1}{100} )</td>
</tr>
<tr>
<td>Glucose</td>
<td>4 drams</td>
</tr>
<tr>
<td>Aq. Dest. q.s. ad.</td>
<td>2 ounces</td>
</tr>
<tr>
<td>Heat to 110° F.</td>
<td></td>
</tr>
</tbody>
</table>

Give as retention enema.

No. 2. Twenty minutes later give:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ether</td>
<td>( \frac{1}{2} ) ounces</td>
</tr>
<tr>
<td>Oil</td>
<td>6 drams</td>
</tr>
</tbody>
</table>

The amount of magnesium sulphate in the above formula varied from two to three drams for obstetrical cases, and to four drams for surgical cases.

One case, 3 drams, was "helped considerably."

One case, 3 drams, pains stopped, patient slept for nearly 20 hours then delivered promptly.

One case, 2 drams (2 omitted), no effect.

Two cases, 2 drams, both helped.

One case, 2 drams, "helped slightly" (slept about three hours), labour good.

Two cases (as written), both "helped."
One case (as written), could not be helped with anything. Rested for seven hours, but it apparently did not ease the pains.

Remarks.

It is stated authoritatively "that no drug which can so far abolish sensation as to make labour painless can be given to this degree without affecting considerably the normal process of labour." We cannot entirely concur in this statement, although it seems to be the consensus of opinion of all obstetricians and of all authorities. (As yet magnesium sulphate alone has not been tested for confinement cases.) By using the minimum dose of a number of drugs synergistically it is believed that the above objection has been overcome. It must be remembered that when the four ounce mixture is placed into the rectum it is still practically outside of the body. When absorbed into the blood it is only then a part of the circulatory system.

"In twilight sleep foetal asphyxia occurs in 9.6 per cent. of cases, but foetal mortality is not above the average." In our series the percentage is less than 1 per cent. and this case was not fatal. The usual objections against twilight sleep: (a) prolonged labour for hours and days, use of forceps more often necessary, the percentage of ruptured perineums higher, failure of occipito-posterior positions to rotate normally, (b) restless delirium and violence, disturbance of heart and lungs, post-partum haemorrhage and uncertain results do not seem to obtain with the present method.

In our series only in one case in 64 did asphyxia occur which gives a percentage of .64. As a general proposition "synergistic analgesia" is a safer condition than either oil-ether analgesia or "twilight sleep." In twilight sleep too much dependence is placed upon morphin and its action is too greatly stressed—hence the high percentage of asphyxia. With the synergistic method we attempt to secure relaxation with the magnesium sulphate as well as using it for its power of prolonging the effect of the morphin. Ether is a powerful stimulant and analgesic as well as an anaesthetic. The attempt is made here to use it only for its stimulating and analgesic properties, and we believe we obtain this by using it in the minimum dosage as given.
Incidentally, in the last formula 12, a very safe preliminary for surgical cases where full relaxation is required has been evolved. It is given one hour before the operation as a retention enema, and is put up as a four ounce mixture and supplemented by nitrous oxide oxygen-ether open method. It has been used in several hundred cases with satisfaction.

**Conclusions.**

We feel that in this small series of cases we have established the fundamental principles upon which painless labour may be safely worked out, i.e., by using the minimum dose of a number of drugs, compatible and synergizing, using each drug for a definite and specific purpose.

**References.**


The term *synergistic anaesthesia* means the reciprocal augmentation of the action of one or more drugs upon one another with unconsciousness. *Synergistic analgesia* is the term employed when consciousness is present. When the agents are properly selected and used the resulted effect is much greater than the simple summation of their pharmacologic action.

J. T. Gwathmey.