The Use of Staples in Orthosurgery
INDEX

PAGE

I. THE USE OF STAPLES IN ORTHOSURGERY . . . . . . . . . 436 - 444

EDWARD H. KELLY, M.D., Resident in Orthopedic Surgery,
University of Minnesota Medical School

II. MEDICAL SCHOOL NEWS . . . . . . . . . . . . . . . . . . . . . . 445

III. WEEKLY CALENDAR OF EVENTS . . . . . . . . . . . . . . . . 446 - 451

Published weekly during the school year, October to June, inclusive.

Editor
George N. Aagaard, M.D.

Associate Editors
Wallace D. Armstrong, M.D. Craig Borden, M.D.
Erling S. Platou, M.D. Richard L. Varco, M.D.
Howard L. Horns, M.D. W. Lane Williams, M.D.
James Rogers Fox, M.D.

James L. Morrill, President, University of Minnesota
Harold S. Diehl, Dean, The Medical School, University of Minnesota
Ray M. Amberg, Director, University of Minnesota Hospitals
O. H. Wangensteen, President, The Minnesota Medical Foundation

Address communications to: Staff Bulletin, 3330 Powell Hall, University of Minnesota, Minneapolis 14, Minn.
I. THE USE OF STAPLES IN ORTHOSURGERY

(Particularly in Regard to Epiphyseal Arrest)

Edward H. Kelly

The purpose of this report is to present a follow-up study on the latest method of treatment of epiphyseal arrest with the use of staples, and to attempt to evaluate the efficacy of this type of treatment.

As nothing new or original is claimed by any of the men working with this latest instrument of stabilization of the lower extremities, it would be of interest to us to review some of the work that lead up to it.

As far back as the time of the Greeks and the warrior tribes of Europe, men have been interested in the problem of equalization of leg length. This was not directed toward the congenital deformities, polio, etc., as these maladies were considered to be punishment of the gods, and the unfortunates were never considered an integral part of the socially accepted populace. Instead, the soldiers sustaining fracture in battle were the first objects of interest because shortening would bring about a loss of prestige and manliness. Some very clever splints were contrived by the ancient physicians to prevent such deformities.

However, it was not until the eighteenth century that anyone was concerned with the physiology of bones. This was stimulated by renewed interest in cadaver dissection by the Italian schools in the 1500's.

Hales, in 1727, first showed that long bones grow by apposition at their ends. He implanted silver markers into the shafts of leg bones of fowl to prove this, and thereby set off a series of experiments by many investigators.

Probably the first detailed study of the histology and function of the epiphysis was done by John Goodsir of Edinburgh in 1841. He stressed the importance of the bone cell (osteoblast) itself in bone growth. He observed that the epiphysis took no part in the regenerating defects of the shaft and felt that physiologically the epiphysis should be considered as a separate bone.

In 1842 a clinician, Sir Astley Cooper, differentiated between epiphyseal separations and the more usual types of fracture and dislocation.

Poland's authoritative book credits Stanley in 1849 with being the first to draw attention to disturbances in growth of bones. The brilliant Louis Ollier of Lyons added very important contributions to bone growth studies. He observed that chronic irritation of the shaft caused increased growth at the epiphyseal lines; that the epiphyseal cartilage continued to cause growth in length only when attached to the shaft; and that transplants of epiphyseal cartilage lose their property of growth. He was the first man to study experimentally the relative proportions of growth contributed by the proximal and distal epiphysis of the long bone which later was to become of major importance in controlling bone growth.

Ollier (quoted by Jahn) stated:
1. Insignificant incisions into the epiphyseal cartilage plate are without influence upon length growth; 2. Marked lesions or excisions have a strong influence and cause shortening or collapse; 3. Separation of the epiphysis is without influence if it is immediately replaced in good position; and 4. Full excision of epiphyseal cartilage causes a complete cessation of growth.

The first surgeon to write extensively on bone growth was Mr. G. M. Humphrey of London. In 1858 he wrote a paper which is of interest because he was one of the first men concerned with the possibility of surgical damage to the epiphyseal growth line and resultant deformity to the limb -- a possibility overlooked by most surgeons through the latter half of the century. In his paper "On Excision of the Knee" he cautioned, "In young persons care should
be taken to make the section through the epiphysis of the femur and the tibia so that a thin layer of epiphysis with its cartilage, which unites it to the shaft, is left on each bone. If this precaution is taken there is every reason to believe that the limb will keep pace in growth with the opposite member." Hugh Thomas commented on deformities encountered after surgical excision of joints saying that the amount of shortening appeared to vary in inverse proportion to the age of the patient at operation.

During the latter half of the nineteenth century there was sufficient interest aroused in the clinical problems of growth disturbance to stimulate experimental work on problems of epiphyseal growth in many countries.

In 1873 Bidder in Germany found that he could alter the epiphyseal growth of rabbits by thrusting a needle or pieces of cotton into the regions between epiphyses and diaphyses. If the injury to bone were on one side only an angular deformity occurred; if the epiphyseal plate was traumatized in its entirety, a uniform growth retardation resulted. He found that no growth interference resulted if the needles didn't pierce the plate. In 1893 Ghillini published a report on mechanical irritation of the epiphyses of rabbits. He used ivory pegs implanted into the bone and observed that over a period of months the ivory was absorbed and disappeared without a trace.

John Poland of London, speaking of deformities due to inequalities of growth in children said, "It is a question of whether or not it would be justifiable intentionally to destroy the central layer of epiphyseal cartilage and so arrest the growth at the epiphyseal line." Just a few years after this in 1906, Bloodgood in describing a case of a repair of a fractured tibial tubercle done by Gaudier and Bouret of Paris mentioned the use of a nail in holding the fragments together. An accompanying illustration revealed a staple exactly like those used today. The Frenchmen referred to it as the clip of Jacoel. Jacoel was a little-known Frenchman who described its use in his thesis "On the Use of Heavy Metals in Bone Surgery" in 1902.

In the United States in 1929 LeRoy Abbot wrote on operative lengthening of the lower extremities. This procedure gave a fairly high percentage of successful results, but was too complicated for the average surgeon.

R. I. Harris in Toronto, reported on lumbar sympathectomy for leg shortening in 1930 with good results. Operative shortening of the long extremities has been performed, after children have reached full growth, with some success by many surgeons. This operation gained more adherents than the bone lengthening because it was slightly easier to perform and was accompanied by less danger.

In 1933 Dallas Phemister reported on the operative arrest of longitudinal growth by epiphyseo-diaphyseal fusion.

In 1945 Haas reported on retarding bone growth with a wire loop passed in a circular fashion around the epiphyseal plate. He found this accidentally in one of a group of experiments he was performing in an attempt to stimulate growth by use of two dissimilar metals. In 1948 he published his findings in a set of experiments on dogs using steel staples to bridge the epiphyseal plate.

In 1949 Walter Blount reported on the use of staples for epiphyseodesis in humans, and the staples have come to bear his name.

We can group all the work that has been done for length and equalization of unequal lower extremities into three methods:

1. Bone lengthening
2. Resection
3. Arrest by destroying or controlling epiphyseal cartilaginous plate

First we will examine Bone Lengthening. It is easy to realize that lengthening of a disease-shortened limb back to the normal length would be the most desirable treatment. However, at the pres-
ent time there is no satisfactory means of attaining such an end. Surgical lengthening as mentioned above is inherent with danger; various workers have tried roentgenotherapy, sympathectomy, periosteal stripping, and direct irritation of the epiphyseal cartilaginous plate. The results in all these procedures have been too inconstant and variable.

Resection has yielded good results in the hands of experienced surgeons, but technically it is difficult and could be catastrophic when attempted by less experienced men.

This left epiphyseodesis (epiphyseodiaphyseal fusion) is the method of choice in the great majority of leg equalization operations. This operation of Phemister or one of its modifications has proven quite satisfactory for control of epiphyseal growth. It has been widely used and where carefully performed has given good results. However, what is done in this procedure cannot later be undone, and regardless of how carefully each patient is studied, the prediction tables used, or how precisely the surgery is performed, the results leave much to be desired.

The use of staples, latest method of leg length equalization, has demonstrated some advantages already. Blount states positively that growth is resumed as soon as the staples are removed. This fact reduces the importance of growth estimation charts once the operation has been performed. When the staples are inserted further decisions are based upon clinical observation and not calculation. With this more flexible method of controlling the epiphysis, the chances for better results in leg equalization have improved measurably, but there are still many questions to be answered.

Before we consider the clinical work, I should like to digress to consider the types of conditions which cause leg length discrepancy. In general there are 5 major groups of conditions which alter growth pattern.

1. Trauma
   Most common are the fractures with
   overriding of fragments or obliteration of the epiphyseal line.

2. Generalized diseases with bone or joint involvement:
   - Poliomyelitis
   - Tuberculosis
   - Arthritis
   - Syphilis
   - Acute Osteomyelitis

3. Localized disease with bone or joint involvement:
   - Legg-Perthes Disease
   - Slipped femoral epiphyses
   - Osteomyelitis

4. Bone Tumors:
   - Neurofibromatosis
   - Hemangiomatosis
   - Osteitis fibrosa cystica
   - Giant cell tumor
   - enchondromas

5. Congenital Conditions:
   - Hemihypertrophy
   - Hemiatrophy
   - Arteriovenous Aneurysms
   - Hemophilia
   - Congenital Dislocation of Hip

The manner in which growth is influenced by any of these forces may be one or a combination of five possible alterations as discussed by Bisgard.

1. Complete or partial destruction of the epiphyseal cartilage.
2. Premature closure of epiphyseal line.
3. Accelerated growth.
4. Local irregularities in epiphyseal growth.
5. Retarded growth.
Method of Measurement:

The measurements of limb length upon which this study is based were made by the use of a tape, measuring from the anterior superior spine of the ilium to the medial malleolus. The measurements were made by many different surgeons, and we realize that there is a variation using the same bony landmarks. However, we believe that there will be little variation in the net difference between the length of the legs and this is of chief importance.

<table>
<thead>
<tr>
<th>Condition</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Poliomyelitis</td>
<td>26</td>
</tr>
<tr>
<td>2. Congenital shortening</td>
<td>5</td>
</tr>
<tr>
<td>3. Pathological Dislocation of Hip</td>
<td>2</td>
</tr>
<tr>
<td>4. Osteopetrosis</td>
<td>1</td>
</tr>
<tr>
<td>5. Legg-Perthes disease</td>
<td>1</td>
</tr>
<tr>
<td>6. Tuberculosis of hip</td>
<td>2</td>
</tr>
<tr>
<td>7. Congenital hypertrophy</td>
<td>1</td>
</tr>
<tr>
<td>8. Congenital Coxa VarA</td>
<td>1</td>
</tr>
<tr>
<td>9. Post-radiation disturbance in Fibrosarcoma</td>
<td>1</td>
</tr>
<tr>
<td>10. Burns on the lower extremity</td>
<td>1</td>
</tr>
<tr>
<td>11. Congenital Dislocation of hip</td>
<td>1</td>
</tr>
<tr>
<td>12. Congenital deformities</td>
<td>1</td>
</tr>
<tr>
<td>13. Osteomyelitis</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
</tr>
</tbody>
</table>

Review of Cases:

From June 1946 to September 1950, 69 operations were performed on 44 patients for epiphyseal arrest. These were performed at University of Minnesota Hospitals, Gillette State Hospital for Crippled Children, and Shriners' Hospital, Twin Cities Unit. These operations included inserting staples, removing and reinserting staples, and removing staples and performing hemiester operations.

Table II shows the predilection of the surgeons for using the lower femoral epiphyses in the great preponderance of
Table II

<table>
<thead>
<tr>
<th>Etiology</th>
<th>No. of Cases</th>
<th>Type of Stapling or Phemister Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Femoral</td>
</tr>
<tr>
<td>Poliomyelitis</td>
<td>26</td>
<td>29</td>
</tr>
<tr>
<td>Non-Paralytic</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>44</strong></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>

cases both in the polio (66%), and the non-paralytic (84%) groups. This is explained on the grounds that the lower femoral epiphysis is easier to approach; when the tibial epiphysis is stapled the fibula must also be taken into account. Secondly, since it is believed that the staples can be removed at will and growth restarted, the femoral epiphysis will grow faster and accomplish more than would the tibial epiphysis; thirdly, marked shortening of the lower leg in girls is not desirable cosmetically.

The stapling of all epiphyses around the knee joint was reserved for cases in which the actual or expected discrepancy was greater or the age of the patient made it imperative to stop growth as fast as possible (at a rate of 2.2 cm. per year).

The age at operation ranged from 7 to 14 years:

<table>
<thead>
<tr>
<th>Age</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>14</td>
<td>2</td>
</tr>
</tbody>
</table>

We believe that eight years is a satisfactory lower age limit for the average case. It is best not to do the procedure on younger patients because of the technical difficulties in driving the staples into the thick cartilaginous ends of the bones of younger children. In younger patients the staples are most liable to spring out again and are more likely to bend.

The follow-up period ranges from 6 months to 4 years, averaging 1 year and 10 months. This does not include the Phemister operation. This was performed in 13 cases when it appeared the staples would not be equal to the task of equalization by the time the growth was concluded.

Experiences with the Staples:

From June, 1946 to July, 1947 sets of two staples to a side were used to contain the epiphysis, and it was in that year that most of the difficulties occurred. Some of the staples pulled out and others were widely spread by the growth force. According to Blount it takes only 25 pounds pull to bend the points of a single staple apart 1/3".

In the second year the legs of the staples were notched in an effort to keep them in place. Later in the second year three notched staples were used on each side. Because the notched staples made removal so difficult and constituted a threat to the integrity of the growing plate on removal, it was deemed advisable to return to smooth staples. Three smooth staples have been found to hold just as well as the notched ones.

The staples we have used throughout are 3/32" in diameter, with a 5/8" bridge, and legs which are 3/4" long. They are made of stainless steel.

Evaluation of Results:

1. Lengths of extremities determined by clinical measurement were used as a check on the operation, and of necessity were frequently made by different clinicians with variable results.

2. In some cases the stated purpose of the operation was to retard an increasing discrepancy rather than to gain a true equalization of leg
length. This occurred in cases in which the child was of very short stature. The physician preferred a slight lift on the short leg rather than an arrest of the growth at a height which might be damaging to the personality of the patient.

3. Occasionally operations were performed for other defects of the limbs which would alter the leg length independently of the stapling operation.

4. If, generally speaking, the growth of extremities is complete at 13.9 years in the female and 15.9 years in the male, the results of this study must be considered incomplete as only 15 patients have passed these limits. However, in a few cases the epiphyseal growth has stopped before the patient reached the predicted age of closure.

Clinical Results:

It is well known that shortening of 1" or less is satisfactory as the shorter side can be equalized easily with a small lift. Therefore, we have chosen a discrepancy of 2 cm. or less as a good result. We include as successful the cases which have achieved the anticipated result regardless of discrepancy. In the mediocre bracket are all corrections between 3½ cm. and 2 cm., and the incomplete studies. Poor results are those showing a discrepancy of leg length over 3½ cm.

<table>
<thead>
<tr>
<th>Results</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good results</td>
<td>19</td>
<td>43%</td>
</tr>
<tr>
<td>Mediocre (some incomplete)</td>
<td>12</td>
<td>27%</td>
</tr>
<tr>
<td>Poor</td>
<td>13</td>
<td>30%</td>
</tr>
</tbody>
</table>

As stated before, it was found that whereas two staples per side bridging the epiphysis could not stop the growth in many cases, sets of three staples to a side seemed to work much better. Therefore, we shall take the results in Table III and divide the cases into those in which two staples per side were used and those in which three or more were used.

Table IV

<table>
<thead>
<tr>
<th>Two Staples Per Side</th>
<th>Results</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>7</td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td>Mediocre</td>
<td>4</td>
<td>19%</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>10</td>
<td>48%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Three or More Per Side</th>
<th>Results</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>12</td>
<td>52%</td>
<td></td>
</tr>
<tr>
<td>Mediocre</td>
<td>8</td>
<td>35%</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>3</td>
<td>13%</td>
<td></td>
</tr>
</tbody>
</table>

In Table III we found that of 19 cases, or 43%, where the anticipated goal was obtained, 11 were in the non-paralytic group and 8 were in the poliomyelitic group. We find it hard to explain the superiority of the results in the non-paralytic group, and statistically at this time no explanation other than "due to chance" would be valid.

We found that sex made no difference as the number of good results were evenly divided percentage-wise between males and females. Also we found no apparent connection between the age of onset of disease and the amount of shortening prior to surgery. This is in agreement with the findings of Stinchfield, Reidy,
and Barr in poliomyelitis patients. 26

Unfortunately, in our studies we have not had an opportunity to confirm Blount's statement 6 that growth resumes upon removal of staples. Twenty-four of the 44 cases still retain the staples; 13 of the early cases have had a Phemister type arrest; of the remaining 7 cases two regained growth after the staples were removed, two showed no growth as the staples were removed after the epiphyses had closed, and three had not been well enough documented to show definite results following the removal of the staples.

Positive knowledge that all cases would resume growth upon removal of staples would make for greater success because the surgeon could operate on younger patients with impunity. There would no longer be the danger of waiting too long to staple because of fear of incorrectable overgrowth of the involved limb.

While considering the clinical results, it would be wise to discuss the deformities of growth resulting from stapling and requiring operative correction.

Deformities resulting from unequal arrest of growth of all parts of the epiphysis constituted a very serious hazard when the operative fusion of Phemister was performed. A careful study of Straub, Thompson, and Wilson 27 on 89 cases which were fused by the method of Phemister showed 8 cases or 10% of their series had a serious deformity resulting which required operative correction. In another 7 cases deformities were noted which were not severe enough to have operative correction.

In our series there have been six cases of deformities requiring operative interference and one which did not. However, only one of the six required a serious operation. The others involved were noted to have a valgus or varus deformity of the knee from the staples pulling out, thereby becoming inefficient in halting growth on one side. These were corrected in every case by one of two ways:

1. Reinserting the staples and removing them from the opposite side until equalization occurred.
2. By doing a Phemister on the side on which the staples had slipped and removing the staples from the other side until the growth was equalized and the deformity corrected, and then doing a Phemister on the second side. These corrective measures are fairly simple and there have been no serious deformities as a final outcome.

In three cases out of the entire series, excessive correction has been obtained. These cases illustrate some of the vagaries of human epiphyseal growth. The first was a boy with a congenital dislocation of the left hip with shortening. He had the lower femoral epiphysis on the right stapled at the age of 12 years, 5 months when the discrepancy was 4 cm. In nine months time the boy underwent a growth spurt of 5 cm. on the affected side following which his epiphysis closed prematurely. He had no clinical asymmetry and was judged a good result.

The second patient was a girl with poliomyelitis who had a stapling of the lower femoral, upper tibial and fibular epiphysis at age 11 years, 5 months for 4 cm. of shortening. In two years six months she had an overcorrection of 2 cm. with a valgus of the stapled knee. The staples were then removed at which time the patient sustained a peroneal nerve injury with foot drop which later improved spontaneously. Now 1 year later she has maintained her 2 cm. of overcorrection and the epiphysis is closed.

The third patient was a boy with Legg-Perthes disease who had a stapling of the lower femoral epiphyses at the age of 13 years, 1 month, for 4 cm. of shortening. In 2 years, 11 months, there was an overcorrection of 1 cm. and the epiphysis was closed.

Although there was overcorrection in three cases, each was minimal and the final result was judged as being good.
B. Other Uses of Staples

1. Unilateral stapling is very important in angular deformity about the knee joint. There have been some excellent reports on its use. In two cases studied the results were indefinite and it was concluded that surgery was performed too late.

2. Unilateral stapling was used in one case of valgus of the ankle joint from osteomyelitis with slight improvement.

3. In arthrodesis of feet the staples have proven very useful in maintaining the bones in desired alignment both during and after applying a cast.

4. Staples have been used with good success in maintaining position in rotational osteotomy of the long bones.

Conclusions:

1. The clinical results from this series compare favorably with the results of the Phemister operation. Present findings suggest that it may prove to be superior when a longer follow-up period has passed.

2. It is our impression that the epiphysis continues to grow after the staples are removed, but the limitations of the present series do not allow for proof.

3. The importance of methods of prediction is reduced after the staples are placed, as clinical evaluation is of greatest importance following surgery.

4. Eight years of age is a satisfactory lower age limit for the average case. Usually it is better to wait a little longer as it is technically difficult to insert staples because of the large amount of cartilage at bone ends.

5. The lower end of the femur seems better accessible and not as fraught with the danger of a cosmetically poor lower leg as is the tibia.

6. Deformities following the stapling procedure are more easily correctible than those seen with the Phemister operation.

7. Angular deformity may be corrected during the growth period by asymmetrical placement of staples.

References

1. Bick, E. A.
   Source Book of Orthopaedics.
   Baltimore. Williams & Wilkins Co., '37.

2. Bidder, Alfred
   Experimente über die künstliche
   Hemmung des Längen Wachstums.
   Arch f. Exp. Path und Pharm. L;248,1873.

3. Bisgard, L. D.
   Longitudinal Bone Growth: The Influence of Sympathetic Denervation.

4. Bloodgood, J. C.
   Progressive Med. 8:171-273 (Fig.18), '06.

5. Blount, W. P. and Clarke, G. R.
   Control of Bone Growth by Epiphyseal Stapling.

6. Blount, W. P.
   Control of Bone Length
   Jour. of Bone and Joint Surg., 32:
   513-514 (Nov.) '50.

7. Blount, W. P.
   Personal Communication

8. Digby, K. H.
   The Measurement of Diaphysial Growth in Proximal and Distal Directions.

8. Gaudier et Bouret
   Arrachement de La Tuberosite Tibiale
Orthoroentgenography as a method of measuring the bones of the lower extremity.

11. Green, W. T. and Anderson, Margaret.
Experiences with epiphyseal arrest in correcting discrepancies in length of lower extremities in Infantile Paralysis. A method of predicting the Effect.

12. Haas, S. L.
Experimental Transplantation of Epiphysis with Observations on Longitudinal Growth of Bone.

13. Haas, S. L.
Relation of Blood Supply to Longitudinal Growth of Bone.

14. Haas, S. L.
Changes produced in Growing Bone after Injury to Epiphyseal Cartilage Plate.

15. Haas, S. L.
Retardation of Bone Growth with a Wire Loop.

16. Haas, S. L.
Mechanical Retardation of Bone Growth.

17. Harris, R. I.
The Effect of Lumbar Sympathectomy on Growth of Legs Shortened by Poliomyelitis.

18. Harris, R. I. and McDonald, J. L.
The Effect of Lumbar Sympathectomy upon the growth of legs paralyzed by Anterior Poliomyelitis.

19. Hendryson, I. E.
An Evaluation of the Estimated Percentage of Growth from the Distal Epiphysial Line.

20. Humphrey, G. M.
Excision of the Knee.
Medico-Chir Trans. 41:193-218, 1858.

21. Lindsay, D. T.
Control of Human Epiphyseal Growth.
M.S. Thesis, '49.

22. Ollier (quoted by Jahn)
Traite experimental de la regeneration des os, et la production artificielle du tissu osseux.
Paris, Masson et Fils, 1867.

23. Phemister, D. B.
Operative Arrest of Longitudinal Growth of Bones in Treatment of Deformities.

24. Poland, J.
Traumatic Separation of the Epiphysis.

Effect of Roentgen Irradiation on Epiphyseal Growth.

Prediction of unequal growth of the lower extremities in Anterior Poliomyelitis.

27. Straub, L. R., Thompson, T. C., and Wilson, B. D.
The Results of Epiphyseodesis and Femoral Shortening in Relation to Equalization of Limb Length.

28. Thomas, Hugh O.
Diseases of the Hip, Knee, and Ankle Joints.

29. White, J. Warren
II. MEDICAL SCHOOL NEWS

Coming Events

April 26-28 Continuation Course in Atomic Medicine for General Physicians
May 7-11 Continuation Course in Electrocardiology for General Physicians
May 8 George E. Fahr Lecture; "Certain Mechanical Peculiarities of the Heart," George E. Burch, Tulane University School of Medicine; Medical Science Amphitheater.
May 16 Special Lecture; "Investigations on the Assimilation of Amino-Acids by Bacteria," Ernest F. Gale, Cambridge University, England; Museum of Natural History Auditorium; 8:00 p.m.
May 16 Journal Lancet Lecture; "Brain Mechanism and Behavior," Heinrich Klüver, University of Chicago; Medical Science Amphitheater; 8:00 p.m.
May 17 Student Day and Medical Six O'Clock Dinner

Faculty News

Dr. Arthur Kirschbaum, Associate Professor of Anatomy, will receive the annual Medal of the American Cancer Society on April 21, 1951, in the Coffman Memorial Union. The award was made on the nomination of the Minnesota Division of the American Cancer Society and will be presented to Dr. Kirschbaum in recognition of his contributions in the field of cancer research. It is fitting that Dr. Kirschbaum should be honored at this time since he will be leaving our faculty at the close of this present academic year to take over his new post as Professor and Head of the Department of Anatomy of the College of Medicine at the University of Illinois. All of Dr. Kirschbaum's friends will wish to express their sense of loss and will wish to congratulate him on his challenging opportunity.

Alumni and Foundation Meet in Rochester

All faculty members, alumni, and friends of the Medical School who will be attending the annual meeting of the Minnesota State Medical Association in Rochester are cordially invited to attend the joint dinner meeting of the Minnesota Alumni Association and the Minnesota Medical Foundation. The dinner will be held in the University Club Cafe at the Hotel Kahler on Monday, April 30. Dr. J. F. Norman, President of the Minnesota State Medical Association, will preside at the festivities which will begin at 6:00 p.m. Principal speaker will be Dr. Theodore C. Blegen, Dean of the Graduate School of the University of Minnesota. His subject will be "The University Research Tradition: A Centennial Perspective." Members and guests of the organization will also hear greetings from Dean H. S. Diehl, Dr. Herman Drill, President of the Minnesota Medical Alumni Association, and Doctors Edwin J. Simons and Owen H. Wangensteen representing the Minnesota Medical Foundation. Ladies are cordially invited. For reservations, write Dr. G. N. Aagaard, 3330 Powell Hall.

Student Day and Medical Six O'Clock Dinner

Students, faculty, and friends of the Medical School are urged to reserve time in their calendars for two important Medical School events. It is fitting that both of these meetings will occur on May 17.

The first, a Medical Student Day Convocation, will be presented under the sponsorship of the Minnesota Medical Foundation at 11:00 a.m. The purpose of the meeting is to give undergraduate medical students an opportunity to report on research projects in which they have been engaged. Four papers will be presented and will be followed by short periods for discussion. Medical students who wish to report on their research are asked to submit titles by May 1, if possible, to Dr. G. N. Aagaard.

The second big event, scheduled for May 17 is the Medical Six O'Clock Club dinner presented under the sponsorship of the Medical Inter-Fraternity Council. Mark Listerud has announced that an outstanding array of talent will be available to entertain undergraduates, faculty, and alumni of the Medical School and their guests. More detailed announcements of both of these meetings will be published in the Bulletin later.
III.

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
WEEKLY CALENDAR OF EVENTS

Visitors Welcome

April 23 - 28, 1951

Monday, April 23

Medical School and University Hospitals

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 - 9:50</td>
<td>Roentgenology-Medicine Conference; L. G. Rigler, C. J. Watson and Staff; Todd Amphitheater, U. H.</td>
</tr>
<tr>
<td>9:00 - 10:50</td>
<td>Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; M-109, U. H.</td>
</tr>
<tr>
<td>10:00 - 12:00</td>
<td>Neurology Rounds; A. B. Baker and Staff; Station 50, U. H.</td>
</tr>
<tr>
<td>11:00 - 11:50</td>
<td>Physical Medicine Seminar; Bone Growth in Poliomyelitis; Glenn Cullickson; E-101, U. H.</td>
</tr>
<tr>
<td>11:00 - 12:00</td>
<td>Cancer Clinic; K. Stenstrom and A. Kremen; Eustis Amphitheater, U. H.</td>
</tr>
<tr>
<td>12:00 - 12:50</td>
<td>Physiology Seminar; Endocrine Factors in Sodium Homeostasis; Daniel Simmons; 214 Millard Hall</td>
</tr>
<tr>
<td>12:15 - 1:20</td>
<td>Obstetrics and Gynecology Journal Club; Staff Dining Room, U. H.</td>
</tr>
<tr>
<td>1:30 - 2:30</td>
<td>Pediatric-Neurological Rounds; R. Jensen, A. B. Baker and Staff; U. H.</td>
</tr>
<tr>
<td>4:00</td>
<td>Public Health Seminar; 113 Medical Sciences.</td>
</tr>
<tr>
<td>4:00</td>
<td>Pediatric Seminar; Clotting Mechanisms in Hemorrhagic Diseases; James Dugger; Sixth Floor West, U. H.</td>
</tr>
<tr>
<td>4:30 - 5:30</td>
<td>Dermatological Seminar; M-436, U. H.</td>
</tr>
<tr>
<td>5:00 - 5:50</td>
<td>Clinical Medical Pathologic Conference; Todd Amphitheater, U. H.</td>
</tr>
<tr>
<td>5:00 - 6:00</td>
<td>Urology-Roentgenology Conference; C. D. Croevey, O. J. Baggenstoss, and Staffs; Powell Hall Amphitheater</td>
</tr>
</tbody>
</table>

Minneapolis General Hospital

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30 - 10:00</td>
<td>Pediatric Rounds; Dr. Lowry; 7th Floor Annex.</td>
</tr>
<tr>
<td>11:00</td>
<td>Pediatric Rounds; Franklin Top; 7th Floor Annex.</td>
</tr>
<tr>
<td>1:00 - 2:00</td>
<td>Staff Meeting; Classroom, 4th Floor.</td>
</tr>
<tr>
<td>1:30</td>
<td>Pediatric Rounds; Dr. Ulstrom; 5th Floor Annex.</td>
</tr>
</tbody>
</table>

Veterans Administration Hospital

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00</td>
<td>G. I. Rounds; R. V. Ebert, J. A. Wilson, Norman Shrifter; Bldg. I.</td>
</tr>
</tbody>
</table>
**Monday, April 23 (Cont.)**

**Veterans Administration Hospital (Cont.)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:30</td>
<td>X-ray Conference; Conference Room, Bldg. I.</td>
</tr>
<tr>
<td>1:00</td>
<td>Metabolic Disease Rounds; N. E. Jacobson and G. V. Loomis; Bldg. I.</td>
</tr>
<tr>
<td>4:00</td>
<td>Therapeutic Conference; Conference Room, Bldg. I.</td>
</tr>
</tbody>
</table>

**Tuesday, April 24**

**Medical School and University Hospitals**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00</td>
<td>Roentgenology-Pediatric Conference; L. G. Rigler, I. McQuarrie and Staffs; Eustis Amphitheater, U. H.</td>
</tr>
<tr>
<td>9:00</td>
<td>Cardiovascular Rounds; Station 30, U. H.</td>
</tr>
<tr>
<td>12:30</td>
<td>Pathology Conference; Autopsies; J. R. Dawson and Staff; 102 I. A.</td>
</tr>
<tr>
<td>1:00</td>
<td>Physiology Seminar on Cardiac Metabolism; 129 Millard Hall.</td>
</tr>
<tr>
<td>3:15</td>
<td>Gynecology Chart Conference; J. L. McKelvey and Staff; Station 54, U.H.</td>
</tr>
<tr>
<td>4:00</td>
<td>Pediatric Rounds on Wards; I. McQuarrie and Staff; U. H.</td>
</tr>
<tr>
<td>4:00</td>
<td>Physiology-Surgery Conference; Todd Amphitheater, U. H.</td>
</tr>
<tr>
<td>5:00</td>
<td>Electrocardiographic Conference; EKG Laboratory, 6th Floor, U. H.</td>
</tr>
<tr>
<td>5:00</td>
<td>X-ray Conference; Presentation of Cases by Ancker Hospital Staff; Eustis Amphitheater, U. H.</td>
</tr>
<tr>
<td>8:00</td>
<td>Journal Club; E-101, U. H.</td>
</tr>
</tbody>
</table>

**Ancker Hospital**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00</td>
<td>X-ray Surgery Conference; Auditorium.</td>
</tr>
</tbody>
</table>

**Veterans Administration Hospital**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:45</td>
<td>Surgery Journal Club; Conference Room, Bldg. I.</td>
</tr>
<tr>
<td>9:30</td>
<td>Surgery-Pathology Conference; Conference Room, Bldg. I.</td>
</tr>
<tr>
<td>10:30</td>
<td>Surgery Tumor Conference; Conference Room, Bldg. I.</td>
</tr>
<tr>
<td>1:00</td>
<td>Chest Surgery Conference; T. Kinsella and Wm. Tucker; Conference Room, Bldg. I.</td>
</tr>
<tr>
<td>1:30</td>
<td>Liver Rounds; Samuel Nesbitt</td>
</tr>
<tr>
<td>2:00</td>
<td>Dermatology and Syphilology Conference; H. E. Michelson and Staff; Bldg. III.</td>
</tr>
<tr>
<td>3:30</td>
<td>Clinical Pathological Conference; Conference Room, Bldg. I.</td>
</tr>
</tbody>
</table>
Wednesday, April 25

Medical School and University Hospitals

8:00 - 8:50 Surgery Journal Club; O. H. Wangensteen and Staff; M-109, U. H.
8:00 - 9:00 Roentgenology-Surgical-Pathological Conference; Allen Judd and L. G. Rigler; Todd Amphitheater, U. H.
11:00 - 12:00 Pathology-Medicine-Surgery Conference; Medicine Case; O. H. Wangensteen, C. J. Watson and Staffs; Todd Amphitheater, U. H.
12:00 - 1:00 Radioisotope Seminar; Literature Review; J. C. Wang; 113 Medical Sciences.
4:00 - 6:00 Ophthalmology Seminar; Todd Room, 5th Floor, U. H.
5:00 - 5:50 Urology-Pathological Conference; C. D. Creevy and Staff; Eustis Amphitheater.
4:30 - Motion Picture; The Heart; Todd Amphitheater, U. H.
5:00 - 7:00 Dermatology Clinical Seminar; Dining Room, U. H.
7:00 - 8:00 Dermatology Journal Club; Dining Room, U. H.
8:00 - 10:00 Dermatological-Pathology Conference; Review of Histopathology Section; Robert Goltz; Todd Amphitheater, U. H.

Ancker Hospital

8:30 - 9:30 Clinico-Pathological Conference; Auditorium.
3:30 - 4:30 Journal Club; Surgery Office.

Minneapolis General Hospital

8:30 - Pediatric Rounds; Dr. Lowry; 7th Floor Annex.
9:00 - Pediatric Allergy Rounds; Dr. Nelson; 4th Floor Annex.
11:00 - 12:00 Pediatric Rounds; Franklin Top; 7th Floor Annex.
12:15 - Staff Meeting; 4th Floor Annex.
1:30 - Pediatric Rounds; Dr. Huenekens and Dr. Ulstrom; 5th Floor Annex.

Veterans Administration Hospital

8:30 - 10:00 Orthopedic-Roentgenologic Conference; Edward T. Evans and Bernard O'Loughlin; Conference Room, Bldg. I.
8:30 - 12:00 Neurology Rehabilitation and Case Conference; A. B. Baker.
7:00 p.m. Lectures in Basic Science of Orthopedics; Conference Room, Bldg. I.
Thursday, April 26

Medical School and University Hospitals

9:00 - 9:50 Medicine Case Presentation; C. J. Watson and Staff; M-109, U. H.
10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.
11:00 - 12:00 Cancer Clinic; K. Stenstrom and A. Kremen; Todd Amphitheater, U. H.
12:00 - Physiological Chemistry Seminar; Photochemical Alteration of Proteins, Enzymes, and Viruses; Sheldon Dray; 214 Millard Hall.
1:00 p.m. Motion Picture; The Heart; Todd Amphitheater, U. H.
4:30 - 5:20 Ophthalmology Ward Rounds; Erling W. Hansen and Staff; E-534, U. H.
5:00 - Bacteriology Seminar; Bacterial Metabolism of Fatty Acids; Arthur Peterson; 214 Millard Hall.
5:00 - 6:00 Radiology Seminar; Follow-up on Thorotrust Studies; John W. MacDonald; Eustis Amphitheater, U. H.
7:30 - 9:30 Pediatrics Cardiology Conference and Journal Club; Review of Current Literature 1st hour and Review of Patients 2nd hour; 206 Temporary West Hospital.

Minneapolis General Hospital

8:30 - Neurology Rounds; Dr. Heilig; 4th Floor Annex.
11:30 - Pathology Conference; Main Classroom.
1:00 - 2:00 EKG and X-ray Conference; Classroom, 4th Floor Annex.
2:00 - Psychiatry Rounds; Dr. Benton; 4th Floor Annex.
2:00 - 4:00 Infectious Disease Rounds; 8th Floor.
4:00 - 5:00 Infectious Disease Conference; Classroom, 8th Floor.

Veterans Administration Hospital

8:00 - Surgery Ward Rounds; Lyle Hay and Staff.
9:15 - Surgery Grand Rounds; Conference Room, Bldg. I.
11:00 - Surgery-Roentgen Conference; Conference Room, Bldg. I.
2:15 - Chest Rounds; William Stead.

Friday, April 27

Medical School and University Hospitals

8:30 - 10:00 Neurology Grand Rounds; J. B. Baker and Staff; Station 50, U. H.
9:00 - 9:50 Medicine Grand Rounds; C. J. Watson and Staff; Todd Amphitheater, U. H.
Friday, April 27 (Cont.)

Medical School and University Hospitals (Cont.)

10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

10:30 - 11:50 Otolaryngology Case Studies; L. R. Boies and Staff; Out-Patient Department, U. H.

11:45 - 12:50 University of Minnesota Hospitals Staff Meeting; Electrophrenic Respiration; G. Keith Stillwell and Frederic J. Kottke; Powell Hall Amphitheater.

1:00 - 2:50 Neurosurgery-Roentgenology Conference; W. T. Peyton, Harold O. Peterson and Staff; Todd Amphitheater, U. H.

2:00 - 3:00 Dermatology and Syphilology Conference; Presentation of Selected Cases of the Week; H. E. Michelson and Staff; W-312, U. H.

3:00 - 4:00 Neuropathological Conference; F. Tichy; Todd Amphitheater, U. H.

4:00 - 5:00 Dermatology Seminar; W-312, U. H.

4:00 - 5:00 Vascular Rounds; Davitt Felder and staff members from the departments of Medicine, Surgery, Physical Medicine, and Dermatology; Eustis Amphitheater, U. H.

5:00 - Urology Seminar; Eustis Amphitheater, U. H.

Ancker Hospital

1:00 - 3:00 Pathology-Surgery Conference; Auditorium.

Minneapolis General Hospital

8:30 - Pediatric Rounds; Dr. Lowry; 7th Floor Annex.

10:00 - Pediatric Rounds; Franklin Top; 7th Floor Annex.

1:30 - Pediatric Rounds; Dr. Ulstrom; 5th Floor Annex.

Veterans Administration Hospital

10:30 - 11:20 Medicine Grand Rounds; Conference Room, Bldg. I.

1:00 - Microscopic-Pathology Conference; E. T. Bell; Conference Room, Bldg. I.

1:30 - Chest Conference; Wm. Tucker and J. A. Myers; Ward 62, Day Room.

3:00 - Renal Pathology; E. T. Bell; Conference Room, Bldg. I.
Saturday, April 28

Medical School and University Hospitals

7:45 - 8:50 Orthopedic X-ray Conference; Wallace H. Cole and Staff; M-109, U. H.

9:00 - 9:50 Medicine Case Presentation; C. J. Watson and Staff; E-221, U. H.

9:00 - 10:30 Pediatric Grand Rounds; I. McQuarrie and Staff; Eustis Amphitheater, U. H.

9:15 - 10:00 Surgery-Roentgenology Conference; J. Friedman, O. H. Wangensteen and Staff; Todd Amphitheater, U. H.

10:00 - 11:30 Surgery Conference; O. H. Wangensteen and Staff; Todd Amphitheater, U. H.

10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

10:00 - 12:50 Obstetrics and Gynecology Grand Rounds; J. L. McKelvey and Staff; Station 44, U. H.

11:00 - 12:00 Anatomy Seminar; Descending Degeneration After Hemispherectomy in Human Adult, A. T. Rasmussen; The Effect of Prolonged Glucose Treatment on Glucose Tolerance and Islet Cell Morphology, L. O. Ingersoll; 226 Institute of Anatomy.

Ancker Hospital

8:30 - 9:30 Surgery Conference; Auditorium.

Minneapolis General Hospital

11:00 - 12:00 Pediatric Clinic; Dr. Thomas and Dr. Good; Classroom, 7th Floor Annex.

Veterans Administration Hospital

8:00 - Proctology Rounds; W. C. Bernstein and Staff; Bldg. III.

8:30 - Hematology Rounds; P. Hagen and E. F. Englund.