

A Glimpse Into the Past of Orthopaedic Surgery at The University of Pennsylvania:

David Hayes Agnew, “the most experienced surgeon, the clearest writer and teacher, and the most venerated and beloved man.”

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Introduction

Every Thursday, Orthopaedic surgery residents, fellows, attendings, medical students and visitors walk into the Agnew Grice Auditorium of The Hospital of The University of Pennsylvania to attend weekly Orthopaedic Grand Rounds (Fig. 1). How many are aware of the history of the men for whom the auditorium is named? Several months ago, the senior author of this article came across a pamphlet that gave insight into one of these two men, David Hayes Agnew (Fig. 2). This pamphlet was written by De Forest Willard, perhaps the first pediatric surgeon and first pediatric orthopaedic surgeon in the Philadelphia region. The current article will focus on the life of David Hayes Agnew and his colleague, friend, student and biographer De Forest Willard (author of the pamphlet written in 1892 describing the life of Agnew, reprinted below). The stories of the two men are as follows.

David Hayes Agnew (Fig. 3)

David Hayes Agnew was born in 1818. He graduated from the University of Pennsylvania in 1838 and shortly thereafter established a general and surgical practice in Philadelphia. He subsequently was appointed Head of the Philadelphia School of Anatomy in 1853; he became the Demonstrator of Anatomy and Assistant Lecturer in Clinical Surgery at the University of Pennsylvania in 1863 after leaving his position at the Philadelphia School of Anatomy. In 1870, he was chosen as Chair of Operative Surgery at The University of Pennsylvania and the next year, in 1871, John Rhea Barton Professor of Surgery at the University of Pennsylvania.

Agnew was one of the foremost anatomists and surgeons of his day with considerable gifts for teaching, writing and

surgery. He developed a large clinical practice and had an outstanding practical experience in most areas of surgical disease. Agnew published many clinical and surgical works. His major work was the three volume, *Principles in Practice of Surgery* written between 1878 and 1883, later called a “monument to his life-work.” As described by his biographer, Jay Howe Adams in *The Life of D. Hayes Agnew* written in 1892, all 2,912 pages of *Principles and Practice of Surgery* were written “with his own pen . . . doing it at odd times, such as working late into the night and getting up early in the morning, working before his early breakfast . . . it is a medical diary of his professional life for 51 years.” The textbook was translated into Japanese and published in Tokyo, Japan in 1888. Agnew was married in 1841 and had no children.

A snapshot of early American surgery and Agnew’s life’s work is depicted in the painting “The Agnew Clinic” by Thomas Eakins (Fig. 4). “The Agnew Clinic” was a tribute to the popular Agnew and was commissioned at the price of \$750.00 by a group of Agnew’s former students to commemorate his 26 years of service at the University of Pennsylvania. The painting is large with the dimensions of 11 × 6½ feet which is physically larger than “The Gross Clinic,” also painted by Eakins (Fig. 5). The inscription on “The Agnew Clinic” reads “D. Hayes Agnew, M.D., Chirurgus Peritissimus. Cripitor et doctor clarissimus. Vir Veneratus at et Carissimus.” Translated, this means “the most experienced surgeon, the clearest writer and teacher, the most venerated and beloved man.” As compared to the “Gross Clinic” painting which was done several years earlier, several advances in surgery can be observed in the Agnew painting. As shown in Figs. 4 and 5, Agnew and his surgical team are gowned in surgical attire rather than the street clothes of the “Gross Clinic.” The dispensing of chloroform for anesthesia is also depicted by the artist in the Agnew painting. Additionally, the presence of an operating room nurse as a member of the surgical team is of particular importance. Both of Eakins famous paintings incorporate an audience of surgical resident onlookers into the background. The painting, which is normally displayed in the John Morgan Building of The University of Pennsylvania, is now going through a cleaning

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Department
of
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Agnew Grice
Auditorium



Fig. 1. The sign posted on the wall outside the Agnew Grice Auditorium at the Hospital of The University of Pennsylvania.

and restoration process after being exhibited at The Philadelphia Museum of Art last year.

Agnew was a very prominent surgeon. His prominence is exhibited when he and several other physicians were summoned to Washington, DC after the assassination of President James Garfield on July 2, 1881. Garfield subsequently died of infection and sepsis. Some speculate that the infection was enhanced by the probing and explorations of the multiple physicians who were summoned to help. The entire affair provoked great controversy surrounding the medical and surgical care of the president. The 1881 Currier and Ives lithograph shown in Fig. 6 depicts the death of President Garfield (1831 to 1881) after his assassination.

Agnew is remembered as one of the founding fathers of American Surgical science and certainly, one of the giants of surgery in Philadelphia medicine.

De Forest Willard (Fig. 7)

De Forest Willard was born in 1846 in Newington, Connecticut. He graduated from Yale College in 1863 and thereafter attended Jefferson Medical College. Willard contracted polio as a young child and consequently developed a clubfoot deformity. He subsequently became a patient of D. Hayes Agnew and in the summer of 1864, Agnew surgically addressed the residual polio contracture with an Achilles tendon tenotomy. This apparently resulted in a considerable improvement in function and ambulation for Willard. Through these interactions with Agnew, Willard was attracted to the field of surgery and transferred from Yale College to the University of Pennsylvania School of Medicine; he graduated in 1867. In March of 1867 Willard,

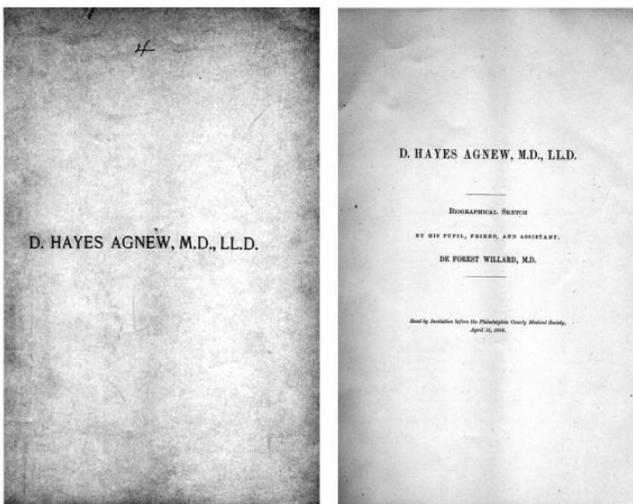


Fig. 2. The pamphlet written and read by De Forest Willard, MD. "D. Hayes Agnew, MD, LLD: Biographical Sketch." April 13, 1892.



Fig. 3. D. Hayes Agnew, MD, LLD.



Fig. 4. “The Agnew Clinic” painted by Thomas Eakins was a large painting with the dimensions of $11 \times 6\frac{1}{2}$ feet. The inscription on the painting reads, “D. Hayes Agnew, MD, Chirurg us Peritissimus. Criptor et doctor clarissimus. Vir Veneratus at et Carissimus.” Translation: “the most experienced surgeon, the clearest writer and teacher, the most venerated and beloved man.”

began work as a resident physician at the Philadelphia General Hospital for the next 15 months. After finishing residency, he developed a large practice in Philadelphia. He was affiliated with the University of Pennsylvania Anatomy and Surgical Departments for his entire career and also worked at Presbyterian Hospital. He was appointed Lecturer in Orthopaedic Surgery at the University of Pennsylvania in 1887, Clinical Professor in 1889 and full Professor in 1893. He had numerous contributions to the surgical literature including the *Surgery of Childhood, including Orthopaedic Surgery* published in 1910. He also wrote numerous chapters for many of the surgical textbooks mostly in the field of orthopaedic surgery.



Fig. 5. “The Gross Clinic” painted by Thomas Eakins.

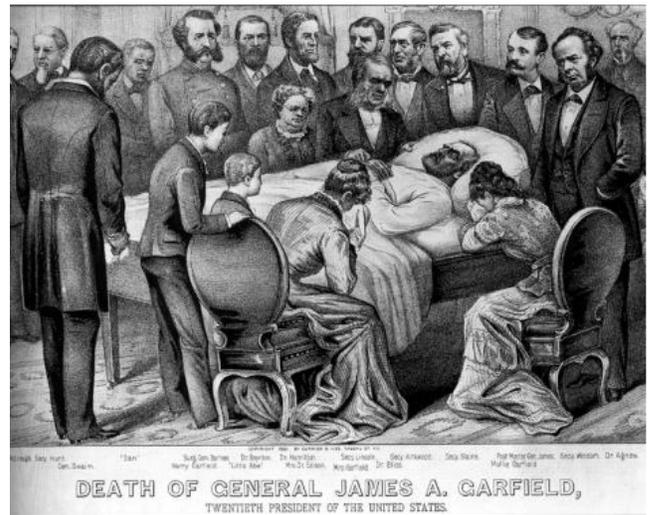


Fig. 6. Currier and Ives lithograph of 1881 depicting the death of President James Garfield (1831 to 1881) after his assassination. Agnew is depicted at the far right.

In addition to his surgical practice, teaching and writing, Willard was involved with many organizations and outside interests. He was involved with fund-raising to build the Agnew wing of the Hospital of the University of Pennsylvania and was credited with organizing the initial Department of Orthopaedic Surgery at the University of Pennsylvania. He served as President of the American Orthopaedic Association in 1890 and President of the American Surgical Association in 1902. He was also chairman of the American Medical Association Section of Surgery in 1902. He served as Surgeon-in-Chief for the *Widener Memorial Industrial Training School for Crippled Children* in Philadelphia.

Willard was a strong advocate for the use of X-rays in orthopaedic surgery. In 1896 he was one of the first to demonstrate the values of roentgenograms for the American

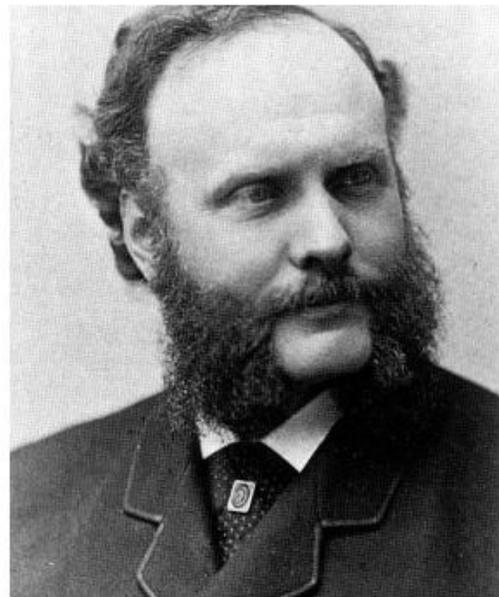


Fig. 7. De Forest Willard, MD.

Surgical Associate and the American Orthopaedic Association. The early portion of the 20th Century was very important in the formation in the specialty for the following reasons. With the widespread availability of X-ray, numerous orthopaedic conditions became better recognized and defined. Further, during this time there was an increasing sense of responsibility for the treatment of children with musculoskeletal and neuromuscular disorders. Numerous "hospital-schools for crippled children" were established and built. Many of these facilities had an orthopaedic surgeon on staff, sometime full-time. One such example was the *Widener Memorial Industrial Training School for Crippled Children* in Philadelphia which was started in 1906. Willard became one of the first pediatric surgeons in the United States. He is known for several surgical advances including costotransversectomy and nerve grafting.

The following are the contents of a biographical sketch of Hayes written after his death on March 22, 1892. De Forest Willard wrote and read the sketch before the Philadelphia Medical Society, April 13, 1892:

The task imposed upon me tonight is one both of sorrow and of pleasure; of sorrow at the loss of a true, tried, and steadfast friend; of pleasure such as comes to all of us who dwell on the sterling qualities of those we love.

During a close and intimate friendship of twenty-five years, Dr. Agnew has been my counsellor, adviser, teacher, helper—a father in everything. For many years I saw him daily; was with him in his work in the dissecting- and operating-rooms, and was associated with him both in his public and private operations. During this time and through all the later years I have had abundant opportunities to judge of his masterly skill and of his rare personal qualities.

There is scarcely one member of this Society tonight who cannot recall some act of kindness from the hands of this grand old man. He was great as a surgeon; but it was especially as a man that we loved him. His personal magnetism and his calm dignity drew the student to him at his first lecture, and never afterward did thought of disrespect enter the latter's mind. Annually, for forty years, he sent forth classes of young men, each one of whom was his friend, and each one of whom he elevated by his innate nobility. He had many great qualities, but for none of them was he so beloved as for his uniform kindness to "his boys," and as we grew in years he did not forget us.

He was eminent as a teacher, a surgeon, a consultant, a writer, and as a noble man.

For many long years in the Philadelphia School of Anatomy, on Chant Street, he toiled patiently and unceasingly, spending, as he has often told me, from twelve to eighteen hours per day in the dissection of the components of that wonderful structure which he learned to know so well. His industry during these years may be judged by the fact that in addition to his dissections and practical work, he lectured five evenings every week from the 1st of September to the 1st of March, and three evenings from the 1st of April to the 1st of August. The rooms were open from 8 A.M. to 10 P.M. During this time he had as Assistant Demonstrators such men as Samuel D. Gross, R. T. Levis, and others.

His addresses, delivered at the close of each winter session, covered a wide variety of subjects, not only medical, but of general literature, and the questions of the day.

His classes were always most enthusiastic, as we may judge from their expressions: "His unrivalled course of lectures his finished manner of teaching; his high-toned, gentlemanly courtesy and kindness to us as strangers."—"There is no course from which we have derived greater gratification and profit than from the one on surgical and practical anatomy," etc.

When he entered the school, as is stated in one of his addresses, "that single front bench afforded ample accommodation for my audience." He left it with two hundred and sixty-seven students, the largest private class ever assembled in this country. His advice in these valedictory addresses was most helpful. "In espousing this profession you incur a moral obligation which may not be lightly shaken off."—"To fathom the laws by which these mysterious processes are conducted requires concentration of mind, acuteness of observation, and the philosophical adaptation of all the facts at command."—"There is a power, a moral sublimity in undismayed perseverance and virtue, which plants its shoulder resolutely against the wheel of Life, and not idly supplicating the aid of Jupiter, forces and compels the world to respect and homage."—"Promotion is a plant of slow growth." (It would be well for those who desire professorships on the year of their graduation to remember that at fifty-two years of age Dr. Agnew was still a Demonstrator of Anatomy!) "Let me pray that in whatever spot you may fix your habitation, you may never cease to cherish the name AMERICAN CITIZEN, enjoy the rich rewards of your profession, and Heaven's choicest blessings."

In calling upon the young men to consider well their qualifications for the profession, he put to them the following questions: "Have you a physical constitution which can endure all things, suffer all things? Have you an intellect trained by a primary education to habits of observation, unending application, rigid analysis, and logical processes? Have you a will inflexible as steel, which no obstacle can daunt, no perplexities embarrass? Have you a high moral sense and unimpeachable integrity?"

"Medicine is amongst the noblest of pursuits. The subject of its investigation is the crowning act of creation, the masterpiece of Heaven's mechanism." Such were the words with which he stimulated and elevated his followers. He was, indeed, like one of the old masters in medicine.

His knowledge of anatomy was so accurate that he never seemed to think about it, and in all his subsequent surgical work his success was largely dependent upon this training. So important did he consider the practical knowledge gained by the study of the cadaver that it pained him to see it falling into neglect, or replaced by the teaching from books or charts, no matter how elaborate. Filled with his subject, and a thorough master of his art, his demonstrations with knife in hand and with cadaver before him were unequalled. Difficulties were cleared away as if by magic, and the students had before them a plain, clear, concise picture of the region under discussion. The surgical anatomy of the per-

ineum and of hernia, those bugbears to students, seemed as plain as noontday.

Years of struggle, patient labor, and hard study brought knowledge; knowledge with him meant skill, and from this slowly came honor, fame, and fortune.

The University of Pennsylvania, ever on the alert to secure the services of just such able men, invited him to the position of Demonstrator of Anatomy, in 1863, and from that time until his death his name has been associated with every advance of that great institution. His success added to her fame and brought crowds of students to her doors. In 1870 he was elected Professor of Clinical Surgery, and in 1871 John Rhea Barton Professor of the Principles and Practice of Surgery. When the University Hospital was added to the enlarged field in West Philadelphia, the opportunities for the display of his skillful methods of clinical teaching were greatly augmented, and his clinics were always most instructive. Whether engaged in didactic or clinical teaching, his manners and methods were nearly the same—eminently practical without any attempt at oratory or dramatic effect. He possessed the power of presenting the truth in an instructive form, and in such a manner that the student could grasp and retain it.

Apparently unconscious of his fame, no student will forget his presence in the amphitheater. He was markedly conservative and cautious, yet, while critical as to innovations, he was always ready to accept rational new methods.

Quick to perceive the practical value of antisepsis, he early lent to it his influence, and by his powerful example and teaching gradually secured for it the foothold which it deserved. He was always progressive, even to the day of his death; never content with less than the best results, and he taught nothing which he had not tested and proven. For thirty years he stamped the surgical teaching of the University with his individual power, and placed the school and himself in the forefront of advancement. The elevated character which he imparted to the surgical atmosphere of America has done much to raise in the esteem of the public this noble branch of science.

As a surgeon he was calm, cool, deliberate, yet rapid. His ambidextrous hands were equally capable of extracting a cataract, or of refracturing a bone. His recognition of surgical conditions by palpation was remarkable, and the accuracy of his diagnosis was seldom questioned. Under the most dangerous conditions, and in the face of appalling hemorrhage, he never lost his head, but quickly and judiciously adopted the best method of action. The writer well remembers a sudden rupture of an axillary vein during a reduction of a dislocation of old standing at the shoulder-joint, when the patient instantly collapsed, apparently into the grave. A quiet, but quick movement of the hand placed his thumb upon the subclavian; the danger was averted and the patient's life saved.

His manipulations with the knife were noted for accuracy, delicacy, and certainty. He was dextrous chiefly because he was so familiar with his anatomy. His rapid, sure, and brilliant cut through the perineum, as he penetrated these tis-

sues in search of a calculus, was not exceeded in grace by even the elder Pancoast. He had not the artistic touch of Levis in his operating, but in his work, as in everything else, his whole aim was safety and success.

In his middle life, when the differentiation of medicine into the specialties was not common, he covered the entire field of surgery and almost that of medicine, and even to the time of his death he had a large consultation practice in strictly medical diseases. He was an expert in nearly all of the leading specialties of today, and in all of these branches he had an excellent practice.

As a consultant, his manners and methods were stamped by two peculiarities—his keen, thorough insight into the disease, and his kindness of heart; these qualities inspired the confidence both of the patient and of the attending physician. His few quiet words and explanations as to the existing conditions were plainly delineated; the treatment to be pursued was carefully indicated, and any error that might have been made was corrected, but never to the detriment of the attending practitioner. There was no attempt to glorify his own services by depreciating those of others. He was, as Dr. Weir Mitchell has admirably said, “the doctor’s doctor.”

He was a recognized counsel of last resort, and whatever difficulty of diagnosis arose, a decision by the old gentleman (as he was affectionately called), was always decisive. He was the last of his generation in this city, as there is no surgeon of his age remaining.

He was an example of punctuality. When one had an engagement to meet him, it was always wiser to be ten minutes in advance of the appointment than two minutes late; yet he never was in a hurry. In driving with him through many years, I never heard him use a more vigorous expression to his driver than, “We must push on.” His counsel was sought for far and wide, and his private and consultation practice were both immense.

His attendance at the bedside of the martyred President Garfield will be remembered by all. He was, as was often remarked, “the most trusted adviser,” and his calm survey of the symptoms attendant upon that mortal wound resulted in prolonging the patient’s life and adding to his comfort. When it became necessary to use the knife, his hand was the one to relieve the pus borrowings, and his voice did most to cheer those who watched with his distinguished patient; yet he never seemed to feel that the eyes of the nation were upon him. I well remember journeying with him to his summer home after one of his memorable visits to Washington, immediately after his operation. All eyes were turned toward him, yet in the crowded car he sat upon a coal-box quietly and unconcernedly chatting now and then on passing events. At the sacrifice of his personal comfort and literary duties (he was then hard at work revising his *System of Surgery* for the second edition) he continued to perform his duty to the nation, caring little for the plaudits of his countrymen or for the criticism of would-be wiser men. His reward came not in the pittance granted by Congress (which he never desired), but in the heart of the widow and in the esteem of the nation. He did his whole duty in this case, as he did to every patient

who came under his care; rich and poor alike were sure of his kind and careful attention.

As an author his permanent fame must rest largely upon his *Principles and Practice of Surgery*. A busy man opening his pages never fails to find useful directions for treatment, clearly drawn lines for diagnosis, carefully delineated deductions in regard to prognosis, and positive opinions as to the arguments for and against operation; for Agnew knew as well when not to operate as when to cut—a quality not possessed by all surgeons. A student finds in its pages careful research and well-selected notes of medical history. Through the whole work runs the distinctive thread of his own personal experiences, from which his thoughtful and practical brain had gleaned so much. It is in this portion of his work that his individuality stands out so markedly. It is written in much the same manner as he lectured. He was always a teacher. When he theorized, his thoughts at once carried him to some practical results.

This work has been translated into the Japanese language, and is a standard of surgery in that country.

His *System of Surgery* covers the entire ground of surgical practice, including all the specialties as now practiced, but which were then but adjuncts. His masterly chapter upon Inflammation was fittingly introduced by his sentence: "Surgery is both a science and an art, and he who aspires to the possession of its principles will at once be confronted with a process so universal in its operation, so constantly recurring, that to ignore its diligent study is to enter upon one of the most responsible of the learned professions with a certainty of defeat; this process is inflammation."

His *Practical Anatomy for Dissectors* was issued in 1856. The preface to this work admirably expresses his whole line of teaching for forty years: "This work has been prepared with an eye single to the faithful economy of the student's time."

His monographs on *Laceration of the Female Perineum and Vesico-Vaginal Fistula* are excellent descriptions of the pioneer work of these operations.

As a writer he was not voluble, yet his industry was remarkable, and in the midst of an enormous practice he published more than one hundred journal articles during the past decade.

As a man and as a physician he was thoroughly honored. His students are scattered from Maine to California, and they are all his friends. His calm, grave face, so ready to light into a smile and never wanting in its kindly aspect, will ever remain in the hearts of his admirers. He was never morose, never discouraged; always calm exteriorly, yet after forty years of continuous teaching he was agitated by an approaching lecture. He was very reticent and undemonstrative, yet always cheerful—a cheerfulness born of his love for God, his profession, and his fellowmen. It was pain for him to be unable to do a friendly act. His convictions were strong, and he never seemed weak save when in his guileless simplicity he was made the tool of designing men. He was so honest that he seemed to fail to recognize the intrigues of others. He was honest in thought, in speech, and in action. He was honest as a surgeon; he always did the thing which

he believed to be the best for his patient. His hand was ever ready to assist the weak and struggling practitioner, and the profession of Philadelphia was, through him, raised to a higher plane. He had no jealousies. His honors came to him unsought, and they aroused no jealousies on the part of others because all recognized that what he gained he won. His success in life was achieved not by any turn of fortune, but by patient industry, by tireless application, by wise judgment, by thorough knowledge, by consummate skill, and by honest purpose of word and act. He was never ostentatious in anything. His familiar duster was a figure in the operating room, and he never seemed to realize that he was other than a surgeon trying to cure disease, and that he was teaching the young men just how to do it best.

His success, contrary to the usual custom of business, but as is not infrequently seen in the profession of medicine, came to him late in life. He was past thirty-five years of age when he returned to Philadelphia and commenced his victorious career. He was fifty-three before he was elected full Professor in the Faculty of the University.

Although frequently urged to accept positions in other colleges, his love for the University was so great that he was never tempted from his allegiance. He was, indeed, a tower of strength to this institution, and at no period could its Trustees have afforded to have submitted to the loss of such a man.

In private and in public he was always the same. In his home life his command to a servant was but a quiet request. For many years his retiring hour was at 9 o'clock, and when under pressure of literary work he was obliged to change his habits to a later hour, the trial seemed dangerous.

He was tall, strong, healthful, and vigorous. Rarely did he rest. His pleasure was work, and he pursued it unremittingly. His capacity for work was prodigious, and until an attack of grippe two years ago, he never seemed to tire. I have seen him after a long office work in the morning, fill ten or fifteen fixed consultation appointments in different parts of the city, in addition to his private work and operations, with a lecture or clinic in the middle of the day, and then travel all night to a distant city; yet it was accomplished with ease and without haste.

He was very fond of horses and of Nature, and in his busy life he found time to store up much of history and general literature.

His presence and his manner inspired confidence on the part of the patient, and his recognized skill brought him steadily increasing influence and practice, so that he rose, step by step, by almost unconscious progression until in the eyes of the nation he stood esteemed, and in the profession he was the recognized surgeon-in-chief. He was conservative, thoroughly skilled, and wise—high qualities possessed by few.

He was born November 24, 1818, in Lancaster County, Pennsylvania, the son of a physician, Dr. Robert Agnew. From both father and mother he was of Scotch-Irish descent, a race notoriously industrious, persevering, intelligent, and God-fearing. His mother was Agnes Noble, a name associated with Presbyterianism in the region of Oxford and

Octorara. She was a woman of extraordinary strength of character, and from her undoubtedly her famous son obtained many of his stable elements of character. His early education was obtained at Moscow Academy, then at Jefferson College, Canonsburg, and completed at Newark College, Delaware.

He graduated in medicine at the University of Pennsylvania in 1838. For some years he practiced in Lancaster and Chester counties, but was persuaded to accept an interest in the large iron manufactory of his father-in-law. He remained in business only about three years, when circumstances beyond his control led to the failure of the firm of which he was a member. His love for anatomy and for his profession was very great, and he sought a larger field by returning to Philadelphia in 1853, when he began his anatomical teaching in the old Philadelphia School of Anatomy, on College Avenue, or Chant Street. A year or two later he established the Philadelphia School of Operative Surgery.

In 1854 he was elected surgeon to the Philadelphia Hospital, where he did most excellent work. He founded the Pathological Museum, and, in connection with the late Dr. John L. Ludlow, succeeded in restoring to public teaching the unusual wealth of material contained within its walls. He was elected Demonstrator of Anatomy and Assistant Lecturer in Clinical Surgery to the University of Pennsylvania in 1863. In 1864 he was elected surgeon to the Wills Eye Hospital. He was called to the Pennsylvania Hospital in 1865, and the same year to the Orthopaedic Hospital.

His action in regard to teaching mixed classes of men and women at the Pennsylvania Hospital is a well-known fact in medical history. He promptly sacrificed his coveted position to his conviction of right, but his value to the hospital was well evidenced in the unanimous call which was extended to him to return, a few years later, with the distinct understanding that he should not be compelled to lecture to women.

During the War of the Rebellion he gained a large experience in military surgery as Consulting Surgeon to the Mower Hospital, at Chestnut Hill, where there were, at times, as many as five thousand patients. In 1862 he was appointed Surgeon to the Military Hospital at Hestonville.

In 1870 he was chosen to fill the Chair of Operative Surgery in the University of Pennsylvania, and in 1871 he became the John Rhea Barton Professor of the Principles and Practice of Surgery to the same institution, which position he held until he resigned all public positions in 1889, when he was elected Emeritus Professor to the University and Honorary Professor to the University Hospital.

In 1841 he married Miss Margaret C. Irwin, a member of a well-known family in Chester County, largely interested in the manufacture of iron, and to her influence and counsel he always attributed much of his success in life. He leaves no children.

He was elected President of the Philadelphia County Medical Society in 1872, of the Pennsylvania State Society in 1877, President of the Philadelphia Academy of Surgery and of the American Surgical Association in 1888, and President of the Philadelphia College of Physicians in 1890.

Table 1.

Among the Books, Addresses, and Journal Articles published by Prof. Agnew are the following:

- Principles and Practice of Surgery. 1st edition, 1878.
- Practical Anatomy, 1856.
- General Principles of Surgical Diagnosis, "Ashhurst's Encyclopedia of Surgery," Vol. i.
- Laceration of Female Perineum and Vesico-vaginal Fistula, 1882, p. 141.
- Laceration of Female Perineum, 1861, p. 59.
- Vesico-vaginal Fistula, 1867, p. 42.
- Address, Philadelphia School of Anatomy, 1856, p. 16.
- Address, Philadelphia School of Anatomy, 1857, p. 20.
- Address, Philadelphia School of Anatomy, 1858, p. 20.
- Address, Philadelphia School of Anatomy, 1860, p. 20.
- Address, Classification of the Animal Kingdom, 1860, p. 20.
- Address, Baron Larrey, 1861, p. 59.
- History of the Philadelphia Almshouse Hospital, 1862, p. 52.
- President's Address, Philadelphia Academy of Surgery, 1889.
- 1888. Laparotomy.
 Senile Hypertrophy of the Prostate Gland.
- 1880. Hernia, Radical Treatment.
 Treatment of Vesical Catarrh, "Philadelphia Medical Times."
- 1889. Injuries to Perineus Longus, "University Medical Magazine."
- 1881. Popliteal Aneurism.
- 1882. Lithotomy.
 Pott's Disease.
 Stone in the Bladder, "Virginia Medical Monthly."
 Chronic Cystitis, "Medical Review."
 Ununited Fracture of the Femur, "Medical and Surgical Reporter."
 Abscess of the Pharynx.
- 1884-85. On the Use of Salvia Officialis in Catarrhal Rhinitis.
 Muscular Spasm and Excision of the Nerve Trunk.
- 1887. Nephorrhaphy and Nephrectomy.
 Excision of the Larynx and Pharynx.
- 60 Articles: Anatomy in its Relations to Medicine and Surgery, "Philadelphia Medical and Surgical Reporter," 1864; also, Clinical Reports, "Philadelphia Medical and Surgical Reporter," 1869, '70, and '71.
- Address before the Philadelphia County Medical Society, January, 1875. "Experiments and Deductions Regarding the Repair of Bone Tissue."
- Address on Surgery, Pennsylvania State Medical Society, 1876.
- Valedictory Address, University of Pennsylvania, 1885.
- President's Address, Delivered before the American Surgical Association, September 18, 1888, Washington, D. C.
- Social Life and Surgical Diseases, "Boston Medical and Surgical Journal," 1888, 119 (2), p. 274.
- Also, nearly a hundred journal articles within the last decade.
- His last paper was "The Present Status of Brain Surgery, founded upon the Practice of Philadelphia Physicians." This was read before the American Surgical Association at Washington, and published in the "University Medical Magazine, October 1891.
- His last public speech was made February 27, 1892 at the banquet of the University Alumni Association, and he gave his last clinic on the following week.

In 1891 he was elected Honorary Surgeon to the Presbyterian Hospital, being the only one on whom this title has ever been conferred. At different times he had been consulting surgeon to numerous hospitals and institutions.

He was manager for twenty years of the Philadelphia House of Refuge and also a director of the Union Trust Company.

He went abroad in 1872, which was the only visit he made to the other side of the Atlantic.

For many years his home was at 16 North Eleventh Street. In 1867 he moved to 1611 Chestnut Street, and from thence in 1886 to 1601 Walnut Street.

In 1888, at the completion of his fifty years of honorable service in medicine, his brethren in the profession tendered him a banquet, on which occasion his friends from Philadelphia and other cities of the Union assembled to do him honor. After listening to the many kind expressions of friendship, his speech, in reply, was one which indicated the deep, strong heart of the man: "I have striven ever to do my duty, and have never turned from what I knew to be right. My account I must give to God." Rarely is there seen so complete and so completed a life.

A staunch member of the Presbyterian Church, even in his busiest years he was seldom absent from his place at service either in the morning or in the evening, thus practically illustrating the truth that a man can do more work, and better work, in six days than he can in seven. He never operated on the Sabbath, except in accident cases. On one occasion he astonished one of the younger members of the profession, with whom it became necessary to make a trip into the country on Sunday, by fixing the hour at 6 A.M. It is almost unnecessary to say that he returned in time to be in his accustomed pew.

Best of all, he carried with him through the week all the ennobling influences gained by a daily resort to the throne of grace, and he possessed all the Christian graces which made him a power in the community, in the college, and in the profession.

His death was as he would have desired it—a quick transition from a busy life to an eternal reward. Thoroughly occupied each day, he left the operating table, disabled by an attack of angina pectoris, due, as was afterward proven, to ossification of the coronary artery. He had told the writer on several occasions that after undue exertions these anginous pains had given him decided discomfort. All who were present during the excitement of his closing speech in 1889,

when he retired from his active duties at the University, will remember the unutterable shock that was imparted when he suddenly reeled. He never recovered fully from the effects of an attack of epidemic influenza two years before his death. On several occasions he had passed renal calculi, and there had been slight manifestations both of diabetic and albuminuric conditions. After the attack of angina alluded to, there speedily followed bronchial and renal complications, and the immediate cause of his death was uraemia. He died on March 22, 1892, respected, loved, honored, not only in the profession, but by the community and by multitudes throughout the land.

The tributes of respect at his funeral were most touching. Sympathizing friends were unable to even gain admittance to the church. A most eloquent tribute to his memory was preached by his friend and pastor, Rev. J. S. MacIntosh, which has already been published. Statesmen, lawyers, physicians, and representatives from all classes seemed anxious to add some word in praise of the good deeds of this noble physician.

Strong of body, earnest of soul, honest of purpose, skillful of hand, keen of eye, and quick of perception, he combined all the elements of permanent success.

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