

# The Pathology Residency Program of the Johns Hopkins University School of Medicine

## A Model of Its Kind

Patrizio Caturegli, MD, MPH; Edward F. McCarthy, MD; J. Brooks Jackson, MD; Ralph H. Hruban, MD

• **Context.**—The Department of Pathology of the Johns Hopkins University pioneered in the late 19th century the application of the scientific method to the study of medicine and fostered the development of residency training programs.

**Objective.**—To trace the history of the Johns Hopkins Pathology Residency Program and assess with quantifiable outcomes the performance of former residents.

**Design.**—We reviewed archival and departmental records from September 1899 to June 2014 to create a database of pathology residents. We then analyzed resident in-service examinations, American Board of Pathology examinations, and career paths.

**Results.**—In 115 years the department trained 555 residents who came from 133 medical schools located in 23 countries. Residents performed well on the in-service examinations, obtaining mean scaled total scores that were

significantly better ( $P = .02$ ) than those of the national peer groups. Residents (371 of 396, 94%) passed their boards typically at the first attempt, a percentage pass that was higher than the national average for both anatomic ( $P < .001$ ) and clinical ( $P = .002$ ) pathology. Approximately half of the residents went into private practice, whereas a third followed an academic career. Of the latter group, 124 (75%) became professors of pathology, 31 (19%) chairs of pathology departments, 10 (6%) deans of medical schools, 5 (3%) were elected into the National Academy of Sciences, and 1 won the Nobel prize.

**Conclusions.**—While maintaining its original core values, the Johns Hopkins Pathology Residency Program has trained physicians to be outstanding researchers, diagnosticians, and leaders in pathology.

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The Department of Pathology of the Johns Hopkins Hospital (Baltimore, Maryland) is a premiere resource for patient care, assembling a faculty of more than 140 members who provide diagnostic expertise in several areas of anatomic and clinical pathology. This clinical practice has always been coupled, since the beginning in the late 19th century, with basic and translational research, an approach that made the department the leader of departments of pathology in funding from the National Institutes of Health for the years 2007–2013 (Supplemental Figure 1 [see supplemental material at [www.archivesofpathology.org](http://www.archivesofpathology.org) in the March 2015 table of contents]).<sup>1</sup> Pivotal for the execution of these clinical and research activities was the launching of a pathology residency program, aimed at training young graduates by exposure to abundant and diverse clinical material as well as research opportunities. We designed this study to trace the history of our residency program and assess with quantifiable outcomes

the performance of former residents. We will set the stage by first summarizing how the department and residency program came to life.

The foundation upon which the pathology department was built can be traced to the late 1860s when Mr Johns Hopkins (1795–1873), a Baltimore merchant, decided to provide a bequest of approximately \$7,000,000 for the establishment of three institutions that perpetuate his name: the Johns Hopkins University (September 13, 1876), the Johns Hopkins Hospital (May 7, 1889), and the Johns Hopkins School of Medicine (October 2, 1893).<sup>2</sup> The founding of the pathology department is also intimately connected to the philanthropy of Mary Elizabeth Garrett (1854–1915), who was fundamental in the opening of the medical school.<sup>3</sup>

While Hopkins and Garrett provided the financial support for the creation of the medical school, it was Dr John Shaw Billings (1838–1913) who largely shaped its early philosophy. While working for the office of the Surgeon General, he advised the trustees of the Johns Hopkins Hospital not only on the construction of the buildings but also on the importance of educating medical students in mastering the scientific literature,<sup>4</sup> and recruiting faculty members who were committed to the European ideals of scientific medicine. As director of the Library of the Surgeon General's Office (from 1865 to 1895), which later became the National Library of Medicine, Billings began publishing

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From the Department of Pathology, Johns Hopkins University, Baltimore, Maryland.

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Reprints: Patrizio Caturegli, MD, MPH, Department of Pathology, Johns Hopkins University, Ross Bldg, Room 656, 720 Rutland Ave, Baltimore, MD 21205 (e-mail: [pcat@jhmi.edu](mailto:pcat@jhmi.edu)).

(in 1879) the *Index Medicus*, a periodical listing the citation of medical journal articles, books, and dissertations that his peers considered “America’s greatest contribution to medicine.”<sup>5</sup> Notably, Billings recruited the first appointed professor in the Johns Hopkins University School of Medicine, Dr William Henry Welch (1850–1934), for “his ability as an independent investigator and as a skillful teacher.”<sup>6</sup>

Welch’s recruitment originated from November 1876 meetings in Leipzig, Germany, where he was a student in the experimental physiology laboratory of Carl Ludwig.<sup>7</sup> In Dr Welch’s words, “Billings came often to the laboratory and the evenings we spent at the Auerbach’s Keller restaurant talking about all sorts of things were delightful experiences.”<sup>8</sup> Welch, hired in 1884, initially taught pathology and bacteriology at the university (since the hospital was still under construction) with the help of Drs William T. Councilman, later first chair of pathology at the Peter Bent Brigham Hospital (Boston, Massachusetts), and Alexander C. Abbott. Then, in 1886, Welch moved to the first completed hospital building, a 2-story structure at the corner of present Monument and Wolfe streets called The Pathological Laboratory. Welch rose quickly to become the first director of the Department of Pathology (1889–1916), the first dean of the medical school (1893–1898), the first dean of the school of public health (1917–1926), and one of the most influential figures of American medicine of his time.<sup>9</sup> He is credited for introducing to American medicine the scientific method, meaning the use of hypotheses, experimentations, and data analyses to systematically advance our knowledge of diseases. As Eugene Opie eloquently put it in 1949, “no one had more influence than Welch in bringing American medicine into the current of European medical science from which it had been widely separated.”<sup>10</sup>

With the introduction of the scientific method came the realization that specialized training should be offered to young doctors who aimed at higher careers in medicine or surgery, and thus the birth of residency training programs around the turn of the 20th century. In remarks made as president at the openings of the Association of American Physicians in 1901, Welch said, “Hospitals should offer salaried resident positions of greater permanence and responsibility to enable promising young men to do scientific work, to acquire thorough clinical experience, and to begin to establish their reputations by contributions to their special departments of knowledge. During this period, which should be one of productive work, their positions would be analogous to those of assistants in laboratories, and, as in the latter case, should bring to the front those of demonstrated ability.”<sup>11</sup> Scholars assign the origin of the American residency programs to the Johns Hopkins Hospital,<sup>12</sup> through the effort of its 4 founding fathers: Welch, Halsted, Osler, and Kelly (hired in 1884, 1886, 1888, and 1889, respectively). As Dr John Cameron eloquently wrote in his surgical heritage essay about Dr Halsted, “up to 1899 there was no formal system to train surgeons in the United States. All surgeons were self-trained or learned by way of an apprenticeship, and few spent more than 1 or 2 years in a hospital setting. Halsted introduced a system in which medical school graduates entered a university-sponsored, hospital-based surgical training program that, over a several-year period of increasing responsibility, slowly led to the training of young surgeons who were well versed in anatomy, pathology,

bacteriology, and physiology. The training program culminated in a final period of near-total independence and autonomous activity.”<sup>13</sup>

Our study begins in 1899 when 2 graduates of the first medical school class, William G. MacCallum and Eugene L. Opie, became the first 2 residents in the Department of Pathology.

## MATERIALS AND METHODS

### Study Cohort

The study covered a period of 115 years, from September 1899 to June 2014. To assemble a database of physicians who worked as pathology residents during this time frame we began by using 3 sources: (1) Electronic records of the residency office of the Department of Pathology. This office holds information about the residents who were interviewed and accepted into the program from July 1993 to present. (2) Johns Hopkins University circulars. These are annual university publications, beginning with volume 1 for academic year 1881–1882, that document appointments and report events from the various schools, including catalogues and announcements of the School of Medicine. We screened volume 23 (1904–1905) through volume 112 (1992–1993). (3) Records of the School of Medicine Registrar’s Office. For the first 11 years of its existence (1893–1894 to 1903–1904), the School of Medicine published its catalogues and announcements separately from the university circulars. We reviewed these 11 years from the collection held in the Registrar’s Office.

Once drafted, the pre-1993 list of pathology residents was verified and expanded by using 4 additional sources: (1) a yearly list of pathology personnel (faculty, residents, fellows, and key staff) prepared in 1931 by Dr MacCallum, first resident in the program and second director of the department, covering the years from 1893–1894 to 1930–1931; (2) a yearly list of pathology personnel prepared in 1964 by Dr Ella Oppenheimer, covering the years 1931–1932 to 1963–1964; (3) a list of house staff officers prepared by the Johns Hopkins Hospital and available from the Alan Mason Chesney Medical Archives, covering the years 1929–1930 to 1992–1993; and (4) a review of photographic material of the Department of Pathology available both in the department and the Chesney Medical Archives, featuring group photographs with residents and faculty identified.

The study was judged by the investigators to be exempt from institutional review board review on the basis of federal regulation 45 CFR 46.101(b)(2), which covers research involving the use of educational tests.

### Demographic Characteristics

Names of the pathology residents were entered into a FileMaker database (FileMaker Inc, Santa Clara, California) that included information about sex, race, ethnicity, place of birth, medical school name and location, graduation year, and degree(s). For residents who entered the program after 1992–1993, scores of the United States Medical Licensing Examination (USMLE) Step 1 and Step 2 were also added, as a surrogate of medical school performance. June 1992 is the time when the USMLE examination changed to the current 3-digit score format and to the current passing score ranges: 188 to 300 for Step 1, 196 to 300 for Step 2, and 190 to 300 for Step 3.

In addition to the demographic characteristics outlined above, the study analyzed 3 main outcome measures: performance on the Resident In-Service Examination, performance on the American Board of Pathology (ABP) examination, and career after completion of the residency.

### Resident In-Service Examination

The Resident In-Service Examination (RISE) is a voluntary testing assessment that has been offered annually since 1983 by the American Society for Clinical Pathology.<sup>14</sup> This examination tests knowledge in anatomic pathology (AP), clinical pathology

(CP), and in special topics common to both AP and CP. It includes more than 350 multiple-choice questions in a “1 best answer” format, and is administered every spring to residents in all years of the training program. RISE results are expressed on a standardized scaled score that makes comparison across years possible. A score of 999 is the highest reportable score, and 100 is the lowest. There are no passing or failing scores. Performance of each resident is provided to the residency program director, along with mean and standard deviation obtained from all United States residency programs. Participation of Johns Hopkins pathology residents to RISE, initially voluntary and mainly limited to laboratory medicine trainees, became mandatory in 1993 with the merging of Laboratory Medicine and Anatomic Pathology into a single Department of Pathology.

### American Board of Pathology Examination

The ABP has administered examinations since 1936 to certify graduating residents in AP and/or CP. Each examination consists of a written and a practical part, covering a total of more than 320 one-best-answer questions. Applicants must pass both the written and practical components with a minimum scaled score of 500. Candidates who pass the examination are given only the pass information but not their actual scores. ABP does not keep overall summary statistics of the candidates who take the boards. It does, however, keep the number of certified diplomates (31 319 from 1936 to 2012), separating them into living (27 813) and deceased (3506), and can provide the number of attempts needed to pass the examination if a list of specific names is provided. We submitted a list of the Johns Hopkins pathology residents to ABP, which then retrieved, on a fee-for-service basis, the pass/fail information regarding their AP and/or CP examinations.

### Career After the Residency

Career after residency was classified into 3 categories: private practice, academic pathology, and left pathology. We defined a career as “academic” exclusively by the output of peer-reviewed publications (ie, original research article, review article, book chapter, or book). In particular, we used a minimum of 5 first or last author publications or 10 coauthored publications for work done after fellowship. Information about publications was obtained by performing individual name searches in PubMed and Index-Catalogue, as well as by reviewing the printed collection in the departmental library.

### Statistical Analysis

Comparisons of frequencies and means among groups were obtained by  $\chi^2$  test and analysis of variance, by using Stata statistical software, release 13 (Stata Corp, College Station, Texas).

## RESULTS

### Demographic and General Characteristics

A total of 555 physicians administratively qualified as pathology residents at the Johns Hopkins Hospital between September 1899 and June 2014. Most were males (407 of 555, 73%; Table 1), with the first woman entering the program in 1968. The male to female ratio of the resident body was 17 in 1968, decreased to 1 in 1988, and inverted to 0.9 in 2005.

Most residents were of white race (498 of 555, 90%) and non-Hispanic ethnicity (543 of 555, 98%; Table 1). The first Asian person entered the program in 1961, the first African American person in 1979, the first Indian person in 1983, and the first Hispanic person in 1967.

Most residents had an MD degree only (461 of 555, 83%), but a significant percentage (92 of 555, 17%) also had a PhD degree (Table 1). The number of residents with dual MD/PhD degree increased in recent times: there were, in fact, only 3 MD/PhD residents during the first 71 years (1899–

**Table 1. Demographic and General Characteristics of 555 Pathology Residents Who Trained at the Johns Hopkins Hospital Between September 1899 and June 2014**

	No.	Percentage
Sex		
Male	407	73
Female	148	27
Race		
White	498	90
Asian	31	6
African American	14	2
Indian (from India)	12	2
Ethnicity		
Non-Hispanic	543	98
Hispanic	12	2
Degree		
MD	461	83
MD, PhD	92	16.6
MD, MPH	2	0.4
Type of training		
AP/CP	280	50
AP only	231	42
CP only	22	4
AP/NP	18	3.2
AP/CP/FP	2	0.4
AP/FP	2	0.4
Length of training, y		
1	93	17
2	98	18
3	86	15
4	218	39
5	48	9
6	12	2
Country of birth		
United States	467	84.1
Europe	23	4.1
China	15	2.7
Middle East	14	2.5
Asia (not China)	12	2.2
Canada	9	1.6
South America	6	1.1
South Africa	4	0.7
Central America	4	0.7
Australia	1	0.2

Abbreviations: AP, anatomic pathology; CP, clinical pathology; FP, forensic pathology; MD, medical doctor; MPH, master of public health; NP, neuropathology; PhD, doctor of philosophy.

1969) of the study (3 of 167, 2%), and 92 in the following 44 years (89 of 388, 23%).

The most common type of training was the combined AP/CP track (280 of 555, 50%), followed by the AP-only track (231, 42%) and CP-only track (22, 4%) (Table 1). The number of years in training was spread between 1 and 6 years, with the greatest number of residents training for 4 years (218 of 555, 39%; Table 1), which is the current standard length of training for the AP/CP track. A significant percentage of residents (93 of 555, 17%) were in the program for just 1 year. Some of these were residents who transferred from other residency programs, but most were residents in surgery, radiology, obstetrics and gynecology, or veterinary pathology training programs that in earlier years were required to complete a year of pathology as part of their training.

Residents were born in 38 of the 193 countries of the world (20%), mostly in the United States (467 of 555, 84%;

**Table 2. Chairmen and Residency Program Directors of the Department of Pathology of the Johns Hopkins Hospital During the First 125 Years (1889–2014)**

Department Name	Department Director	Period	No. of Years	Residency Director	New Residents per Chair	Average No. of New Residents per Academic Year
Pathology and Bacteriology	William H. Welch	1889–1916 <sup>a</sup>	28	William H. Welch	15 (15 M; 0 F)	0.8
Pathology and Bacteriology	William G. MacCallum <sup>b</sup>	1917–1942	26	William G. MacCallum	29 (29 M; 0 F)	1.1
Pathology	Arnold R. Rich <sup>b</sup>	1943–1957	15	Arnold R. Rich	36 (36 M; 0 F)	2.4
Pathology	Ivan L. Bennett	1958–1968	11	Ivan L. Bennett	76 (75 M; 1 F)	6.9
Pathology and Laboratory Medicine	Robert H. Heptinstall	1969–1987	19	Robert H. Heptinstall	168 (124 M; 44 F)	8.8
Pathology and Laboratory Medicine	John H. Yardley <sup>b</sup> & John K. Boitnott	1988–1992	5	John H. Yardley and John K. Boitnott	36 (14 M; 22 F)	7.2
Pathology	Alfred P. Sanfilippo	1993–1999	7	Risa B. Mann <sup>c</sup>	61 (34 M; 27 F)	8.7
Pathology	J. Brooks Jackson	2000–2013	14	Edward F. McCarthy	126 (69 M; 57 F)	9.0
Pathology	Ralph H. Hruban <sup>b</sup>	2014–	1	Charles Steenbergen	8 (3 M; 5 F)	8.0

<sup>a</sup> For the first 10 years (from 1889–1890 to 1898–1899) there was no residency program.

<sup>b</sup> Department directors trained by Welch or a Welch trainee.

<sup>c</sup> Dr Mann served de facto as residency director from 1984 to 1992.

Table 1). Residents came from 133 different medical schools located in 23 countries. The most represented medical school was that of the Johns Hopkins University, which supplied 136 of the total 555 residents (25%). This was especially true for the initial 40 years of the program (1899–1939), where Johns Hopkins supplied 34 of the total 40 residents (85%). Following World War II and the increased mobility that accompanied the economic boom, the diversity of medical school sources markedly increased. The 5 most commonly represented medical schools after Johns Hopkins were University of Maryland, Baltimore (18), Vanderbilt University, Nashville, Tennessee (16), University of Virginia, Charlottesville (14), Case Western Reserve University, Cleveland, Ohio (12), and George Washington University, Washington, DC (12). Of note is the fact that Vanderbilt University provided the most residents from outside the state of Maryland, perhaps because its Department of Pathology was founded by Ernest Goodpasture, the eighth pathology resident under Welch (after MacCallum, Opie, Marshall, Bunting, Whipple, Meloy, and Winternitz).

### Resident Body

The number of pathology residents was small during the initial years. A total of 15 residents were trained during the 28 years in which Welch was director of the department, and 30 were trained in the 26 years MacCallum directed, for an average of approximately 1 resident per year (Table 2). The yearly number of residents remained low and fairly constant up to the early 1960s (Figure 1, A; solid line), coupled to the number of full professors, which was essentially just 1 up to 1961 (Figure 1, A; dashed line). After the early 1960s, the number of faculty members expanded significantly, and so did the residency body (Figure 1, A).

Currently, the residency program has 34 residents at any given time, distributed among the 4 years of the training program. Johns Hopkins Pathology is the second largest training program in the nation following Massachusetts General Hospital (Boston), which has 40 residents. The program presently offers an average of 9 resident slots each year (Figure 1, B, filled squares; and Table 2). Based on previous match rankings, these positions could be theoretically filled by interviewing a 3-fold larger number of applicants (Figure 1, B; open squares), although in practice

twice as many applicants (Figure 1 B; filled circles) are interviewed.

### Resident In-Service Examination Performance

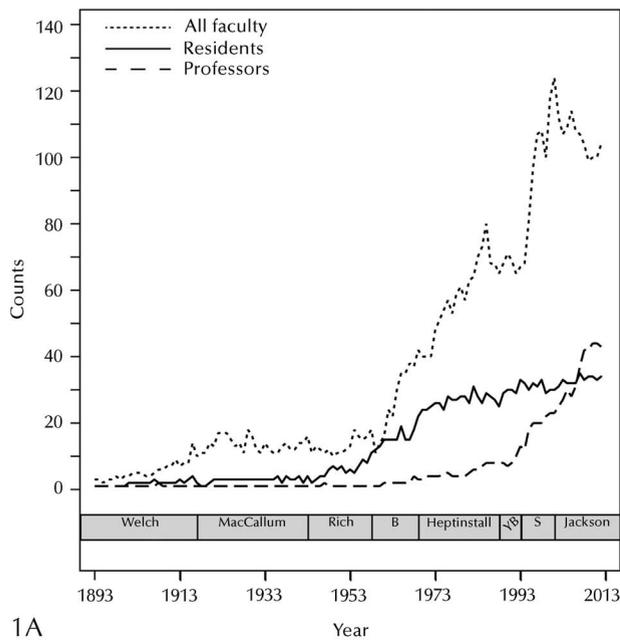
A total of 155 graduating residents from Johns Hopkins have taken the pathology RISE from May 1993 to May 2013. The median (Figure 2, A) and mean (Figure 2, B) scaled total scores increased significantly over time, likely as a consequence of multiple factors. The teaching during the residency training has become more structured, but residents are also more motivated to prepare themselves for a job market that is more competitive and holds higher standards. The mean scaled total score of the Johns Hopkins residents (Figure 2, B; filled squares) was significantly greater ( $P = .02$ ) than that of their national peer group (Figure 2, B; open squares).

### American Board of Pathology Examination Performance

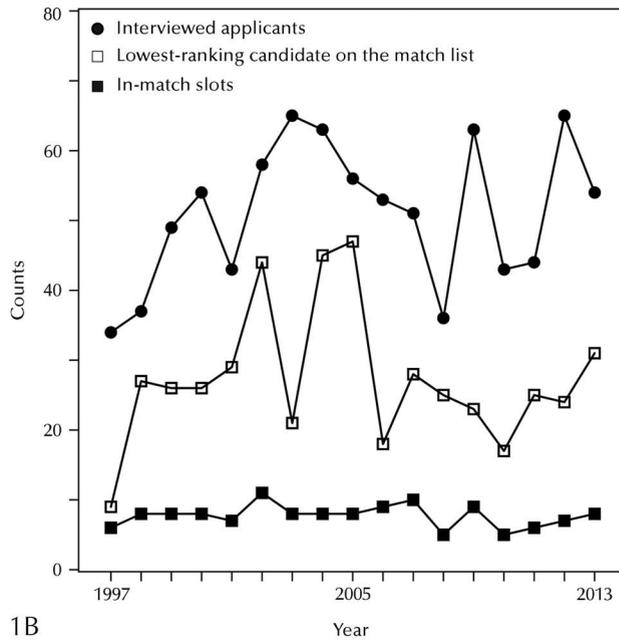
A total of 396 residents have taken the boards from March 1937 to November 2013. Most sat for the combined AP/CP (235, 59%) or AP-only (126, 32%) tests. The remaining residents took the CP-only (18, 4.5%), the AP/neuropathology (10, 2.5%), the neuropathology-only (5, 1.3%), the AP/CP/forensic pathology (2, 0.5%), or the AP/forensic pathology (2, 0.5%) tests. Most of the residents (371 of 396, 93.7%) passed the ABP examination on the first attempt (Figure 3, A). A minority (20 of 396, 5%) required two (17), three (2), or four (1) attempts to pass (Figure 3, B). Five residents never retook the boards after the initial failure (Figure 3, B). Comparing the performance of first-time takers between Johns Hopkins and national pathology residents revealed that Johns Hopkins residents (Figure 3, B and C; filled squares) performed significantly better than their national peers (Figure 3, B and C; open squares), both in anatomic (Figure 3, B;  $P < .001$ ) and clinical pathology (Figure 3, C;  $P = .002$ ).

### Career After the Residency

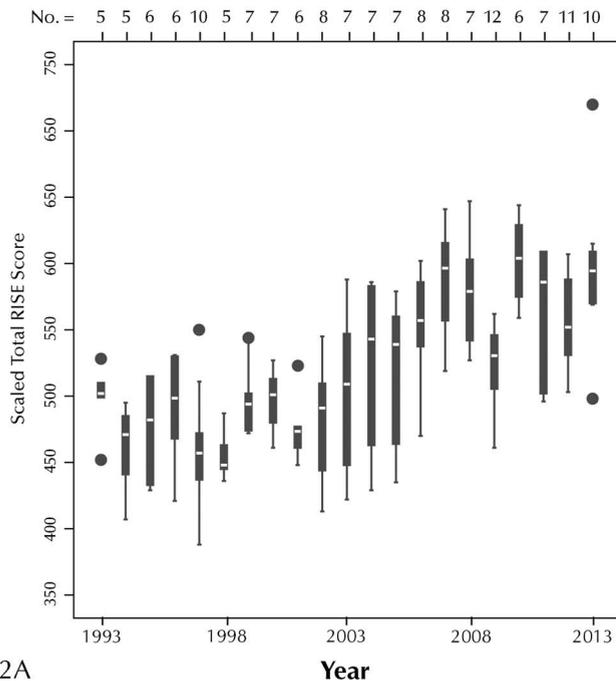
Career information was searched for 503 residents from 1899 to 2009. Of 503, a total of 263 went into private practice (52%), 165 followed an academic career (33%), 62 (12%) left the field of pathology, and 13 (3%) were lost to follow-up (Figure 4). Most of the residents who did not pursue a career



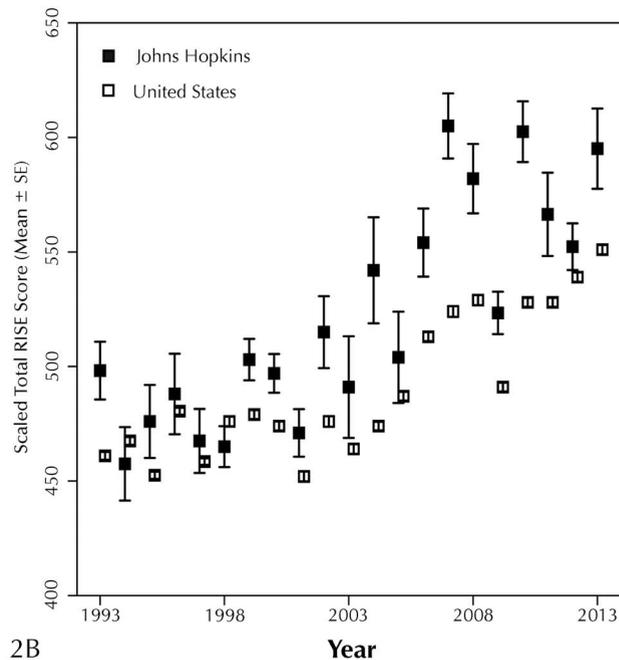
1A



1B



2A



2B

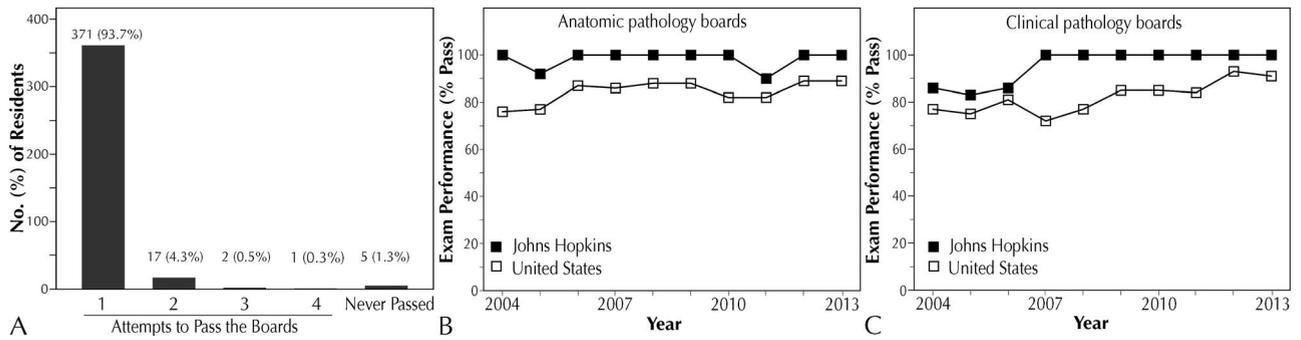
**Figure 1.** The resident body. A, Yearly count of pathology residents from 1899 to 2013 (solid line). For comparison, the yearly counts of full professors (dashed line) and all faculty (dotted line) are also shown. The abbreviations for the department directors indicate Drs Bennett (B), Yardley & Boitnott (Y B), and Sanfilippo (S). B, Yearly count of in-match residency slots from 1997 to 2013 (filled squares). The number of interviewed applicants (filled circles) and the lowest-ranking applicant on the match list (open squares) are also shown.

**Figure 2.** Resident In-Service Examination (RISE) performance. A, Distribution of the total scaled RISE score for Johns Hopkins graduating pathology residents from 1993 to 2013. Each box represents the middle 50% of the observations (interquartile range), bordered at the 25th and 75th percentiles. The line inside the box indicates the median (50th percentile). The whisker lines extend from the box to data points that are equal to or less than 1.5 interquartile ranges. Extreme values are shown as circles outside the whisker lines. B, Comparison of the RISE performance (mean  $\pm$  standard error [SE]) between Johns Hopkins (filled squares) and United States (open squares) pathology residents from 1993 to 2013.

in pathology (42 of 61, 69%) were physicians who trained in the Department of Pathology for just 1 year.

Of the 165 residents who remained in academics, 72 (44%) stayed on as Johns Hopkins faculty after their residency training for 3 or more years. The top 3 longest-serving former residents and then faculty members were

John K. Boitnott (57 years), John H. Yardley (53 years), and Grover M. Hutchins (47 years). Of the Johns Hopkins residents who followed an academic path, 124 (75%) became full professors of pathology; 31 (19%), chairs of pathology departments; and 10 (6%), deans of medical schools. Nine residents were inducted into the prestigious

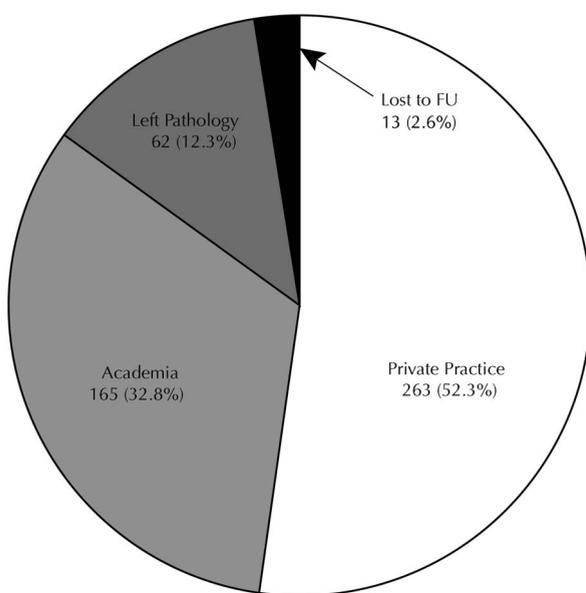


**Figure 3.** American Board of Pathology examination performance. A, The Johns Hopkins pathology residents (No. = 396) who sat for the boards between 1937 and 2013 are distributed according to the number of attempts needed to pass the examination. B, The performance (pass percentage) at the anatomic pathology boards for Johns Hopkins and United States residents. C, The performance (pass percentage) at the clinical pathology boards for Johns Hopkins and United States residents.

Johns Hopkins Society of Scholars (Table 3), and of these, 7 had previously served as chief residents (Table 3). The position of chief resident, always critical for the operation of the residency program, was first established in the academic year 1945–1946 with Harrison Latta, who became a renowned renal pathologist credited for the discovery of the glass knife technique for cutting ultrathin sections for electron microscopy. Five of the former residents were elected into the National Academy of Sciences (MacCallum, Opie, Goodpasture, Whipple, and Rich). One of them (Whipple) was awarded the Nobel Prize in Physiology and Medicine in 1934 for the discovery that liver extracts cure iron-deficiency anemia (subsequently inspiring George Minot and William P. Murphy to use them for pernicious anemia).

### COMMENT

The Johns Hopkins University School of Medicine was the first medical school in the United States modeled on the European method of applying science to the study of medicine, an imprinting largely imparted by Dr Welch. A



**Figure 4.** Distribution of the career path taken by Johns Hopkins pathology residents after graduating from the training program. Abbreviation: FU, follow-up.

stout bachelor fond of cigars and fine food, he was described as eccentric, a prankster, and a night owl,<sup>15</sup> gifted with a superior memory and intellect. In the words of Sir William Osler, “in addition to a three-story intellect, Welch has an attic on top.”<sup>16</sup> Dr Welch was a very influential figure of superb public relation and fund-raising skills. Through him the Pathology Department received the first endowed professorship at the Johns Hopkins University (a gift of \$23,836.52 left in 1876 by Dr Henry Willis Baxley of Baltimore, Maryland, and first used in 1901). Often portrayed in the company of the rich and famous and featured on the cover of the April 14, 1930 issue of *Time*, Dr Welch was able to secure a donation from John D. Rockefeller for the establishment of a School of Public Health at Johns Hopkins, of which he became the first dean (1917–1927). There he founded the prestigious *American Journal of Hygiene* and the *Journal of Experimental Medicine*.<sup>15</sup> But perhaps his greatest contribution was the insight that science should be the foundation of medicine, a vision that revolutionized American universities. He imprinted this modus operandi on his department and residents, many of whom became chairs of pathology and thus in turn perpetuated his message (MacCallum at Johns Hopkins, Baltimore, Maryland<sup>17,18</sup>; Opie at Washington University in St Louis, St Louis, Missouri<sup>19,20</sup>; Winternitz at Yale, New Haven, Connecticut<sup>21,22</sup>; Goodpasture at Vanderbilt University, Nashville, Tennessee<sup>23–25</sup>; Bunting at the University of Wisconsin, Madison<sup>26</sup>; von Glahn at New York University, New York; and Whipple at the University of Rochester, Rochester, New York<sup>27,28</sup>). The involvement in research is still fostered nowadays, so that Johns Hopkins pathology residents typically rank among the top 5 programs in the world in terms of acceptance of first-authored scientific abstracts submitted for the prestigious Stowell-Orbison Awards Competition for pathologists-in-training.

If the passion for research has remained constant, there have been a number of changes in the pathology program since MacCallum and Opie first trained at Johns Hopkins in 1899. First, the number of residents trained each year has grown. While there was no time limit placed on early residents (William Osler’s residents stayed so long that during his 16 years at Johns Hopkins he trained only 5 resident physicians), today’s maximum training time is 4 years, which allows a total of 34 residents in the program at any given time. Second, the diversity of the residents has expanded greatly. While almost all of the residents in the early days were white and male, most are now women and

**Table 3. Johns Hopkins Pathology Residents Inducted Into the Johns Hopkins Society of Scholars**

Name	Residency Years	Induction Year	Notes
Harrison Latta	1944–1946	1995	Chief resident 1945–1946
Morgan Berthrong	1946–1949	1991	Chief resident 1948–1949
Gordon Ross Hennigar	1949–1950	1988	
Huntington Sheldon	1957–1959	2001	
Sharon Anne Whelan Weiss	1971–1975	2000	Chief resident 1974–1975
Stanley Ralph Hamilton	1973–1979	2005	Chief resident 1978–1979
Steven Jay Qualman	1979–1983	2008	Chief resident 1982–1983
Kathleen Ruth Cho	1984–1988	2011	Chief resident 1987–1988
Elizabeth Madelle Jones Perlman	1984–1990	2008	Chief resident 1988–1989

there is more racial and ethnic diversity. Third, the RISE test scores of the residents have shown improvement in the last 2 decades.

The career tracks chosen by graduates of the residency training program are surprisingly diverse. The early emphasis on academic values and scientific medicine is reflected in the significant proportion of the residents who chose academic careers and their accomplishments. Nonetheless, a significant portion of the residents ultimately pursue careers in private practice. This fact should, perhaps, not be surprising as pathology is a field that bridges the basic and clinical sciences. It does, however, suggest that even top-notch pathology departments need to prepare their residents for practice pathology as well as for academic careers. Ideally, this can be done in a manner that benefits both kinds of residents. Emphasis on inquisitiveness and lifelong learning will benefit practicing pathologists, and conversely, diagnostic excellence can serve as a guide to research excellence, as knowledge of diagnostic pathology can keep research relevant and focused on clinically important questions. It is also what separates the residency-trained scientist from the pure PhD-trained researcher.

Historical projects such as the one presented here inherently have numerous shortcomings. The main limitation is perhaps the lack of comparison with other pathology training programs, or other residency programs in general. Unfortunately, we could not find similar types of data, published or unpublished, from other institutions and it is therefore not possible to determine whether the successful track records of Johns Hopkins pathology residents is unique to Johns Hopkins or, more likely, also shared by other training programs with long-standing research interest.

In conclusion, the Johns Hopkins Pathology Residency Program has grown and changed significantly during the last 115 years in terms of number and diversity of the residents, but has retained its focus on training pathologists to be outstanding researchers, diagnosticians, and leaders in this evolving specialty.

#### ADDENDUM

On September 10, 2014, US News and World Report and Doximity announced their first-ever comprehensive national assessment of residency training programs, based on 50 000 peer nominations from board-certified US physicians. The Johns Hopkins Pathology Residency Training Program ranked #1.

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