



## Short communication

## A practice analysis of toxicology

Carol S. Wood <sup>a,\*</sup>, Christopher P. Weis <sup>b</sup>, Carla M. Caro <sup>c</sup>, Amy Roe <sup>d</sup><sup>a</sup> PO Box 2008, Bldg 1507, MS 6407, Oak Ridge National Laboratory, Oak Ridge, TN 38501, USA<sup>b</sup> National Institute of Environmental Health Sciences, 31 Center Drive, Building 31, Room B1C02, Bethesda, MD 20892-2256, USA<sup>c</sup> Professional Exam Services, 475 Riverside Drive, 6th Floor, New York, NY 10115, USA<sup>d</sup> The Procter & Gamble Company, 8700 Mason-Montgomery Rd, Cincinnati, OH 45040, USA

## ARTICLE INFO

## Article history:

Received 14 September 2016

Accepted 15 September 2016

Available online 16 September 2016

## Keywords:

Toxicology

Practice analysis

Delineation

Examination specifications

## ABSTRACT

In 2015, the American Board of Toxicology (ABT), with collaboration from the Society of Toxicology (SOT), in consultation with Professional Examination Service, performed a practice analysis study of the knowledge required for general toxicology. The purpose of this study is to help assure that the examination and requirements for attainment of Diplomate status are relevant to modern toxicology and based upon an empirical foundation of knowledge. A profile of the domains and tasks used in toxicology practice was developed by subject-matter experts representing a broad range of experiences and perspectives. An on-line survey of toxicologists, including Diplomates of the ABT and SOT members, confirmed the delineation. Results of the study can be used to improve understanding of toxicology practice, to better serve all toxicologists, and to present the role of toxicologists to those outside the profession. Survey results may also be used by the ABT Board of Directors to develop test specifications for the certifying examination and will be useful for evaluating and updating the content of professional preparation, development, and continuing education programs.

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## 1. Introduction

The science of toxicology is advancing at a record pace, where new knowledge increases daily. With advances in our understanding of the toxicity of new materials like nano-sized particles coupled with the use of new technologies involved in high-throughput screening, genomics, and adverse pathway analysis, the manner and methods scientists use to determine mechanisms and effect levels are constantly changing. Along with these changes comes the need to be able to understand and utilize the advancing science as a professional within the toxicology discipline.

The American Board of Toxicology (ABT), the largest professional toxicology credentialing organization in the world, strives to identify, maintain, and evolve a standard for professional competency in the field of toxicology. It is the vision of ABT to establish a globally recognized credential in toxicology that represents competency and commitment to human health and the environmental

sciences. The purpose of ABT is to: 1) encourage the study and science of toxicology, 2) stimulate advancement in the field of toxicology by establishing standards of practice and keeping these standards current with advances in toxicology, and 3) confer recognition upon members of the profession who, when measured against such standards, demonstrate competence in the science and practice of toxicology.

The first ABT exam was administered on August 4, 1980 resulting in the certification of 217 Diplomates (Rinehart, 2000). Today there are approximately 2300 certified Diplomates of the American Board of Toxicology (DABT) world-wide. The benefits of attaining Diplomate status indicate that certification in toxicology continues to play an important role in employment opportunity, compensation, and professional advancement (Gad and Sullivan, 2016).

As mentioned, the science of toxicology is undergoing continued advancements in knowledge and techniques since the inception of professional certification by American Board of Toxicology. In order to assess these changes and evolve accordingly, the ABT Board of Directors (BoD) has embarked upon an evaluation of the current practice and standard of knowledge of toxicology relevant to the evolution of toxicology in the twenty-first century.

The purpose of this analysis is to help assure that the examination and requirements for attainment of Diplomate status are

Abbreviations: ABT, American Board of Toxicology; DABT, Diplomates of the American Board of Toxicology; ABT BoD, The American Board of Toxicology Board of Directors; PATE, Practice Analysis Task Force; SOT, Society of Toxicology.

\* Corresponding author.

relevant to modern toxicology practice and based upon an empirical foundation of knowledge. To this end, the ABT BoD has taken the steps presented here to ensure that these requirements and the testing content of the ABT exam reflect the knowledge required in the professional practice of toxicology and comply with the standards and recommendations outlined by the National Commission for Certifying Agencies (NCCA) standards (National Commission for Certifying Agencies, 2014).

## 2. Methods

### 2.1. Selection of the Practice Analysis Task Force

The ABT BoD, together with the Society of Toxicology (SOT), selected a 10-member Practice Analysis Task Force (PATF). In determining the composition of the PATF, key stakeholders from the ABT BoD and SOT leadership considered critical demographic and professional background variables such that the toxicologists selected to serve on the PATF represented the diversity of toxicology in practice settings and roles. Three members of the PATF held the DABT credential and seven did not. Members of the PATF are listed in Table 1.

The PATF was charged with the following activities over the course of the study:

- Develop an initial model or organizational structure describing general toxicology practice and delineate the tasks performed in practice;
- Review and incorporate the work of the additional subject-matter experts (SMEs) contributing to various qualitative data collection initiatives;
- Develop survey rating scales and a demographic and professional questionnaire for the quantitative survey of toxicologists; and
- Review the data obtained via the survey to create the final delineation of practice.

The PATF was responsible for developing the delineation of domains and tasks of general toxicologists. In a process-based description of practice, the work performed by professionals is organized into domains, which are the major areas of responsibility that make up the role of a toxicologist. Domains encompass all of

the tasks performed in practice. Tasks are the distinct, identifiable, and specific job-related activities performed in the course of work in the profession of toxicology.

Professional Examination Service (ProExam; New York, NY) is a recognized expert in the development, implementation, and evaluation of credentialing programs, including the conduct of practice analysis studies and the development of test specifications on which to base credentialing program activities. The ABT BoD contracted with ProExam to conduct the practice analysis study of general toxicologists in order to develop and validate a process-based delineation of the competencies of general toxicologists.

### 2.2. Task force meetings

ProExam facilitated eight two-hour virtual meetings of the PATF over the course of the study. ProExam provided introductory materials (for the first meeting) or the current iteration of the delineation to be discussed (for subsequent meetings) and a brief agenda outlining the meeting goals for each virtual meeting. After each meeting, the work output was distributed to PATF members for comment and review; email feedback was circulated among PATF members for consideration at each subsequent meeting.

The PATF developed the delineation through this iterative process, working from an initial model developed during the first two meetings. The domain structure and tasks were refined and augmented during subsequent meetings based on input from subject matter experts, as well as feedback received from the complementary data collection initiatives described below and the results of a pilot test of the on-line survey.

### 2.3. Thought leader interviews

ProExam conducted telephone interviews with four thought leaders in the toxicology profession who were selected to represent key perspectives in practice (Table 1). These thought leaders responded to a series of questions under a protocol designed to elicit information about major trends in the profession, recent and anticipated changes in the roles and work functions of toxicologists, and the impact of these changes on the competencies and knowledge base required of general toxicologists. Thought leaders also commented on the delineation of practice and provided feedback on the domain structure and tasks. The PATF reviewed the feedback

**Table 1**  
Members of the Practice Analysis Task Force (PATF), thought leaders, and independent reviewers.

PATF	Thought leaders	Independent reviewers
Myrtle Davis, PhD., DVM National Cancer Institute	Melvin E. Anderson, PhD., DABT The Hamner Institutes for Health Sciences	Desmond I. Cannon, PhD., DABT US Army Institute of Public Health
Yvonne Dragan, PhD. Haskell Labs	Linda Birnbaum, PhD., DABT, ATS National Institute of Environmental Health Sciences	Janet Clarke, PhD., DABT Newid Consulting
Jodi A. Flaws, PhD. University of Illinois	Jack H. Dean, PhD., DABT University of Arizona	Jamie DeWitt, PhD. East Carolina University
Jeff Fowles, PhD. CA Dept. of Public Health	Lois Lehman-McKeeman, PhD, ATS Bristol-Myers Squibb Company	Janice Lansita, PhD., DABT ToxStrategies, Inc.
Michael Holsapple, PhD., ATS Michigan State University		John Snawder, PhD., DABT CDC-NIOSH
Lewis B. Kinter <sup>a</sup> , PhD., DABT AstraZeneca Pharmaceuticals		
Serrine Lau, PhD. University of Arizona		
David Mayfield, MS., DABT Gradient		
E. Spencer Williams, PhD. Baylor University		
Adam Woolley, DABT, FRCPATH, ERT, ATS ForthTox Limited		

<sup>a</sup> Currently with Green Lawn Professional Scientific Consulting.

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