From the Food andDrug Administration (FDA) report a public workshop the FDA held on October 13and 14, 2015, regarding Physiological Closed-Loop Controlled Devices. Thematerial they are reporting on is derived from the white paper they preparedfor this workshop.2 This event was widely attended by various organizations,including the American Society of Anesthesiologist, the Department of DefenseOffice of Naval Research, academia, industry representatives, and the FDA. Thesignificance of this event was that closed-loop systems used in anesthesia andthe critical care setting are an emerging technology that impacts the future ofanesthesia practice. The article summarizes regulatory considerations forclosed-loop critical care devices for readers in the areas of critical caremedicine, anesthesiology, systems engineering, physiological modeling, andhuman factors. As an executive editor of Anesthesia & Analgesia since 2012,I am honored that the FDA decided to submit this very important article to ourJournal. Anesthesia & Analgesia is the official journal of theInternational Anesthesia Research Society (IARS), whose mission statement is“to encourage, stimulate, and fund ongoing anesthesia-related research projectsthat will enhance and advance the specialty, and to disseminate current,state-of-the art, basic and clinical research data in all areas of clinicalanesthesia, including perioperative medicine, critical care, and painmanagement. The IARS is focused solely on the advancement and support ofeducation and scientific research related to anesthesiology.” As such, ourJournal has played a pivotal role in the publication of several high-levelresearch manuscripts dedicated to physiological closed-loop systems inperioperative settings. A simple search on PubMed using the search query:(anesth analg and “closed loop”) provides interesting insights regarding thedevelopment of this topic in our profession. The oldest reference was publishedin 1994, reporting on the interaction of rocuronium (Org 9426) with etomidate,fentanyl, midazolam, propofol, thiopental, and isoflurane using closed-loopfeedback control of rocuronium infusion.3 Twenty-nine references were foundbetween 1994 and today, encompassing all fields of physiological closed-loopcontrolled systems in anesthesiology: muscle relaxation,4 pharmacologicalmodeling,5,6 reinforcement learning techniques,7,8 large clinical studiesevaluating closed-loop coadministration of remifentanil and propofol based onthe bispectral index monitor,9 fluid management and hemodynamic optimizationsystems,10,11 arterial blood pressure optimization using closed-loopphenylephrine administration,12,13 closed-loop neonatal oxygen therapy,14 useof closed-loop anesthesia systems during high-risk procedures such as cardiacsurgery15 or moderate sedation for transcatheter aortic valve implantation,16and a multicenter trial in India evaluating closed-loop anesthesia managementversus standard of care.17 Of these 29 articles, 9 have been published between1994 and 2012, and the remaining 20 have been published since 2012. Anesthesia& Analgesia has been a leader in this field and is especially proud to beable to publish this report from the FDA in this month’s issue of the Journal.What did we learn regarding the development of these systems over the past 10years? First, closed-loop anesthesia is a polarizing topic: people either loveit or hate it. There is a strong push back

from some anesthesiologists, who arguethat these systems could hurt patients and take over our jobs.18 However, thisremains an oversimplification of what anesthesiologists perform well on a dailybasis. These systems can only be accepted if they improve the workflow andquality of care. They also need to be developed by clinicians who are the onlyone to know how these systems can best benefit our patients. The goal of thesedevices is not to replace anesthesiologists, but to help us focus on higherlevels of care to improve quality. Second, developing these systems requires aspecific set of engineering skills and a very thorough approach intechnological development. Contrary to popular belief, computers may crash andthus do not always do what they have been asked to do. Closed-loop softwaresneed to be tested extensively in silico before being used in vivo in animalsand subsequently in patients. Robustness and stability have to be evaluated forall of these softwares, and any change made to the computer code before orafter use in patients will be considered a new device.

FROM INVENTION TO INNOVATION: BRINGING PERIOPERATIVE PHYSIOLOGICAL CLOSED-LOOP SYSTEMS TO THE BEDSIDE.