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# Delivering High-Quality Products Through Quality Processes

Amgen, either independently or in collaboration with industry peers, has developed important processes for producing high-quality products in compliance with regulatory requirements. Additionally, Amgen has adopted the Quality by Design (QbD) principles, which further integrate quality control into the manufacturing process.[1]

For QbD, the product and process knowledge base must include an understanding of variability in raw materials, the relationship between a process and product's critical quality attributes (CQAs), and the association between CQAs and a product's clinical properties. Successful implementation of QbD concepts requires cooperation across a multitude of company teams, from R&D to manufacturing to quality control and regulatory affairs.[2] By utilizing QbD principles and adhering to regulatory requirements, Amgen follows a systematic approach to the development of its medicines that begins with predefined objectives and emphasizes extensive product knowledge, process understanding and process control, based on sound science and quality risk management.[1]

Knowledge and experience gained from previous biologic medicine development is utilized to create a list of CQAs. Potential impacts on CQAs comprise many elements, including formulation components (excipients, buffer components, surfactant, raw materials impurities, and protein concentrations), solution conditions (pH, temperature, ionic strength), process conditions (freeze/thaw, transportation, photo exposure, mixing, hold time, ultrafiltration/diafiltration, filtration, filling, lyophilization, inspection), and components (IV bags, tubings, vials, syringes, stoppers, devices) is created and the effects of these parameters on CQAs are then studied. This knowledge and expertise allows Amgen to identify and understand quality variability during process development so they can be measured and controlled in real-time during manufacturing.[1]

Understanding the impact of attributes of aggregates/particulates in monoclonal antibody-based formulations on potential biomarkers of the innate and adaptive immune responses are important predictors of the potential immunogenicity of aggregates/particles in biotherapeutics.[3] Given the association between protein aggregation (intrinsic to manufacturing and storage of biotherapeutics) and the increased risk of immunogenicity, Amgen scientists established a series of quality target profiles and continue to investigate the process inputs most likely to impact these attributes.

**References:**
[1]Jameel F, Khan M. Am. Pharm. Review 2009.
[2]Rathore AS. Nat Biotechnol 2009.
[3]Joubert MK, Hokom M, et al. J Biol Chem 2012; 287(30).