



Standard Guide for Pre-clinical *in vivo* Evaluation of Spinal Fusion¹

This standard is issued under the fixed designation F2884; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide covers general guidelines for the pre-clinical *in vivo* assessment of tissue-engineered medical products (TEMPs) intended to repair or regenerate bone in an interbody and/or posterolateral spinal environment. TEMPs included in this guide may be composed of, but are not limited to, natural or synthetic biomaterials or composites thereof, and may contain cells or biologically active agents such as growth factors, synthetic peptides, plasmids, or cDNA. The models described in this document represent a stringent test of a material's ability to induce and/or augment bone growth in the spinal environment.

1.2 While clinically TEMPs may be combined with hardware for initial stabilization or other purposes, the focus of this guide is on the appropriateness of the animal model chosen and evaluation of the TEMP induced repair and as such does not focus on issues of hardware.

1.3 Guidelines include a description and rationale of various animal models for the *in vivo* assessment of the TEMP. The animal models utilize a range of species including rat (murine), rabbit (lapine), dog (canine), goat (caprine), pig (porcine), sheep (ovine), and non-human primate (primates). Outcome measures include *in vivo* assessments based on radiographic, histologic, CT imaging as well as subsequent *in vitro* assessments of the repair, including histologic analyses and mechanical testing. All methods are described briefly and referenced. The user should refer to specific test methods for additional detail.

1.4 This guide is not intended to include the testing of raw materials, preparation of biomaterials, sterilization, or packaging of the product. ASTM standards for these steps are available in Referenced Documents (Section 2).

1.5 The use of any of the methods included in this guide may not produce a result that is consistent with clinical performance in one or more specific applications.

1.6 Other pre-clinical methods may also be appropriate and this guide is not meant to exclude such methods. The material

must be suitable for its intended purpose. Additional biological testing in this regard would be required.

1.7 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.8 *The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.*

2. Referenced Documents

2.1 ASTM Standards:²

F561 Practice for Retrieval and Analysis of Medical Devices, and Associated Tissues and Fluids

F565 Practice for Care and Handling of Orthopedic Implants and Instruments

F895 Test Method for Agar Diffusion Cell Culture Screening for Cytotoxicity

F981 Practice for Assessment of Compatibility of Biomaterials for Surgical Implants with Respect to Effect of Materials on Muscle and Bone

F1983 Practice for Assessment of Compatibility of Absorbable/Resorbable Biomaterials for Implant Applications

F2150 Guide for Characterization and Testing of Biomaterial Scaffolds Used in Tissue-Engineered Medical Products

2.2 Other Standards

ISO 10993 Biological Evaluation of Medical TEMPs—Part 5: Tests for *in vitro* Cytotoxicity³

21 CFR Part 58 Good Laboratory Practice for Nonclinical Laboratory Studies⁴

21 CFR 610.12 General Biological Product Standards – Sterility⁴

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

¹ This guide is under the jurisdiction of ASTM Committee F04 on Medical and Surgical Materials and Devices and is the direct responsibility of Subcommittee F04.44 on Assessment for TEMPs.

Current edition approved April 1, 2012. Published April 2012. DOI: 10.1520/F2884-12.