
Contents

Foreword	ix
Acknowledgments	xiii
Introduction	xvii
Chapter 1. Biobanks, a Source of Human Samples and Health Data	1
1.1. From the collection of biological samples to the concept of a biobank	3
1.1.1. The biobank concept	6
1.1.2. The first biobank described in the Framingham study	7
1.1.3. Classification of human sample biobanks	8
1.2. Mapping of biobanks	13
1.2.1. The large catalog of European biobanks	15
1.2.2. International biobanks	17
1.2.3. The first results from the megacohorts	26
1.3. Process management in biobanks	34
1.3.1. Sample quality, the priority of biobanks	35
1.3.2. Protection of the human person and personal information	41
Chapter 2. Biobanks in the Digital Age and Precision Medicine	51
2.1. Medical imaging biobanks	52
2.1.1. The UK Biobank prospective medical imaging study	53
2.1.2. The Rotterdam prospective imaging study	56
2.1.3. The German National Cohort	59
2.1.4. The European medical imaging biobank project	63
2.2. Radiomics data powered by digital technology	65

2.2.1. A multitude of application areas for biomarkers	67
2.2.2. Biomarkers in quantitative imaging	69
2.2.3. Artificial intelligence for automatic reading of medical images	74
2.3. The infallible traceability of biobank data	83
2.3.1. Automated sample flow, essential for population biobanks	83
2.3.2. Computerized management of clinicobiological annotations	85
2.3.3. International Biobanks of Excellence or Expert Centers	90
2.3.4. The FAIR principles of health data management	98
Chapter 3. The Biobanking Lexicon	101
3.1. Accreditation	101
3.2. Anonymization (or de-identification)	104
3.3. ANSM, the French National Agency for the Safety of Medicines and Health Products	104
3.4. Artificial intelligence	104
3.5. BBMRI, the coordinating center for European biobanks	104
3.6. BBMRI-ERIC, the research infrastructure for biobanking	105
3.7. BBMRI-ERIC Biobank of Excellence or Expert Center	105
3.8. Biobank information management system (BIMS)	105
3.9. Biobank or biological resource center (BRC)	106
3.10. Biomarker	106
3.11. Biospecimen	106
3.12. Buffy coat	108
3.13. Certification	108
3.14. Clinical biobank	109
3.15. Clinical research or clinical trials	109
3.16. Clinical trial sponsor	109
3.17. CNIL, the French National Commission for Information Technology and Civil Liberties	110
3.18. Cohort and megacohort	110
3.19. Collection of biological samples	110
3.20. Companion test	111
3.21. Computed tomography (CT)	111
3.22. CPP, the French Committee for the Protection of Individuals	111
3.23. Data protection officer (DPO)	111
3.24. Diagnostic biomarker	112
3.25. Digital health or e-health	112
3.26. Electronic case report form (eCRF)	112
3.27. ESBB, the European, Middle Eastern and African Society for Biopreservation and Biobanking	113
3.28. FDA, the US Food and Drug Administration	113
3.29. Formalin-fixed, paraffin-embedded (FFPE) tissue	113

3.30. Free and informed consent	114
3.31. General Data Protection Regulation (GDPR)	114
3.32. Imaging biobank	115
3.33. Imaging biomarker.	115
3.34. ISBER, the International Society for Biological and Environmental Repositories	115
3.35. ISO 20387:2018 Biotechnology – biobanking – general requirements for biobanking	115
3.36. Laboratory information management system (LIMS)	116
3.37. Liquid biopsy (in oncology)	116
3.38. Machine learning and deep learning	118
3.39. Medical imaging	118
3.40. Microbiota.	118
3.41. Monitoring biomarker.	122
3.42. MTA or biological material transfer contract	122
3.43. NF S96-900	124
3.44. Omics	124
3.45. Peripheral blood mononuclear cells (PBMCs)	124
3.46. Personalized or individualized medicine	125
3.47. Pharmacodynamic/response biomarker.	125
3.48. Population biobanking	125
3.49. Positron emission tomography (PET).	125
3.50. Pre-analytical phase	126
3.51. Precision medicine.	126
3.52. Predictive biomarker.	127
3.53. Prognostic biomarker	127
3.54. Prospective study/survey	127
3.55. Quality management system (QMS)	127
3.56. QR code	128
3.57. Radiomics	128
3.58. Region of interest or volume of interest (ROI/VOI)	128
3.59. Retrospective study/survey	128
3.60. Standard operating procedures (SOPs)	128
3.61. Stratified medicine.	129
3.62. The process of fixation and paraffin embedding	129
3.63. Translational research	130
3.64. Tumor biobank	131

Conclusion	133
Glossary	137
References	145
Index	159