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Standard PREanalytical Code Version 3.0

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Quality Assurance in biospecimen collection, processing, and storage is the focus of International Best Practices[1] and accreditation standards.[2] Traceability and documentation of the preanalytical phase is part of recently recommended lists of essential biobank datasets.[3,4] The Standard PREanalytical Code (SPREC) was first developed and published by the ISBER Biospecimen Science Working Group in 2009[5] and was updated in 2012.[6] The SPREC is a seven-element code corresponding to the most critical preanalytical variables of fluid and solid biospecimens. In this short communication, the SPREC version 3.0 is published. It includes more options, based on recent technological developments and on recently acquired knowledge about the critical ranges of preanalytical times, such as tissue ischemia times (Table 1, Table 2).

Table 1. Preanalytical Variables, with New Elements in Bold Italic, Included in SPREC (7-Element Long SPREC), Version SPREC 3.0, Applied to Fluid Samples

Type of sample	
Ascites fluid	ASC
Amniotic fluid	**AMN**
Bronchoalveolar lavage	**BAL**
Blood (whole)	**BLD**
Bone marrow aspirate	**BMA**
Breast milk	**BMK**
Buccal cells	**BUC**
Nondensity-gradient-centrifugation-separated buffy coat, viable	**BUF**
Nondensity-gradient-centrifugation-separated buffy coat, nonviable	BFF

(*continued*)

Table 1. (Continued)

(*continued*)

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Table 1. (Continued)

Type of sample	
Density-gradient-centrifugation-separated mononuclear cells, viable	**CEL**
Fresh cells from nonblood specimen type	**CEN**
Cells from nonblood specimen type (e.g., ascites, amniotic), viable	**CLN**
Cord blood	**CRD**
Cerebrospinal fluid	**CSF**
Enriched (physicochemically) circulating tumor cells	***CTC***
Dried whole blood (e.g., Guthrie cards)	**DWB**
Nasal washing	**NAS**
Density-gradient-centrifugation-separated mononuclear cells, nonviable	**PEL**
Cells from nonblood specimen type (e.g., ascites, amniotic), nonviable	**PEN**
Pleural fluid	**PFL**
Dental pulp	***PLP***
Plasma, single spun	**PL1**
Plasma, double spun	**PL2**
Red blood cells	RBC
Saliva	**SAL**
Semen	**SEM**
Serum	**SER**
Sputum	**SPT**
Stool	**STL**
Synovial fluid	SYN
Tears	**TER**
24 h urine	U24
Urine, random (''spot'')	**URN**
Urine, first morning	URM
Urine, timed	URT
Other	ZZZ

Type of primary container	
Acid citrate dextrose	**ACD**
Chemical additives/***stabilizers***	ADD
Serum tube without clot activator	CAT
Citrate phosphate dextrose	**CPD**
Cell Preparation Tube® citrate	CPT
Cell Preparation Tube heparin	***CPH***
Aldehyde-based stabilizer for CTCs	***CSV***
EDTA and gel	EDG
Physical filtration system	***FIL***
Glass	***GLS***
Lithium heparin	**HEP**
Hirudin	HIR
Lithium heparin and rubber plug	***LHB***
Lithium heparin and gel	**LHG**
Oragene collection container *or equivalent*	**ORG**
Stool collection container with DNA stabilizer	***OMN***
PAXgene® blood RNA$^+$	**PAX**
Potassium EDTA	**PED**
Polyethylene tube sterile	PET
S8820 protease inhibitor tablets *or equivalent*	**PI1**
Protease inhibitors	PIX
Polypropylene tube sterile	PPS
PAXgene blood DNA	PXD
PAXgene bone marrow RNA	PXR
RNA Later®	***RNL***
Sodium citrate	**SCI**

(*continued*)

Table 1. (Continued)

Type of primary container	
Nonaldehyde-based stabilizer for cell-free nucleic acids	***SCK***
Sodium EDTA	**SED**
Sodium heparin	SHP
Sodium fluoride/potassium oxalate	**SPO**
Serum separator tube with clot activator	**SST**
Tempus® tube	**TEM**
Trace elements tube	TRC
Unknown	XXX
Other	ZZZ

Precentrifugation (delay between collection and processing)		
RT	***<30 min***	***A1***
2°C–10°C	***<30 min***	***B1***
RT	<2 h	A
2°C–10°C	<2 h	B
RT	2–4 h	C
2°C–10°C	2–4 h	D
RT	4–8 h	E
2°C–10°C	4–8 h	F
RT	8–12 h	G
2°C–10°C	8–12 h	H
RT	12–24 h	I
2°C–10°C	12–24 h	J
RT	24–48 h	K
2°C–10°C	24–48 h	L
RT	>48 h	M
2°C–10°C	>48 h	N
>35°C	<2 h	O
Unknown		X
Other		Z

Centrifugation		
RT 10–15 min	<3000 g no braking	A
RT 10–15 min	<3000 g with braking	B
2°C–10°C 10–15 min	<3000 g no braking	C
2°C–10°C 10–15 min	<3000 g with braking	D
RT 10–15 min	3000–6000 g with braking	E
2°C–10°C 10–15 min	3000–6000 g with braking	F
RT 10–15 min	6000–10000 g with braking	G
2°C–10°C 10–15 min	6000–10000 g with braking	H
RT 10–15 min	>10000 g with braking	I
2°C–10°C 10–15 min	>10000 g with braking	J
RT 30 min	<1000 g no braking	M
No centrifugation		N
Unknown		X
Other		Z

Second centrifugation		
RT 10–15 min	<3000 g no braking	A
RT 10–15 min	<3000 g with braking	B
2°C–10°C 10–15 min	<3000 g no braking	C
2°C–10°C 10–15 min	<3000 g with braking	D
RT 10–15 min	3000–6000 g with braking	E
2°C–10°C 10–15 min	3000–6000 g with braking	F
RT 10–15 min	6000–10000 g with braking	G
2°C–10°C 10–15 min	6000–10000 g with braking	H
RT 10–15 min	>10000 g with braking	I
2°C–10°C 10–15 min	>10000 g with braking	J
No centrifugation		N

(*continued*)

Table 1. (Continued)

Second centrifugation		
Unknown		X
Other		Z
Postcentrifugation delay		
<1 h 2°C–10°C		A
<1 h RT		B
1–2 h 2°C–10°C		C
1–2 h RT		D
2–8 h 2°C–10°C		E
2–8 h RT		F
8–24 h 2°C–10°C		G
8–24 h RT		H
24–48 h 2°C–10°C		I
24–48 h RT		J
>48 h RT		***M***
Not applicable		N
Unknown		X
Other		Z
Long-term storage		
PP tube 0.5–2 mL	(−85) to (−60)°C	A
PP tube 0.5–2 mL	(−35) to (−18)°C	B
PP tube 0.5–2 mL	<−135°C[a]	V
Cryotube[b] 1–2 mL	LN	C
Cryotube[b] 1–2 mL	(−85) to (−60)°C	D
Cryotube[b] 1–2 mL	Programmable freezing to <−135°C	E
Plastic cryo straw	LN	F
Straw	(−85) to (−60)°C	G
Straw	(−35) to (−18)°C	H
Straw	Programmable freezing to <−135°C	I
PP tube ≥5 mL	(−85) to (−60)°C	J
PP tube ≥5 mL	(−35) to (−18)°C	K
Microplate well	(−85) to (−60)°C	L
Microplate well	(−35) to (−18)°C	M
Cryotube[b] 1–2 mL	LN after temporary (−85) to (−60)°C	N
Plastic cryo straw	LN after temporary (−85) to (−60)°C	O
Paraffin block	RT or 2–10°C	P
Paraffin block	***(−35) to (−18)°C***	***U***
Bag	LN	Q
Dry technology medium	RT	R
PP tube 40–500 µL	(−85) to (−60)°C	S
PP tube 40–500 µL	(−35) to (−18)°C	T
PP tube 40–500 µL	<−135°C[a]	W
Original primary container	(−35) to (−18)°C or (−85) to (−60)°C	Y
Unknown		X
Other		Z

Codes in bold come from the LDMS. Volumes refer to container size.

[a]Temperature <−135°C may correspond to LN vapor phase or to −150°C electrical freezer.

[b]Cryotube is defined as a tube that can be stored in LN either vapor or liquid phase.

LDMS, Laboratory Data Management System; h, hour; LN, liquid nitrogen, referring to either vapor or liquid phase (this specific information should be documented in the biobank's SOPs); min, minute; PP, polypropylene; RT, room temperature: 18°C–28°C; SOPs, standard operating procedures.

Table 2. Preanalytical Variables, with New Elements in Bold Italic, Included in the SPREC (7-Element Long SPREC), Version SPREC 3.0, Applied to Solid Samples

Type of sample	
Bone	***BON***
Fresh cells from nonblood specimen type (e.g., biopsy)	**CEN**
Cells from nonblood specimen type (e.g., dissociated tissue), viable	**CLN**
Cells from fine needle aspirate	FNA
Hair	**HAR**
Cells from laser capture microdissected tissue	LCM
Nails	***NAL***
Cells from nonblood specimen type (e.g., dissociated tissue), nonviable	**PEN**
Placenta	**PLC**
Solid tissue	**TIS**
Disrupted tissue, nonviable	TCM
Teeth	***TTH***
Other	ZZZ
Type of collection	
Autopsy <6 h postmortem	A06
Autopsy 6–12 h postmortem	A12
Autopsy 12–24 h postmortem	A24
Autopsy 24–48 h postmortem	A48
Autopsy 48–72 h postmortem	A72
Biopsy in culture media	BCM
Biopsy	**BPS**
Biopsy in normal saline or phosphate buffered saline	BSL
Biopsy in tissue low-temperature transport media	BTM
Fine needle aspirate	FNA
Punction	PUN
Surgical excision in culture media	SCM
Surgical excision	SRG
Surgical excision in normal saline or phosphate buffered saline	SSL
Surgical excision in tissue low-temperature transport media	STM
Surgical excision in vacuum container	VAC
Swab	**SWB**
Other	ZZZ
Warm ischemia time	
<2 min	A
2–10 min	B
10–20 min	C
20–30 min	D
30–60 min	E
>60 min	F
Unknown	X
Not applicable (e.g., biopsy)	N
Other	Z
Cold ischemia time	
RT <2 min	A
RT 2–10 min	B
RT 10–20 min	C
RT 20–30 min	D
RT 30–60 min	E

(*continued*)

Table 2. (Continued)

Cold ischemia time	
RT* 60 min–*3 h	F
RT 3 h–6 h	***G***
RT 6 h–12 h	***H***
RT >12 h	***I***
2°C–10°C <60 min	***E4***
2°C–10°C 60 min–3 h	***F4***
2°C–10°C 3–6 h	***G4***
2°C–10°C 6–12 h	***H4***
2°C–10°C >12 h	***I4***
Unknown	X
Not applicable (e.g., autopsy)	N
Other	Z
Fixation/stabilization type	
Nonaldehyde with acetic acid	ACA
Aldehyde based	ALD
Allprotect® tissue reagent	ALL
Alcohol based	ETH
Nonbuffered formalin	FOR
Heat stabilization	HST
Snap freezing	**SNP**
Nonaldehyde based without acetic acid	NAA
Neutral buffered formalin	NBF
Optimum cutting temperature medium	**OCT**
PAXgene tissue	PXT
RNA Later	**RNL**
Vacuum technology stabilization	***VAC***
Unknown	XXX
Other	ZZZ
Fixation time	
<15 min	A
15 min–1 h	B
1–4 h	C
4–8 h	D
8–24 h	E
24–48 h	F
48–72 h	G
>72 h	***H***
Not applicable	N
Unknown	X
Other	Z

Long-term storage		
PP tube 0.5–2 mL	(−85) to (−60)°C	A
PP tube 0.5–2 mL	(−35) to (−18)°C	B
PP tube 0.5–2 mL	<−135°C[a]	V
Cryotube[b] 1–2 mL	LN	C
Cryotube[b] 1–2 mL	(−85) to (−60)°C	D
Cryotube[b] 1–2 mL	Programmable freezing to <−135°C	E
Plastic cryo straw	LN	F
Straw	(−85) to (−60)°C	G
Straw	(−35) to (−18)°C	H
Straw	Programmable freezing to <−135°C	I
PP tube ≥5 mL	(−85) to (−60)°C	J
PP tube ≥5 mL	(−35) to (−18)°C	K
Microplate well	(−85) to (−60)°C	L
Microplate well	(−35) to (−18)°C	M
Cryotube[b] 1–2 mL	LN after temporary (−85) to (−60)°C	N
Straw	LN after temporary (−85) to (−60)°C	O
Paraffin block	RT or 2 to 10°C	P
Paraffin block	***(−35) to (−18)°C***	***U***
Bag	LN	Q
Dry technology medium	RT	R
PP tube 40–500 µL	(−85) to (−60)°C	S
PP tube 40–500 µL	(−35) to (−18)°C	T
PP tube 40–500 µL	<−135°C[a]	W
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Author Disclosure Statement

No competing financial interests exist.

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