LABORATORY NOTEBOOK


030

LABORATORY NOTEBOOK

Company Name: CMRL 

Assigned To: Denise Hsu

Department: BME 

Notebook No: 030

INSTRUCTIONS

1. This notebook and all the information recorded therein are the sole property of this Company. The contents of this notebook are strictly confidential and may be disclosed to others only with the written permission of the Company. The employee must return this notebook upon request or termination of employment. Keep this notebook in a protected place to prevent loss. In the event of loss, notify your supervisor immediately and draft a written statement describing the contents of the notebook and the manner in which it was lost.

2. This notebook is intended to be a permanent record of your lab or field work. In order to fully protect your work and achieve the desired recognition, either academic or economic, you will need to pay careful attention to the manner in which you record entries in this notebook.

3. Write in concise and clear language and write everything down. Draw and diagram directly on these pages. To include a printout: label the printout, attach it securely to the notebook page, and then write a brief description of the printout in the notebook directly below the place where it is attached. All note should be made in the book, not on loose pages stuck inside the notebook. Be clear and safeguard your work.

4. Use only ink when marking in this notebook. Pencil markings should be avoided. To delete an error: draw a single line through the error and place your initials and the date close by.

5. The title, date and project name should be recorded at the start of each entry. Make sure you write down your full name, lab location and company or institution in the front of the notebook.

6. Begin your entries by explaining in chronological order exactly what procedure were used and in what order you completed the various steps. Date your entries. Specify the equipment and consumable materials that were used, preferably by manufacturer and part number. Describe completely and accurately exactly what results were achieved, and at what stages, including the time. It is always better to include too much detail in your entries, than too little. If you make a scientific discovery, or invent a product, these details may be very important to proving any new discoveries.

7. Witnesses are important in cases where new concepts or approaches are determined. Also, where new discoveries are made, or where the potential exists for a patent. In those cases, at least one witness who is not a co-discoverer should sign and date in the indicated space at the bottom of the relevant work sheets. The witness needs to be able to understand and describe the basic procedures and the results they observed.

8. Patentable subject matter may appear in the course of your work. Any new and surprising product, composition or method may be patentable. Be especially alert for patentability when results appear strange, interesting or of commercial importance. Protect the results by writing in your notebook: a) what the result is, b) why the result is significant, and c) how the result was produced.

9. The time between the actual experiment or procedure and the time that you record your findings should be minimized. Act immediately in order to fully record your findings.

10. Separate your notes for each long term project into separate notebooks. Do not use a single page to record observations or procedures from more than one subject.

Assigned To _____ Date_____ Notebook No._____

Returned To _____ Date_____ By _____

Transferred To _____ Date_____ By _____

Continued From Notebook Number _____ Date _____

Continued To Notebook Number _____ Date _____

Plate1 ARS - Raw

	1	2	3	4	5	6	7	8	9	10	11	12
A	OVRFLW	OVRFLW	OVRFLW	OVRFLW	OVRFLW	OVRFLW	3.314	0.043	0.05	0.051	0.05	0.05
B	0.681	0.689	0.596	2.038	2.017	1.7	0.051	0.052	0.053	0.052	0.051	0.05
C	1.276	1.262	1.068	1.306	1.321	0.949	1.283	1.268	0.928	1.421	1.413	1.107
D	0.57	0.573	0.443	0.792	0.779	0.596	0.585	0.59	0.45	0.657	0.642	0.463
E	0.763	0.768	0.634	1.333	1.327	0.982	0.918	0.925	0.767	1.291	1.277	1.085
F	1.114	1.107	0.798	1.143	1.117	0.897	0.705	0.705	0.512	1.8	1.793	1.388
G	1.964	1.929	1.4	1.781	1.784	1.268	1.885	1.888	1.419	1.631	1.595	1.184
H	1.322	1.29	1.001	0.648	0.66	0.465	0.72	0.733	0.556	2.15	2.148	1.912

Plate1 BCA - Raw

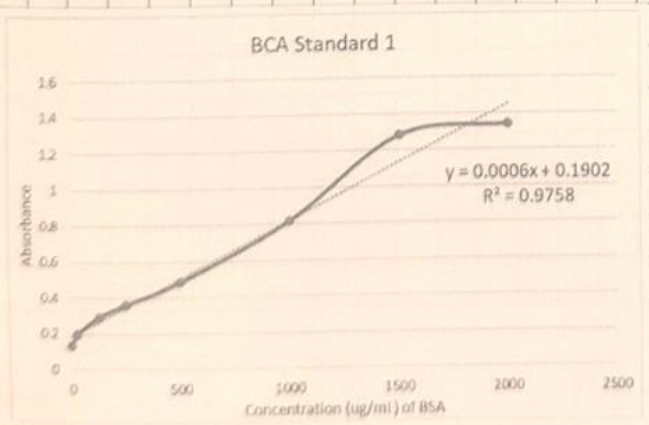
	1	2	3	4	5	6	7	8	9	10	11	12
A	1.341	1.284	0.821	0.489	0.365	0.295	0.2	0.132	0.043	0.043	0.044	0.043
B	0.42	0.603	0.538	0.588	0.601	0.545	0.044	0.043	0.044	0.044	0.044	0.043
C	0.925	1.036	0.955	0.688	0.726	0.725	0.681	0.687	0.696	0.856	0.927	0.916
D	0.543	0.588	0.555	0.376	0.41	0.382	0.544	0.462	0.435	0.387	0.623	0.406
E	0.738	0.848	0.757	0.785	0.919	0.829	0.677	0.677	0.757	0.774	0.826	0.77
F	0.394	0.447	0.414	0.386	0.536	0.456	0.488	0.423	0.337	0.575	0.639	0.558
G	0.605	0.745	0.696	0.752	0.622	0.666	0.551	0.568	0.666	0.647	0.672	0.684
H	0.563	0.585	0.623	0.537	0.661	0.634	0.522	0.486	0.445	0.574	0.608	0.574

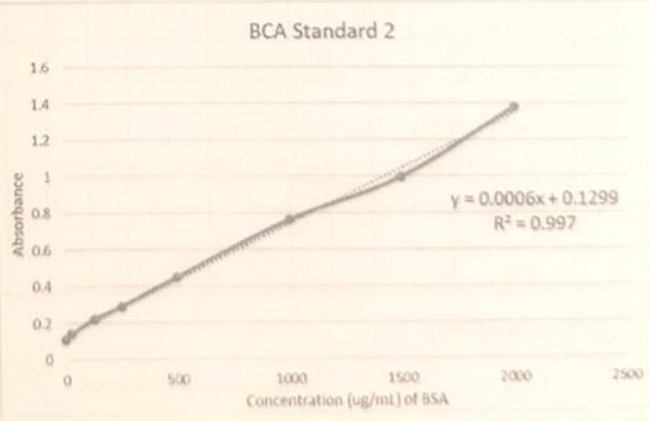
Plate2 ARS - Raw

	1	2	3	4	5	6	7	8	9	10	11	12
A	OVRFLW	OVRFLW	3.479	3.029	2.226	1.667	0.815	0.05	0.051	0.051	0.05	0.05
B	1.755	1.782	1.492	0.053	0.053	0.051	0.051	0.052	0.053	0.052	0.051	0.05
C	0.759	0.753	0.616	0.704	0.693	0.541	0.316	0.319	0.232	1.609	1.582	1.467
D	0.742	0.749	0.668	0.704	0.698	0.569	0.549	0.55	0.432	1.005	1.009	0.82
E	0.701	0.707	0.58	0.337	0.342	0.25	0.355	0.356	0.234	1.088	1.065	0.987
F	0.05	0.052	0.053	0.053	0.053	0.052	0.053	0.053	0.053	0.053	0.052	0.05
G	1.341	1.334	1.194	0.584	0.583	0.567	0.438	0.442	0.39	0.36	0.354	0.308
H	0.592	0.596	0.481	0.768	0.766	0.672	0.369	0.37	0.312	0.842	0.837	0.844

Plate2 BCA - Raw

	1	2	3	4	5	6	7	8	9	10	11	12
A	1.378	0.996	0.76	0.449	0.29	0.22	0.139	0.111	0.043	0.043	0.044	0.044
B	0.508	0.548	0.556	0.044	0.044	0.043	0.044	0.043	0.044	0.045	0.045	0.044
C	0.41	0.432	0.434	0.409	0.426	0.43	0.372	0.395	0.385	0.679	0.715	0.723
D	0.55	0.587	0.594	0.496	0.516	0.508	0.501	0.533	0.535	0.555	0.577	0.584
E	0.535	0.556	0.548	0.395	0.451	0.461	0.44	0.414	0.427	0.562	0.61	0.615
F	0.043	0.045	0.045	0.044	0.044	0.044	0.044	0.044	0.044	0.045	0.043	0.044
G	0.447	0.458	0.463	0.366	0.386	0.385	0.379	0.407	0.394	0.364	0.395	0.381
H	0.393	0.416	0.416	0.345	0.371	0.377	0.372	0.399	0.375	0.343	0.377	0.371





Signed Date

Signed 1/9/2022 Date

96-well plate 1

	1	2	3	4	5	6	7	8	9	10	11	12
A				Bad Standards		Fresh PC A						
B	Fresh PC 1	Fresh PC 1	Fresh PC 1	Fresh PC A	Fresh PC A							
C	Static Org PC1	Static Org PC1	Static Org PC1	Steady Org PC 1	Steady Org PC 1	Steady Org PC 1	0.25 Org PC 1	0.25 Org PC 1	0.25 Org PC 1	0.50 Org PC 1	0.50 Org PC 1	0.50 Org PC 1
D	Static EX-PC 1	Static EX-PC 1	Static EX-PC 1	Steady EX-PC 1	Steady EX-PC 1	Steady EX-PC 1	0.25 EX-PC 1	0.25 EX-PC 1	0.25 EX-PC 1	0.50 EX-PC 1	0.50 EX-PC 1	0.50 EX-PC 1
E	Static CY-PC 1	Static CY-PC 1	Static CY-PC 1	Steady CY-PC 1	Steady CY-PC 1	Steady CY-PC 1	0.25 CY-PC 1	0.25 CY-PC 1	0.25 CY-PC 1	0.50 CY-PC 1	0.50 CY-PC 1	0.50 CY-PC 1
F	Static Org PC A	Static Org PC A	Static Org PC A	Steady Org PC A	Steady Org PC A	Steady Org PC A	0.25 Org PC A	0.25 Org PC A	0.25 Org PC A	0.50 Org PC A	0.50 Org PC A	0.50 Org PC A
G	Static EX-PC A	Static EX-PC A	Static EX-PC A	Steady EX-PC A	Steady EX-PC A	Steady EX-PC A	0.25 EX-PC A	0.25 EX-PC A	0.25 EX-PC A	0.50 EX-PC A	0.50 EX-PC A	0.50 EX-PC A
H	Static CY-PC A	Static CY-PC A	Static CY-PC A	Steady CY-PC A	Steady CY-PC A	Steady CY-PC A	0.25 CY-PC A	0.25 CY-PC A	0.25 CY-PC A	0.50 CY-PC A	0.50 CY-PC A	0.50 CY-PC A

96-well plate 2

	1	2	3	4	5	6	7	8	9	10	11	12
A	Standard 8	Standard 7	Standard 6	Standard 5	Standard 4	Standard 3	Standard 2	Standard 1				
B	Fresh PC B	Fresh PC B	Fresh PC B									
C	Static Org PC B	Static Org PC B	Static Org PC B	Steady Org PC B	Steady Org PC B	Steady Org PC B	0.25 Org PC B	0.25 Org PC B	0.25 Org PC B	0.50 Org PC B	0.50 Org PC B	0.50 Org PC B
D	Static EX-PC B	Static EX-PC B	Static EX-PC B	Steady EX-PC B	Steady EX-PC B	Steady EX-PC B	0.25 EX-PC B	0.25 EX-PC B	0.25 EX-PC B	0.50 EX-PC B	0.50 EX-PC B	0.50 EX-PC B
E	Static CY-PC B	Static CY-PC B	Static CY-PC B	Steady CY-PC B	Steady CY-PC B	Steady CY-PC B	0.25 CY-PC B	0.25 CY-PC B	0.25 CY-PC B	0.50 CY-PC B	0.50 CY-PC B	0.50 CY-PC B
F												
G	Static EX-PC C	Static EX-PC C	Static EX-PC C	Steady EX-PC C	Steady EX-PC C	Steady EX-PC C	0.25 EX-PC C	0.25 EX-PC C	0.25 EX-PC C	0.50 EX-PC C	0.50 EX-PC C	0.50 EX-PC C
H	Static CY-PC C	Static CY-PC C	Static CY-PC C	Steady CY-PC C	Steady CY-PC C	Steady CY-PC C	0.25 CY-PC C	0.25 CY-PC C	0.25 CY-PC C	0.50 CY-PC C	0.50 CY-PC C	0.50 CY-PC C

GROUP	mmoles/ug	SEM
Fresh PC	0.002637188	0.000359949
Static PC	0.001873615	0.000321546
Steady PC	0.001935328	0.000296043
0.25 PC	0.001296915	0.000222872
0.50 PC	0.002073129	0.000259905
Static EX-PC	0.0018235	0.000289855
Steady EX-PC	0.001795101	0.000194549
0.25 EX-PC	0.001473574	0.000324419
0.50 EX-PC	0.001419089	0.000194826
Static CY-PC	0.001269825	0.000169382
Steady CY-PC	0.001159877	0.000186345
0.25 CY-PC	0.000920445	0.000121013
0.50 CY-PC	0.002296644	0.00029647

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Date

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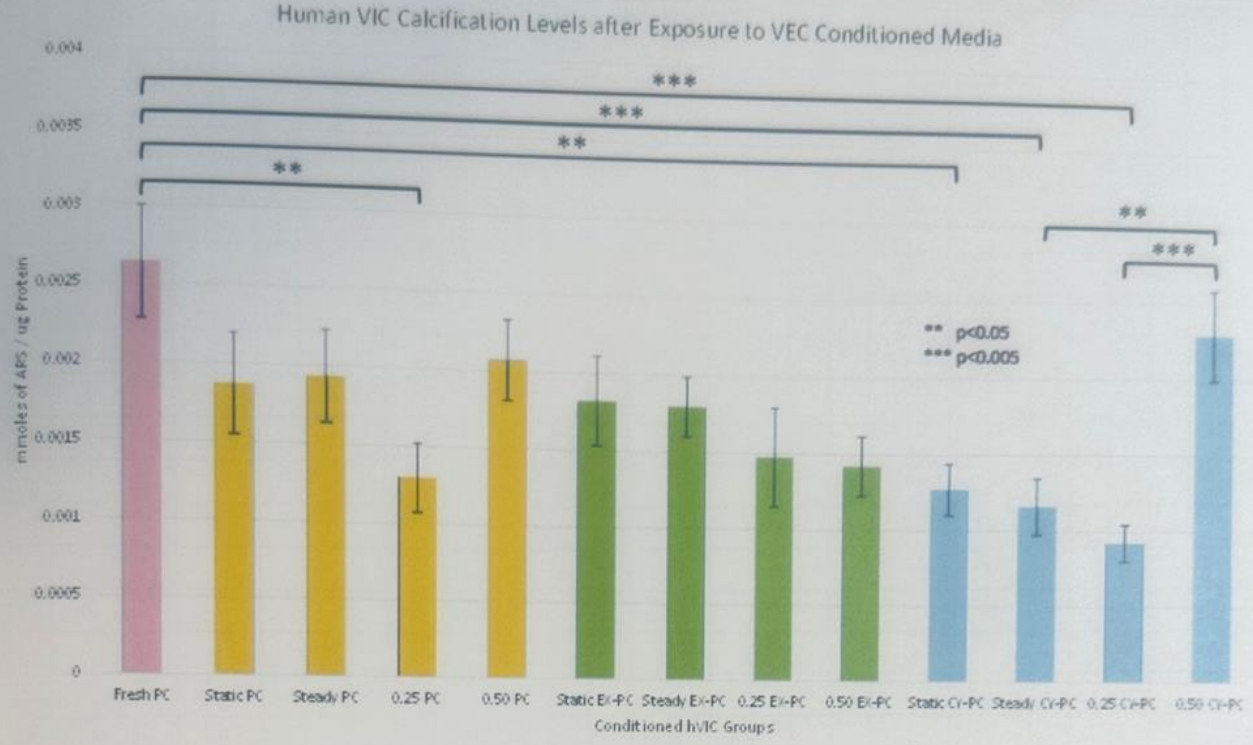
1/26/2022

Date



1/15/2022: hVIC RNA extraction/quantification

TUBE #		ng/uL
1-1	FRESH	144.2
1-2		234.4
2-1	PC	16.8
2-2		45.5
3-1	Static	34.0
3-2		76.2
4-1	Steady	39.7
4-2		116.6
5-1	0.25	32.7
5-2		51.8
6-1	0.50	74.4
6-2		130.3

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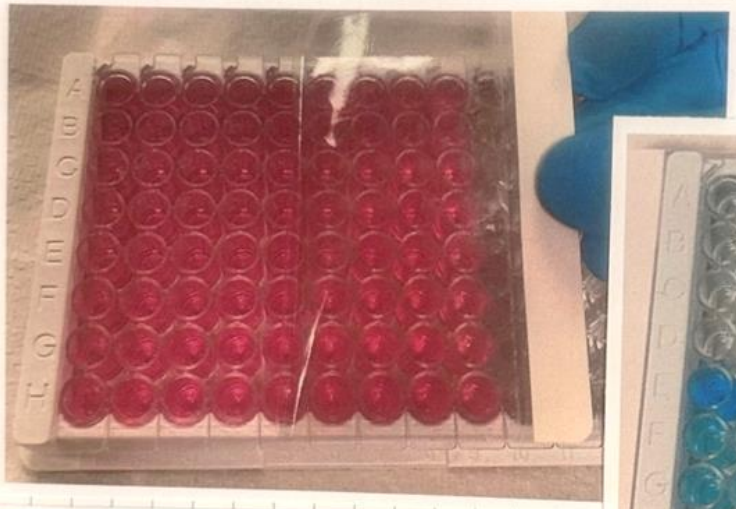
3/12/2022: Cytokine panel (96-well plate, 8 cytokines per strip, total 12 strips)

	Fresh PC	static EX-PC	steady EX-PC	0.25 EX-PC	0.50 EX-PC	static CY-PC	steady CY-PC	0.25 CY-PC	0.5D CY-PC	X
	1	2	3	4	5	6	7	8	9	10-12
A	TGFB									
B	VEGF									
C	TNFα									
D	IL-1β									
E	IL-6									
F	IL-8									
G	MCP-1									
H	GM-CSF									

ELISA

protocol on pg. 100~98



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	1	2	3	4	5	6	7	8	9	10	11	12	
A	0.119	0.117	0.123	0.12	0.112	0.106	0.117	0.119	0.105	0.042	0.043	0.045	450
B	0.134	0.124	0.142	0.141	0.134	0.133	0.128	0.141	0.134	0.046	0.043	0.048	450
C	0.094	0.083	0.095	0.092	0.086	0.086	0.087	0.092	0.089	0.044	0.046	0.049	450
D	0.077	0.067	0.072	0.07	0.07	0.069	0.074	0.076	0.072	0.044	0.044	0.049	450
E	3.51	3.351	3.352	3.341	3.395	3.571	3.206	3.465	3 619	0.043	0.047	0.043	450
F	0.566	0.301	0.229	0.289	0.31	1.545	0.231	0.55	1.314	0.044	0.045	0.044	450
G	0.641	0.543	0.658	0.605	0.461	0.625	0.546	0.543	0.498	0.046	0.049	0.048	450
H	0.116	0.094	0.103	0.101	0.094	0.094	0.102	0.11	0.121	0.043	0.042	0.043	450

	Fresh PC		Static EX-PC		Steady EX-PC		0.25 EX-PC		0.50 EX-PC		Static CY-PC		Steady CY-PC		0.25 CY-PC		0.50 CY-PC		X		X	
	1		2		3		4		5		6		7		8		9		10		11	12
A	TGFb		TGFb		TGFb		TGFb		TGFb		TGFb		TGFb		TGFb		TGFb		TGFb		TGFb	TGFb
B	VEGF		VEGF		VEGF		VEGF		VEGF		VEGF		VEGF		VEGF		VEGF		VEGF		VEGF	VEGF
C	TNFa		TNFa		TNFa		TNFa		TNFa		TNFa		TNFa		TNFa		TNFa		TNFa		TNFa	TNFa
D	IL-1b		IL-1b		IL-1b		IL-1b		IL-1b		IL-1b		IL-1b		IL-1b		IL-1b		IL-1b		IL-1b	IL-1b
E	IL-6		IL-6		IL-6		IL-6		IL-6		IL-6		IL-6		IL-6		IL-6		IL-6		IL-6	IL-6
F	IL-8		IL-8		IL-8		IL-8		IL-8		IL-8		IL-8		IL-8		IL-8		IL-8		IL-8	IL-8
G	MCP-1		MCP-1		MCP-1		MCP-1		MCP-1		MCP-1		MCP-1		MCP-1		MCP-1		MCP-1		MCP-1	MCP-1
H	GM-CSF		GM-CSF		GM-CSF		GM-CSF		GM-CSF		GM-CSF		GM-CSF		GM-CSF		GM-CSF		GM-CSF		GM-CSF	GM-CSF

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3/12/2022

Date

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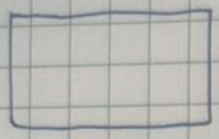
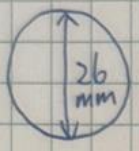
Date

6/13/2022: PSIS Scaffold Valve Area Cell Count

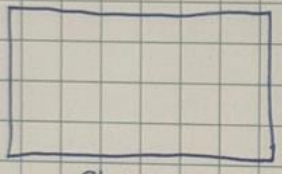


→ three posts' widths at 7mm per post
81.64 − 21 = 60.64 mm



$C = \pi \times 26\,mm$
$C = 81.64\,mm$

Valve area



$20mm = 1632.8\,mm^2 = 16.328\,cm^2$

$$\frac{2 \text{ million cells}}{2.5\,cm^2} = \frac{X \text{ cells}}{16.328\,cm^2}$$

from B. Gonzalez (2020)
PSIS scaffold
Seeding density: 2 million cells per strip

$2.5X = 32.656$ million cells

$X = 13.1$ million cells

VEC : VIC ratio = 27:34 from Wang, X. (2018)

VEC + VIC = 13,100,000

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$\frac{VEC}{VIC} = \frac{27}{34} \Rightarrow VEC = \frac{27}{34} \times VIC$

$\frac{27}{34} \times VIC + VIC = 13,100,000$

$\frac{61}{34} \times VIC = 13,100,000$

VIC = 7.3 million
VEC = 5.8 million
} for 1 side of scaffold

1 valve PSIS scaffold

VIC: 14.6 million
VEC: 11.6 million
] 2 sides

6/13/2022: Plated hVEC (P5) and hVIC (P3) in two separate T75 flasks
6/14/2022: media change for both VEC & VIC
6/20/2022: Seeded hVICs on PSIS
6/23/2022: Changed hVEC media and added celltracker dye (red)
6/25/2022: Seeded hVECs on the hVICs, and seeded another plate of hVICs alone w/no exposure to hVECs on PSIS
7/1/2022: Started PC conditioning
- hVEC-hVIC static
- hVEC-hVIC flow
- hVIC only static
- hVIC only flow

7/8/2022: Collected all conditioned media and placed samples in 10% formalin
7/9/2022: Embedded samples in OCT, stored in -80 °C.
7/25/2022: Sectioned w/cryostat at AHC1

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6/13/2022
Date

Innoprot
Speeding up drug discovery

PACKING LIST (PURCHASE ORDER # PO-39202022)

SHIPPER	CONSIGNEE
Jorge Gamiz	Att. Dr. Denise Hsu
Innovative Technologies in Biological Systems S.L. Parque Tecnológico de Bizkaia Edificio 502-1ª planta 48.160 Derio-Vizcaya Spain Phone number: +34944005355 E-mail: aaldecocea@innoprot.com Tax ID/VAT number: ESB95481909	Florida International University Biomedical Engineering Department 10555 West Flagler Street - Suite EC2600 Miami, FL 33174 USA E-mail: chsu013@fiu.edu Phone Number: 305 348 6717

Nºpackages	Nº units	Unit of Measure	Country of origin	Description of goods/Harmonized Tariff
2	1	kit	Spain	Fibroblast Medium Kit - II
	1	kit	Spain	Hu. Valvular Interstitial Cells
				MANUFACTURER: INNOPROT (SPAIN)
				Cell Culture Medium for stable cell lines Non-hazardous, non-toxic, non-infectious. For laboratory research only. For invitro research purposes only.

Date: 07/15/2022	Signature:

7/21/2022

8/1/2022: Plated 1 frozen vial of hVEC (P1) & hVIC (P1)
8/2/2022: Changed media on hVIC & hVEC
8/4/2022: Passaged hVEC P1 → P2. Made bioreactor media with DMEM + 10% FBS + 2% P/S + 82 µg/mL AA2P + 2 ng/mL bfgf

Lonza
Store Amps In Liquid Nitrogen Upon Arrival
Part # 00225975
Lot # 1F5027
Qty: 2
Instructions for use:
www.lonza.com/cellbioinstructions
Deviation from recommended protocol voids guarantee.
Lonza
Walkersville, MD USA
301-898-7025, www.lonza.com
Lonza
00521521

hVEC → bad batch → Innoprot P10462 HUMAN VALVULAR INTERSTITIAL CELLS Batch #25222 - Qty: > 5x10⁵cells
hVICs → Innoprot P10462 HUMAN VALVULAR INTERSTITIAL CELLS Batch #21059 - Qty: > 5x10⁵cells

hVEC supplements:

VEGF
CAT. NO.: CC-4114B 0.5 ML
ENDOTHELIAL GROWTH FACTOR VASCULAR HUMAN RECOMBINANT
LOT NO.: 0000974191 EXP.: 11 FEB 2022
STORE AT -20° C
FOR RESEARCH USE ONLY

GA-1000
CAT. NO.: CC-4331B 0.5 ML
GENTAMICIN SULFATE AMPHOTERICIN-B
CELL CULTURE TESTED
LOT NO.: 0000974196 EXP.: 16 FEB 2022
STORE AT -20° C
FOR RESEARCH USE ONLY SEE MSDS

rhFGF-B
CAT. NO.: CC-4113B 2.0 ML
r HUMAN FIBROBLAST GROWTH FACTOR-B
LOT NO.: 0000974190 EXP.: 17 FEB 2022
STORE AT -20° C
FOR RESEARCH USE ONLY

Lonza
Clonetics®
EGM®-2 MV SingleQuots®
Catalog No.: CC-4147
Lot No.: 0000974197
Expiration Date: 10 FEB 2022
Contains: Date Added
CC-4182B FBS, 25 mL
CC-4112B HYDROCORTISONE, 0.2 mL
CC-4113B hFGF-B, 2 mL
CC-4114B VEGF, 0.5 mL
CC-4115B R3- IGF-1, 0.5 mL
CC-4116B ASCORBIC ACID, 0.5 mL
CC-4317B hEGF, 0.5 mL
CC-4381B GA-1000, 0.5 mL
Store at -20 C
For Research Use Only. Not for use in diagnostic procedures.
Instructions for use: www.lonza.com
(rev. 6/08)
Lonza
Walkersville, MD USA
301-898-7025
www.lonza.com
Lonza

AoVEC 41911
WARNING HUMAN SOURCE MATERIAL
Human Aortic Valvular Endothelial Cells
≥500,000 CELLS/ML STORE AT -180 C
DATE CRYOPRESERVED: 01 FEB 2021
CAT. #: 00225975
LOT NO.: 1F5027
FOR RESEARCH USE ONLY
04689

ASCORBIC ACID
CAT. NO.: CC-4116B 0.5 ML
IN AQUEOUS SOLUTION
CELL CULTURE TESTED
LOT NO.: 0000974194 EXP.: 15 FEB 2022
STORE AT -20° C
FOR RESEARCH USE ONLY

R³-IGF-1
CAT. NO.: CC-4115B 0.5 ML
RECOMB. LONG R INSULIN-LIKE GROWTH FACTOR-1 IN AQUEOUS SOLUTION
CELL CULTURE TESTED
LOT NO.: 0000974193 EXP.: 26 FEB 2022
STORE AT -20° C
FOR RESEARCH USE ONLY

HYDROCORTISONE
CAT. NO.: CC-4112B 0.2 ML
WARNING: R11 HIGHLY FLAMMABLE
CELL CULTURE TESTED
LOT NO.: 0000974189 EXP.: 10 FEB 2022
STORE AT -20° C
FOR RESEARCH USE ONLY

rhEGF
CAT. NO.: CC-4317B 0.5 ML
EPIDERMAL GROWTH FACTOR HUMAN, RECOMB. IN A BUFFERED BSA SALINE SOLUTION
LOT NO.: 0000974195 EXP.: 05 MAR 2022
STORE AT -20° C
FOR RESEARCH USE ONLY

FBS
CAT. NO.: CC-4102B 25 ML
FETAL BOVINE SERUM
CELL CULTURE TESTED
LOT NO.: 0000974188 EXP.: 08 MAR 2025
STORE AT -20° C
FOR RESEARCH USE ONLY

hVIC supplements:

Innoprot FBS
Innoprot P/S SOLUTION
Innoprot FGS-2

Bioreactor media:
bfgf: CORNING
REF 354060
Fibroblast Growth Factor, Basic Human, Recombinant
Lot# 2017006

8/6/2022: Passaged hVIC P1 → P2 & hVEC P2 → P3. Plated 3 coverslips for Dani
8/9/2022: Passaged hVIC P2 → P3 & hVEC P3 → P4. Plated 3 coverslips for Dani
8/11/2022: Froze 1 T75 of hVICs in 5 vials.
8/12/2022: Seeded hVICs onto PSIS scaffolds (at P3) in BR media.
Seeding density: 2.5 cm² : 2 million cells.
8/16/2022: Seeded hVECs onto PSIS scaffolds

Continued on Page

Read and Understood By

Signed _____ Date _____ Signed _____ Date 8/1/2022

Lonza

Certificate of Analysis

Florida International University
Attn: Hutcheson/Denise/Claudia
Engineering Ctr / EC 02610
10555 West Flagler Street
Miami FL 33174

Despatch Date: 01-Aug-2022
Customer Order: FIU01-0000244627
Delivery: 72518691
Sales Order: 33857732

Product Name: hAoVEC-Aortic Valve Endothelial Cells
Material Number: 00225975
Batch No: 1F5339
Quantity: 1.000 AMP
Manufacturing Date: 28-Feb-2022

Test	*RESULT*	*SPECIFICATION MIN*	*MAX*	*UNIT*
DONOR INFORMATION				
Age	56			
Sex	FEMALE			
VIRUS TESTING				
HIV	Not Detected			
Hepatitis B	Not Detected			
Hepatitis C	Not Detected			
SAFETY TESTING				
Sterility Test	Negative	Negative		
Mycoplasma	Negative	Negative		
CELL STRAIN CALCULATIONS				
Viability	83	For Information Only	Target: >= 70%	
%				
Cell Count (cells/amp)	1139400	>= 5x10E5 cells/vial		
Seeding Efficiency	64	For Information Only	9999999	%
Doubling Time	19	For Information Only	9999999	hrs
CELL STAINING				
Factor VIII Expression	27	For Information Only	9999999	%

This lot has been reviewed by Quality Assurance in compliance with requirements of Lonza's Quality System. This document was generated from a validated Part 11-compliant electronic system and thus handwritten signatures are not required.

For Technical Assistance, call 1-800-521-0390

Lonza
523 Davis Drive Suite 400B
Morrisville, NC, 27560

Signed Date

Signed Date

Lonza

Lonza Walkersville Inc.
Walkersville Warehouse
8830 Biggs Ford Road
Walkersville 21793-0127
Phone:
Fax:

Customer PO Number

0072518691

Packing List

FIU01-0000244627

Shipping Point:	Walkersville 21793-0127		
Shipping Point:	21793-0127Walkersville		
Delivery Date:	02-Aug-2022	**Shipping Terms:**	CPT - Carriage paid to Incoterms2020
Freight Carrier:	FEDEX		
Freight Mode:	LBS Overnight Air	**Delivery:**	0072518691
Route:	ZLAL1-LBS Overnight Air		

Customer No.: 6023094

Ship to:
Florida International University
Attn: Hutcheson/Denise/Claudia
Engineering Ctr / EC 02610
10555 West Flagler Street
MIAMI FL 33174
USA

Sold to:
Florida International University
10555 West Flagler Street
MIAMI FL 33174
USA

Bill to:
Florida International University
Accounts Payable
11200 South West 8th Street
MIAMI FL 33199
USA

Order No.	Order Date	Customer Order No.	Customer Contact
33857732	20-Jul-2022	FIU01-0000244627	Donald Corbitt - 305 348 1243

Line Item	Product Code/ Description	Order Qty	Ship Qty	UOM	Lot No./Ser.Nr.	Expiration date	Temperature Storage Conditions
009	REFRIG REFRIGERATION	1.000	1.000	EA			-20°C
010	00225975 hAoVEC-Aortic Valve Endothelial Cells	1	1	AMP	1F5339		-180°C
020	CC-3202 EGM-2 MV BulletKit (CC-3156 & CC-4147)	1.000	1.000	KT			2 to 8 °C
030	CC-3156 EBM-2 Basal Medium 500 ml	1.000	1.000	BOT	0001111882	18-Apr-2023	2 to 8 °C
040	CC-4147 EGM-2 MV SingleQuot Kit Suppl. & Growth Factors	1.000	1.000	KT	0001107616	04-Apr-2023	-20°C

Delivery Instructions:

8/21/2022: started bioreactor conditioning in Procalcific Bioreactor media
8/28/2022: Terminated bioreactor. Placed samples in formalin and stored in 4°C
IP: Sigma-aldrich
I1643-100 UN
Pyrophosphatase, inorganic, from baker's yeast
Powder ≥ 500 units/mg protein (E 1%/280)
Stored conditioned media in -80°C
8/29/2022: Conducted vitro hydrodynamic tests on conditioned valves.
Mechanical: control (26mm)
Bioprosthetic: control (27mm)
Static PC (26mm) PSIS seeded w/VIC & VEC in static PC media
Bioreactor PC (26mm) PSIS seeded w/VIC & VEC in Bioreactor PC media
Raw PSIS
Embedded valve tissues after hydrodynamic testing in OCT
8/30/2022: Cryostat sectioning @ AHC1
Cut thickness: 16 µm
9/1/2022: ARS staining & BOSE mechanical testing of valve tissues
9/2/2022: Imaged ARS stains
9/3/2022: Immunostain w/ CD31 & αSMA antibodies
BSA: Cytiva HyClone Laboratories
Cat # SH30574.01
LoT # AF29530033B
Exp: Apr. 14, 2023
Primary antibody: Rabbit anti CD31 (green)
Prod # PA5-14372
Lot # SH24207228
Mouse anti αSMA (red)
Invitrogen eBioscience
REF 14-9760-82
LoT # 2288516
Secondary antibody: ab150108
Donkey pAb to Ms IgG
Alexa Fluor 594 (red)
lot: GR3235186-2
ab150073
Donkey pAb to Rabbit IgG
Alexa Fluor 488 (green)
Lot: GR3273045-1

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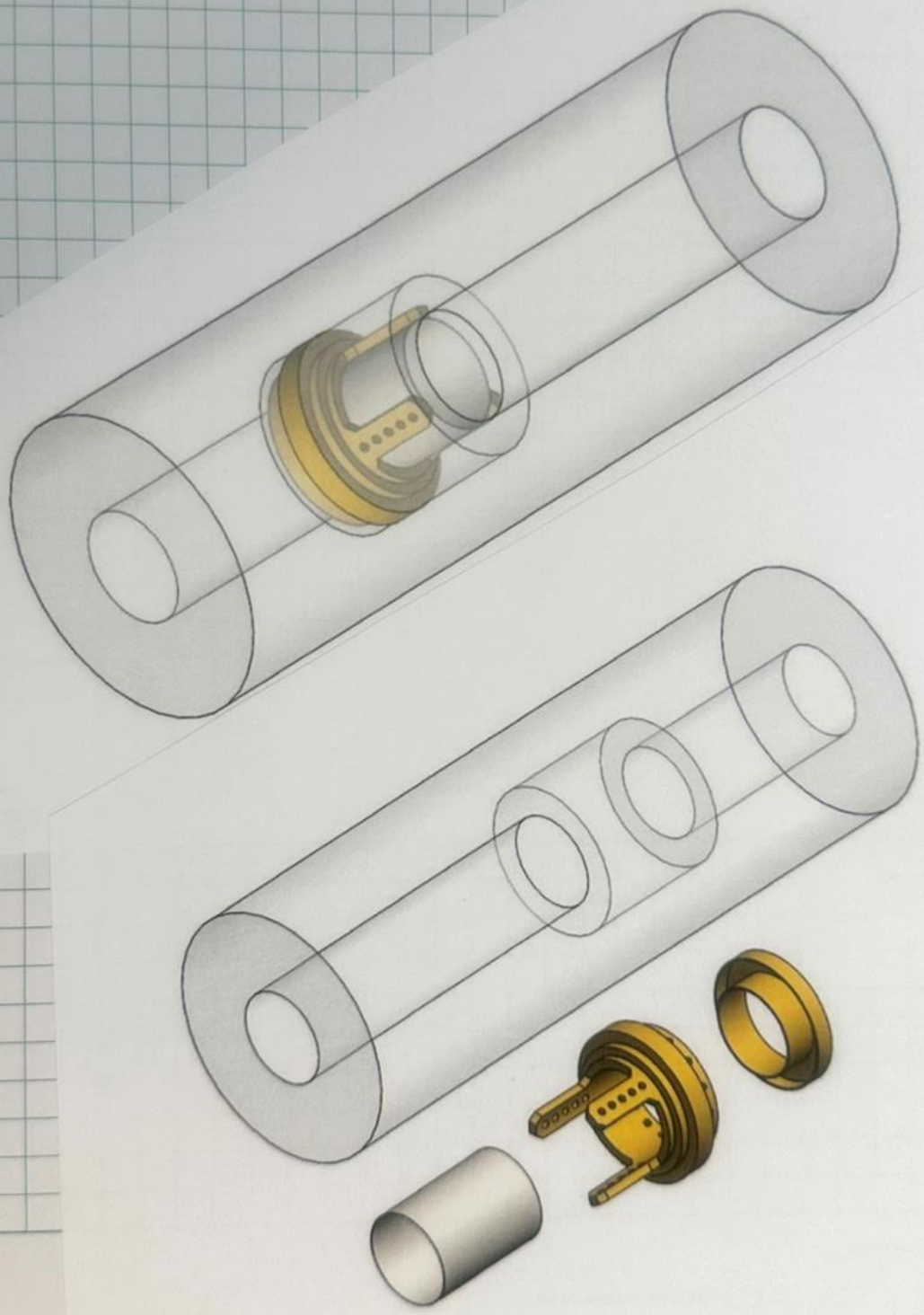
Read and Understood By

Signed Date Signed 8/21/2022 Date



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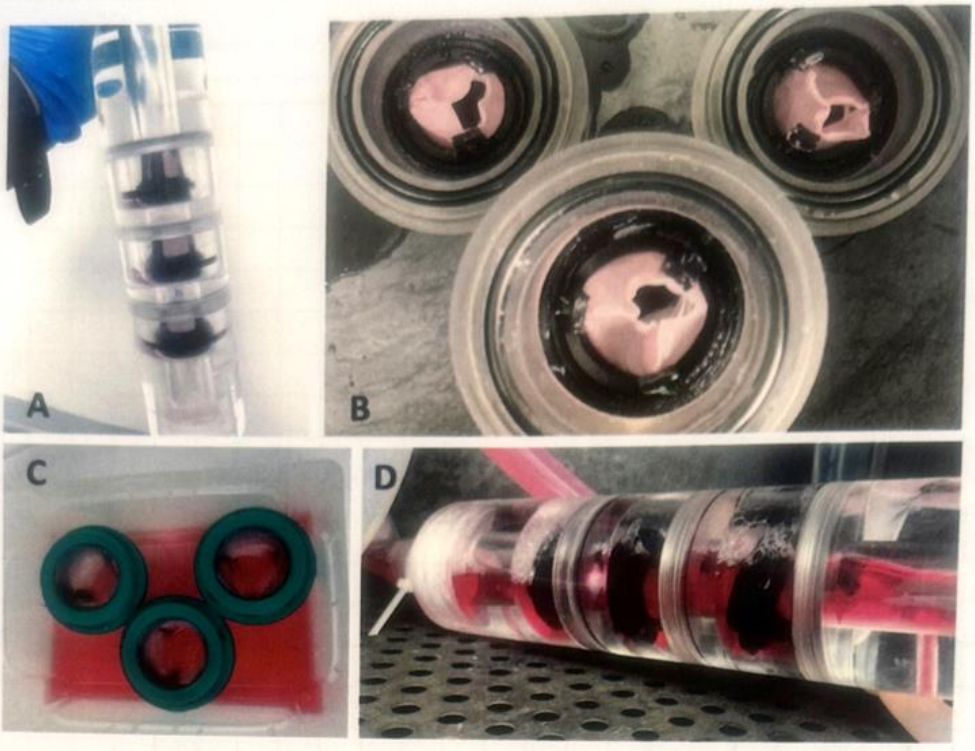

Figure 24. (A) Drained bioreactor with three conditioned PSIS valves. Each valve was seeded with VECs and VICs and conditioned in PC media under 0.50 OSI flow environment. (B) Removal of conditioned valves from bioreactor chambers. (C) Three PSIS valves, each seeded with VECs and VICs and conditioned in static PC media. (D) Bioreactor conditioning of PSIS valves with PC media.

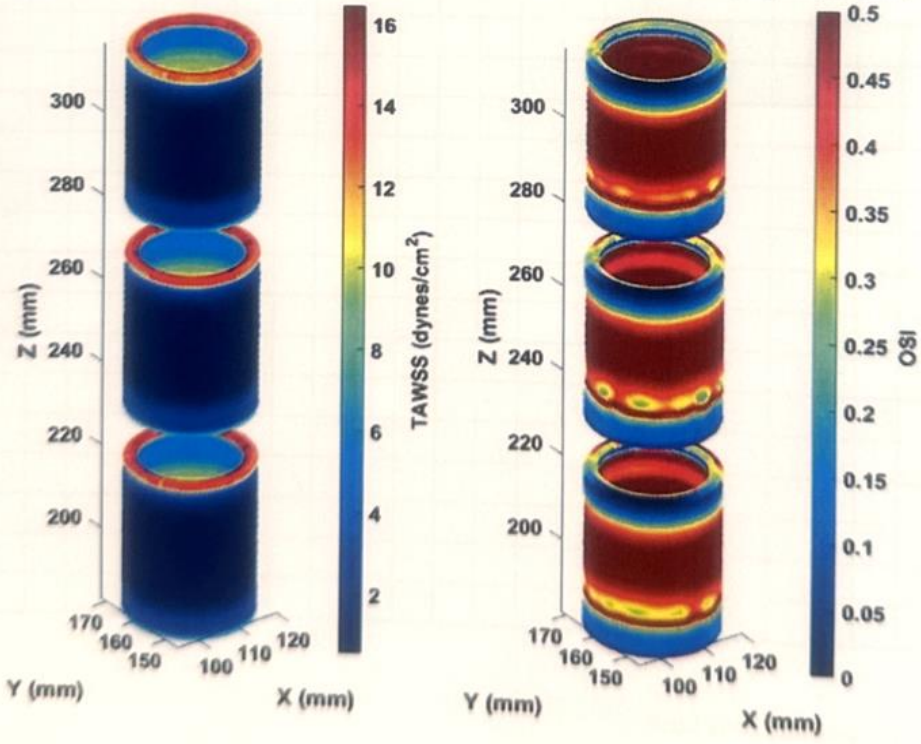

Figure 28. CFD simulation results of wall shear stress and OSI ranges on conditioned valve surfaces

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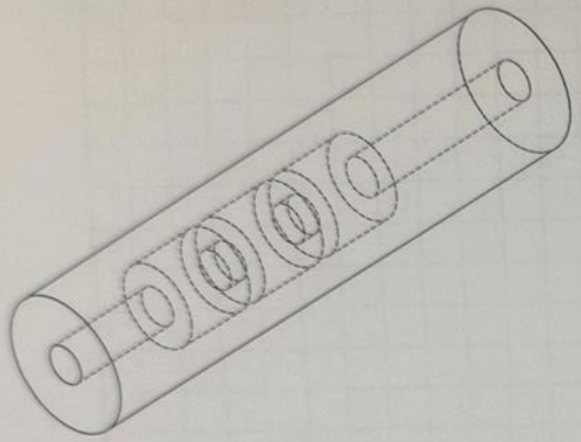
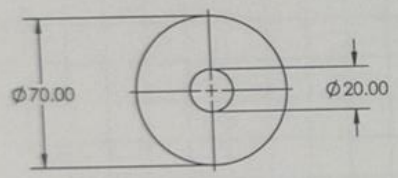
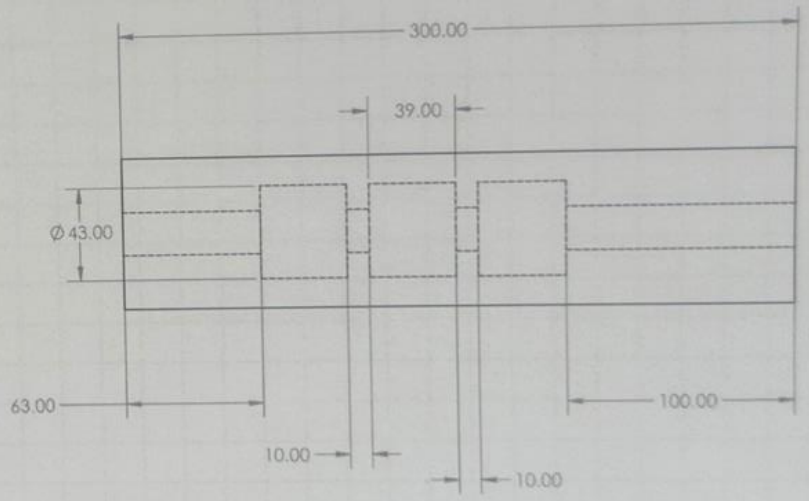
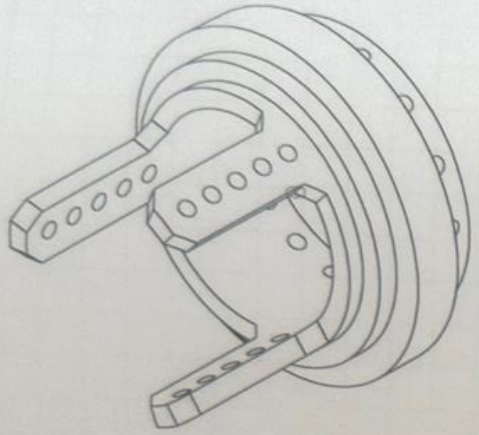
Date

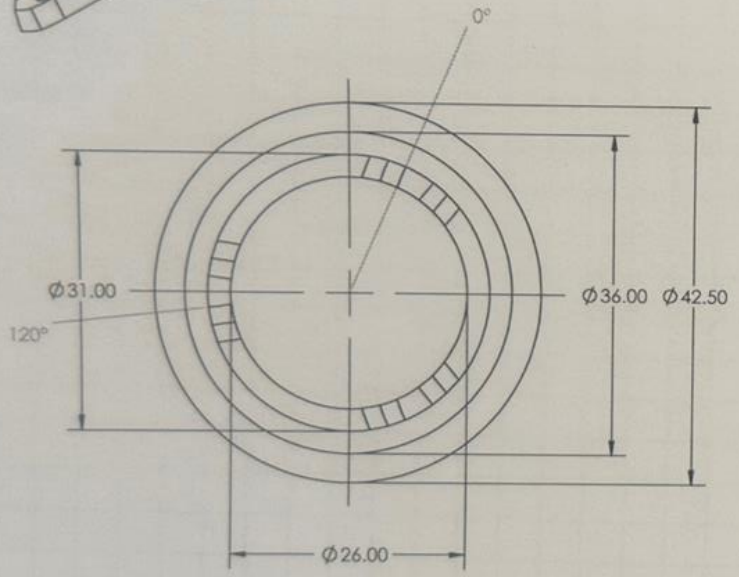


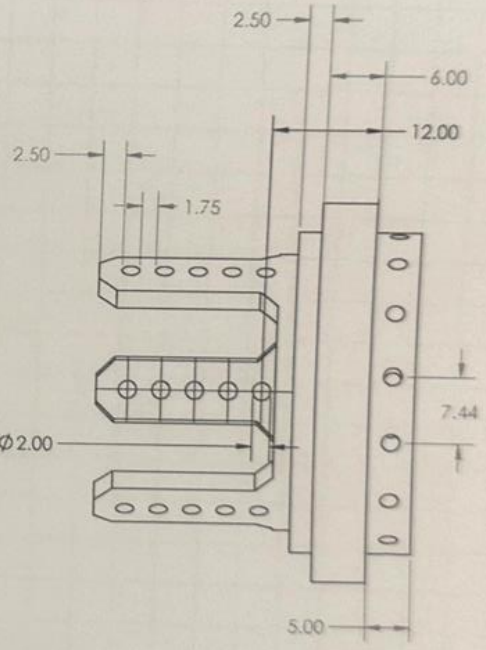




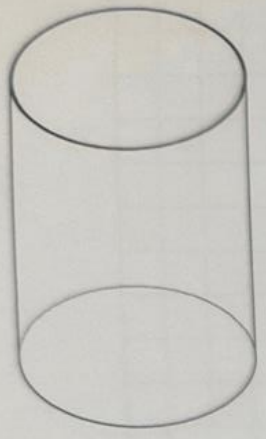
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:			DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE		TITLE:	
DRAWN						
CHK'D						
APP'V'D						
MFG						
Q.A						
				MATERIAL:	DWG. NO. Bioreactor Chamber	A3
				WEIGHT:	SCALE:1:4	SHEET 1 OF 1

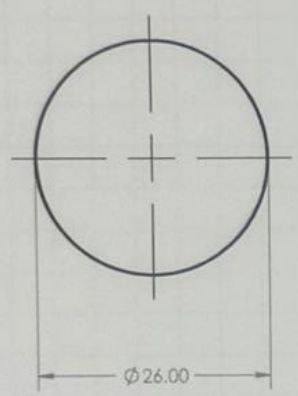


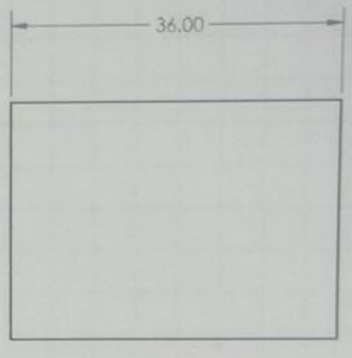




UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:				FINISH:		DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING
	NAME	SIGNATURE	DATE				TITLE:
DRAWN							
CHK'D							
APPV'D							
MFG							
Q.A							
				MATERIAL:			DWG. NO. Valve Ring Holder A3
				WEIGHT:			SCALE:2:1 SHEET 1 OF 1



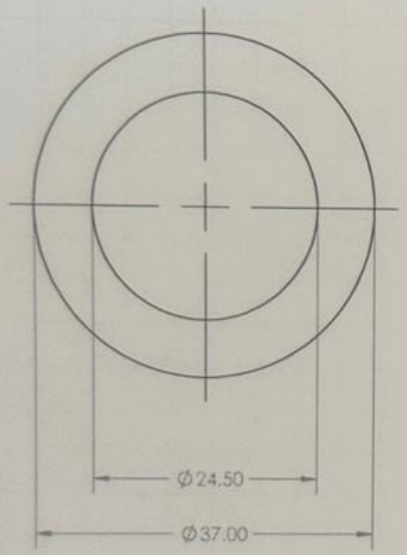


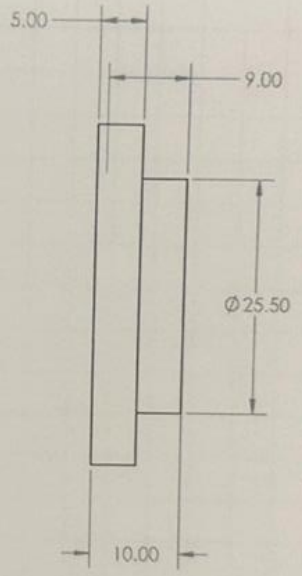


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS. SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:				DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING
	NAME	SIGNATURE	DATE				TITLE:
DRAWN							
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL:			DWG NO. Cylindrical PSIS Valve
				WEIGHT:			SCALE:2:1

A3

SHEET 1 OF 1





UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:				FINISH:		DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING
	NAME	SIGNATURE	DATE				TITLE:
DRAWN							
CHK'D							
APPV'D							
MFG							
Q.A.				MATERIAL:			DWG NO. Valve Ring Cap A3
				WEIGHT:			SCALE:2:1 SHEET 1 OF 1

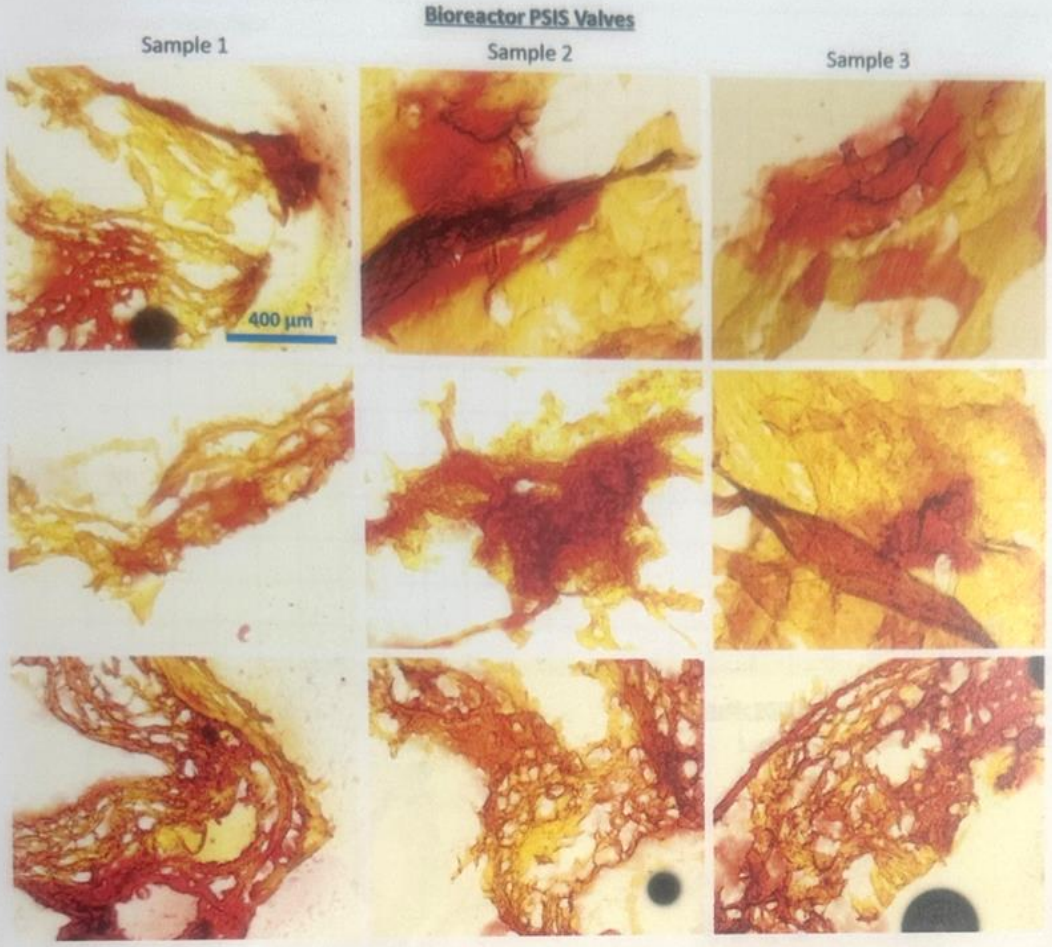


Figure 36. ARS images of bioreactor-conditioned valves. VECs and VICs were seeded in PSIS and conditioned at 0.50 OSI with PC media for 7 days.

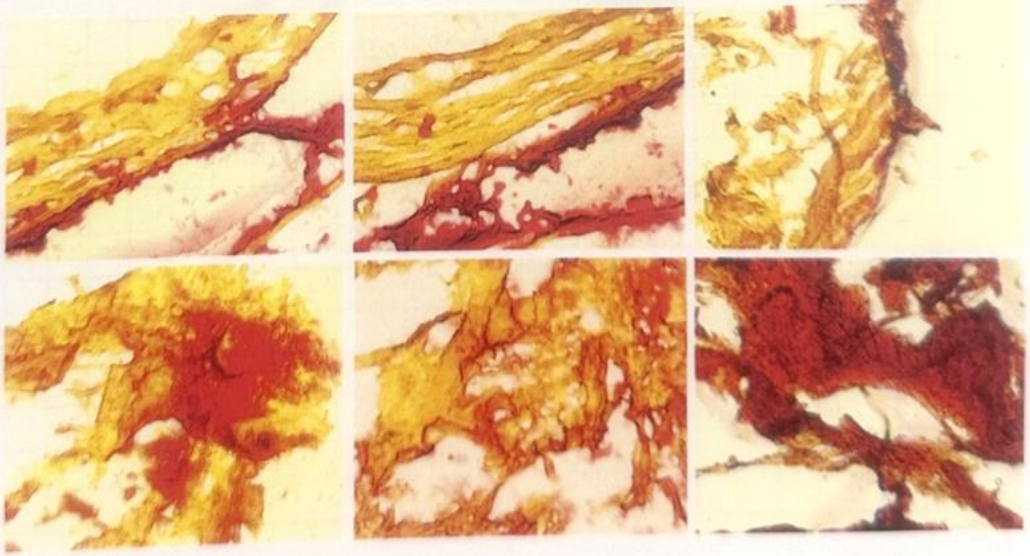


Figure 38. ARS images of statically conditioned valves. VECs and VICs were seeded in PSIS and placed in static environment with PC media for 7 days.

Signed Date Signed Date

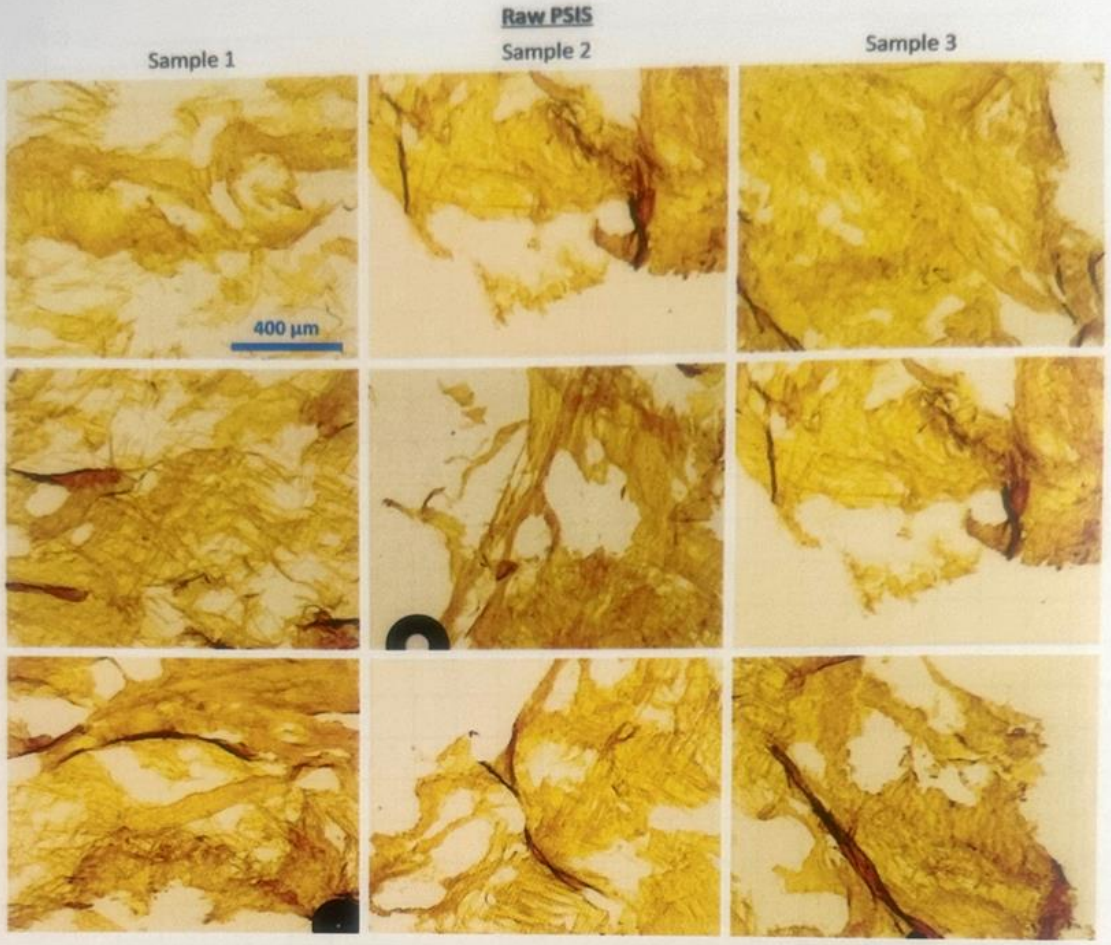


Figure 37. ARS images of raw PSIS.

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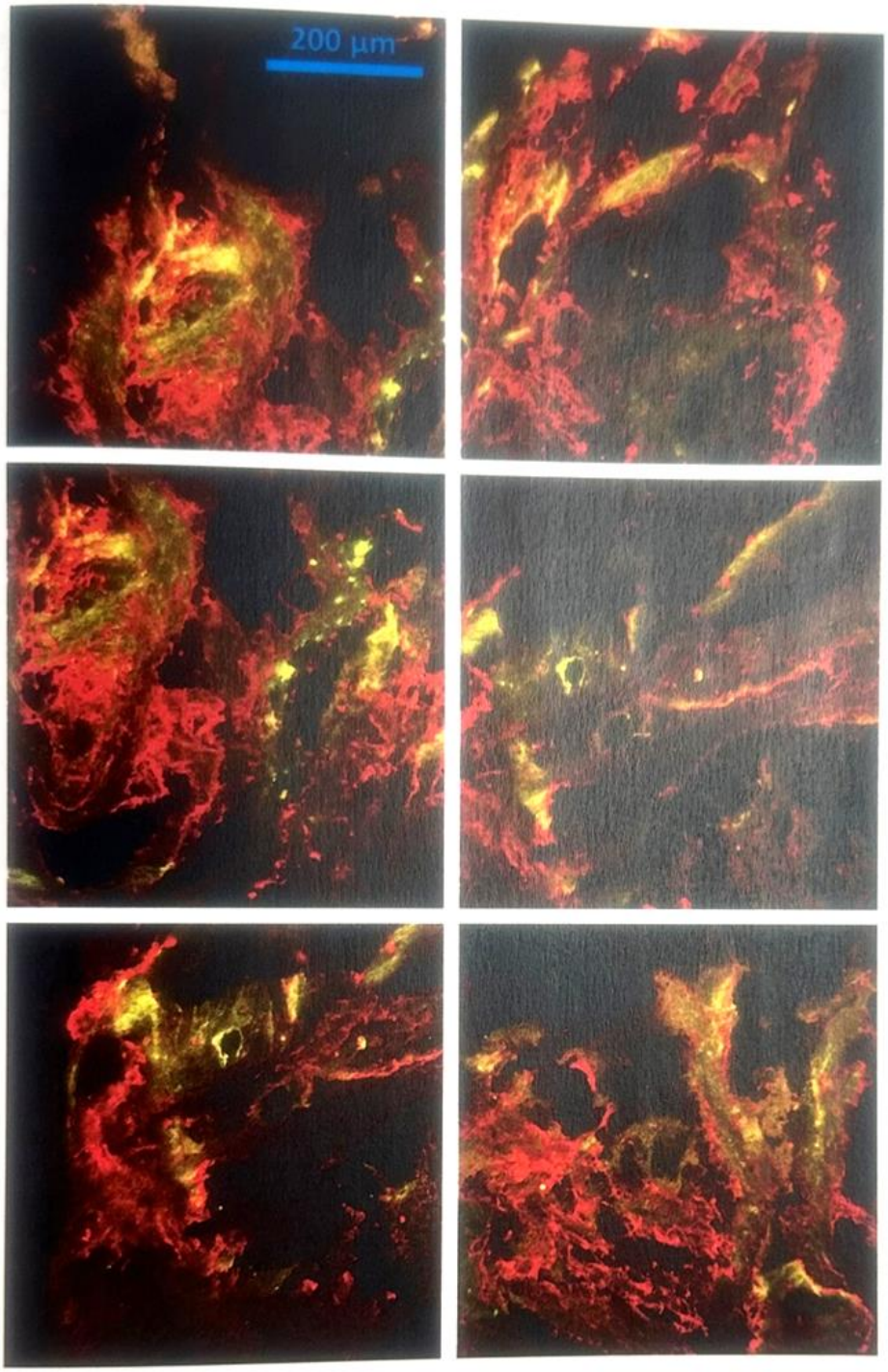

Figure 29. CD31 (green) and αSMA (red) immunofluorescent stains after conditioning in bioreactor with co-culture of VECs and VICs

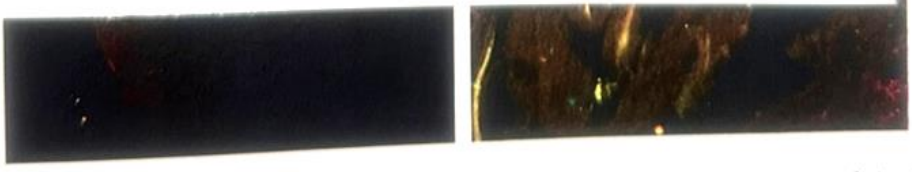

Figure 30. CD31 (green) and αSMA (red) immunofluorescent stains after conditioning in static with co-culture of VECs and VICs

PROTOCOLS

Signosis

Innovative Plate Assay Solutions

Product Information

Customized Human Cytokine ELSA Strip (Cus-EA-1001)

Product

Customized Human Cytokine ELISA Strip is a sandwich assay for profiling different cytokines in samples. This product is intended for research use only.

Components

The product contains all the materials and reagents required for different samples in a 12 X 8 - well assay format.

Please centrifuge all small components before opening

- ☐ **12 strips, coated with 8 different anti-human cytokine antibodies:**
  Store at 4°C until required
  Ready to use
- ☐ **Biotin-labeled detection antibody mixture against 8 different human cytokines (200µl):**
  Store in -20°C frost-free freezer until required
  Dilute with 1X Diluent Buffer at **1:50** just before use
- ☐ **Streptavidin conjugated to horseradish peroxidase (50 µl):**
  Store at 4°C until required
  Dilute with 1X Diluent Buffer at 1:200 just before use
- ☐ **1X Diluent Buffer (40ml):**
  Store at 4°C until required
  Ready to use
- ☐ **5X Assay Wash Buffer (40ml):**
  Store at 4°C until required
  Dilute 40ml of 5X Assay Wash Buffer with 160 ml of dH_2O before use
- ☐ **Substrate (10 ml):**
  Store at 4°C until required
  Ready to use
- ☐ **Stop Solution (2N H_2SO_4, 5ml):**
  Store at 4°C until required
  Ready to use
  ****Caution: It is a strong acid substance. Therefore, be careful not to contact your skin and clothes with Stop solution and pay attention to the disposal of Stop solution.****

Shelf Life

The shelf life of this product is 6 months. Use it before expiration.

Contacting Signosis

For technical questions, contact our technical support group by telephone at 1-408-747-0771 or by email at support@signosisinc.com

Signosis, Inc. • 1700 Wyatt Drive Suite 10-12 • Santa Clara, CA 95054 • Tel 408 747 0771 • Fax 408 470 7719

3/13/2022

Signosis
Innovative Plate Assay

Customized Human Cytokine ELISA Strip

Catalog # Cus-EA-1001_inv#005289 **(For Research Use Only)**

Introduction

Cytokines are essential molecules that have crucial roles in many biological functions including viral infection, inflammation, immunity, and hematopoiesis. Cytokines are produced by a variety of cell types in response to different stimuli. In addition, the expression of cytokine genes appears to be regulated by complex mechanisms. Expression of one cytokine gene could be regulated by other cytokines. Dysregulation of cytokine gene expression may be caused by chromosomal alterations or by infection of viruses that induce activation or inactivation of the expression machinery. Therefore, profiling of these cytokines is critical in understanding these biological functions. Signosis' Customized Cytokine ELISA Strip quantitatively profiles and measures 8 human cytokines: TGFβ, VEGF, TNFα, IL-1β, IL-6, IL-8, MCP-1, and GM-CSF. The difference of these proteins between samples can be determined through data comparison.

Principle of the assay

In each well of the strip, a primary antibody against a specific cytokine is coated and 8 wells of the strip are coated with 8 different antibodies. The test sample is allowed to react simultaneously with pairs of two antibodies, resulting in the cytokines being sandwiched between the solid phase and enzyme-linked antibodies. After incubation, the wells are washed to remove unbound-labeled antibodies. A HRP substrate, TMB, is added to result in the development of a blue color. The color development is then stopped with the addition of Stop Solution changing the color to yellow. The concentrations of the cytokines are directly proportional to the color intensity of the test sample. Absorbance is measured spectrophotometrically at 450 nm.

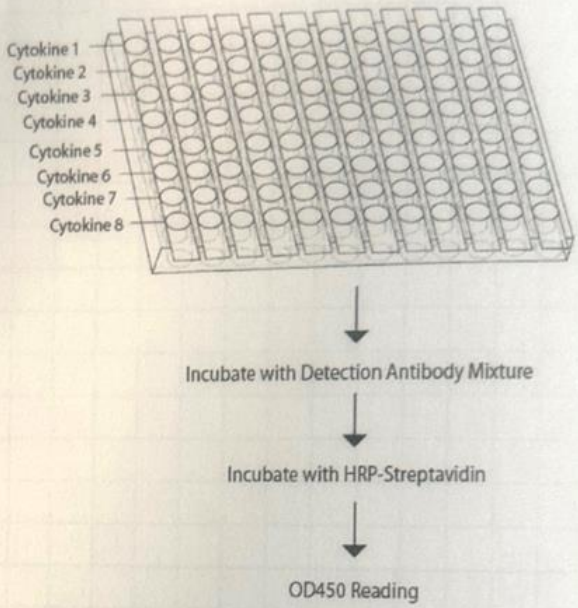

Diagram of Cytokine ELISA Strip

Materials provided with the kit

Component	Qty	Store at
96-Well 12 strip Plate coated with 8 different antibodies against customized human cytokines	1	4°C
Biotin labeled antibody mixture against 8 different human cytokines	200 µL	-20°C
***Streptavidin-HRP* conjugate**	50 µL	4°C
1X Diluent buffer	40 mL	4°C
5X Assay wash buffer	40 mL	4°C
Substrate	10 mL	4°C
Stop solution	5 mL	4°C

Signosis, Inc. • 1700 Wyatt Drive, Suite 10-12 • Santa Clara, CA 95054 • Tel 408 747 0771 • Fax 408 470 7719

3/13/2022

Continued from Page

Reagent preparation before starting experiment

- Dilute the 5x Assay wash buffer to 1x buffer:
  - 40 ml 5x Assay wash buffer
  - 160 ml ddH2O
- Dilute 50 times of biotin labeled antibody mixture with 1X Diluent buffer.
- Dilute 200 times of streptavidin-HRP with 1X Diluent buffer.

Sample preparation before starting experiment

- For **cell culture medium samples**, add 100 µl directly to the well.
- For **cell lysate samples**, use cell lysis buffer (Catalog# EA-0001). Follow protocol in Cell Lysate Buffer User Manual.
- For **serum or plasma samples**, we recommend a 1:10 dilution with 1X diluent buffer, for example, add 80ul sample in 720 ul 1X diluent buffer. When serum-containing conditional media is required, be sure to use serum as control.

Recommendation

- If you would like to quantitatively measure the cytokines in the samples, you can make standard curves through a series of 2-fold dilutions of protein standards. Protein standards can be purchased separately from Signosis.

Assay procedure

1. Take the desired strips from the plate. Make sure the rest of strips are well sealed.
2. Standard curve (optional):
If protein standard curve is desired, 4-5 wells for a cytokine may be used to make Standard curve.
3. Sample assay:
Apply each sample on the well, 100ul per well and incubate for 1-2 hour at room temperature with gentle shaking.
4. Aspirate each well and wash by adding 200 µl of 1X assay wash buffer. Repeat the process three times for a total of three washes. Completely remove liquid at each wash. After the last wash, remove any remaining liquid by inverting the plate against clean paper towels.
5. Add 100 µl of diluted biotin-labeled antibody mixture to each well and incubate for 1 hour at room temperature with gentle shaking.
6. Repeat the aspiration/wash as in step 4.
7. Add 100 µl of diluted streptavidin-HRP conjugate to each well and incubate for 45 min at room temperature with gentle shaking.
8. Repeat the aspiration/wash as in step 4.
9. Add 100 µl substrate to each well and incubate for 10-30 minutes.

Note: Substrate incubation time may vary due to different antibodies reactivity. Stronger signals (Strong blue color) could be stopped early after 5 minutes. Weaker signals should be incubated for 10-30 minutes.

9. Add 50 µl of Stop solution to each well. The color in the wells should change from blue to yellow.
10. Determine the optical density of each well with a microplate reader at 450 nm within 30 minutes.

Customized Human 8 Cytokine ELISA Strip Diagram

	1	2	3	4	5	6	7	8	9	10	11	12
A	TGFβ	TGFβ	TGFβ	TGFβ	TGFβ	TGFβ	TGFβ	TGFβ	TGFβ	TGFβ	TGFβ	TGFβ
B	VEGF	VEGF	VEGF	VEGF	VEGF	VEGF	VEGF	VEGF	VEGF	VEGF	VEGF	VEGF
C	TNFα	TNFα	TNFα	TNFα	TNFα	TNFα	TNFα	TNFα	TNFα	TNFα	TNFα	TNFα
D	IL-1β	IL-1β	IL-1β	IL-1β	IL-1β	IL-1β	IL-1β	IL-1β	IL-1β	IL-1β	IL-1β	IL-1β
E	IL-6	IL-6	IL-6	IL-6	IL-6	IL-6	IL-6	IL-6	IL-6	IL-6	IL-6	IL-6
F	IL-8	IL-8	IL-8	IL-8	IL-8	IL-8	IL-8	IL-8	IL-8	IL-8	IL-8	IL-8
G	MCP-1	MCP-1	MCP-1	MCP-1	MCP-1	MCP-1	MCP-1	MCP-1	MCP-1	MCP-1	MCP-1	MCP-1
H	GM-CSF	GM-CSF	GM-CSF	GM-CSF	GM-CSF	GM-CSF	GM-CSF	GM-CSF	GM-CSF	GM-CSF	GM-CSF	GM-CSF

Continued from Page

3/13/2022

Innoprot
Speeding up drug discovery

REF: P104

CARDIAC CELL SYSTEM INNOPROFILE™
HUMAN CARDIAC VALVULAR INTERSTITIAL CELLS

Product Type:	Cryo-preserved Valvular Interstitial Cells
Catalog Number:	P10462
Source:	Human Heart Valves
Number of Cells:	5 x 10^5 Cells / vial (1ml)
Storage:	Liquid Nitrogen

Human Valvular Interstitial Cells (HVIC) provided by Innoprot have been derived from heart valves that are explanted in culture. Human valvular interstitial cells are from a single donor. They are cryopreserved at primary culture and can be cultured and propagated at least 10 population doublings in the conditions provided by Innoprot.

These cells are positive for smooth muscle actin. These cells enable researchers to study the role of cardiac valves in vitro. Human valvular interstitial cells may be used for various types of valve replacement, stimulus contraction and transplantation studies into normal or diseased systems. In addition, they may be used for tissue engineering applications.

Product Use

THESE PRODUCTS ARE FOR RESEARCH USE ONLY. Not approved for human or veterinary use, for application to humans or animals, or for use in vitro diagnostic or clinical procedures

Recommended Medium

- Fibroblast Medium II Kit (Reference: P60166)

Product Characterization

Immunofluorescent method

- α-smooth muscle actin
- Vimentin

The cells test negative for HIV-1, HIV-II, HBV, HCV, mycoplasma, bacteria, yeast and fungi

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INSTRUCTIONS FOR CULTURING CELLS

IMPORTANT: Cryopreserved cells are very delicate. Thaw the vial in a 37 °C waterbath and return them to culture as quickly as possible with minimal handling!

Set up culture after receiving the order:

1. Prepare a poly-L-lysine coated flask (2 µg/cm², T-75 flask is recommended). Add 10 ml of sterile water to a T-75 flask and then add 150 µl of poly-L-lysine stock solution (1 mg/ml, Innoprot cat. no. PLL). Leave the flask in incubator overnight (minimum one hour at 37°C incubator).

2. Prepare complete medium: decontaminate the external surfaces of medium and medium supplements with 70% ethanol and transfer them to sterile field. Aseptically open each supplement tube and add them to the basal medium with a pipette. Rinse each tube with medium to recover the entire volume.

3. Rinse the poly-L-lysine coated flask with sterile water twice and add 20 ml of complete medium to the flask. Leave the flask in the hood and go to thaw the cells.

4. Place the vial in a 37°C waterbath, hold and rotate the vial gently until the contents are completely thawed. Remove the vial from the waterbath immediately, wipe it dry, rinse the vial with 70% ethanol and transfer it to a sterile field. Remove the cap, being careful not to touch the interior threads with fingers. Using 1 ml eppendorf pipette gently resuspend the contents of the vial.

5. Dispense the contents of the vial into the equilibrated, poly-L-lysine coated culture vessels. A seeding density of 5,000 cells/cm² is recommended.

Note: Dilution and centrifugation of cells after thawing are not recommended since these actions are more harmful to the cells than the effect of DMSO residue in the culture. It is also important that fibroblasts are plated in poly-L-lysine coated culture vessels that promote cell attachment.

6. Replace the cap or cover, and gently rock the vessel to distribute the cells evenly. Loosen cap if necessary to permit gas exchange.

7. Return the culture vessels to the incubator.

8. For best result, do not disturb the culture for at least 16 hours after the culture has been initiated. Change the growth medium the next day to remove the residual DMSO and unattached cells, then every other day thereafter.

Maintenance of Culture:

1. Change the medium to fresh supplemented medium the next morning after establishing a culture from cryopreserved cells..

2. Change the medium every three days thereafter, until the culture is approximately 70% confluent.

3. Once the culture reaches 70% confluence, change medium every other day until the culture is approximately 90% confluent.

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Subculture:

1. Subculture the cells when they are over 90% confluent.

2. Prepare poly-L-lysine coated flasks (2 µg/cm²) one day before subculture.

3. Warm medium, trypsin/EDTA solution (T/E, cat. no. 0103), trypsin neutralization solution (TNS, cat. no. 0113), and DPBS to room temperature. We do not recommend warming the reagents and medium at 37°C waterbath prior to use.

4. Rinse the cells with DPBS.

5. Add 8 ml of DPBS first and then 2 ml of trypsin/EDTA solution into flask (in the case of T-75 flask); gently rock the flask to make sure cells are covered by trypsin/EDTA solution; incubate the flask at 37°C incubator for 1 to 3 minutes or until cells are completely rounded up (monitored with inverted microscope). During incubation, prepare a 50 ml conical centrifuge tube with 5 ml of fetal bovine serum; transfer trypsin/EDTA solution from the flask to the 50 ml centrifuge tube (a few percent of cells may detached); continue incubate the flask at 37°C for 1 minutes (no solution in the flask at this moment); at the end of trypsinisation, one hand hold one side of flask and the other hand gently tap the other side of the flask to detach cells from attachment; check the flask under inverted microscope to make sure all cells are detached, add 5 ml of trypsin neutralization solution to the flask and transfer detached cells to the 50 ml centrifuge tube; add another 5 ml of TNS to harvest the residue cells and transfer it to the 50 ml centrifuge tube. Examine the flask under inverted microscope to make sure the cell harvesting is successful by looking at the number of cells left behind. There should be less than 5%.

Note: DPBS, trypsin/EDTA solution & trypsin neutralization solution are included in the "Primary Cells Detach Kit provided by Innoprot (Cat. N° P60305).

6. Centrifuge the 50 ml centrifuge tube (harvested cell suspension) at 1000 rpm (Beckman Coulter Allegra 6R centrifuge or similar) for 5 min; re-suspend cells in growth medium.

7. Count cells and plate cells in a new, poly-L-lysine coated flask with cell density as recommended.

Caution: *Handling human derived products is potentially bioharzadous. Although each cell strain testes negative for HIV, HBV and HCV DNA, diagnostic tests are not necessarily 100% accurate, therefore, proper precautions mush be taken to avoid inadvertent exposure.*
Always wear gloves and safety glasses when working these materials. Never mouth pipette. We recommend following the universal procedures for handling products of human origin as the minimum precaution against contamination [1].

[1]. Grizzle, W. E., and Polt, S. S. (1988) Guidelines to avoid personal contamination by infective agents in research laboratories that use human tissues. *J Tissue Culture Methods.* 11(4).

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REF: P601(

FIBROBLAST MEDIUM-2

Product Type: Fibrobast Medium-2
Catalog Number: P60108-2

Product Description

Fibroblast Medium-2 (FM-2) is a complete medium designed for optimal growth of normal human cardiac fibroblasts in vitro. It is a sterile, liquid medium which contains essential and non-essential amino acids, vitamins, organic and inorganic compounds, hormones, growth factors, trace minerals and a low concentration of fetal bovine serum (5%). The medium is HEPES and bicarbonate buffered and has a pH of 7.4 when equilibrated in an incubator with an atmosphere of 5% CO_2/95% air. The medium is formulated (quantitatively and qualitatively) to provide a defined and optimally balanced nutritional environment that selectively promotes proliferation and growth of normal human cardiac fibroblasts in vitro.

Components

- 500 ml of Basal Medium
- 25 ml of Fetal Bovine Serum (FBS)
- 5 ml of Fibroblast Growth Supplement 2 (FGS-2)
- 5 ml of penicillin/streptomycin solution (P/S solution)

Prepare for use

Thaw FGS-2, FBS and P/S solution at 37°C. Gently tilt the FGS tube several times during thawing to help the contents dissolve. **Make sure the contents of the supplement are completely dissolved into solution before adding to the medium.** Rinse the bottle and tubes with 70% ethanol, and then wipe to remove excess. Remove the cap, being careful not to touch the interior threads with fingers. Add FGS, FBS and P/S solution into basal medium in a sterile field, mix well and then the reconstituted medium is ready for use. Since several components of this medium are light-labile, it is recommended that the medium not be exposed to light for lengthy periods of time. If the medium is warmed prior to use, do not exceed 37°C. When stored in the dark at 4°C, the reconstituted medium is stable for one month.

Caution

If handled improperly, some components of the medium may present a health hazard. Take appropriate precautions when handling it, including the wearing of protective clothing and eyewear. Dispose of properly.

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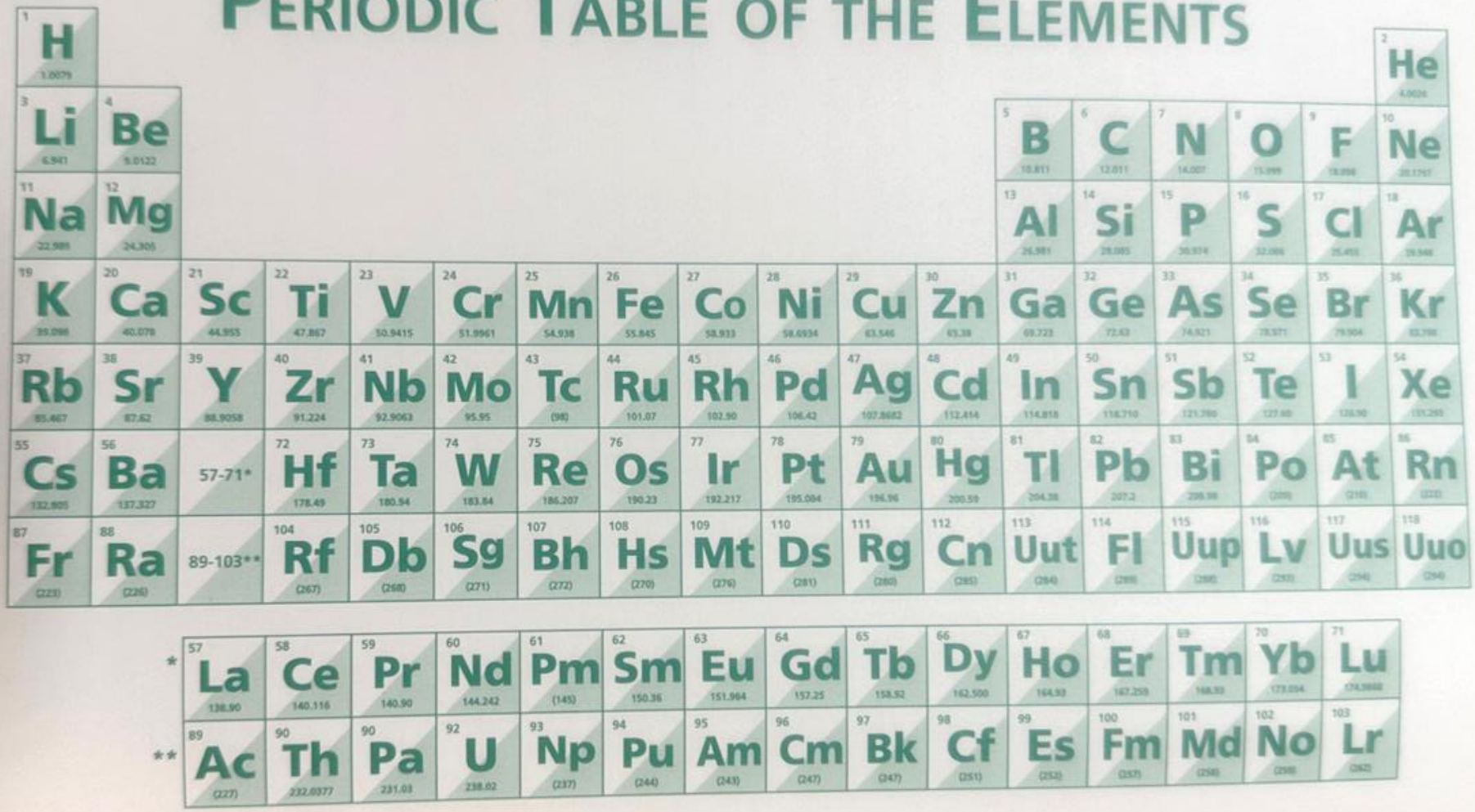
Periodic Table of the Elements



CONVERSION FACTORS

To Convert From	To	Multiply By
Centimeters	Inches	0.39370079
Cubic Feet	Liters	28.31605
Cu. Ft/min	Liters/sec	0.4719342
Cu.meters/min	Liters/min	999.972
Feet	Centimeters	30.48
Feet/min	Meters/sec	0.00508
Gallons	Liters	3.785306
Gal./sec	Liters/min	227.1183
Horsepower	Btu/hr	2547.16
Horsepower	Watts	746
Inches	Centimeters	2.54
Inches of H_20 (4°C)	Dynes/sq cm.	2490.82
Inches of H_20 (4°C)	In. of Hg (32°)	.07355
Kilograms	Pounds	2.2046226
Kilowatts	Btu/hr	3414.43
Liters	Gallons	0.2641794
Meters/sec	Feet/min	196.85039
Milliliters	Ounces	0.03381497
Millimeters	Inches	0.039370079
Millimeters of Hg (0°)	Pounds/sq. in.	0.0193368
Ounces	Liters	0.029572702
Pounds	Kilogram	0.45359237
Sq. Feet	Sq. Meters	0.09290304
Sq. Meters	Sq. Feet	10.763910
Watts	Btu/hr.	3.41443

TEMPERATURE SCALES

°C: degree Celcius (centigrade)
°F: degree Farenheit
K: Kelvin

	°C	°F	K
Boiling point of water (at 1 atm = 101325 Pa)	100	212	373.15
Freezing point of water (at 1 atm = 101325 Pa)	0	32	273.15
Interval freezing point/ boiling point of water (at 1 atm = 101325 Pa)	100	100	180
Triple point of water (solid-liquid-gas equilibrium)	0.01	32.02	273.16

TEMPERATURE CONVERSIONS

°C	=	[(°F - °32)(5/9)]
°F	=	[{°C)(9/5)} + 32)]
K	=	(°C + 273.15)
K	=	(TK - 273.15)
°C	=	[1.80 * (K - 273.15) + 32] °F

PRESSURE/VACUUM CONVERSIONS

micron	=	Torr	x 1000
Torr	=	mBar	x .075
psi	=	Torr	x 0.019
psi	=	in Hg vac (abs)	x 0.491
mBar	=	Torr	x 1.33
psi	=	in Hg vac (abs)	x 33.86
Pascal	=	Torr	x 133.3

CONDUCTIVITY CONVERSIONS

µS/cm	=	µmoh/cm	x 1
mS/cm	=	µS/cm	x 100
ppm	=	µS/cm	x 0.5

CONCENTRATION CONVERSIONS

$$\text{Molar (M)} = \frac{\text{Moles of solute}}{\text{Liters of solution}}$$

$$\text{Weight \%} = \frac{\text{g of solute x 100\%}}{\text{g of solute + g of solvent}}$$

$$\text{Volume \%} = \frac{\text{Liters of solute x 100\%}}{\text{Liters of Solution}}$$

$$\text{ppm} = \frac{\text{mg of solute}}{\text{kg of solution}} = \frac{\text{mg of solute}}{\text{Liters of water}}$$

DENSITY CONVERSIONS

Specific Gravity x 1 = g/mL
g/L x 8.345404 = lb/gal
lb/gal x 0.119826 = g/mL

RELATIVE CENTRIFUGAL FORCE

To calculate RFC in centimeters:
$RCF = 0.0000118 \times r \times N^2$

To calculate RCF in inches:
$RCF = 28.38 \times (N/1000)^2 \times r$

RCF = Relative Centrifugal Force
r = Rotating Radius (cm or inches)
N = Rotating Speed (rpm)

METRIC PREFIXES

Prefix	Abbreviation	Meaning
tera-	T	x 10^{12}
giga-	G	x 10^{9}
mega-	M	x 10^{6}
kilo-	k	x 10^{3}
deci-	d	x 10^{-1}
centi-	c	x 10^{-2}
milli-	m	x 10^{-3}
micro-	µ	x 10^{-6}
nano-	n	x 10^{-9}
pico-	p	x 10^{-12}

GEOMETRIC AREA FORMULAS

A = Area B = Base H = Height
R = Radius S = Side π = 3.14159

Triangle = B x H/2
Square = S x S
Rectangle = S1 x S2
Parallelogram = B x H
Regular Pentagon = 1.720 x S x S
Regular Hexagon = 2.598 x S x S
Regular Octagon = 4.828 x S x S
Circle Area = $\pi \times R^2$
Circle Circumference - $2 \times \pi \times R$
Ring = $\pi \times ((R2 \times R2) - (R1 \times R1))$
Ellipse = $\pi \times R1 \times R2$
Sphere Area = $4 \times \pi \times R^2$
Sphere Volume = $(4/3) \times \pi \times R^3$
Cone Volume = $(1/3) \times \pi \times R^2 \times H$
Cylinder Volume = $\pi \times R^2 \times H$

OHM LAW RELATIONSHIPS

E	=	$IR + W/I = \sqrt{WR}$
W	=	$I^2R = E^2/R = EI$
I	=	$E/R = W/E = \sqrt{WR}$
R	=	$E/I = W/I^2 = E^2/W$

For direct current