

ESCO
HEALTHCARE



MiniTide[®]

The Tiny Titan of
Adherent Bioprocessing



MiniTide®

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MiniTide® bioreactor leverages the proprietary Tide Motion® technology in a compact and user-friendly design. This facilitates linear scalability for research-oriented experiments. The streamlined bioprocess design expedites licensing due to the consistent application of the core Tide Motion® technology across all scales. This consistency ensures a seamless transition from initial discovery stages to *in-vivo* studies, GLP compliance testing, clinical trials, and ultimately, commercialization. This approach optimizes the patent lifespan by employing the same core technology throughout the entire development pipeline.

Esco MiniTide® simplifies the high-throughput screening of exosomes derived from diverse biological sources, covering primary tissues, cancer cells, and immortalized cell lines. This capacity is especially advantageous for the development of diagnostic and screening assays. It acknowledges the substantial variability in therapeutic potential between exosome populations, potentially influenced by culture conditions. The capability of MiniTide® to generate exosomes through cell culture enables researchers to investigate these contributing factors and pinpoint functionally potent exosome subsets.

Tide Motion Platform

(Schematic with Cell Harvesting System)

MiniTide®

CelCradle X®

TideCell / TideXcell® 2 L

TideCell / TideXcell® 20 L

TideCell / TideXcell® 100-300 L

TideCell / TideXcell®

Tide 2 mm/s: 3,000-5,000 L (stainless steel tanks)
Tide 6 mm/s: 55,000 L

3D seed to 3D bioreactor unlike many other bioreactors which seed in 2D

- GMP (TideCell®) and cGMP units (TideXcell®)
- Surface area: 3 x 10⁵ cm² (110 grams of macrocarriers)
- Larger scale manufacturing

Applications

- Culture of anchorage-dependent cells with BioNOC II® and BioMesh® macrocarriers
- Proof-of-concept for 3D carrier culture.
- MSC/EVs study or process optimization
- Vaccine/virus study or process optimization
- Tissue engineering

Features

- Single use
- Siemens HMI PLC-based monitoring system
- Offers significant advantages for research applications utilizing precious starting materials, high-cost culture media, and expensive analytical technique.
- Facilitates rapid exosome generation from various sources, including primary tissue, cancer cells and immortalized cell lines.

Tide Motion® Principle on MiniTide®

The Tide Motion bioprocessing technique leverages the cyclical rise and fall of culture medium within a bioreactor to mimic the natural ebb and flow of a tidal environment. This gentle, cyclical motion fosters optimal aeration and nutrient exchange for adherent cell cultures. The process effectively replicates the alternating exposure to nutrients and oxygen that these cells experience in their native environment.

Environmental Control

For normoxic or hypoxic cell cultures, temperature is meticulously maintained using EscO CO₂ incubators or compatible third-party CO₂ incubators. It is recommended that these incubators be equipped with HEPA or ULPA filters to ensure aseptic conditions.



Top Holding Time

Top holding time refers to the phase in the Tide Motion® cycle where the macroporous carriers undergo nutrient exchange.

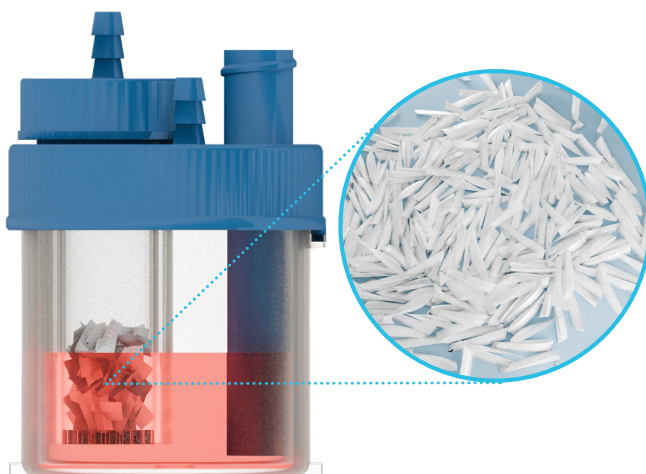


Bottom Holding Time

Bottom holding time refers to the phase in the Tide Motion® cycle where the macroporous carriers are exposed and transition into the oxygenation stage. During this phase, the oxygen or suppressed oxygen diffuse from the headspace within the vessel to the surface of the macroporous carriers.

Approximately 20% of the culture medium remains in contact with the macroporous carriers throughout the phase. This facilitates the passive diffusion of oxygen, or limited oxygen in the case of hypoxic cultures, from the surrounding air into the cell layer adjacent to the carriers, ultimately reaching the 3D cell culture within the macroporous matrix.

BioNOC II® and BioMESH®: The Heart of MiniTide®

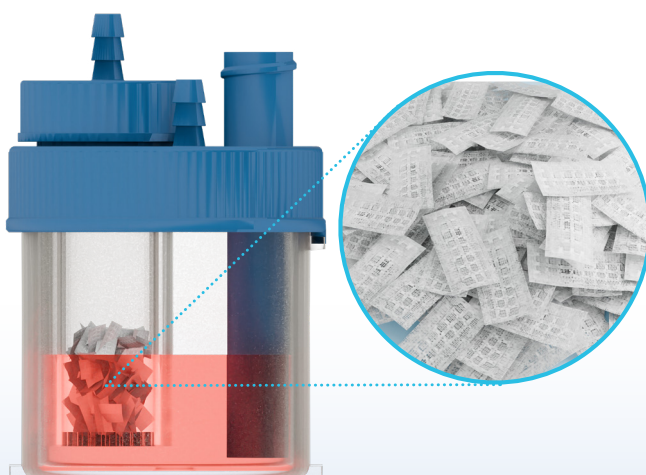


BioNOC II® Macrocarriers

BioNOC II® is a macroporous carrier that supports the growth of anchorage-dependent cells including animal, mammalian, and insect cells in either serum-containing or serum-free culture media.

It produces higher cell yields by providing a larger surface area (up to 2,730 cm²/g) that allows the growth of up to 5×10^9 cells/0.1 L of BioNOC II® (for Vero cells). Due to >95% porosity (50-200 µm), adherent cells are easily exposed to the necessary amount of culture media and aeration.

BioNOC II® is made of 100% PET manufactured according to cGMP guidelines. With its structure, it has a high load-bearing capability to support packed-bed structure and a 45° angle that generates microscopic eddy for mixing. The special geometric design and surface treatment on the carrier enhance fluid mixing, immobilization efficiency, protection from shear forces, and nutrient transfer during cell culture.



BioMESH® Macrocarriers

BioMESH® is a low-lint macrocarrier designed specifically for cell therapy applications. BioMESH® is often used when harvesting cells as the end product, such as skin fibroblasts, cardiac fibroblasts, mesenchymal stromal cells (also known as medicinal signaling cells or pericytes), pluripotent stem cells, epithelial cells, and chondrocytes.

Cells can grow undisturbed in 3D while maintaining a stable environment with minimal shear stress through Tide Motion® bioreactor that enables adherent cells to grow at high density and produce larger volumes of biomass, secreted or non-secreted products with low lint and particulate contamination.

Note: Surface area varies on the cell line used.



Key Benefits

Highest Yield

MiniTide® employs advanced macroporous carriers, BioNOC II® and BioMESH®, to optimize cell culture applications. BioNOC II® offers a 100% PET, fibrous culture matrix, while BioMESH® utilizes a combination of polypropylene (PP) netting and PET mesh. These macrocarriers offer several advantages:

High surface area: The macroporous design provides cells with a significantly increased surface area for optimal attachment and growth.

Biomimetic environment: The 3D structure closely mimics a cell's natural in vivo environment, promoting healthy cell behavior.

Efficient mass transfer: The matrix vessel facilitates efficient exchange of oxygen and nutrients, ensuring optimal cell proliferation and high bioproduct yields.

Affordable Cost

MiniTide® scaled down bioreactor also offers significant advantages for research applications utilizing precious starting materials, high-cost culture media, or expensive analytical techniques. This translates to a substantial reduction in the overall cost per experiment.

Linearly Scalable Quality

Esco Adherent Cell Tide Motion® platform offers a groundbreaking solution for adherent cell cultures. This innovative, world-first packed bed bioreactor system boasts full linear scalability. Starting with research-scale units designed for standard CO₂ incubators, the platform seamlessly expands to production volumes while maintaining the core Tide Motion® principle. This ensures consistent and reliable cell growth throughout the development and manufacturing process.

Cells	Estimated Cell Number per MiniTide Vessel	Carriers
MSC*	1.2×10^6	BioNOC II®**
	$1.3 - 2.8 \times 10^7$	BioMESH®***
iPSC	$1.2 - 3.1 \times 10^6$	BioNOC II®
Fibroblast	1.2×10^7	BioNOC II®
Vero	6.2×10^6	BioNOC II®
HEK293	8.8×10^7	BioNOC II®
MDCK	3.5×10^7	BioNOC II®
BHK-21	1.5×10^8	BioNOC II®
Sf-9	1.7×10^8	BioNOC II®
Sf-21	1.2×10^7	BioNOC II®
HuH-7	7.1×10^7	BioNOC II®

*The density of MSCs varies depending on the tissue of origin, the donor's age and characteristics, and the composition of the culture medium.

**BioNoc II® is optimally suited for the culture of MSCs when the goal is to obtain secretomes or small exosomes as the final products.

***BioMESH® is optimally suited for the cultivation of MSCs when the primary goal is cell harvesting as the final product. However, in cases where it is essential to maintain the cells' morphology, particularly if they have been extensively characterized in a 2D environment, BioMESH® may be more appropriate for harvesting small exosomes.

The choice of carrier type will ultimately depend on the specific requirements of the client's final experiment.

MiniTide® Key Components

Cable Complete Set

Connects the base frame to the main control box.

MiniTide® Culture Stage

Stainless steel 304 that can hold up to 4 MiniTide® vessels.

MiniTide® Matrix Vessel

Specialized containers that hold 35 mL of culture medium and promotes optimal cell growth and production.



BioNOC II® / BioMESH® (Packed Bed)

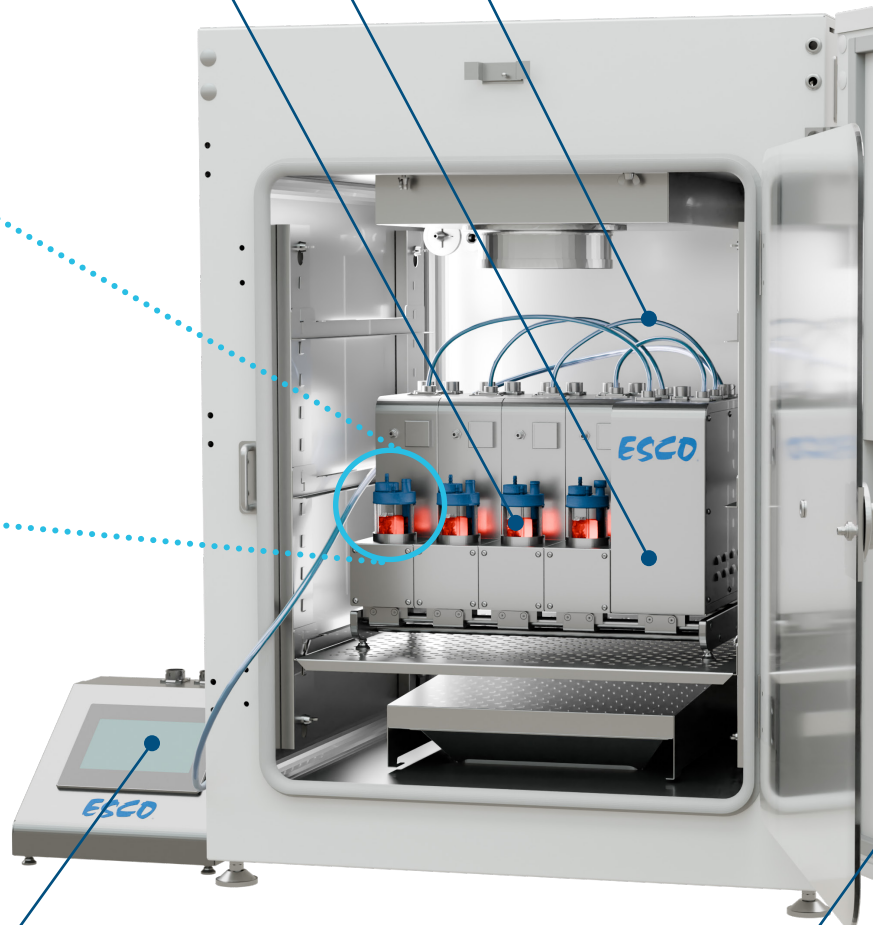
Cells remain entrapped in the carriers, simplifying media replacement and product harvesting.

HMI Box

MiniTide® HMI utilizes Siemens HMI KTP700/PLC 1214C, which allows for independent control of the experiment conditions.

CO₂ Incubators (optional)

Esco CO₂ incubators have top-notch features, making it a reliable choice to cradle precious cells.



MiniTide® Matrix Vessel

The MiniTide® system utilizes a multi-purpose culture vessel capable of holding up to 60 mL. However, for optimal performance, a working volume of 35 mL is recommended. The usable volume is further optimized based on the chosen macrocarriers, BioNOC II® or BioMESH®. This flexibility empowers scientists and researchers with the ability to tailor production processes, particularly advantageous for initial small-scale studies.

Polystyrene

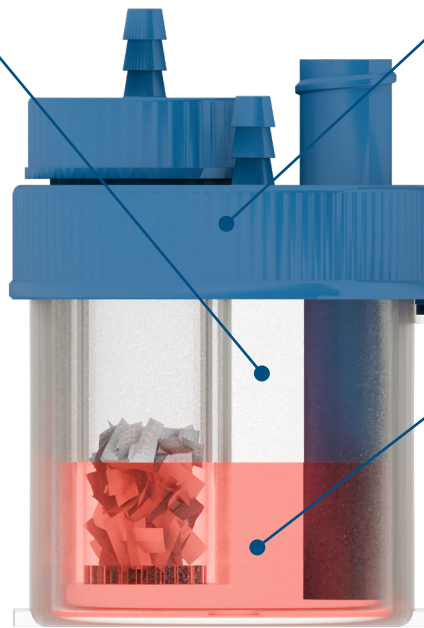
Polystyrene stands out as a preferred choice for cell culture flasks. This selection is driven by its key properties: superior optical clarity, ensuring unobstructed observation, exceptional durability for reliable performance, and minimal cytotoxicity.

Polypropylene

Polypropylene exhibits exceptional resistance to moisture, a variety of acids, and alkalis. This material offers a robust combination of high impact strength and fatigue resistance, creating a favorable environment for cell growth and proliferation.

Working Volume

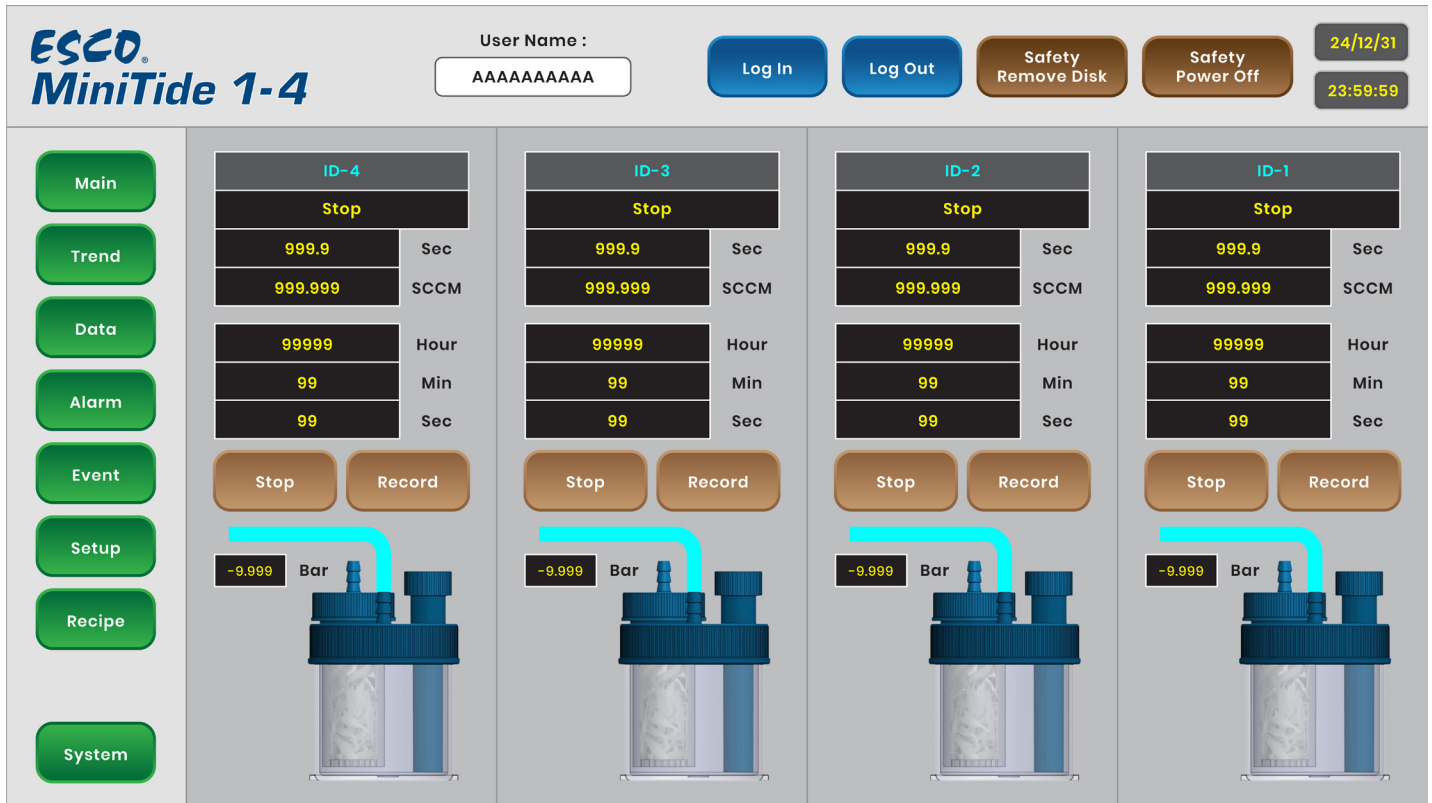
The MiniTide® system employs a versatile cell culture vessel with a maximum capacity of 60 mL, but a working volume of 35 mL is recommended.



Working Volume	35 mL	
Pre-Packed Carrier	BioNOC II®	0.17 ± 0.005 g
		25 pcs
	BioMESH®	0.5 ± 0.05 g
		Initially supplied as 10 BioMESH® sheets (24 × 9 mm). These sheets are bisected to yield a total of 20 BioMESH® sheets (12 × 9 mm).
Material	Cap	Polypropylene
	Bottle	Polystyrene

MiniTide® HMI Main Screen

MiniTide-4 features independent control, enabling researchers to design diverse experiments. This allows for the exploration of various parameters, including independent manipulation of top holding (nutrient exchange) and bottom holding (aeration phase) durations, as well as the investigation of the impact of different media types.



HMI Main Screen	Displays the main screen
Trend	Displays the trend graph
Data	Displays the data list
Alarm	Displays the alarm list
Event	Displays the operation history
Setup	Displays the programming settings page and the manual operation page
Recipe	Displays recipe operation page
System	Displays the system configuration settings page
Log In	Displays user login screen
Log Out	Logging out the current user
Safety Remove Disk	Ensuring the files are properly saved
Safety Power Off	Function key to confirm closing the background program

MiniTide® Product Specification

Esco Tide Motion® system bioreactors are a leading technology platform for global commercial production of human and animal vaccines. Additionally, Esco Tide Motion® system bioreactors play an essential role in clinical applications, supporting the development of adherent cell therapies and their derivatives. These derivatives include exosomes, extracellular vesicles, cell-derived nanovesicles, collagen for medical and cultivated meat applications, proteins for diagnostics and therapeutics, growth factors, and biomaterials like cultivated leather, all with applications in the biomedical field. MiniTide® is for research use or further manufacturing only and cGMP/GMP usage is subject to the site Quality Manufacturing Systems to be in place.

Note: MiniTide® needs to be placed in a cooled CO₂ incubator to offset the heat it produces.

Weight*	HMI Box**	6.5 kg
	Main control box + 1 MiniTide® Module unit	11 kg
	Main control box + 2 MiniTide® Module units	13.7 kg
	Main control box + 3 MiniTide® Module units	16.7 kg
	Main control box + 4 MiniTide® Module units	20 kg
Required space (W × H × D)	HMI Box**	290 × 360 × 290 mm
	Main control box + 1 MiniTide® Module unit	210 × 270 × 460 mm
	Main control box + 2 MiniTide® Module units	295 × 270 × 460 mm
	Main control box + 3 MiniTide® Module units	380 × 270 × 460 mm
	Main control box + 4 MiniTide® Module units	465 × 270 × 460 mm
Power supply	100-230 VAC, 50/60 Hz	
Housing	304 stainless steel	
Tide Motion® rate range	15 ~ 75 mL/min	
Accuracy	1.5 mL/min ¹	
Holding Time	0 ~ 9999 s	
Other properties	Data trend chart Data sheet Alarm list Recipe management User authority management Export in PDF and CSV format	

* The user needs to ensure that the third-party CO₂ incubator with a cooling function can withstand the weight

** The HMI box is placed outside of the CO₂ incubator

Item Code	Model Code	Description
Main Unit		
2231110	MIT-1M10	1 VESSEL, MODULE, 110-230V, 50/60HZ, - M for Modular
2231111	MIT-2M10	2 VESSELS, MODULE, 110-230V, 50/60HZ
2231112	MIT-3M10	3 VESSELS, MODULE, 110-230V, 50/60HZ
2231113	MIT-4M10	4 VESSELS, MODULE, 110-230V, 50/60HZ
2231097	MINITIDE, MIT-16A-8	16 VESSELS, AUTO, 230V, 50/60HZ

Note: Existing MiniTide® from stages 1 through 4 are capable of being retrofitted as per user's requirement.

Consumables
MiniTide Vessel (MTMV)

1400309	MINITIDE VESSEL-E, MTMV-E	4 EMPTY VESSELS <i>*Matrix depends on client's requirements</i>
1400310	MINITIDE-BIONOC II, MTMV-BII, 10 PCS	For virus and applications which are sensitive to pH 10 pieces of BioNOC II Matrix:Media Ratio is 1:20 4 Vessel/Pack
1400311	MINITIDE-BIONOC II, MTMV-BII, 25 PCS	25 pieces of BioNOC II Matrix:Media Ratio is 1:7 4 Vessel/Pack
1400312	MINITIDE-BIOMESH 50 MICRON, MTMV-BM50	MiniTide-BioMESH 50 micron Matrix:Media Ratio is 1:7 4 Vessel/Pack
1400313	MINITIDE-BIOMESH 200 MICRON, MTMV-BM200	MiniTide-BioMESH 200 micron Matrix:Media Ratio is 1:7 4 Vessel/Pack

MiniTide Base Frame

5012040	BASE FRAME, MINITIDE-2	SS CARCASS ONLY
5012041	BASE FRAME, MINITIDE-3	SS CARCASS ONLY
5012042	BASE FRAME, MINITIDE-4	SS CARCASS ONLY

North America

USA

Esco Technologies, Inc.

Life Sciences/Medical
903 Sheehy Drive, Suite F, Horsham,
PA 19044, USA
Toll-Free USA and Canada:
1-877-479-3726
Tel: +1 215 441 9661
Fax: 484 698 7757
Email: eti.admin@escolifesciences.com
Website: www.escolifesciences.com

Healthcare Division/Factory
2512 Metroprolitan Dr, Suite 120-B
Feasterville-Trevose, PA 19053-6738
Tel: +1 215 322 2155
Email: eti.pharma@escolifesciences.com
Website: www.esco-pharma.com

Europe

DENMARK

Esco Medical ApS
Kringelld 10, DK-8250 Egaa, Denmark
Tel: +45 5397 3067
Email: medical@escolifesciences.com

UK

Esco GB Ltd
Unit 2 R-Evolution @ Gateway 36,
Kestrel Way, Barnsley S70 5SZ
Tel: +44 (0) 1226 360 799 (Pharma)
+44 (0) 1226 361 529 (Lab)
Email: egb.info@escolifesciences.com
Websites: www.esco-pharma.com
www.escolifesciences.com

GERMANY

Esco Lifesciences GmbH
Straßheimer Straße 17
61169 Friedberg, Germany
Tel: +49 6031 6873447
Email: ede.info@escolifesciences.com
Website: www.esco-global.de

RUSSIA

Esco Russia
Building 4, 8, Novovladikinskii proezd
Moscow, Russian Federation 127106
Email: esco.russia@escolifesciences.com
Website: escolifesciences.ru

LITHUANIA

Esco Medical Technologies UAB
Gamybos g. 2, Ramučiai, Kauno r., 54468
Lithuania
Email: medical@escolifesciences.com
support-medical@escolifesciences.com
Website: esco-medical.com

Asia Pacific

BANGLADESH

Esco Lifesciences (Bangladesh) Pvt. Ltd.
H # 662 (6th Floor), Apt. # A-6, R # 9
Mirpur DOHS, Mirpur, Dhaka-1216,
Bangladesh
Tel: +8801958541100
Email: rafia.oshin@escolifesciences.com
ebd.customerservice1@escolifesciences.com

CHINA

Esco Shanghai Trading Co. Ltd.
Email: mail@escolifesciences.cn
Website: www.escolifesciences.cn

Beijing

Rm. 502, Tower A, Times Fortune,
Sanyuanqiao, Chaoyang District, Beijing,
China 100028
Phone: +86 (10) 5867 7868 / 5867 7823
Fax: +86 (10) 5867 9244
Email: dora.miao@escolifesciences.com

Guangzhou

Room 802, Yuanyang Building,
20 Huacheng Avenue, Tianhe District,
Guangzhou
Tel: +86 (20) 3837 3621

Qingdao

Room 1809, Cyberport Flagship Building,
No. 40 Hong Kong Middle Road, Shinan
District, Qingdao,
Shandong Province, China
Email: ailey.wang@escolifesciences.com

Shanghai

4-5th Floor, Building 16, No.388
Shengrong Road, Pudong New District,
Shanghai, China
Tel: +852 3628 3986
Fax: +852 3186 2821
Email: mail@escolifesciences.hk
Website: http://escolifesciences.hk

Hong Kong (China)

Esco Technologies (Hong Kong) Limited
Unit 06-07, 27/F, New Treasure Centre,
10 Ng Fong Street, San Po Kong,
Kowloon, Hong Kong
Tel: +852 3628 3986
Fax: +852 3186 2821
Email: mail@escolifesciences.hk
Website: http://escolifesciences.hk

Taiwan (China)

Esco Lifesciences Taiwan Co., Ltd.
No. 122-2, Wuqing Rd., Dayuan Dist.,
Taoyuan City 337014, Taiwan
Tel: +886 33818837
Fax: +886 33817135
Email: mail@escolifesciences.tw
Website: http://escolifesciences.tw

INDIA

ELG Lifesciences India Private Limited
2nd Floor, No.7/3, KVD Towers, Old
Madras Road, Kolar Road, Bengaluru,
Karnataka, 560038
Tel: +91 8971532303
Email: india@escolifesciences.com

INDONESIA

PT Esco Utama
Taman Tekno BSD Blok H8 No.1 BSD
Sektor XI, Serpong, Tangerang Selatan
15314
Tel: +6221 30 446 565
Fax: +6221 30 446 566
Email: euics2@escolifesciences.com
Website: http://escolifesciences.co.id

MALAYSIA

Esco Micro (M) Sdn. Bhd.
Technical Support Hotline:
1 300 88 ESCO (3726)
Selangor
No. 15, Jalan Sungai Buloh 27/101A,
Persiaran Klang, HICOM 27 Industrial
Park,
40400 Shah Alam, Selangor, Malaysia
Tel: +603 5103 8480
Fax: +603 5614 3385
Email: malaysia@escolifesciences.com
Website: https://www.escolifesciences.com

Melaka

No 109 & 109-1, Jalan Zapin 1,
Taman Paya Rumput Utama,
75460, Melaka, Malaysia
Tel: 010-2638007
Website: https://www.escolifesciences.com

MYANMAR

Esco Lifesciences Co.,Ltd
No. 376 (E), Shwe Hnin Si Road, Say Ou
Yin Street, 5 Ward, Mayangone Township,
Yangon, Myanmar
Tel: +959 970 615 645
+959 961 456 426
Email: ingyin.haymarn@escolifesciences.com
eaint.taemon@escolifesciences.com

PHILIPPINES

Esco Philippines, Inc.

Manila
Unit 707E, 7th floor, East Tower Four
E-com
Bldg, Block 22 Seaside Cor Diokno Ave.
MOA Complex, Pasay City 1300
Direct Line: +63 (02) 8828 1527
Trunkline: +63 (02) 8478 0384
Email: philippines@escolifesciences.com
Website: https://www.escolifesciences.com

Cebu

Unit 2K, Baseline Residences, Juana
Osmena St. Brgy. Capitol Site, Cebu City
6000
Tel: +63 (32) 232 5826

Davao

71-C Lupo Diaz St. cor Nicasio Torres St.,
Bo. Obrero, Davao City 8000
Tel: +63 (082) 234-0997

SINGAPORE

Esco Micro Pte Ltd
19 Changi South Street 1,
Singapore 486779
Tel: +65 65420833
Fax: +65 65426920
Email: mail@escolifesciences.com
Website: https://www.escolifesciences.com

SOUTH KOREA

Esco Korea Micro Pte Ltd
2F, 845, Geumo-ro, Gwangmyeong-si,
Gyeonggi-do, Republic of Korea (14297)
Tel: +82 2 830 0482
Fax: +82 2 830 0491
Email: info@escoglobal.co.kr
Website: http://www.esco-global.co.kr

THAILAND

Esco Lifesciences (Thailand) Co.,Ltd.
8/3 Soi Rimthangduan 2, Sukhumvit Road,
Bangchak,
Phrakanong, Bangkok 10260
Tel: 02 082 2029
Fax: 02 117 3746
Email: csts.th.sales1@escolifesciences.com
Official Line: @escothailand
Website: http://escolifesciences.co.th/

VIETNAM

Esco Vietnam Company Ltd.,
Email: vietnam@escolifesciences.com
Website: vn.esco-global.com

Hanoi

Floor 2, Dream Home Center Building,
282 Nguyen Huy Tuong street, Thanh Xuan
Trung Ward, Thanh Xuan District, Hanoi City,
Vietnam
Tel: +84 24 6269 1460
+84 24 6269 1461

Ho Chi Minh

No. 14 - Lot G3, Street No. 53,
Tan Quy Dong Settlements,
Tan Phong Ward, District 7, HCMC, Vietnam
Tel: +84 28 3776 0363

Middle East

DUBAI

Esco Lifesciences Trading LLC
Showroom 2 SW2 Gate 1 Jadaf 1 Dubai, UAE
P.O Box: 182099
Tel.: +971 (4) 5461137
Email: gildence.casipit@escolifesciences.com
abdeldmageed.shalaby@escolifesciences.com

Africa

SOUTH AFRICA

Esco Technologies Pty Ltd

Centurion
Unit 2 Landmark Park,
17 Landmarks Avenue,
Kosmosdal Extension 11,
Centurion 0157 South Africa
Tel: +27 (0) 11 314 3184
Mobile: +27 (0) 82 853 9655
Email: sonja.strydom@escolifesciences.com
Website: https://www.escolifesciences.com

Cape Town

Unit 2, 7 Edison Way, Century City,
Cape Town, 7441
Tel: +27 (0) 11 314 3184

Oceania

AUSTRALIA

Esco LifeSciences (Australia) Pty Ltd

Suite 7, Level 7, 330 Collins Street,
Melbourne,
Victoria 3000, Australia

ESCO LIFESCIENCES GROUP NETWORK

42 Locations in 21 Countries All Over the World



- Air Shower
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- Cleanroom Transfer Hatch
- Containment Barrier Isolator (CBI)
- Downflow Booth (DFB)
- Dynamic Floor Laminar Hatch
- Dynamic Pass Box
- Evidence Drying Cabinet
- Garment Storage Cabinet
- General Processing Platform Isolator (GPPI)
- Laminar Flow Horizontal Trolley
- Laminar Flow Straddle Units, Single and Double
- Laminar Flow Vertical Trolley
- Pass Box
- Soft Wall Cleanroom
- Sputum Booth
- Ventilated Balance Enclosure (VBE)
- Weighing and Dispensing Containment Isolator (WDCI)

Since 1978, Esco has emerged as a leader in the development of controlled environment, laboratory and pharmaceutical equipment solutions. Products sold in more than 100 countries include biological safety cabinets, fume hoods, ductless fume hoods, laminar flow clean benches, animal containment workstations, cytotoxic cabinets, hospital pharmacy isolators, and PCR cabinets and instrumentation. With the most extensive product line in the industry, Esco has passed more tests, in more languages, for more certifications, throughout more countries than any biosafety cabinet manufacturer in the world. Esco remains dedicated to delivering innovative solutions for the clinical, life science, research and industrial laboratory community. www.lifesciences.com.



Esco VacciXcell

19 Changi South Street 1 Singapore 486779
Tel: +65 65420833
Email: mail@vaccixcell.com



Esco Lifesciences Offices: Bangladesh | China | Denmark | Germany | Hong Kong | Indonesia | Italy | Lithuania | Malaysia | Myanmar | Philippines | Russia | Singapore | South Africa | South Korea | Taiwan | Thailand | UAE | UK | USA | Vietnam



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