

## OsteoLife™ Complete Osteogenesis Medium Instruction Sheet



### Safety and Use Statement

This product is for Research Use Only. This product is not approved for human or veterinary use or for use in *in vitro* diagnostics or clinical procedures.

Lifeline recommends storing cryopreserved vials in liquid nitrogen vapor phase. Handle cryopreserved vials with caution. Always wear eye protection and gloves when working with cell cultures. Aseptically vent any nitrogen from cryopreserved vials by carefully loosening the vial cap in a biosafety cabinet prior to thawing the vials in a water bath. If vials must be stored in liquid phase, the vials should be transferred to vapor phase storage or -80°C for up to 24 hours prior to being thawed.

OsteoLife Complete Osteogenesis Medium is optimized for the differentiation of Human Mesenchymal Stem Cells into osteocytes.

### Medium Storage

OsteoLife Medium should be stored at -20°C until ready to use. For long-term storage, DifFactors should be stored at -70°C or lower. Once thawed, it should be stored at 2 to 8°C for up to three weeks. Do not use product beyond expiration date. Multiple freeze/thaw cycles are not recommended. Users should take care to protect medium from extended exposure to light.

Product	Part No.	Volume	Final Concentration in Supplemented Medium	Storage
<b>OsteoLife Complete Osteogenesis Medium</b>	<a href="#">LM-0023</a>	100 mL	Proprietary	-20°C or 2-8°C once thawed
<b>OsteoLife Fibronectin Kit</b>	<a href="#">LL-0067</a>	Kit	OsteoLife Complete Medium Fibronectin Coating Solution	-20°C 2-8°C

Other Recommended Products	Part No.	Unit	Components	Storage
Human Mesenchymal Stem Cells-Wharton's Jelly	<a href="#">FC-0020</a>	0.5 x 10 <sup>6</sup> Cells		-150°C
Human Mesenchymal Stem Cells-Adult	<a href="#">FC-0034</a>	10 <sup>6</sup> Cells		-150°C
StemLife™ MSC Medium Complete Kit	<a href="#">LL-0034</a>	Kit	StemLife MSC Basal Medium StemLife MSC LifeFactors® Kit	2-8°C when prepared
Human Mesenchymal Stem Cells-Bone Marrow	<a href="#">FC-0057</a>	10 <sup>6</sup> Cells		-150°C
StemLife MSC-BM Medium Complete Kit	<a href="#">LL-0062</a>	Kit	StemLife MSC Basal Medium StemLife MSC-BM LifeFactors Kit	2-8°C when prepared
Human Pre-Adipocyte Cells, Adult	<a href="#">FC-0062</a>	10 <sup>6</sup> Cells		-150°C
StemLife PA Medium Complete Kit	<a href="#">LL-0058</a>	Kit	StemLife PA Basal Medium StemLife PA LifeFactors Kit	2-8°C when prepared
Fibronectin Coating Solution	<a href="#">CM-0063</a>	5 mL	20 µg/mL solution	2-8°C
2% Alizarin Red Stain	<a href="#">CM-0058</a>	100 mL		RT
TrypKit™	<a href="#">LL-0013</a>	Kit	PBS 0.05% Trypsin/0.02% EDTA Trypsin Neutralizing Solution	RT -20°C -20°C
Optional Supplements	Part No.	Volume	Concentrations of Supplement	Storage
Phenol Red Supplement	<a href="#">LS-1009</a>	1 mL	33 mM	RT
Antimicrobial Supplement: Gentamicin and Amphotericin B (Provided with purchase of LL-0034, LL-0058, or LL-0062)	<a href="#">LS-1104</a>	0.5 mL	Gentamicin 30 mg/mL Amphotericin B 15 µg/mL	-20°C

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## Basic Aseptic Technique

Medium, LifeFactors®, and cells should only be used in an aseptic environment, a Class II biological safety cabinet with front access and filtered laminar airflow, or an equivalent device. Always wear gloves and eye protection when working with these materials. Wipe or spray all bottles and vials with 70% ethanol or isopropanol, especially around the area of the cap, before placing them in the biological safety cabinet. Allow these surfaces to dry completely before opening the bottle or vials. Transfer cells, medium or LifeFactors with disposable sterile pipettes. Do not mouth pipette! Take up the volume needed into the pipette, being careful not to touch the sterile tip to the rim of the container or any other surface. Close the container and open the container into which the transfer is being made, again being careful not to touch any surfaces with the sterile tip. Transfer the material and close the container. Wash your hands before and after working with cell cultures. Do not block airflow in a laminar flow hood as this may compromise sterility. Ensure that biological safety cabinets are certified routinely and that the HEPA filters are replaced regularly.

## Pre-warming Medium

If using less than 100 mL of medium, Lifeline® recommends warming only the volume needed in a sterile conical tube. Repeated warming of the entire bottle over extended periods will cause degradation and reduced shelf life of the medium. When warming the entire bottle of medium, Lifeline recommends using a Lifeline water bath sleeve (included with medium) to help protect the medium from contaminants in the 37°C water bath. Medium will warm to 37°C in 10 to 30 minutes, depending on the volume. Do not leave medium in water bath for extended periods.

## Thawing and Plating Cryopreserved Cells

Pre-warm fully supplemented StemLife™ Medium, respective to cell type. See StemLife Instruction Sheets for details on how to prepare each medium.

Remove vial from dewar and check the cap to be sure that the vial is securely sealed. Spray the vial with 70% ethanol or isopropanol and transfer it to a biosafety cabinet. Allow it to dry thoroughly and carefully loosen the cap to vent any liquid nitrogen that may have entered the vial. Recap the vial and hold only the bottom half of the vial in a 37°C water bath for approximately one minute or until vial is almost completely thawed—a small amount of ice should still be visible. To avoid potential contamination, do not allow the vial cap to make contact with the water. Do not over thaw as this may damage the cells. Dry the vial, spray the exterior of the vial with 70% ethanol or isopropanol and place the vial in a biological safety cabinet and allow it to dry. Carefully remove the cap to avoid contamination or splatter. Gently resuspend the cells in the vial using a 1 or 2 mL sterile pipette. Do not centrifuge; the cells may be directly plated from the vial. Plate cells into pre-warmed fully supplemented medium (respective to cell type) in the desired culture vessel at a density of 5,000 cells per cm<sup>2</sup>. Flasks with vented caps, commonly referred to as filter caps, are strongly recommended. Gently rock the culture vessel from side to side and front to back to evenly distribute cells within the vessel. Place seeded culture vessel in a 37°C, 5% CO<sub>2</sub> incubator. Re-feed the cells after they have attached (approximately 4 to 36 hours after inoculation) to remove cryopreservation reagents.

## Recommended Feeding Guidelines for Undifferentiated Expansion of HMSC:

### Guidelines for a T-75 Flask. Adjust volumes according to culture surface area.

Every other day, remove medium and feed with 15 mL of fresh supplemented medium.

Most cultures which are 50% confluent will be ready for passage within 2 to 4 days and should be fed with 15 to 20 mL of supplemented medium.

Do not use more than 10 mL of medium per 25 cm<sup>2</sup> of culture surface to ensure the depth of the medium is at a level where gas diffusion will be sufficient to support the cells' requirements for oxygen.

*Gas diffusion gradients through the culture medium to the cells are affected by the depth of the medium. The volumes of medium recommended in this table result in a range of depths between 2 mm and 5 mm, which is compatible with general recommendations, 30 mL being at the maximum depth allowable (5 mm) for a T-75 flask.*

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## Passaging Cells

HMSC may be passaged when the culture is 70 to 80% confluent and actively proliferating. Lifeline® recommends passaging HMSC before reaching confluence since post-confluent cells exhibit morphological changes, slower growth and differentiation.

Lifeline recommends using the TrypKit™ Subculture Reagent Kit (LL-0013). Aspirate the medium from the culture vessel. Rinse the flasks with Lifeline's Phosphate Buffered Saline (PBS; CM-0001) by adding at least 1 mL of PBS per each 5 cm<sup>2</sup> and gently tilting the flask to cover the surface with PBS. Aspirate the PBS from the culture vessel, repeat the rinse if desired. Add at least 2 mL of Lifeline's 0.05% Trypsin/0.02% EDTA (CM-0017) per each 25 cm<sup>2</sup> to the vessel. Swirl gently to ensure all cells are coated with the Trypsin/EDTA. Observe the cells carefully under the microscope. When the cells round up they are ready to be released. This normally takes from 2 to 3 minutes depending on the confluence of the cells. Do not over trypsinize as this may damage the cells. Detach the cells by gently striking the culture vessel against your hand several times. Observe the cells under the microscope to be sure they have become detached. Once the cells are fully detached, add Lifeline's Trypsin Neutralizing Solution (TNS; CM-0018) using a volume equal to the amount of Trypsin/EDTA that was originally used. Gently swirl to ensure all of the trypsin solution is neutralized. Using aseptic laboratory techniques, pipette the cells into a sterile centrifuge tube. Collect the remaining cells by rinsing the culture vessel with at least 1 mL of PBS per each 5 cm<sup>2</sup> and pipetting the cells into the sterile centrifuge tube. Check culture vessel under the microscope for cells still attached and repeat steps if necessary to retrieve all the cells from the vessel. All steps must be completed under aseptic conditions in a biological safety cabinet.

Centrifuge the cells at 250 x g\* for 3 to 5 minutes. For best results, calculate speed for individual centrifuge type. Time may also be centrifuge dependent. Do not over centrifuge cells as this will cause cell damage. After centrifugation, the cells should form a clean loose pellet. Please consult Lifeline's technical service department if issues arise from trypsinization or centrifugation.

Aspirate the neutralized trypsin solution from the centrifuge tube and resuspend the cell pellet in pre-warmed culture medium (respective to cell type) by gently pipetting up and down with a 2 or 5 mL pipette. Count cells using a hemacytometer. If expansion of cells is desired, re-plate at 5,000 cells per cm<sup>2</sup> (**or use a split ratio of 1:6 to 1:10**) in vessel containing the respective pre-warmed culture medium. If differentiation of cells is desired, see instructions below.

\*To calculate RCF ('x g')

$$RCF = 0.00001118 \times (rpm)^2 \times r$$

r = rotational radius in centimeters

rpm = rotations or revolutions per minute

## Standard Calculation for Plating of Cells for Osteogenesis

Gently re-suspend the cells evenly in the respective pre-warmed complete StemLife™ Culture Medium. Using a clean hemacytometer and aseptic technique, remove 25 µL of the cell suspension to a separate tube, such as a microcentrifuge tube. Add 75 µL of 0.4% Trypan Blue solution to the cell suspension in the microcentrifuge tube and allow it to sit for up to 1 to 5 minutes. Place 10 µL of the cell suspension into each chamber of the hemacytometer. Count a minimum of 4 quadrants on the hemacytometer (see diagram below). Dead and dying cells are permeable to Trypan Blue, viable cells will not be blue. For accurate cell counts, optimal number of cells per quadrant should be 25 to 75 cells. After counting the cells, calculate the average of the number of quadrants counted. Take the cell count average and multiply by the dilution factor and by 10<sup>4</sup> to get the number of cells per mL. Multiply the desired inoculation density (5,000 to 20,000 viable cells per cm<sup>2</sup>, respective to cell type) by the surface area of the well(s) to be inoculated. This will give you the total number of cells to inoculate one well. Divide the number of cells needed to inoculate the well(s) by the total number of cells in the cell suspension. This will give you the volume of cell suspension with which to inoculate the well(s). Inoculate the cells into the well(s) of the culture vessel(s) prepared with pre-warmed culture medium. Mix gently to evenly distribute the cells and place culture vessel(s) into the incubator at 37°C, 5% CO<sub>2</sub>. (See TrypKit Instructions for more detailed cell counting instructions.)

### Sample calculation:

Average viable cells per quadrant = 31

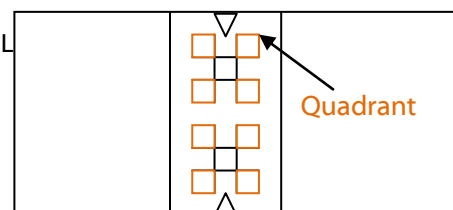
31 cells/quadrant x 10,000 quadrants/mL x 4 (dilution factor) = 1,240,000 cells/mL

### Inoculating a 6-well plate at 18,000 cells/cm<sup>2</sup>:

18,000 cells/cm<sup>2</sup> x 9.5 cm<sup>2</sup>/well = 171,000 cells/well

### Calculate volume of cell suspension required to inoculate each well with:

171,000 cells/well divided by 1,240,000 cells/mL = 0.138 mL/well



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### Fibronectin Coating of Culture Surface Prior to Seeding for Differentiation

Due to the increased cell tension that occurs during the differentiation process, Lifeline® recommends pre-coating the culture surface with Fibronectin (CM-0063). This is an optional step, but is highly recommended.

To coat the well plate(s) with fibronectin, add the volume of the fibronectin solution to each well(s) as indicated in the chart below. Gently rock the plate to coat the entire surface. Incubate the newly coated plate(s) in a cell culture incubator for at least 20 minutes at 37°C. Aspirate the fibronectin solution from the wells and gently rinse once with PBS. Aspirate the PBS and add the appropriate volume of expansion culture medium (respective to cell type) as indicated in the chart below.

### Seeding Density for Osteogenesis by Cell Type

Cell Part Number	Cell type	Seeding Density (cells/cm <sup>2</sup> )	Expansion Medium	Expansion Medium Part Number
<a href="#">FC-0020</a>	HMSC-WJ	15,000 to 20,000	StemLife™ MSC Medium	<a href="#">LL-0034</a>
<a href="#">FC-0034</a>	HMSC-Ad	15,000 to 20,000	StemLife MSC Medium	<a href="#">LL-0034</a>
<a href="#">FC-0057</a>	HMSC-BM	5,000 to 10,000	StemLife MSC-BM Medium	<a href="#">LL-0062</a>
<a href="#">FC-0062</a>	HMSC-Pre-adipocyte	15,000 to 20,000	StemLife PA Medium	<a href="#">LL-0058</a>

### Format for Cell Density and OsteoLife™ Medium Volume for Standard Well Plates:

Plate Format	Fibronectin Coating Volume (Optional)	HMSC-WJ HMSC-Ad HMSC-Pre-Adipocyte (cells/well)	HMSC-Bone Marrow (cells/well)	Medium Volume	Feeding Schedule
6-well	0.5 mL	142,000 to 190,000	48,000 to 95,000	2 mL	Every 3 to 4 days, for 3 to 4 weeks
12-well	0.25 mL	71,000 to 95,000	25,000 to 48,000	1 mL	Every 3 to 4 days, for 3 to 4 weeks
24-well	0.125 mL	30,000 to 40,000	10,000 to 20,000	0.5 mL	Every 3 to 4 days, for 3 to 4 weeks
48-well	0.0625 mL	15,000 to 20,000	5,000 to 10,000	0.3 mL	Every 3 to 4 days, for 3 to 4 weeks

### OsteoLife Medium Preparation

OsteoLife Complete Osteogenesis Medium contains no antimicrobials and no phenol red. Antimicrobials are not required, but are recommended during differentiation due to the duration of culture and the frequency of handling of the cultures. Antimicrobials and phenol red may be purchased separately from Lifeline.

OsteoLife Complete Osteogenesis Medium contains all the factors necessary to support the differentiation of HMSC into osteocytes. OsteoLife Medium is prepared by thawing and warming to 37°C. OsteoLife Medium contains no antimicrobials or phenol red. Antimicrobials and phenol red are not required for osteogenesis, but may be purchased separately.

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## Plating and Culturing Cells for Osteogenesis

Using the passaging and cell counting instructions on page 3, inoculate HMSC in the respective culture medium. (See chart on page 4 for cell density and medium volumes, respective to multi-well plate format). Gently rock the multi-well plate(s) from side to side and front to back to evenly distribute cells within the well(s). Never swirl the plate(s) as this will result in uneven distribution of cells. Place inoculated plate(s) in a 37°C, 5% CO<sub>2</sub> incubator.

48 hours after seeding the multi-well plate(s) with HMSC, initiate osteogenesis by aspirating culture medium from each well. Rinse the well(s) once with Lifeline's PBS (CM-0001) by adding a full volume of PBS per well (see chart above for volume per well). Aspirate the PBS from the well(s). Add a full volume of OsteoLife™ Complete Osteogenesis Medium to each well containing cells (see chart above for volume per well). Return the plate(s) to a 37°C, 5% CO<sub>2</sub> incubator.

The monolayer of cells is fragile, under tension and must be handled with extreme care or it may detach from the plate(s): Do not tilt plate(s) during aspiration. Once differentiation has been initiated, never completely aspirate a well and expose the monolayer to air. When adding OsteoLife Complete Osteogenesis Medium, pipette the medium gently down the side of the well. This will also prevent disturbance of the accumulating calcium crystals.

The culture(s) should be re-fed every 3 to 4 days (for example, every Monday and Friday) using pre-warmed OsteoLife Complete Osteogenesis Medium. Re-feeding is performed by aspirating half of the medium volume from each well and adding a full volume of pre-warmed OsteoLife Complete Osteogenesis Medium to each well (see chart for respective osteogenesis medium volumes).

After 21 days of differentiation, osteogenesis is complete and cells should be fixed and stained for calcium deposition using Alizarin Red (CM-0058). If curling at the edges of the monolayer is observed prior to 21 days in culture, the well should immediately be fixed and stained for calcium deposition.

## Quick Steps for Differentiation of HMSC to Osteocytes

### Pre-Differentiation

1. **Always wash hands before and after working with cell cultures.**
2. **Always wear eye protection and gloves when working with cell cultures.**
3. **When working with cells or medium, always use a certified biological safety cabinet.**
4. **Store cryopreserved cells in liquid nitrogen, vapor phase.**
5. **Handle cryopreserved vials with caution. Aseptically vent any nitrogen from cryopreserved vials in a biosafety cabinet prior to thawing in a water bath.**
6. Feed cells using pre-warmed Lifeline® culture medium according to feeding guidelines.
7. Expand HMSC in the respective StemLife™ Medium as detailed on page 3.

### Differentiation

#### Day 0

1. When cells are 70 to 80% confluent and actively proliferating, passage cells using Lifeline subculture reagents (as detailed on page 3).
2. Pre-coat multi-well plate(s) with Fibronectin. (Optional, but highly recommended).
3. Resuspend pellet in the complete StemLife Culture Medium respective to cell type.
4. Inoculate cells into multi-well plate(s) at 5,000 to 20,000 cells/cm<sup>2</sup>, respective to cell type (see the chart on page 4 for details).
5. Incubate multi-well plate(s) at 37°C, 5% CO<sub>2</sub>.

#### Day 2

6. Gently aspirate the culture medium from each well and rinse with PBS.
7. Replace the PBS with OsteoLife™ Complete Osteogenesis Medium, respective to the multi-well plate size (see the chart on page 4).
8. Incubate multi-well plate(s) at 37°C, 5% CO<sub>2</sub>.

#### Day 5 or 6 Through Day 21

9. Gently aspirate half the volume of medium in each well.
10. Gently add a full volume of OsteoLife Complete Osteogenesis Medium per well every 3 to 4 days, respective to the multi-well plate size (see the chart on page 4).
11. Incubate multi-well plate(s) at 37°C, 5% CO<sub>2</sub>.

#### Day 21

12. Differentiation is complete.
13. Fix the cells then stain for calcium deposition with Alizarin Red.

**For any question on cell handling, differentiation, or staining;  
please contact technical service at 877.845.7787.  
We are here to help.**

#### Notes:

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