



Human Skeletal Muscle Myoblasts

Maintenance and Differentiation from Myoblasts to Myocytes

INSTRUCTION MANUAL ZBM0044.01

SHIPPING CONDITIONS

Human Skeletal Muscle Myoblast Cells

Orders are delivered via Federal Express courier. All US and Canada orders are shipped via Federal Express Priority service and are usually received the next day. International orders are usually received in 3-4 days.

Must be processed upon shipment receipt.

STORAGE CONDITIONS

Media: Short Term 4°C 6 months -20°C

All Zen-Bio Inc products are for research use only. Not approved for human or veterinary use or for use in diagnostic or clinical procedures.

LIMITED PRODUCT WARRANTY

This warranty limits our liability to replacement of this product. No other warranties of any kind, expressed or implied, including without limitation implied warranties of merchantability or fitness for a particular purpose, are provided by Zen-Bio, Inc. Zen-Bio, Inc. shall have no liability for any direct, indirect, consequential, or incidental damages arising out of the use, the results of use, or the inability to use this product.

Zen-Bio, Inc warrants its cells only if Zen-Bio media are used and the recommended protocols are followed. Cryopreserved myoblasts are assured to be viable when thawed and maintained according to Zen-Bio protocols.

ORDERING INFORMATION AND TECHNICAL SERVICES

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INTRODUCTION

Cultured human skeletal muscle myoblasts

Skeletal muscle is an important site of insulin-stimulated glucose disposal and often the site of insulin resistance in obesity. Human primary cultured skeletal muscle cells can directly reflect a patient’s metabolic phenotype, because many of the signaling pathways are maintained intact. Zen-Bio offers human primary skeletal muscle cells from a variety of donors, including obese donors with Type 2 diabetes.

Skeletal muscle satellite cells are isolated from the *rectus abdominus* and propagated in culture as myoblasts. Each lot is analyzed for myotube formation and the expression of myocyte specific markers. The myoblasts are cryopreserved and guaranteed for use with Zen-Bio support media.

PRECAUTIONS

This product is for research use only. It is not intended for human, veterinary, or in vitro diagnostic use. Proper precautions and biological containment should be taken when handling cells of human origin, due to their potential biohazardous nature. **Always wear gloves and work behind a protective screen when handling primary human cells.** All media, supplements, and tissue cultureware used in this protocol should be sterile.

Human myoblast viability depends greatly on the use of suitable media, reagents, and sterile plastic wear. If these parameters are not carefully observed, limited differentiation may occur and cell growth may be slow.

MATERIALS PROVIDED FOR EACH CATALOG ITEM

Note: Zen-Bio recommends that the Human skeletal muscle myoblasts be processed immediately upon receipt.

- ❖ **Cryopreserved Human Skeletal Muscle Myoblasts** (catalog # [SKB-F](#))
Frozen vial containing at least 0.5 x10⁶ myoblasts (store in liquid nitrogen upon receipt)
50 ml Skeletal Muscle Cell Growth medium

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MEDIA COMPOSITIONS

<u>Skeletal Muscle Cell Growth Medium</u> <u>cat # SKM-M</u>	<u>Skeletal Muscle Cell Differentiation Medium</u> <u>cat # SKM-D</u>
DMEM	DMEM
Fetal bovine serum	Horse serum
Bovine Serum Albumin	Bovine Serum Albumin
Fetuin	Fetuin
Human Epidermal Growth Factor	Penicillin
Dexamethasone	Streptomycin
Human Insulin	Amphotericin B
Penicillin	
Streptomycin	
Amphotericin B	

All media contain 1.0 g/L D-glucose.

MEDIA EXPIRATION DATES:

- If placed at 4°C upon arrival, the media is stable until the expiration date on the bottle label.
- If stored at -20°C upon arrival, it is stable for 6 months. Add fresh antibiotics when you are ready to use.

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PLATING PROCEDURE

Cryopreserved Human Skeletal Muscle Myoblasts (Catalog # SKB-F)

1. Remove cells from liquid nitrogen and place immediately into a 37° C water bath and agitate while in bath. Be careful not to submerge the cap of the vial into water. Do not leave the vials in water bath after most of the content has thawed. Rinse the vials with 70% ethanol before taking them to the culture hood.
2. Upon thawing, transfer the cells to a sterile conical bottom centrifuge tube containing 10 ml of Skeletal Muscle Growth Medium (cat # SKM-M). Centrifuge: 1,200 rpm (282 X g) / 20°C / 5 minutes. Aspirate the supernatant. TAKE CARE TO NOT ASPIRATE ANY OF THE CELL PELLET.
3. The cell vial contains a minimum of 0.5×10^6 viable cells; however, we recommend performing a cell count to determine a more exact number of cells. Resuspend the cell pellet in 0.5 ml Skeletal Muscle Growth Medium, dilute an aliquot in 0.4% trypan blue solution. We suggest withdrawing an aliquot of 50 µl of cells and mixing with 100 µl of the trypan blue solution, resulting in a dilution factor of 3. Count live (unstained) cells on a hemacytometer.
4. Plate approximately 5,000-15,000 cells / cm² using the media volumes from the table below. Refer to the manufacturer's specifications for the specific cultureware brand you are using.

FORMAT	VOLUME PER WELL	TOTAL VOLUME PER FORMAT*
96 well plate	150 µl	14.4 ml
48 well plate	500 µl	24.0 ml
24 well plate	1 ml	24.0 ml
12 well plate	2 ml	24.0 ml
6 well plate	3 ml	18.0 ml
10 cm dish	15 ml	15.0 ml
T-75 flask	20 ml	20.0 ml
T25 flask	7 ml	7.0 ml

Deleted: Please note: Primary human skeletal muscle myoblasts must be plated on Type I collagen coated cultureware if they are going to be differentiated into mature myocytes. Zen-Bio scientists are using Biocoat collagen I cultureware from Becton Dickinson. For expansion of the myoblasts our scientists are using Nunc or Costar/Corning tissue culture treated flasks. Please contact us if you have any questions.¶

*We recommend preparing slightly larger volumes to allow for loss due to foam and pipet error.▼

5. Plate cells in desired format and place in a humidified 37°C incubator with 5% CO₂. Do not agitate the plate, as cells will not plate evenly.
6. To differentiate the cells please see the protocol on page 6 starting at step 1.

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DIFFERENTIATION OF MYOBLASTS INTO MYOCYTES

1. Plated myoblasts in Skeletal Muscle Growth Medium (cat # SKM-M) can undergo differentiation using Skeletal Muscle Cell Differentiation Medium (cat # SKM-D). **Differentiation should be initiated when the plated myoblasts reach 80-90% confluence.** The exact number of days

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necessary to reach 80-90% confluence will depend on your initial seeding density (typically 1-3 days).

2. To start the process, aspirate the entire volume of Skeletal Muscle Growth Medium from all wells. Add the appropriate volume of Skeletal Muscle Cell Differentiation Medium (catalog # SKM-D) to the wells (see Table 1. Feeding Volumes). Incubate the plate at 37°C and 5% CO₂. Fresh Differentiation Medium will need to be added every 2-3 days. Remove all of the medium and replace with fresh medium.
3. After 6 days the cells should have fused to form myotubes. These are elongated, multinucleated cells. They will appear to be lined up when viewed under a microscope.
4. The myocytes may be used for assays 6-8 days after the initiation of differentiation and are suitable for most assays.

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Table 1. Feeding Volumes

Format	Plating	Change SKM-M to SKM-D		Change SKM-D to SKM-D		Change SKM-D to SKM-D	
	IN	OUT	IN	OUT	IN	OUT	IN
96 well plate	150 µl/ well	150 µl/ well	150µl/ well	150µl/ well	150µl/ well	150µl/ well	150µl/ well
48 well plate	500 µl/ well	500µl/ well	500µl/ well	500µl/ well	500µl/ well	500µl/ well	500µl/ well
24 well plate	1.0 ml/well	1.0 ml/well	1.0 ml/well	2.0 ml/well	3.0 ml/well	4.0 ml/well	5.0 ml/well
12 well plate	2.0 ml/well	2.0 ml/well	2.0 ml/well	2.0 ml/well	2.0 ml/well	2.0 ml/well	2.0 ml/well
6 well plate	3.0 ml/well	3.0 ml/well	3.0 ml/well	3.0 ml/well	3.0 ml/well	3.0 ml/well	3.0 ml/well
T-75 flask	20 ml/flask	20 ml/flask	20 ml/flask	20 ml/flask	20 ml/flask	20 ml/flask	20 ml/flask
T-25 flask	7 ml/flask	7 ml/flask	7 ml/flask	7 ml/flask	7 ml/flask	7 ml/flask	7 ml/flask

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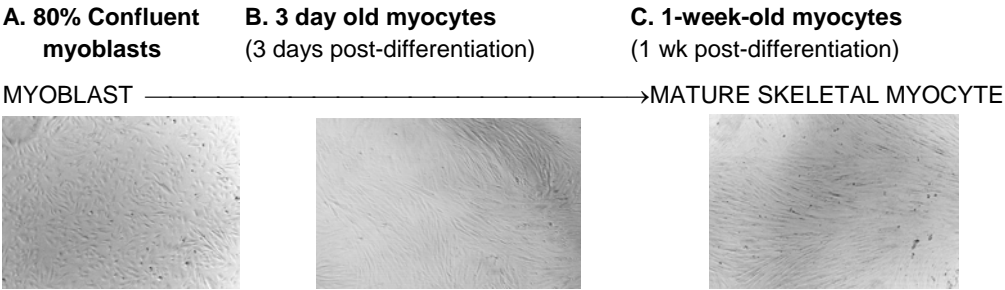


Figure 1: Photographs of 80% confluent Myoblasts (A), 3 day-old (post-differentiation) cultured myocytes (B) and mature (1 week post-differentiation) cultured Myocytes (C). These are unstained photographs of human myocyte morphology (20X). The cells should appear comparable in appearance to these pictures. The myocytes should be 80% confluent after plating for differentiation. If they are not 80% confluent, the cells will not differentiate well. Please see the Troubleshooting guide for any problems.

EXPANSION PROCEDURE

Cryopreserved Human Skeletal Muscle Myoblasts (Catalog # SKB-F)

1. Remove cells from liquid nitrogen and place immediately into a 37°C water bath with agitation. Be careful not to submerge the cap of the vial into water. Do not leave the vials in water bath after most of the content has thawed. Rinse the vials with 70% ethanol before taking them to the culture hood.
2. Upon the thawing, add the cells to a sterile conical bottom centrifuge tube, containing 10 ml of Skeletal Muscle Growth Medium (SKM-M).
3. Centrifuge at 280 x g, 20°C, 5 minutes. Aspirate the medium and resuspend cells in a volume of SKM-M appropriate for counting the cells. Count using a hemacytometer.
4. Place approximately 0.5×10^6 cells in T-75 culture flasks using Skeletal Muscle Growth Medium.
5. Incubate cells until they are 70% confluent (in about 3-5 days). **Do not let the cells become 100% confluent.** Cells will need to be fed every 2-3 days with SKM-M. Replace all medium with fresh SKM-M.
6. Aspirate medium and wash myoblasts 4-5 times using sterile Phosphate Buffered Saline (PBS) to remove all traces of serum (until there is no foaming of the medium). Remove the PBS and release the cells from the flask bottom by adding 2 mL/T-75 flask of 0.25% trypsin/ 2.21mM EDTA solution. Allow cells to trypsinize for 5 minutes at 37°C. Tap the flask gently to loosen the cells.
7. Neutralize the trypsin using 7 ml Skeletal Muscle Cell Growth Medium (cat# SKM-M) per T-75 flask. Check the flask under a microscope to ensure all cells are free of the flask bottom.
8. Count the cells and plate in desired format (see page 5 for plating protocol). Ensure cells are evenly suspended when plating large numbers of plates or flasks. Do not agitate plates and flasks after plating. Place in a humidified incubator at 37°C and 5% CO₂, making sure the surface is level for even cell distribution.
9. Follow the differentiation protocol as outlined on page 6 or split the cells 1:4 for further expansion.
10. We DO NOT recommend differentiating myoblasts that are older than Passage 6. Cells will arrive at Passage 3 or 4.

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TROUBLESHOOTING GUIDE

Observation	Possible causes	Suggestions
Myoblasts do not differentiate	<ol style="list-style-type: none"> 1. Cells have been passaged too many times 2. Differentiation conditions not optimal 3. Cells were plated at a low density 4. Cultureware used not optimal for human primary myoblasts 	<ol style="list-style-type: none"> 1. Use cells of a lower passage number 2. Use our defined differentiation media. Make sure that wells are 80% confluent BEFORE initiating differentiation. 3. Use the cell density recommended in our manual 4. Verify the surface area for the cultureware brand you are using.
Myoblasts do not grow	<ol style="list-style-type: none"> 1. Cells have been passaged too many times 2. Cells expanded too high 	<ol style="list-style-type: none"> 1. Use cells of a lower passage number 2. Do not exceed 1:4 expansion ratio
Edge effects	<ol style="list-style-type: none"> 1. Medium in outside wells evaporated 	<ol style="list-style-type: none"> 1. Ensure a saturated humidity in the incubator and feed the cells no less than every 3 days. Make sure multiple plates are stacked no more than 3 plates high.

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FREQUENTLY ASKED QUESTIONS

- **When do the cells differentiate?**

Cells should begin to fuse and line up within 3 days after differentiation is induced. [See Figure 1]

- **Can I pass the cells?**

Myocytes cannot be passed because they are terminally differentiated. Myoblasts can be trypsinized and replated several times. Myoblasts grow slower with each passage and differentiate poorly after passage 6. Cells are shipped at Passage 2-3.

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- **How fast do the cells replicate?**

The average doubling time is 24-36 hours. However, keep in mind that the replication rate for human myoblasts varies slightly from patient to patient.

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- **How long do the cells last in culture?**

Myocytes retain similar morphology and express myocyte specific genes for at least 1 week after induction of differentiation.

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- **Should antibiotics be included in the medium?**

Yes. Antibiotics and anti-fungal agents are always recommended since the cells are primary cells. All Zen-Bio media contain antibiotics and anti-fungal agents.

- **Where are the cells from?**

The myoblasts are isolated from human rectus abdominus muscle.

- **How are the cells shipped?**

Frozen cells will be packaged on dry ice and shipped to customers via Federal Express overnight delivery.

- **How long do I have to wait before receiving the cells?**

We do not ship cells to domestic locations on Fridays. In general, myoblasts can be shipped the second day after the purchase order is confirmed.

- **Do the cells respond to insulin treatment?**

Yes. Insulin does stimulate glucose uptake.

- **Do you test for pathogens? Which ones?**

Yes. Samples from each donor are tested via PCR to confirm non-reactivity for HIV-1, HIV-2, HTLV I, HTLV II, hepatitis B and hepatitis C. However, since we cannot test all pathogens, please treat the culture as a potentially infectious agent.

- **What donor information do I receive?**

The donor's gender, age, and BMI will be provided.

- **Are the cells from one donor?**

Yes. We can also provide lot numbers containing cells mixed donors to get average responses. Please inquire about availability of single donor and mixed donor (called a superlot) lots at time order is placed.

PATHOGEN TESTING

Samples from each donor are tested via PCR to confirm non-reactivity for HIV-1, HIV-2, HTLV I, HTLV II, hepatitis B and hepatitis C. However, no known test can offer complete assurance that the cells are pathogen free. Our products are tested and are free from mycoplasma contamination. Proper precautions and biological containment should be taken when handling cells of human origin, due to their potential biohazardous nature. All human based products should be handled at a BSL-2 (Biosafety Level 2) or higher. Always wear gloves and work behind a protective screen when handling primary human cells.

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REFERENCES

Lists of articles using ZenBio, Inc cultured human cultured products may be found at our website (<http://www.zenbio.com>) under the COMPANY button.

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