VERVE Holistic Health

ELEVATE YOUR VITALITY

AN EDUCATIONAL GUIDE

Muse *Cell* Therapy

Nature's own repair system —
the science, the evidence, the experience.

REGENERATIVE MEDICINE AT VERVE

VERVE HOLISTIC HEALTH · TUSTIN, CALIFORNIA

Elevate Your Vitality

INTRODUCTION

What are *Muse* cells?

A rare class of naturally occurring, pluripotent-like stem cells that live inside the human body — discovered, named, and characterized by Dr. Mari Dezawa and her team at Tohoku University.

Muse cells — short for *Multilineage-differentiating Stress-Enduring cells* — were first identified in 2010.[8] They represent a small subpopulation of cells found within mesenchymal tissue (bone marrow, adipose, dermis, and the connective tissues of nearly every organ), distinguished by a surface marker called SSEA-3. What makes them remarkable is that they combine qualities previously thought to be mutually exclusive: they are *pluripotent-like* (able to become any of the three germ-layer tissue types — ectoderm, mesoderm, endoderm), yet they are also *endogenous* (already present in the adult body) and *non-tumorigenic* (they do not form teratomas).[5,8]

In the broader stem cell landscape, this combination is unusual. Embryonic stem cells and iPS cells are pluripotent but carry tumor risk and ethical concerns. Standard mesenchymal stem cells (MSCs) are safe but multipotent only — limited primarily to bone, cartilage, and fat lineages. Muse cells occupy a distinct middle ground: the differentiation breadth approaching that of embryonic cells, with the safety profile of adult tissue-resident cells.[4,5]

Where they live

Muse cells are constantly mobilized from bone marrow into peripheral blood and distributed throughout connective tissues of nearly every organ — skin, liver, adipose, dental pulp, and more. Under normal conditions they maintain tissue at a low baseline turnover.[2,5]

What wakes them up

When tissue is injured or under serious stress (e.g. heart attack, stroke), circulating Muse cell numbers rise dramatically — often within 24 hours — as the body recruits them to the damaged site.[2,3]

> ***The guiding principle***
>
> Muse cells are the body's own repair stem cells. They are present in every adult. Therapy aims to meaningfully increase their number at the moment repair is needed — or when the body's baseline supply is insufficient for the demand being placed on it.

HOW THEY WORK

The *biology* of Muse cells.

Four characteristics, documented across more than a decade of peer-reviewed research, set Muse cells apart from every other stem cell type available for regenerative medicine.

Pluripotent-like differentiation *i.*

A single Muse cell can generate cells from all three embryonic germ layers. They express pluripotency markers (Nanog, Oct3/4, Sox2) — yet, unlike ES or iPS cells, they do so naturally, without genetic manipulation.[7,8]

Non-tumorigenic *ii.*

Because Muse cells exist as a natural part of adult tissue, they do not form teratomas when transplanted. This makes them fundamentally safer than embryonic stem cells or iPS cells for clinical use.[5,8]

Stress-enduring *iii.*

Muse cells were originally isolated under conditions (long-term trypsin incubation) that kill most other cells. Their ability to survive hostile environments helps them persist long enough in damaged tissue to contribute to repair.[6,8]

Targeted tissue homing *iv.*

Damaged cells release sphingosine-1-phosphate (S1P) as a distress signal. Muse cells express the S1PR2 receptor, which recognizes S1P — allowing them to migrate selectively toward injured tissue after intravenous delivery.[2,3]

How Muse cells repair tissue — the four-step mechanism

Step 01
Delivery
Muse cells enter circulation via IV infusion, joining the body's natural pool of reparative cells.

→

Step 02
Homing
Damaged tissue releases S1P. Muse cells detect the signal via S1PR2 and migrate to the site.

→

Step 03
Differentiation
Once at the site, Muse cells spontaneously become the specific cell type needed for repair.

→

Step 04
Integration
New cells integrate into existing tissue architecture, replacing damaged cells with functional ones.

COMPARATIVE OVERVIEW

Muse cells vs. *other* stem cell therapies.

A side-by-side look at how Muse cells compare with the other major stem cell categories used in research and clinical practice today.

	Embryonic (ESC)	*Induced Pluripotent (iPSC)*	*Mesenchymal (MSC)*	*Muse cells*
Source	Embryonic tissue	Reprogrammed adult cells	Bone marrow, adipose, cord	**Naturally present in adult tissue**
Pluripotency	● Full pluripotent	● Full pluripotent	● Multipotent only	● **Pluripotent-like (3 germ layers)**
Tumor risk	● Forms teratomas	● Forms teratomas	● No teratoma formation	● **Non-tumorigenic**
Gene manipulation	Not required	● Required (Oct3/4, Sox2, etc.)	Not required	● **Not required**
Tissue homing	Passive	Passive	● Limited (largely lung-trapped)	● **Active (S1P–S1PR2 axis)**
Mechanism of repair	Differentiation	Differentiation	Primarily paracrine signaling	**Differentiation + signaling**
Ethical considerations	● Significant	Minimal	Minimal	● **Minimal**
Administration	Surgical	Surgical / injection	IV or local injection	**IV infusion**

Muse cells occupy a unique position in the regenerative medicine landscape: the broad differentiation capacity associated with pluripotent cells, combined with the safety and ethical profile of adult tissue-resident stem cells. [4,5]

AT VERVE

Two paths to *regenerative* care.

Verve offers both live Muse cell therapy and Muse-derived exosome therapy, each positioned for different clinical and wellness goals.

30M
million
CELLS

OPTION I · CELLULAR THERAPY

Muse Cell Infusion

A live cellular infusion delivering 30 million Muse cells. Once introduced, the cells migrate through the bloodstream to areas of need via the S1P–S1PR2 axis and differentiate into the specific cell types required for repair.

> ***Best for:*** *comprehensive regeneration, recovery from significant physical stress, neurological and cardiovascular support, and patients seeking the most complete form of Muse-based therapy available.*

300B
billion
EXOSOMES

OPTION II · CELL-FREE SIGNALING

Muse Exosome Therapy

Extracellular vesicles secreted by Muse cells — carrying the growth factors, microRNAs, and signaling proteins that drive regenerative communication between cells, without introducing cells themselves. A refined, lower-intensity option that still delivers meaningful regenerative messaging.

> ***Best for:*** *ongoing rejuvenation, skin and hair vitality, anti-aging protocols, and patients new to regenerative medicine who want to begin with a lighter touch.*

Cells or exosomes — how do I choose?

Live Muse cells physically become the cells your body needs; exosomes deliver the instructional signals that Muse cells use to orchestrate repair. Cells offer the most complete mechanism; exosomes offer a more accessible entry point and work particularly well for aesthetic and maintenance applications. The right choice depends on your goals, history, and what your physician consultation reveals — many Verve patients use both at different phases.

PATIENT JOURNEY

What to *expect*.

From your first consultation through post-treatment care, here is how a Muse therapy protocol typically unfolds at Verve.

I

WEEK 0 · INITIAL CONSULTATION

Physician-led evaluation

Your journey begins with a comprehensive consultation with our medical team. We review your health history, goals, and current therapies to determine whether regenerative medicine — and which specific Muse protocol — is appropriate for you.

II

WEEK 1–2 · CANDIDACY & PREPARATION

Diagnostics and planning

If you're a candidate, we complete any necessary lab work, baseline imaging, and pre-treatment preparation. Your physician will walk you through the full protocol, expected timeline, and any lifestyle considerations in advance of therapy.

III

TREATMENT DAY · 2–3 HOURS

The infusion

Administration is typically intravenous and performed in our clinic in a private, comfortable setting. Most patients find the experience similar to a standard IV therapy session — relaxed, closely monitored, and without the need for anesthesia or recovery time.

IV

DAYS 1–30 · HOMING & EARLY RESPONSE

The body gets to work

In the days following treatment, Muse cells migrate toward sites of stress or damage and begin the process of differentiation and integration. Many patients notice early shifts in energy, sleep quality, and sense of wellbeing during this window.

V

MONTHS 2–6 · ONGOING REPAIR

Follow-up and measurement

We schedule structured follow-up visits to assess response, review objective markers, and make recommendations for complementary therapies. Regenerative effects often continue to develop over weeks to months; individual timelines vary.

FREQUENTLY ASKED

Common *questions*.

Clear answers to the questions patients most often ask before beginning Muse cell therapy.

Q. *Are Muse cells the same as stem cells I've heard about before?*

A. Muse cells are a specific, well-characterized *subset* of stem cells. They differ meaningfully from the umbilical-cord or adipose MSC products commonly marketed as "stem cell therapy" — in particular, their pluripotent-like differentiation capacity and their ability to home actively to damaged tissue.[3,5,8]

Q. *Are Muse cell therapies safe?*

A. Published research consistently demonstrates that Muse cells are non-tumorigenic — they do not form teratomas — and express an immunomodulatory profile that supports favorable tolerability.[5,8] As with any medical therapy, safety is highly individual: your physician will review personal contraindications during your consultation.

Q. *Is Muse cell therapy FDA-approved?*

A. Cellular and exosome-based regenerative therapies occupy an evolving regulatory landscape in the United States. The therapies offered at Verve are administered under physician supervision in accordance with applicable guidelines. This educational material describes published scientific findings and is not a claim that Muse therapy is FDA-approved for the treatment of any specific disease.

Q. *How soon will I feel results?*

A. Response varies considerably between patients and goals. Some people notice early changes in energy, sleep, or recovery within the first few weeks; other effects — particularly those related to tissue repair — continue to develop over two to six months. Your physician will help set realistic expectations based on your specific protocol.

Q. *How is this different from a PRP or standard IV therapy?*

A. PRP and nutrient IVs deliver growth factors or nutrients but do not supply new regenerative cells or cell-signaling vesicles. Muse cell therapy introduces actual pluripotent-like cells capable of differentiating into tissue-specific cell types; Muse exosome therapy delivers the specific signaling payload those cells use to orchestrate repair.

Q. *Can I combine Muse therapy with other treatments?*

A. In most cases, yes. Verve frequently pairs Muse protocols with complementary modalities — peptide therapy, advanced aesthetic treatments, nutritional optimization — as part of a broader regenerative plan. Combinations are always designed collaboratively with your physician to ensure therapies support, rather than interfere with, one another.

SCIENTIFIC REFERENCES

The *evidence* behind this booklet.

The claims in this guide are drawn from the landmark peer-reviewed publications of Dr. Mari Dezawa and colleagues at Tohoku University, whose work established the characterization and mechanism of Muse cells.

1. **Dezawa M (editor).** *Muse Cells: Endogenous Reparative Pluripotent Stem Cells.* Springer, Tokyo; 2018. Advances in Experimental Medicine and Biology, Vol. 1103.

2. **Kushida Y, Wakao S, Dezawa M.** *Muse Cells Are Endogenous Reparative Stem Cells.* Advances in Experimental Medicine and Biology. 2018;1103:43–68.

3. **Yamada Y, Wakao S, Kushida Y, et al.** *S1P–S1PR2 axis mediates homing of Muse cells into damaged heart for long-lasting tissue repair and functional recovery after acute myocardial infarction.* Circulation Research. 2018;122(8):1069–1083.

4. **Dezawa M.** *Muse cells provide the pluripotency of mesenchymal stem cells: direct contribution of Muse cells to tissue regeneration.* Cell Transplantation. 2016;25(5):849–861.

5. **Wakao S, Akashi H, Kushida Y, Dezawa M.** *Muse cells, newly found non-tumorigenic pluripotent stem cells, reside in human mesenchymal tissues.* Pathology International. 2014;64(1):1–9.

6. **Kuroda Y, Wakao S, Kitada M, Murakami T, Nojima M, Dezawa M.** *Isolation, culture and evaluation of multilineage-differentiating stress-enduring (Muse) cells.* Nature Protocols. 2013;8(7):1391–1415.

7. **Wakao S, Kitada M, Kuroda Y, et al.** *Multilineage-differentiating stress-enduring (Muse) cells are a primary source of induced pluripotent stem cells in human fibroblasts.* Proceedings of the National Academy of Sciences. 2011;108(24):9875–9880.

8. **Kuroda Y, Kitada M, Wakao S, et al.** *Unique multipotent cells in adult human mesenchymal cell populations.* Proceedings of the National Academy of Sciences. 2010;107(19):8639–8643.
   Original discovery paper — Muse cells first identified and named.

YOUR NEXT STEP

Begin with a consultation.

Every Muse protocol at Verve begins with a physician-led conversation. We'll review your history, your goals, and whether regenerative therapy is the right path forward.

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