Editorial

I am ~~not~~ a robot:

what Chat GPT says are the future priorities for wound healing research in humans?

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Artificial Intelligence (AI) is transforming our lives: how we communicate, do business, travel, in education and research and almost every single daily activity is monitored or influenced in some way by AI. Given the enormous impact wounds have on the lives of people, on health systems and society as a whole, and because of the increase in the use of AI in wound diagnostics and monitoring, it was a curiosity to see what ChatGPT says are the priorities for wound healing research in humans. The results are very interesting and provide a platform to discuss these priorities. I will leave it to you, the reader, to decide if you agree or disagree. The following text has been copied directly from ChatGPT and is, therefore, the output of the large language model.

ChatGPT said:

That's an excellent and timely question — the field of human wound healing research is evolving rapidly, with new priorities shaped by advances in regenerative medicine, bioengineering, and systems biology

Here's a concise summary of current and future priorities that researchers and funding agencies (like NIH, Horizon Europe, and Wellcome Trust) are emphasising for the next decade:

1. Regenerative and stem cell-based therapies

Goal: Move beyond simple wound closure toward *true tissue regeneration* (restoring skin appendages, pigmentation, and function).

Priorities:

- Optimising stem cell delivery (mesenchymal, epidermal, or induced pluripotent stem cells).
- Understanding stem cell–immune system interactions in wound beds.
- Developing off-the-shelf allogeneic cell therapies with predictable safety profiles.

2. Bioengineered skin substitutes and smart biomaterials

Goal: Create skin replacements that mimic the structure and biology of native skin.

Priorities:

- Next-generation hydrogels, nanofiber scaffolds, and bioprinted constructs.
- 3D bioprinting and organoid-based skin equivalents with vascular and neural integration.
- Smart dressings with sensing, drug release, and self-healing capabilities.

3. Neuroimmune and inflammatory regulation

Goal: Control the chronic inflammation that impairs healing, especially in diabetic and aged patients.

Priorities:

- Characterising immune cell phenotypes (macrophage polarisation, T-cell responses).
- Targeting neuropeptides and cytokines to modulate inflammation without delaying regeneration.
- Mapping nerve–immune–fibroblast signaling in the wound niche.

4. Chronic and diabetic wound management

Goal: Prevent non-healing wounds and limb amputations.

Priorities:

- Biomarkers for predicting healing trajectory.
- Metabolic and microbiome modulation (gut–skin axis, local probiotics).
- Precision medicine approaches using AI-based wound assessment and digital twins.

5. Genetic and epigenetic regulation of healing

Goal: Understand why some individuals heal scarlessly (e.g., fetal wounds) while others scar excessively.

Priorities:

- Identifying epigenetic switches that control fibroblast activation and scarring.
- Single-cell omics to profile cell states during healing.
- Gene editing (e.g., CRISPR-based modulation) to restore regenerative pathways.

6. Personalised and systems-level approaches

Goal: Integrate biology, data, and environment for individualised treatment.

Priorities:

- AI-driven prediction models for wound progression and treatment response.
- Incorporating social determinants (nutrition, stress, comorbidities).
- Using systems biology to map the entire wound healing network.

7. Translational and clinical implementation

Goal: Bridge the gap between discovery and therapy.

Priorities:

- Standardised clinical trial endpoints for wound healing efficacy.
- Real-world evidence platforms for device and biomaterial testing.
- Cost-effective therapies for low-resource settings.

Asked to focus on AI in wound healing, as ChatGPT suggested, ChatGPT said:

Excellent — focusing on AI in wound healing opens one of the most transformative frontiers in the field. Artificial intelligence is shifting wound care from reactive treatment toward predictive, personalised, and precision-guided healing. Here's a structured overview of future priorities for AI-driven wound healing research in humans:

1. AI-powered wound assessment and monitoring

Current status: AI is already being used to analyse wound images (via smartphone apps or clinic-based imaging) to estimate size, depth, tissue type, and healing rate.

Future priorities:

- **Multimodal image analysis:** Combine RGB, hyperspectral, thermal, and 3D imaging for more accurate tissue characterisation.
- **Standardised datasets:** Build large, labeled, and diverse wound image databases across skin tones, wound types, and lighting conditions.
- **Edge AI integration:** Deploy real-time image analysis on portable or smartphone-based systems, especially for telemedicine or low-resource settings.
- **Regulatory-grade validation:** Establish frameworks (FDA/EMA) for validating AI wound classifiers as medical devices.

2. Predictive analytics for healing trajectories

Goal: Predict *who will heal, when, and how*.

Priorities:

- **Machine learning models** that integrate:
  - Clinical data (age, diabetes status, comorbidities)
  - Biochemical markers (cytokines, proteomics)
  - Lifestyle and environmental factors
- **Digital twin models:** Virtual replicas of individual patients' wounds that simulate healing under different treatments.
- **Adaptive learning:** Systems that continuously learn from new patient data to improve prediction accuracy.

3. AI in personalised treatment optimisation

Goal: Use AI to choose the *right intervention for the right wound at the right time*.

Priorities:

- **Reinforcement learning systems** that optimise wound care pathways dynamically (e.g., debridement timing, dressing choice, antibiotic use).
- **Decision-support tools** for clinicians that integrate AI outputs with clinical guidelines.
- **Drug/device personalisation:** Predict patient-specific responses to stem cell, growth factor, or biomaterial therapies.

4. Integrative "omics" and systems biology

Goal: Discover new healing biomarkers and therapeutic targets.

Priorities:

- **AI-driven analysis of single-cell and spatial transcriptomics** to map wound microenvironments.
- **Multi-omics integration** (genomics, proteomics, metabolomics) to define healing signatures.
- **Causal AI models** to distinguish correlation from mechanism — identifying what *drives* healing vs. what just *correlates* with it.

5. Smart wound dressings and Internet of Things (IoT)

Goal: Real-time wound monitoring with AI interpretation.

Priorities:

- **Sensor-embedded dressings** measuring pH, oxygen, moisture, and temperature.
- **AI algorithms** that interpret sensor data to alert for infection, ischemia, or delayed healing.
- **Closed-loop systems** that automatically release drugs or adjust therapy based on AI feedback.

6. Ethical, bias, and data governance frameworks

Goal: Ensure trustworthy and equitable AI in wound care.

Priorities:

- **Bias mitigation** in datasets — particularly across skin tones and global populations.
- **Transparent algorithms** (explainable AI) that clinicians can interpret and trust.
- **Privacy-preserving learning** (federated AI) to share data securely across hospitals and regions.

7. Clinical translation and regulatory pathways

Goal: Move AI from research prototypes to bedside use.

Priorities:

- **Prospective clinical trials** validating AI performance in real-world settings.
- **Interoperability standards** so AI tools integrate with electronic health records (EHRs).
- **Implementation science** to study how AI adoption impacts workflow, cost, and outcomes.

Vision for 2030+

"Wound healing ecosystems" — where AI continuously integrates patient data, imaging, and sensor feedback to create *adaptive, individualised healing plans* that evolve in real time.

For further debate and discussion on this topic and on the use of AI in wound management the upcoming EWMA–DEWU 2026 conference, "*Rebooting versus rethinking wound care in a changing world*" Will be of interest to readers.