Executive Summary – Phase I of NIRIS

A Flagship Module of Synthetic Repair Systems (S.R.S.)

# Overview

NIRIS is a modular, open-source neuro-repair system designed to assist in the regeneration and functional recalibration of the human nervous system—starting with spinal cord, peripheral nerve, and trauma-linked neurocircuitry. It uses a blend of AI, bio-nanotech scaffolding, adaptive feedback mechanisms, and trauma-aware modulation protocols to restore neurobiological integrity in patients suffering from degenerative, traumatic, or psychosomatic conditions.

# Primary Objectives

- Build a functional neuro-AI interface for real-time monitoring and modulation of neural states  
- Develop and test 3D-printed microchannel scaffolds for axonal regrowth  
- Create closed-loop biocompatibility systems responsive to real-time immune and electrical activity  
- Embed optional trauma-sensitive emotional feedback calibration for holistic healing environments  
- Position the system for long-term deployment in clinical and decentralized health environments

# Core Components in Phase I

1. ENCP (Embedded Neuro-CoProcessor): Personalized, on-device AI agent mapping and modulating neural signals  
2. T-NMA (Targeted Neural Microchannel Arrays): Biocompatible 3D-printed scaffolds with stem cell seeding potential  
3. RT-BCC (Real-Time Biocompatibility Calibration): Live physiological state monitoring and responsive modulation protocols  
4. AFDMP (Affective Feedback Modulation) (Optional): Facial/emotional biofeedback loop integration for trauma-informed treatment

# Phase I Timeline & Milestones (6–9 Months)

Month 1: Finalize hardware architecture and AI stack (Pi/Nano + OpenBCI)  
Month 2: Develop ENCP + RT-BCC for initial neural feedback loop test rig  
Month 3: Begin early scaffold fabrication using PEG or bio-printing compounds  
Month 4–5: Launch trauma-informed sensing protocol integration (AFDMP)  
Month 6–7: First system integration: prototype test rig functional  
Month 8–9: Begin formal reporting, academic whitepapers, and grant finalizations

# Target Use Cases

- Patients with spinal cord injuries or peripheral nerve trauma  
- Early-stage neurodegenerative disease management (ALS, MS, etc.)  
- Chronic pain and PTSD modulation via adaptive AI feedback systems  
- Low-resource environments via portable biofeedback modules

# Technical Stack (Phase I)

Hardware: Raspberry Pi, Jetson Nano, OpenBCI EEG, Arduino Biosensors  
AI/ML: TensorFlow Lite, Edge Impulse, Scikit-Learn  
BioFab: PEG-infused scaffolds, 3D printers, stem cell labs (partnered)  
Emotional Feedback: Affectiva DB, MindFlex, OpenFace API (optional tier)

# Estimated Initial Budget

Prototyping (EEG, microcontrollers, biosensors): $7,500 – $12,000  
AI/Software Development (open-source models + integration): $10,000 – $20,000  
Legal/IP and Ethics Review: $5,000  
Access to BioLab/Test Environment: $3,000 – $10,000  
Grant Application & Operational Prep: $1,500 – $2,500  
Total Estimate: $27,000 – $49,500

# Ethical & Regulatory Readiness

- IRB Prep: In contact with university partners for ethics onboarding  
- Open Source Strategy: Core protocols to remain open under GPL/MIT  
- Human-Centered Design: Emphasis on trauma-informed, consent-first architecture  
- Future FDA/ISO Compliance: Design language aligned with emerging MedTech standards

# Deployment Vision

NIRIS is designed to function as a modular system—starting in labs and clinics but ultimately evolving into portable, home-accessible healing nodes integrated into the full S.R.S. architecture.

Prepared by: Nathan L. Broniman, in collaboration with ChatGPT (OpenAI), Gemini, and the Pantheon Initiative  
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