Search for a Spanish Partner for a Bilateral R&D Project (this document will be shared with potential Spanish companies)

Organization	
Date of Request:	
Company name:	. (Research focus: Nanotheranostics & Photodynamic Therapy Group)
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SECTION 1: Your Company Profile *(Please give brief / to the point explanations. For more explanation on any point below, you may add a short paragraph as an annexure, with this document.)*	
Business Sector	• **Dental Medicine, Nanomedicine, Targeted Drug Delivery, and Antimicrobial Photodynamic Therapy (aPDT).**
Company mission or core functions	To develop novel **nanotheranostic-guided photodynamic therapy nanoplatforms** for non-invasive, site-specific treatment of chronic and aggressive periodontitis in pediatric and adult populations
Date of establishment	2006- Sinai University was established by Presidential Decree No. 363 of 2005 (operating under Law No. 101 of 1992, replaced by Law No. 12 of 2009 on Private and National Universities); the Faculty of Pharmacy commenced teaching in 2006.

Ownership (if public and traded, add stock exchange and ticker symbol)	Private, non-profit Egyptian university governed by Law No. 12 of 2009 and its executive regulations (Presidential Decree No. 302 of 2010). Not publicly traded; no stock-exchange listing.
Total number of employees	850
Number of employees in R&D	10
Key products sold or services provided	**Chlorin e6-loaded liposome-chitosan nanoparticles (Ce6-LCNPs)** engineered for nanotheranostics-guided photodynamic therapy against periodontal pathogens.
Company core technical competences	○ **Nanocarrier Synthesis & Formulation:** Thin-film hydration synthesis of lipid bilayers (DPPC, cholesterol, DSPE-PEG2000) integrated with low molecular weight chitosan polymer coating and sodium tripolyphosphate (TPP) cross-linking. ○ **Photosensitizer Encapsulation:** Efficient loading of hydrophobic Chlorin e6 (Ce6) into biocompatible hybrid liposome-chitosan nanostructures. ○ **Nanotheranostic & Fluorescence Imaging:** Utilization of intrinsic Ce6 fluorescence for real-time tissue tracking, bio-distribution monitoring, and guided light application. ○ **Targeted Antimicrobial & Antibiofilm Therapy:** Cationic surface modification enabling electrostatic targeting of negatively charged bacterial cell membranes and biofilms (P. gingivalis, A. actinomycetemcomitans, F. nucleatum, S. mutans).

	○ **Biocompatibility & Age-Specific Evaluation:** In vitro cell culture evaluation on human gingival fibroblasts (HGF-1) and human periodontal ligament stem cells (hPDLSCs) across pediatric and adult cellular models.
Key R&D programs and activities	○ Physicochemical characterization including **TEM/SEM morphological analysis, Fourier Transform Infrared Spectroscopy (FTIR), UV-Vis encapsulation efficiency, and spectrofluorometry**. ○ In vitro antimicrobial and antibiofilm testing using **CFU quantification, live/dead bacterial viability assays, and Confocal Laser Scanning Microscopy (CLSM)**. ○ Cytocompatibility, cytotoxicity (MTT, LDH release assays), and phototoxicity testing on periodontal tissue cells. ○ Quantitative PCR (qPCR) subgingival microbiological tracking and clinical parameter evaluation (Probing Depth, Clinical Attachment Level, Bleeding on Probing).
Examples of accomplishments	○ Successfully synthesized stable **Ce6-LCNPs** with high drug encapsulation efficiency and uniform size distribution (200 nm extrusion). ○ Demonstrated **complete eradication of periodontal pathogens and biofilms** under 660 nm red-light activation (100 mW/cm^2, 30 J/cm^2) without generating bacterial resistance.

	○ Confirmed high cytocompatibility and cell viability in human gingival fibroblasts and stem cells.
Company strategic orientation	• Translational development of **non-invasive, age-optimized nanotheranostic modalities** to overcome antibiotic resistance and overcome conventional mechanical debridement limitations in pediatric and adult periodontitis.

SECTION 2: Partner of Interest *(Please provide a brief summary of the prospective partner company or organization. This summary may address some or all of the points below)*	
Profile of ideal technology partner	• Spanish pharmaceutical, biotechnology, or medical device company specializing in **advanced drug delivery scale-up, liposomal/polymeric nanomedicine manufacturing, or dental light/laser therapy equipment**.
Core technological competencies and expertise	○ Industrial **GMP manufacturing scale-up** of nanoparticle and liposome formulations. ○ **Clinical trial management** and regulatory submission expertise (EMA / Spanish AEMPS) for dental or nanomedicine therapeutics. ○ **Dental laser or LED illumination device engineering** (e.g., 660 nm / diode light systems with fiber-optic delivery).

Other essential qualifications (e.g.: ownership, track records etc.)	○ Industrial **GMP manufacturing scale-up** of nanoparticle and liposome formulations. ○ **Clinical trial management** and regulatory submission expertise (EMA / Spanish AEMPS) for dental or nanomedicine therapeutics. ○ **Dental laser or LED illumination device engineering** (e.g., 660 nm / diode light systems with fiber-optic delivery).
If you have a list of companies with whom you are in contact or interested in contacting, please provide contact details	• to co-develop, scale, and clinically validate the Ce6-loaded liposome-chitosan nanotheranostic platform for clinical periodontics.
If you are interested in collaboration: please specify details and other important information you want to share with a potential company	Interest in a **bilateral R&D collaboration** to co-develop, scale, and clinically validate the Ce6-loaded liposome-chitosan nanotheranostic platform for clinical periodontics.
Interested areas of collaboration	○ Process optimization and GMP scale-up synthesis of Ce6-LCNPs. ○ Joint preclinical and clinical trials evaluating treatment efficacy in pediatric and adult periodontal disease. ○ Integration with specialized dental diode light/laser delivery systems.
Specific R&D contribution you are seeking/offering	○ **Offering: Proprietary Ce6-LCNP formulation protocols, nanotheranostic fluorescence tracking methodology, and**

	complete in vitro efficacy/cytocompatibility dataset. ○ **Seeking: Industrial formulation scale-up/stability testing, clinical trial infrastructure, regulatory clearance support, and advanced light delivery hardware**

Signature :
Name: Somaia Ghobar
Date: 25-10-2026

Title: Chlorin e6-Loaded Liposome-Chitosan Nanoplatform for Nanotheranostics-Guided Photodynamic Therapy in Pediatric and Adult Periodontitis

Abstract

Background: Conventional periodontitis treatments such as mechanical debridement and antibiotics face severe challenges from anatomical pocket depth, antimicrobial resistance, and contraindications in pediatric patients
. Objective: To address the poor aqueous solubility and aggregation of Chlorin e6 (Ce6), this study designed a Ce6-loaded liposome–chitosan nanoplatform (Ce6-LCNPs) for nanotheranostics-guided photodynamic therapy (PDT)

1. **Challenge of the Project**

Limitations of Conventional Therapies: Standard mechanical debridement (scaling and root planing) often fails to completely eradicate bacteria in deep anatomical pockets and furcation areas

Antimicrobial Resistance & Pediatric Contraindications: Overuse of antibiotics has driven resistance in key periodontal pathogens such as Porphyromonas gingivalis and Aggregatibacter actinomycetemcomitans

Furthermore, systemic antibiotics are frequently contraindicated in pediatric patients due to concerns regarding adverse side effects and tooth/dentition development

Delivery Bottlenecks of Chlorin e6 (Ce6): Although Ce6 is an effective second-generation photosensitizer that activates under red light (~660 nm) without inducing bacterial resistance, its clinical use is severely hampered by poor water

solubility, aggregation in physiological environments, and lack of targeted delivery to biofilms
Age-Specific Biological Variations: Pediatric periodontal tissues display higher vascularity, distinct immune responses, accelerated cellular turnover, and different biofilm compositions compared to adult tissues, creating an unmet need for age-tailored therapeutic platforms

2. Scope of the Proposal
The proposal centers on synthesizing, characterizing, and evaluating a Ce6-loaded liposome–chitosan nanoplatform (Ce6-LCNPs) for nanotheranostics-guided photodynamic therapy (PDT) in pediatric and adult periodontitis models . The core technical and experimental scope comprises:
Formulation & Engineering: Synthesizing liposomes via thin-film hydration (DPPC, cholesterol, DSPE-PEG2000), loading Ce6, and applying an electrostatically bound, TPP-cross-linked chitosan coating to ensure positive surface charge, stability, and mucoadhesion

Nanotheranostic Dual Functionality: Combining real-time fluorescence imaging (using Ce6's intrinsic optical properties) to guide light delivery and track biodistribution with 660 nm light irradiation to trigger reactive oxygen species (ROS) generation

Antimicrobial & Antibiofilm Testing: Assessing bacterial eradication and biofilm destruction against P. gingivalis, A. actinomycetemcomitans, Fusobacterium nucleatum, and Streptococcus mutans

Biosafety & Comparative Evaluation: Evaluating cytocompatibility in human gingival fibroblasts (HGF-1) and periodontal ligament stem cells (hPDLSCs/dPDLSCs), followed by comparative efficacy assessments in adult and pediatric disease models

3. Market Opportunity
Global Epidemiological Need: Periodontitis affects approximately 42% of adults aged 30 and older, with severe forms impacting 11.2% of the global population, making it one of the most widespread chronic diseases worldwide

Target Clinical Segments: The platform targets both general/adult periodontology and pediatric dentistry, serving as a non-invasive, resistance-free alternative or adjunct to conventional debridement and antibiotic regimens

The roles of the 3 partners in the consortium: the Egyptian research institution, the Egyptian company and the Spanish company.

1. Egyptian Research Institution (Nanotechnology & Preclinical R&D Lead)

Core Mandate: Advanced nanomaterial synthesis, physicochemical optimization, and in vitro photophysical/antimicrobial validation (driving the core science from TRL 3 to TRL 4).
Key Work Packages & Responsibilities:
Nanoplatform Formulation & Engineering: Thin-film hydration synthesis of liposomes, encapsulation of Chlorin e6 (Ce6), and coating/cross-linking with cationic chitosan and tripolyphosphate (TPP).
Physicochemical & Optical Characterization: Dynamic light scattering (DLS) size, polydispersity, zeta potential, encapsulation efficiency, stability, and singlet oxygen/ROS quantum yield characterization under 660 nm irradiation.
Fundamental Antimicrobial & In Vitro Assays: Testing photodynamic bactericidal kinetics against standard reference strains (P. gingivalis, A. actinomycetemcomitans, F. nucleatum) and baseline cell viability in human gingival fibroblasts (HGF-1).
Preclinical Technical Dossier & Core Formulation IP: Compiling laboratory SOPs, co-drafting formulation patents, and preparing technical data sheets.

2. Sinai University (Clinical Translation, Dental Hospital Infrastructure & Trial Lead)

Core Mandate: Translation from bench to bedside, clinical formulation optimization (intra-pocket delivery vehicles), ex vivo/in vivo modeling, and clinical evaluation at the Faculty of Dentistry & University Clinics (taking the project from TRL 4 to TRL 5/6).
Key Work Packages & Responsibilities:
Clinical Formulation & Delivery Formulation: Collaborating to incorporate the Ce6-LCNPs into an easy-to-apply, bioadhesive in-situ dental gel or syringe-based pocket applicator optimized for subgingival administration.
Comparative Cell Biology (Adult vs. Pediatric): Utilizing primary dental stem cells derived from clinical specimens (e.g., adult periodontal ligament stem cells [hPDLSCs] vs. deciduous stem cells [dPDLSCs] from pediatric patients) to benchmark age-specific biological responses.
Clinical Protocol & Ethical Approvals: Formulating the clinical investigation protocols and obtaining institutional review board (IRB) and national ethics approvals for dental trials.
Investigator-Led Phase I/II Clinical Studies: Conducting controlled clinical trials on adult and pediatric periodontitis patients within Sinai University's dental clinics:
Measuring primary endpoints: Pocket Probing Depth (PPD), Clinical Attachment Level (CAL), and Bleeding on Probing (BOP).
Monitoring subgingival plaque microbiome reduction before and after PDT.
Regional Dissemination & Clinical Training: Establishing continuing education workshops and hands-on clinical training modules for dental practitioners across Egypt and the MENA region.

3. Spanish Industrial Partner (MedTech / Advanced Photonics & Commercialization Lead)

Core Mandate: Photonic hardware design, theranostic imaging integration, medical device compliance (ISO 13485 / EU MDR), and commercial scaling.

Key Work Packages & Responsibilities:
Optical Hardware & Periodontal Tip Engineering: Designing, prototyping, and manufacturing a dedicated, dental-grade 660 nm laser/LED system featuring flexible, calibrated fiber-optic tips designed for subgingival illumination.
Theranostic Imaging & Guidance Sensor: Integrating optical/fluorescence sensor modules to monitor Ce6 fluorescence emission in real time, validating pocket placement and tracking photosensitizer clearance.
Pilot Scale-Up & Quality Management: Developing certified manufacturing processes (ISO 13485) and producing clinical-grade device prototypes for trial testing at Sinai University.
Regulatory Dossier (CE Mark / EU MDR): Leading the medical device regulatory strategy under EU MDR 2017/745 for device–drug combination products.
Commercialization & Global Distribution: Managing international distribution, licensing, and commercial rollout across Europe and international dental markets