What does peer-reviewed literature report on gold-coated or ...

Question: What does peer-reviewed literature report on gold-coated or gold nanoparticle-functionalized optical fiber biosensors for bacterial detection?

📄 Overview

🔍 Applying searching strategies...

📋 **Screening Results**

↳ Database: Europe PMC

↳ Search query: ("gold nanoparticle*" OR "gold-coated" OR "gold film" OR "AuNP*" OR "colloidal gold" OR "gold functionalized") AND ("optical fiber" OR "optical fibre" OR "fibre optic" OR "fiber optic" OR "evanescent wave" OR "surface plasmon resonance fiber" OR "LSPR fiber") AND ("biosensor*" OR "bio-sensor*" OR "sensing" OR "detection") AND ("bacteria*" OR "bacterial" OR "pathogen*" OR "microbial" OR "Escherichia coli" OR "Salmonella" OR "Staphylococcus" OR "Listeria")

↳ Total identified: 1,431

↳ After relevance screening: 20

↳ Excluded: 1,411

⚠️ This report is based on Europe PMC abstract-level screening. Full-text screening requires institutional access and must be completed by the user. The full-text assessment stage of the PRISMA flow chart is not included in this output.

✅ Analyzed 1431 studies · Synthesized the top 20

↳ Ranked by KlastroHeron using publicly available relevance criteria

↳ Citation impact: 🏆 Top 1%, 🥇 Top 5%, 🥈 Top 10% displayed

↳ Excluded 1411 studies with lower relevance

✅ Found 20 papers. Analyzing...

🔬 Evidence

Research Evidence:

- **Surface Plasmon Resonance (SPR) for foodborne pathogen detection**: A comprehensive review (DOI: https://doi.org/10.3390/bios15120774) describes how SPR biosensors — which rely on gold-coated metal-dielectric interfaces — exploit resonant absorption of incident photons by surface plasmons to detect minute refractive index changes. The review highlights SPR's advantages over conventional microbiological methods, including faster detection speed, higher sensitivity, and reduced susceptibility to contamination, making it particularly relevant for bacterial detection in food safety contexts.

- **Gold nanoparticle (AuNP)-functionalized fiber-optic LSPR biosensor**: A study on tetracycline detection in milk (DOI: https://doi.org/10.1016/j.fochx.2026.103782) engineered a fiber-optic Localized Surface Plasmon Resonance (LSPR) biosensor using AuNP-labeled DNA molecular switches. While the target analyte was tetracycline rather than bacteria directly, the platform demonstrates the core principle applicable to bacterial biosensing: AuNPs immobilized on optical fiber surfaces generate measurable LSPR blue shifts upon target binding, achieving a detection limit of 0.28 ng/mL with recovery rates of 96.75–104.15% in real food matrices. This architecture is directly transferable to bacterial antigen or nucleic acid detection.

- **Nanoparticle-enabled biomolecular detection platforms**: A review focused on agricultural and plant applications (DOI: https://doi.org/10.1021/acsomega.6c00231) summarizes how gold nanoparticles enhance SERS and SPR-based detection of DNA, RNA, and proteins. The review notes that AuNP functionalization improves sensitivity, specificity, and throughput — properties directly relevant to optical fiber biosensors targeting bacterial analytes.

- **Optical biosensor operating principles**: A dedicated review on optical biosensor design (DOI: https://doi.org/10.3390/mi17050579) covers the principles underlying gold-coated and nanoparticle-functionalized fiber-optic platforms, including evanescent wave sensing, LSPR, and SPR configurations relevant to bacterial detection architectures.

- **Biosensing platforms for sepsis and bacterial pathogen detection**: A recent review on sepsis diagnostics (DOI: https://doi.org/10.1039/d5ra06963g) discusses multiple biosensing strategies for blood-based pathogen identification, including optical approaches, with emphasis on sensitivity and limit of detection (LOD) benchmarks relevant to clinical bacterial detection.

💡 Implications

Clinical and Research Implications:

• This report is intended for literature review, scientific education, and professional reference; it does not replace patient-specific clinical or diagnostic judgment.

• Gold-coated optical fiber SPR biosensors operate by functionalizing a thin gold film on the fiber surface, enabling real-time, label-free detection of bacterial binding events through refractive index shifts — a well-established principle supported across multiple reviewed sources.

• AuNP functionalization of fiber-optic surfaces enhances LSPR signal amplitude, lowers detection limits, and enables multiplexed detection, making these platforms particularly promising for rapid point-of-care bacterial identification.

• The fiber-optic LSPR format (as demonstrated in the tetracycline study) is architecturally adaptable to bacterial detection by substituting the recognition element (e.g., antibodies, aptamers, or bacteriophage-derived probes) targeting bacterial surface antigens or nucleic acid sequences.

• SPR-based platforms have demonstrated advantages over culture-based methods (speed, sensitivity) and PCR-based methods (cost, real-time readout without amplification steps), as noted in the foodborne pathogen detection review.

• For sepsis-relevant bacterial detection, biosensor LOD benchmarks and clinical sensitivity thresholds remain an active area of development, as highlighted in the sepsis biosensing review.

⚠️ Limitations

Study Limitations:

• The most directly relevant fiber-optic LSPR study (DOI: https://doi.org/10.1016/j.fochx.2026.103782) targets a small-molecule antibiotic (tetracycline) rather than intact bacteria or bacterial biomarkers, limiting direct extrapolation to whole-cell bacterial detection performance.

• Several provided abstracts are review articles rather than original experimental studies, which limits assessment of specific analytical performance metrics (e.g., LOD, selectivity, reproducibility) for gold-coated fiber biosensors in bacterial detection specifically.

• The nanoparticle biomolecule detection review (DOI: https://doi.org/10.1021/acsomega.6c00231) focuses primarily on plant and agricultural applications, which may not fully reflect clinical or food safety bacterial detection contexts.

• No abstract in the provided set reports a head-to-head comparison of gold-coated vs. non-gold-coated optical fiber biosensors specifically for bacterial targets, representing a gap in the available evidence.

• Evidence from the sepsis biosensing review is based on a broad survey of methods, and performance data for specific optical fiber gold nanoparticle platforms in clinical bacterial detection settings are not individually detailed in the abstract provided.

📋 Summary

Summary:

• Peer-reviewed literature consistently supports that gold-coated and AuNP-functionalized optical fiber biosensors leverage SPR and LSPR principles to achieve rapid, sensitive, and label-free detection of biological analytes, with strong applicability to bacterial detection.

• The core mechanism — refractive index change at a gold-functionalized fiber surface upon target binding — is well-validated, and AuNP labeling further amplifies signal through localized plasmonic effects, as demonstrated in fiber-optic LSPR platforms achieving sub-ng/mL detection limits.

• For bacterial-specific applications, the recognition layer (antibody, aptamer, phage protein) immobilized on the gold surface determines selectivity, while the gold nanoparticle or gold film provides the transduction mechanism — a modular design that the literature identifies as a key advantage for adapting these sensors to diverse bacterial targets.

• Researchers and clinicians developing or evaluating such platforms should consult primary experimental studies reporting LOD, dynamic range, matrix effects, and clinical validation data for the specific bacterial target of interest, as the current evidence base includes substantial review literature but fewer large-scale clinical validation studies for fiber-optic gold nanoparticle bacterial biosensors specifically.

🧪 Methodology

🔬 Methodology Summary from Top 3 Studies

Reference # 2: Situ X, Li J, Zhang Y, Yan H. (2026)

DOI: https://doi.org/10.1016/j.fochx.2026.103782

Study Type: Mechanism Study

Design: Analytical biosensor development and validation study with real sample testing and HPLC reference comparison
Sample Size: Not specified (real milk samples tested)
Duration: Not mentioned

Model/Population:

• Real milk samples spiked with tetracycline; no human subjects or animal models involved

Intervention:

• Treatment: Tetracycline detection using fiber-optic LSPR biosensor with AuNP-labeled DNA triple-helix molecular switch

• Comparator: HPLC reference analysis

• Parameters: Linear detection range: 5–100 ng/mL; LOD: 0.28 ng/mL; recovery rates: 96.75%–104.15%; RSD 0.05) confirming no significant difference

Outcomes:

• LSPR blue shift magnitude as primary detection signal

• Linear detection range (5–100 ng/mL)

• Limit of detection (LOD: 0.28 ng/mL)

• Recovery rates in real milk samples (96.75%–104.15%)

Focus: A fiber-optic LSPR biosensor using AuNP-labeled DNA triple-helix switches was developed and validated for ultrasensitive on-site detection of tetracycline residues in milk, demonstrating performance comparable to HPLC.

Reference # 3: Li T, Datson Z, Darwish N, Lopez-Ruiz FJ. (2026)

DOI: https://doi.org/10.1021/acsomega.6c00231

Study Type: Review

Design: Narrative review summarizing advances in nanoparticle-based biomolecule detection methods for plant and agricultural applications

Sample Size: Not mentioned

Duration: Not mentioned

Model/Population:

- Published studies on nanoparticle-enabled detection of DNA, RNA, and proteins, with focus on plant and agricultural diagnostics

Intervention:

- Treatment: Nanoparticle-based detection approaches including SERS, SEIRS, SPR, mass spectrometry, chromatographic techniques, fluorescence methods, and electrochemical techniques

- Comparator: Progression from early large-biomolecule detection techniques (SERS, SEIRS) to advanced label-free, real-time sensing methods

- Parameters: Chemical-free techniques; label-free sensing; real-time monitoring; high sensitivity and specificity

Methodology:

- Comprehensive review of nanoparticle applications in biomolecular detection across multiple analytical platforms

- Covers transition from techniques without defined detection limits (SERS, SEIRS) to high-sensitivity label-free methods (SPR, mass spectrometry)

- Specific focus on plant and agricultural applications of nanoparticle-based diagnostics

- Evaluation of detection capabilities for DNA, RNA, and protein biomolecules

Outcomes:

- Sensitivity and specificity of detection methods

- Detection limits of various nanoparticle-based techniques

- Real-time monitoring capability of biomolecular interactions

- Cost-effectiveness and throughput of detection approaches

Focus: This review investigates the advances in nanoparticle-enabled biomolecule detection techniques, emphasizing their evolution toward higher sensitivity, label-free sensing, and applicability in plant and agricultural diagnostics.

Reference # 5: Mishra VD, Pandey M, Kumar H, Panigrahi PK, Bhattacharya S. (2026)

DOI: https://doi.org/10.1039/d5ra06963g

Study Type: Review

Design: Comprehensive narrative review of biosensing platforms and diagnostic technologies for sepsis detection
Sample Size: Not specified
Duration: Not specified (covers recent developments up to at least 2020)

Model/Population:

- Published studies on sepsis biosensors, including neonatal sepsis biomarkers, electrochemical and optical sensing methods, and AI/ML-based diagnostics

Intervention:

- Treatment: Not applicable

- Comparator: Not applicable

- Parameters: Comparison of six categories of sepsis biosensors based on sensitivity, LOD, and sensing mechanisms

Methodology:

- Review of six categories of sepsis biosensors with relevant biomarkers and limits of detection (LOD)

- Comparative analysis of electrochemical and optical detection methods for blood-based pathogens

- Evaluation of point-of-care platforms including paper-based, microfluidic, and low-energy devices for resource-limited settings

- Discussion of AI and machine learning integration into sepsis diagnostic processes

Outcomes:

- Sensitivity and limit of detection (LOD) of various biosensing platforms

- Ease of biomarker extraction from bodily/interstitial fluids

- Reliability and durability of sensing mechanisms

- Processing time and innovation in pathogen detection

Focus: This review comprehensively analyzes recent advances in biosensing technologies for sepsis diagnosis, covering biomarkers, sensing mechanisms, and AI-based approaches across six biosensor categories.

📊 Methodological Patterns Across Studies:

Study Types:

- Review: 2 studies

- Mechanism Study: 1 study

Research Models:

- Literature: 2 studies

Interventions Studied:

- Nanoparticle-based detection approaches including SERS, SEIRS, SPR, mass spectrometry, chromatographic techniques, fluorescence methods, and electrochemical techniques

- Not applicable

- Tetracycline detection using fiber-optic LSPR biosensor with AuNP-labeled DNA triple-helix molecular switch

💡 Insights for Research Design:

From Review/Meta-Analysis:

- Note inclusion criteria for study selection

- Review analytical approaches for data synthesis

- Consider scope when planning systematic reviews

General Recommendations:

- Methodological consistency aids reproducibility

- Most commonly used approaches may have better validation

- Consider variations when adapting protocols to your context

⚠️ Important Note:

These summaries are extracted from abstracts, which provide limited methodological detail.

For complete experimental protocols:

- Access full-text articles via DOI links below

- Review Materials & Methods sections thoroughly

- Check supplementary materials for detailed procedures

• Consider contacting authors for specific methodological questions

• Verify protocols match your research context and regulatory requirements

📚 References

📚 References:

• The Development of Foodborne Pathogen Detection and Biosensor Design for Surface Plasmon Resonance Technology.

Authors: Hu Y, Yang J, Chen J, Sun X, Hu W, Liu X
DOI: https://doi.org/10.3390/bios15120774

• An AuNP-labeled triple-helix molecular switch for ultrasensitive, on-site detection of tetracycline in milk via fiber-optic localized surface plasmon resonance biosensing.

Authors: Situ X, Li J, Zhang Y, Yan H
DOI: https://doi.org/10.1016/j.fochx.2026.103782

• Biomolecule Detection Methods Based on Nanoparticle Approaches.

Authors: Li T, Datson Z, Darwish N, Lopez-Ruiz FJ
DOI: https://doi.org/10.1021/acsomega.6c00231

• Optical Biosensors—Principles of Operation and Applications

Authors: Blachowicz T, Ehrmann G, Stepula E, Ehrmann A
DOI: https://doi.org/10.3390/mi17050579

• Recent advances in the biosensing platforms for sepsis diagnosis.

Authors: Mishra VD, Pandey M, Kumar H, Panigrahi PK, Bhattacharya S
DOI: https://doi.org/10.1039/d5ra06963g

• Smart Bioaerosol Monitoring: Advanced Sampling and Sensing across Environmental, Clinical, and Industrial Domains.

Authors: Batool SS, Batool SM, DeSutter T, Meehan M, Oduor PG
DOI: https://doi.org/10.1021/acsomega.5c09151
📚 3 | 🥇 Top 5%

• Metal-Organic-Framework-Based Optical Biosensors: Recent Advances in Pathogen Detection and Environmental Monitoring.

Authors: Kidanemariam A, Cho S
DOI: https://doi.org/10.3390/s25165081
📚 15 | 🥇 Top 5%

• Optical Method for the Detection of Viral RNA Using an Optical Fiber Sensor.

Authors: Sokołowski P, Wityk P, Raczak-Gutknecht J, Brzezińska W, Sobaszek M, Kalinowski P, Garcia-Galan S, Szczerska M

DOI: https://doi.org/10.1002/jbio.202500063

- Carbohydrate-based biosensors for enhanced pathogen detection.

Authors: Elgiddawy N, Azzazy HME

DOI: https://doi.org/10.1007/s00216-025-06272-6

📚 1 | 🥇 Top 5%

- Research Progress on Point-of-Care Testing Technology for Mycoplasma Pneumonia.

Authors: Guo Z, Hu R, Wang J, Zhou M, Zhu K, Xu Y

DOI: https://doi.org/10.2147/ijgm.s584824

- Ultrasensitive detection of amlodipine using plasmonic optical fiber sensors enhanced with graphene oxide and chitosan nanocomposite.

Authors: Sedeeq FT, Nasiri H, Abbasian K, Khodaei H

DOI: https://doi.org/10.1038/s41598-025-13980-7

📚 8 | 🥇 Top 5%

- Biosensing Strategies to Monitor Contaminants and Additives on Fish, Meat, Poultry, and Related Products.

Authors: Tsegay ZT, Hosseini E, D'Amore T, Smaoui S, Varzakas T

DOI: https://doi.org/10.3390/bios15070415

📚 8 | 🥇 Top 5%

- Evanescent wave-based optical biosensors for innovations, medical application and future perspectives.

Authors: Chen C, Singh R, Huo S, Song Y, Wang K, Chiavaioli F, Hou X

DOI: https://doi.org/10.1016/j.jare.2025.07.007

📚 10 | 🥇 Top 5%

- Emerging trends in nano-sensors: A new frontier in food safety and quality assurance.

Authors: Awlqadr FH, Altemimi AB, Qadir SA, Hama Salih TA, Alkanan ZT, AlKaisy QH, Mohammed OA, Hesarinejad MA

DOI: https://doi.org/10.1016/j.heliyon.2024.e41181

📚 43 | 🏆 Top 1%

- Integration of Artificial Intelligence in Biosensors for Enhanced Detection of Foodborne Pathogens.

Authors: Banicod RJS, Tabassum N, Jo DM, Javaid A, Kim YM, Khan F

DOI: https://doi.org/10.3390/bios15100690

📚 27 | 🥇 Top 5%

• Biosensing technology for detection and assessment of pathogenic microorganisms.

Authors: Sinha S, Bachan Upadhyay LS

DOI: https://doi.org/10.1080/17460913.2024.2417621

📚 3 | 🥇 Top 5%

• Advancing Food Safety Surveillance: Rapid and Sensitive Biosensing Technologies for Foodborne Pathogenic Bacteria.

Authors: Feng Y, Shi J, Liu J, Yuan Z, Gao S

DOI: https://doi.org/10.3390/foods14152654

📚 10 | 🥇 Top 5%

• Biosensors for the detection of arthropod-borne veterinary viruses: A comprehensive review.

Authors: Staji H, Angoshtan SF

DOI: https://doi.org/10.1016/j.vas.2026.100577

• Immunosensors and Immunoassays to Detect Francisella tularensis and Diagnose Tularemia.

Authors: Pohanka M

DOI: https://doi.org/10.3390/bios16030158

• Uncovering Analytical Patterns for Hazardous Components in Agricultural Production Systems.

Authors: Deng S, Wu X, Shi Y, El-Mesery HS, Zhang X

DOI: https://doi.org/10.3390/foods14183261

📚 4 | 🥈 Top 10%

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Screening Results Flow

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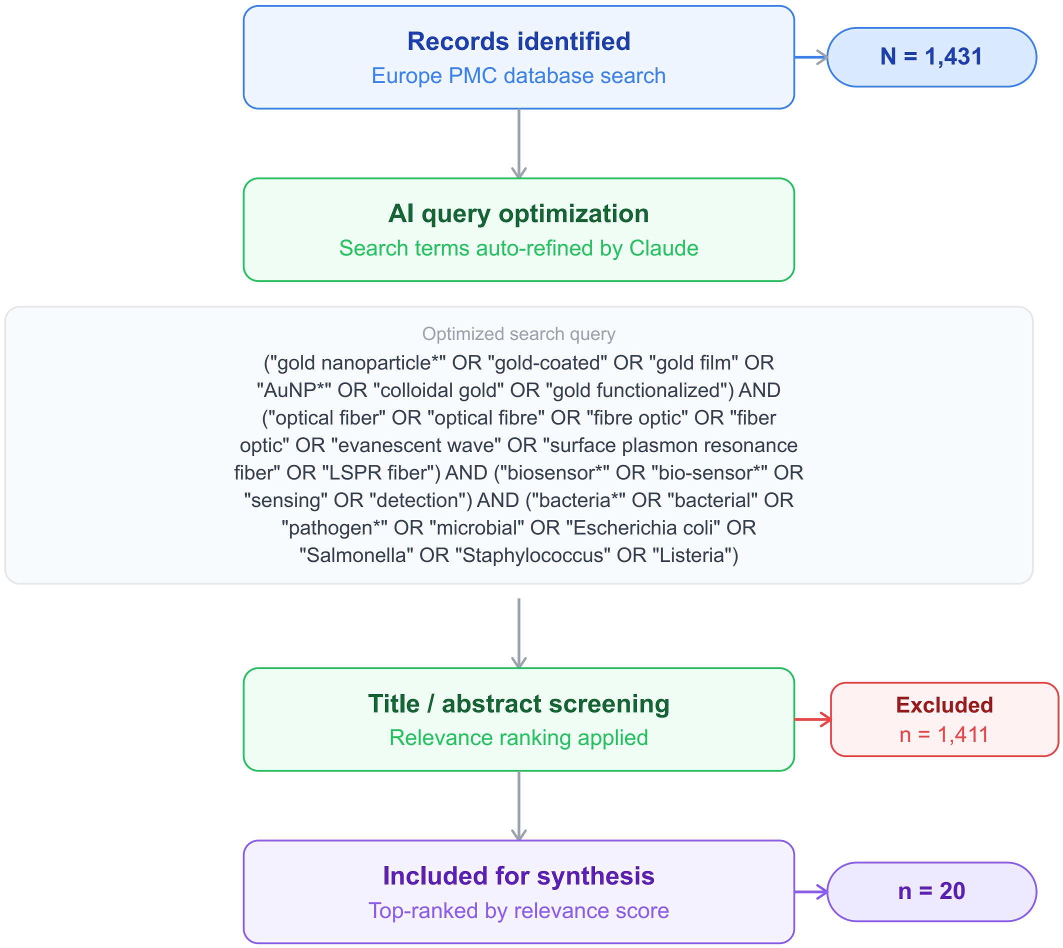

⚠️ Abstract-based screening only

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The full-text assessment stage of the PRISMA flow chart is not included in this output.