

# NMR Markets: Global Analysis and Opportunity Evaluation 2016 - 2020

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## Abstracts

Biopharm Reports has carried out a comprehensive market study of the laboratory use of nuclear magnetic resonance spectroscopy (NMR). This involved the participation of 363 experienced end-users and profiled current practices, developments, trends and end-user plans over the next three years, as well as growth and opportunities. These areas include growth in the use of NMR, Instrument suppliers, NMR instruments, needs and innovation requirements, hyphenated NMR techniques, main suppliers of NMR accessories or consumables, NMR instrument frequencies, main NMR applications, biological applications of NMR, current probe designs or capabilities requirements, NMR runs each month, dynamic nuclear polarization (DNP-NMR), per sample running costs, NMR software, NMR systems, flow-through techniques, NMR spectroscopy types, multi-dimensional NMR, molecule types studied, isotopes used and other areas. Its findings provide a wealth of market information on the current and developing used of NMR.

### Laboratory NMR

Growth in end-user's NMR now and anticipated in 3 years ( $\pm\%$  change)

High-growth areas of NMR now and anticipated in 3 years ( $\pm\%$  change)

NMR instrument suppliers now and anticipated in 3 years ( $\pm\%$  change)

NMR instruments used now and anticipated in 3 years ( $\pm\%$  change)

End-users' NMR consumables suppliers

End-users' three-year plans for the use of NMR

NMR types used now and anticipated in 3 years ( $\pm\%$  change)

General applications of NMR now and anticipated in 3 years ( $\pm\%$  change)

Use of NMR in biological applications now and in 3 years ( $\pm\%$  change)

Biological applications of NMR now and anticipated in 3 years ( $\pm\%$  change)

Isotopes used now and anticipated in 3 years ( $\pm\%$  change)

NMR software types used now and anticipated in 3 years ( $\pm\%$  change)

NMR systems used now and anticipated in 3 years ( $\pm\%$  change)

Multi-dimensional NMR used now and anticipated in 3 years ( $\pm\%$  change)

DNP-NMR used now and anticipated in 3 years ( $\pm\%$  change)

Cryogen vs. Cryogen-Free used now and anticipated in 3 years ( $\pm\%$  change)

NMR surface sensors used now and anticipated in 3 years ( $\pm\%$  change)

NMR flow-through used now and anticipated in 3 years ( $\pm\%$  change)

Hyphenated NMR techniques used now and anticipated in 3 years ( $\pm\%$  change)

Probe designs and requirements now and anticipated in 3 years ( $\pm\%$  change)

Samples analysed now and anticipated in 3 years ( $\pm\%$  change)

NMR instrument frequencies used now and anticipated in 3 years ( $\pm\%$  change)

Other market areas

## Other Areas

Costs of sample analysis estimated by end users, using NMR

Average monthly throughput of samples by end users, using NMR

Countries and global regions

Organisation types

## This Report

Biopharm Reports' specialised market studies are designed to assist suppliers and developers to profile current and evolving laboratory market opportunities. All of our studies are carried out through specialist groups of experienced end-users and therefore findings are based on 'real world' market data. By providing new insights and a better understanding of end-user practices, needs and future plans, our studies assist suppliers to sell into these markets, and also support innovation and strategic planning. The following study areas were investigated:

## NMR Market Study

### 1. Growth

Based on recent trends in the numbers of NMR runs carried out in their laboratories, end-users' own estimates of by how much (% increase or % decrease) their laboratory use of NMR has changed over the last three years. Also, based on current trends in the numbers of samples analysed in their laboratories, end-users' own estimates of by how much (% increase or % decrease) they anticipate their laboratory use of NMR will change over the next three years.

### 2. Current NMR instrument suppliers and suppliers anticipated in 3 years

End-users' current NMR instruments suppliers and those suppliers they anticipate will be supplying their NMR instruments in three years time, where the companies++ considered were: Anasazi Instruments, Angstrom Advanced, Anvendt Teknologi, Aspect Imaging, Bridge12 Technologies, Bruker, COSA, HTS-100, JASTEC, JEOL, JS Research, Kimble, Lab-Tools, LexMarGlobal, Magritek, MobiLab, MR Resources, Nanalysis, Niumag, One Resonance Sensors, Oxford Instruments, Process NMR Associates, Protasis Corp, Spin Core, Spinlock, Stelar, T2 Biosystems, TeachSpin, Tecmag, Thermo Fisher, Varian/Agilent, Vista Clara and Xigo Nanotools.

### 3. Current NMR instruments and instruments anticipated in 3 years

End-users' current NMR instruments and those they anticipate using in in three years time, where the instruments considered were Anasazi Instruments Eft 60 MHz, Anasazi Instruments Eft 90 MHz, Angstrom-Advanced NMR-900, Anvendt Teknologi NMR Systems, Bridge12 Technologies DNP-NMR Upgrades, Bruker AV III HD 200, Bruker AV III HD 250, Bruker AV III HD 300, Bruker AV III HD 400, Bruker AV III HD 500, Bruker AV III HD 600, Bruker AV III HD 700, Bruker AV III HD 850, Bruker AV III HD 900, Bruker AV III HD 1000, Bruker III HD Aeon Wide-Bore 800, Bruker III HD Ascend 600 MHz, Bruker III HD Ascend 700 MHz, Bruker III HD Ascend 800 MHz, Bruker III HD Ascend 850 MHz, Bruker III HD Ascend Wide-Bore 600 MHz with DNP, Bruker DPX200, Bruker DPX300, Bruker DPX400, Bruker minispec mq series, Bruker minispec LF Series, Bruker minispec ProFiler, Bruker Solid-state NMR, Bruker Fourier 300 NMR, COSY Aspect AI-60, COSY SpinPulse CX-20, HTS-100 Cryogen-free NMR 100 Mhz, HTS-110 Cryogen-free NMR 200 Mhz, JEOL JNM-ECZR ZETA Research NMR, Lab-Tools low-field relaxation NMR, LexMarGlobal MagnePulse AT, LexMarGlobal MagModule II, LexMarGlobal MagStation II, LexMarGlobal MagStation Lite, Magritek Kea2 digital 400 Mhz, Magritek NMR Rock Core Analyzer 2Mhz, MobiLab MobiLab 130, MR Resources NMR Spectrometers, Nanalysis NMReady 60 Pro, Nanalysis NMReady 60e, Nanalysis NMReady60, Niumag EDUMR Educational, Niumag EduVMR, Niumag MacroMR, Niumag MesoQMR, Niumag MicroMR, Niumag NMI20, Niumag PQ001 NMR, Niumag VTMR TD-NMR, One Resonance Sensors MobiLab 130 Elemental, Oxford Instruments GeoSpec, Oxford Instruments MQC Benchtop NMR, Oxford Instruments Pulsar, Process NMR Associates NMR Process Systems 60, Protasis Corp MicroFlow NMR, Spin Core iSpin-NMR Portable NMR, Spinlock SRL SLK 200 analyzer, Stelar SMARtracer™, Stelar Spinmaster FFC2000, T2 Biosystems T2 Magnetic Resonance (T2MR), TeachSpin Pulsed/CW NMR System, Tecmag LapNMR, Thermo Fisher picoSpin 45, Thermo Fisher picoSpin 80, Varian/Agilent 400-MR Automated NMR, Varian/Agilent Agilent DirectDrive 500, Varian/Agilent Agilent DirectDrive 600, Varian/Agilent Agilent DirectDrive 800, Varian/Agilent 300 MHz Varian Inova, Varian/Agilent 400 MHz Varian Inova, Varian/Agilent 500 MHz Varian Inova, Varian/Agilent 600 MHz Varian Inova, Varian/Agilent Varian Infinity-Plus 400 (Solid-State), Varian/Agilent Varian Mercury 300, Varian/Agilent Varian Unity+-500, Vista Clara Corona, Vista Clara Discus, Vista Clara GMR, Vista Clara Javelin, Xigo Nanotools Flow, Xigo Nanotools Area and Xigo Nanotools Drop.

### 4. Suppliers of NMR Accessories or Consumables

## 5. Current general applications of NMR and applications anticipated in 3 years

End-users' current general applications of NMR and those they anticipate in three years time, where the applications considered were Biological research, Chemical analysis, Chemical composition determination, Chemical reaction monitoring, Chemical structure determination, Compound identification and confirmation, Formulations analysis, Fragrance and flavours, General research, Incoming chemical inspection, Material structure, Medicinal chemistry, Mixture analysis, Molecular characterisation, Molecular hydration, Molecular interactions, Natural products/molecules, Physical chemistry, Polymers, Quality assurance, Quantitative analysis, Raw materials, Reaction Kinetics, Reaction mechanisms, Sample purity determination and Teaching Labs.

## 6. Use of NMR for biological applications

End-users' use of NMR for biological applications, where the options considered were: Yes and No.

## 7. Current NMR biological applications and anticipated in 3 years

For those who answered yes to the previous questions (6), end-users' current use of NMR for biological applications and their anticipated use of NMR for biological applications in three years, where the options considered were: Analysis of inter-and intramolecular exchange processes, Bimolecular dynamics (molecular motion), Bimolecular solution structure, Biological and biochemical research, Conformational analysis of bio macromolecules, Drug screening (e.g. with enzymes, receptors and other proteins), Hydrogen bonding interactions., Intrinsically Disordered Proteins (IDPs), Ionization state of biomacromolecules (e.g. at the active sites of enzymes etc), Membrane (native) analysis, Membrane interactions, Metabolite analysis, Metabolomics, Molecular dynamics of biomacromolecules, Protein folding/protein folding intermediates, Protein hydration (water interaction with biomacromolecules)., Solution structure under near physiological conditions, Solution structure in membrane environments and Weak interactions between macrobiomolecules.

## 8. Future use of NMR for biological applications

For those who answered no to the previous question (6), end-users' anticipated use of NMR for biological applications in three years, where the options considered were: Yes and No and Not Sure

## 9. Current NMR isotopes used and anticipated in 3 years

End-users' currently used NMR isotopes and those they anticipate using in their NMR in three years, where the options considered were: Aluminium (Al-27), Antimony 121Sb, Antimony 123Sb, Arsenic (As-75), Barium (Ba-135), Barium (Ba-137), Beryllium (be-9), Bismuth (Bi-209), Boron (B-10), Boron (B-11), Bromine (Br-79), Bromine (Br-81), Cadmium (Cd-111), Cadmium (Cd-113), Caesium (Cs-133), Calcium (Ca-43), Carbon (C-13), Chlorine (Cl-35), Chlorine (Cl-37), Chromium (Cr-53), Cobalt (Co-59), Copper (Cu-63), Copper (Cu-65), Fluorine (F-19), Gallium (Ga-69), Gallium (Ga-71), Germanium (Ge-73), Gold (Au-197), Hafnium (Hf-177), Hafnium (Hf-179), Helium (He-3), Hydrogen (H-1), Hydrogen (H-2) Deuterium, Hydrogen (H-3) Tritium, Indium (In-113), Indium (In-115), Iodine (I-127), Iridium (Ir-191), Iridium (Ir-193), Iron (Fe-57), Krypton (Kr-83), Lanthanum (La-139), Lanthanum (La-138), Lead (Pb-207), Lithium (Li-6), Lithium (Li-7), Magnesium (Mg-25), Manganese (Mn-55), Mercury (Ag-201), Mercury (Hg-199), Molybdenum (Mo-95), Molybdenum (Mo-97), Neon (Ne-21), Nickel (Ni-61), Niobium (Nb-93), Nitrogen (N-14), Nitrogen (N-15), Osmium (Os-187), Osmium (Os-189), Oxygen (O-17), Palladium (Pd-105), Phosphorus (P-31), Platinum (Pt-195), Potassium (K-39), Potassium (K-40), Potassium (K-41), Rhenium (Re-185), Rhenium (Re-187), Rhodium (Rh-103), Rubidium (Rb-85), Rubidium (Rb-87), Ruthenium (Ru-101), Ruthenium (Ru-99), Scandium (Sc-45), Selenium (Se-77), Silicon (Si-29), Silver (Ag-107), Silver (Ag-109), Sodium (Na-23), Strontium (Sr-87), Sulphur (S-33), Tantalum (Ta-181), Tellurium (Te-123), Tellurium (Te-125), Thallium (Tl-203), Thallium (Tl-205), Tin (Sn-117), Tin (Sn-119), Titanium (Ti-47), Titanium (Ti-49), Tungsten (W-183), Vanadium (V-50), Vanadium (V-51), Xenon (Xe-129), Xenon (Xe-131), Yttrium (Y-89), Zinc (Zn-67), Zirconium (Zr-91) and Other.

## 10. Current NMR software used and anticipated in 3 years

End-users' currently used NMR software and the NMR software they anticipate using in three years, where the options considered were: ACD Labs: Software, Acorn NMR NUTS, ADF Scientific: Software, Anvendt Teknologi: Software, Bruker SampleTrack, Bruker: AMIX, Bruker: AssureNMR, Bruker: CMC, Bruker: IconNMR, Bruker: InsightMR, Bruker: Top-Spin, Chenomx: NMR Suite, Cosmos: Software, Dune Scientific: Software, Extra Byte: Software, Felix NMR: Software, Green Imaging: Software, Hallogram HyperNMR, HTS-110: Opera 2D, HTS-110: Opera 3D, IneedWS: Software, Innovative Solutions: Software, JEOL: Delta, Logicom: NMR Petrophysics, Magritek: Prospa, Mestrelab: Mnova ( MestReC), ModGraph NMRPredict, NMR Science: NMRPipe, NMRTEC: NMRnotebook, NRGsSys: Software, Nucleomatica: iNMR, One Moon Scientific DataChord, One Moon Scientific NmrViewJ, Perch (Bruker): Software,



ScienceSoft: Software, ScientificSoft: FindIt, ScientificSoft: LockIt, ScientificSoft: NMRAnalyst, ScientificSoft: ShimIt, ScientificSoft: VerifyIt, Sigma-Aldrich: Spectral Viewer, Stelar: Software, Upstream Solutions: NMR, Yasara: Software and Other.

#### 11. Current NMR fields and anticipated in 3 years

End-users' currently NMR fields of application and those NMR fields they anticipate in three years, where the options considered were: Agrochemicals, Airport Security, Archaeology, Art & Restoration, Biochemistry, Biofuels, Biology, Biomedical, Chemicals, Clinical Diagnostics, Clinical Therapeutics, Cosmetics, Food or Drinks, Food Safety & Agriculture, Forensics, Gemology, Geology, Government, Healthcare, Life Sciences, Medicine, Mineralogy, Nanotechnology, Oil & Gas, Online Monitoring, Perfumes, Petrochemicals, Pharmaceuticals, Polymers, Process Control, Quality Control, Safety, Security, Semiconductors, Textiles, Veterinary, Water and Other.

#### 12. Current location of NMR activities and anticipated in three years

End-users' currently location of their NMR activities and those locations anticipate for their NMR in three years, where the options considered were: Your own laboratory, By an external service laboratory and Both your own laboratory and by an external service laboratory.

#### 13. Current NMR spectroscopy types and those they anticipate using in 3 years

End-users' currently used NMR spectroscopy types and those NMR spectroscopy types they anticipate using in three years, where the options considered were: Continuous-Wave (CW) Spectroscopy, Fourier-Transform Spectroscopy, Multi-Dimensional NMR Spectroscopy, Solid-State NMR spectroscopy and Other.

#### 14. Current multi-dimensional NMR and anticipated in 3 years

End-users' currently used multi-dimensional NMR and those multi-dimensional NMR systems that anticipate using in three years, where the options considered were: 1D, 2D, 3D, 4D, 5D, 6D, 7D, 8D and Other.

#### 15. Current NMR systems and those they anticipate in 3 years

End-users' currently used NMR systems and those NMR systems that anticipate using in three years, where the options considered were: Stand-Alone, Benchtop, Portable

and Other.

#### 16. Current use of Dynamic Nuclear Polarization NMR (DNP-NMR)

End-users' current use of Dynamic Nuclear Polarization NMR (DNP-NMR), where the options considered were: Yes and No

#### 17. End-users' current use of Dynamic Nuclear Polarization (DNP-NMR)

End-users' current use of Dynamic Nuclear Polarization (DNP-NMR) and their anticipated use of this technique in three years, where the options considered were: Off-the-Shelf DNP-NMR, Existing system DNP-NMR Upgrade and Both Off-the-Shelf DNP-NMR + an DNP-NMR Upgrade.

#### 18. Use of Dynamic Nuclear Polarization (DNP-NMR) in three years

For those who answered no to question 16, end-users' anticipated use of Dynamic Nuclear Polarization (DNP-NMR) in three years, where the options considered were: Yes, No and Not Sure.

#### 19. Cryogen-based Systems Vs. Cryogen-Free Systems and anticipated in 3 years

End-users' current use of Cryogen-based Systems Vs. Cryogen-Free Systems and their anticipated use of either of these in three years, where the options considered were: Cryogen-based Systems, Cryogen-Free Systems and Both Cryogen AND Cryogen-Free Systems.

#### 20. Molecule types analysed using NMR and those anticipated in 3 years

End-users' currently analysed molecule classes using NMR and those they anticipate analysing using NMR in three years, where the options considered were: Organic: Small Molecules, Organic: Large Molecules, Biological: Small Molecules, Biological: Large Molecules, Inorganic: Small Molecules and Inorganic: Large Molecules.

#### 21. Use of NMR surface sensors

End-users' current use of NMR surface sensors, where the options considered were: Yes and No.



## 22. Current use of NMR surface sensors and anticipated in 3 years

End-users' current use of NMR surface sensors and their anticipated use of these in three years, where the options considered were: High-penetration Surface NMR Sensor, Standard-Type Compact NMR Sensor, standard-Type Super Compact NMR Sensor, MRI Surface System and Other

## 23. Use of NMR surface sensors in three years

For those who answered no to question 21, end-users' anticipated use of NMR surface sensors in three years, where the options considered were: Yes, No and Not Sure.

## 24. Use of flow-through NMR

End-users' use of flow-through NMR techniques, where the options considered were: Yes and No.

## 25. Current flow-through NMR techniques and anticipated in 3 years

End-users' current use of flow-through NMR techniques and their anticipated use of these in three years, where the options considered were: Continuous Flow, Single-Step Flow, Multiple-Step Flow and Other.

## 26. Use of flow-through NMR techniques in three

For those who answered no to question 24, end-users' anticipated use of flow-through NMR techniques in three years, where the options considered were: Yes, No and Not sure.

## 27. Use of hyphenated NMR techniques

End-users' use of hyphenated NMR techniques, where the options considered were: Yes and No.

## 28. Current use of hyphenated NMR techniques and anticipated use in 3 years

End-users' current use of Hyphenated NMR techniques and their anticipated use of these in three years, where the options considered were: Mass Spectrometry: NMR, Liquid Chromatography: NMR, Gas Chromatography: NMR, Size Exclusion

Chromatography (SEC): NMR, Gel Permeation Chromatography (GPC): NMR, Supercritical Fluid Chromatography (SFC): NMR, Capillary Electrophoresis (CE): NMR, Capillary Zone Electrophoresis (CZE): NMR, Capillary Isotachopheresis (cITP): NMR, Photo-diode array (PDA): NMR, Fluorescence detection (FLD): NMR, Evaporative Light Scattering Detection (ELSD): NMR and Centrifugal Partition Chromatography (CPC): NMR.

## 29. Future use of hyphenated NMR techniques

For those who answered no to question 27, end-users' anticipated use hyphenated NMR techniques in three years, where the options considered were: Yes, No and Not sure.

## 30. Current important probe designs or capabilities and those anticipated in 3 years

End-users' currently important probe designs or capabilities and those they anticipate being important in 3 years, where the options considered were: Single coil probes, Multiple coil probes, Ambient Temp operation probes, Cryogen controlled probes, Micro probes, Low volume probes, High Volume probes, Pulsed field gradient probes, Auto-tuning probes and Flow probes.

## 31. Sample types analysed using NMR

End-users' sample types analysed using NMR, where the options considered were: Options Evaluated: Solids, Liquids, Gasses and Other.

## 32. Current NMR instrument frequencies and those anticipated in 3 years

End-users' current NMR instrument frequencies and those anticipated in 3 years, where the options considered were: 1000 MHz.

## 33. NMR needs for innovation, development or improvement

End-users' NMR needs for innovation, development or improvement, where the options considered were: Accuracy, Applicability to complex mixtures, Automation, Cost, Ease of use, Hyphenation, Sample preparation, Sample throughput, Sensitivity, Service support, Software capabilities and Speed.

## 34. Average per-sample NMR running costs

End-users' average per-sample NMR running costs, where the options considered were: \$1000 and Not applicable.

### 35. Average NMR runs (samples analysed) each month

End-users' average NMR runs (samples analysed) each month per-sample, where the options considered were: 2500 and Not applicable.

### 36. Participants

Organisation Types: NMR end-user's organisation type, where the options were Clinic, Government Organisation, Hospital, Large International Company, Medium Sized Company, Research Institute, Small Company, Teaching Hospital, University, Veterinary Organisation or other.

Experience: End-users' years of experience using NMR

Job Title: End-user's job title, role and main activities.

Countries and Regions: NMR end-user's countries and global regions; Asia, North America, South America, Africa (Sub-Saharan), Central America/Caribbean, Australia, New Zealand and Oceania and Middle East/North Africa/and Greater Arabia.

Participants: Names and organisations.

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