

anatomy of a car battery

anatomy of a car battery is a crucial topic for anyone looking to understand how vehicles operate. Car batteries are the heart of the electrical system, providing the necessary power to start the engine and supply energy to various electrical components. In this article, we will explore the anatomy of a car battery in detail, covering its key components, how it functions, maintenance tips, and the differences between various types of batteries. By the end of this article, you will have a comprehensive understanding of what makes a car battery work and how to care for it effectively.

- Introduction
- Understanding Car Battery Basics
- Key Components of a Car Battery
- How Car Batteries Function
- Types of Car Batteries
- Maintenance Tips for Car Batteries
- Common Issues and Troubleshooting
- Conclusion
- FAQ

Understanding Car Battery Basics

Car batteries are essential for starting the engine and powering the vehicle's electronic systems. They store electrical energy in chemical form and convert it into electrical energy when needed. Typically, car batteries are lead-acid batteries, but advancements have led to the development of various types, including lithium-ion batteries. Understanding the basics involves recognizing their role in a vehicle's electrical system and the types of energy they provide.

When a driver turns the ignition key, the battery sends a high voltage to the starter motor, which cranks the engine. Once the engine starts, the alternator takes over, recharging the battery and supplying power to the vehicle's electrical systems.

Key Components of a Car Battery

The anatomy of a car battery consists of several critical components that work together to store and deliver electrical energy. Understanding these components helps in grasping how the battery operates and how to maintain it effectively.

Lead Plates

Lead plates are the primary components in a traditional lead-acid battery. They are submerged in the electrolyte solution and serve as electrodes. The positive plates are coated with lead dioxide, while the negative plates are made of sponge lead. The chemical reactions at these plates are what generate electricity.

Electrolyte Solution

The electrolyte solution in a lead-acid battery is typically a mixture of sulfuric acid and water. This solution facilitates the chemical reactions between the lead plates, allowing the generation of electrical energy. Proper levels of electrolyte are crucial for optimal battery performance.

Separator

Separators are materials that keep the positive and negative plates apart to prevent short-circuiting. They are usually made from porous materials that allow the electrolyte to pass through while preventing direct contact between the plates.

Battery Case

The battery case is made from durable plastic or resin and houses all the internal components. It is designed to withstand vibrations and environmental conditions while protecting the battery's internal chemistry from outside influences.

How Car Batteries Function

The functioning of a car battery is based on electrochemistry. When the battery is charged, a chemical reaction occurs that converts electrical energy into chemical energy. Conversely, when the battery discharges, this chemical energy is converted back into electrical energy.

The process involves several steps:

1. **Charging:** When the car is running, the alternator generates electricity that charges the battery. During this process, lead sulfate forms on the plates.
2. **Discharging:** When the engine is off, the battery discharges electricity to power accessories like lights and radios, converting lead sulfate back into lead dioxide and sponge lead.
3. **Cycle:** This charging and discharging cycle continues throughout the battery's lifespan, typically lasting 3 to 5 years, depending on usage and maintenance.

Types of Car Batteries

There are several types of car batteries available, each with unique characteristics and advantages. Understanding these differences is essential for selecting the right battery for your vehicle.

Lead-Acid Batteries

Lead-acid batteries are the most common type used in vehicles. They are reliable, cost-effective, and capable of providing high current for starting engines. However, they require regular maintenance and have a shorter lifespan compared to newer technologies.

Absorbent Glass Mat (AGM) Batteries

AGM batteries are a type of lead-acid battery that uses a glass mat to absorb the electrolyte. This design allows for higher durability, better vibration resistance, and faster charging times. They are often used in vehicles with advanced electrical systems.

Lithium-Ion Batteries

Lithium-ion batteries are becoming increasingly popular in hybrid and electric vehicles. They are lighter, have a longer lifespan, and can charge faster than traditional lead-acid batteries. However, they are more expensive and require specialized charging systems.

Maintenance Tips for Car Batteries

Proper maintenance of a car battery can significantly enhance its lifespan and performance. Here are some essential maintenance tips:

- Regularly check the battery terminals for corrosion and clean them if necessary.

- Ensure the electrolyte levels are adequate, adding distilled water if needed.
- Keep the battery case clean and free from dirt and grime that can lead to short circuits.
- Test the battery voltage periodically to ensure it is holding a proper charge.
- Disconnect the battery if the vehicle will be unused for an extended period to prevent drainage.

Common Issues and Troubleshooting

Understanding common issues related to car batteries can help in troubleshooting problems effectively.

Some frequent issues include:

Battery Drain

Battery drain can occur due to leaving lights or accessories on when the engine is off. It's essential to check for parasitic drains and rectify them promptly.

Corrosion

Corrosion at the terminals can impede performance. Regular cleaning and applying a corrosion prevention spray can mitigate this issue.

Age-Related Decline

As batteries age, their ability to hold a charge diminishes. If your battery is over three years old and showing signs of weakness, consider replacing it.

Conclusion

The anatomy of a car battery encompasses numerous components and processes that are vital for vehicle operation. By understanding how car batteries work, their types, and maintenance practices, car owners can ensure their vehicles operate efficiently and avoid unexpected breakdowns. Regular maintenance and awareness of common problems can extend the life of a car battery, ultimately saving money and enhancing vehicle reliability.

Q: What is the lifespan of a typical car battery?

A: The lifespan of a typical car battery ranges from 3 to 5 years, depending on usage, maintenance, and environmental conditions.

Q: How can I tell if my car battery is failing?

A: Signs of a failing car battery include difficulty starting the engine, dim headlights, and corrosion around the battery terminals.

Q: Should I replace my car battery with the same type?

A: It is generally recommended to replace your car battery with the same type to ensure compatibility with your vehicle's electrical system.

Q: How often should I check my car battery?

A: It is advisable to check your car battery at least twice a year, especially before extreme weather seasons, to ensure it is in good working condition.

Q: Can extreme temperatures affect my car battery?

A: Yes, extreme temperatures can negatively impact battery performance. High heat can accelerate battery fluid evaporation, while extreme cold can reduce the battery's ability to start the engine.

Q: Is it safe to jump-start a car battery?

A: Yes, jump-starting a car battery is safe if done correctly. Follow the proper procedures and ensure that the batteries are compatible.

Q: What should I do if my battery is leaking?

A: If your battery is leaking, it is crucial to handle it with care. Wear protective gloves, avoid direct contact with the acid, and consult a professional for safe disposal.

Q: How can I prolong the life of my car battery?

A: To prolong the life of your car battery, keep it clean, check the electrolyte levels, avoid short trips that prevent the battery from fully charging, and ensure good terminal connections.

Q: Are lithium-ion batteries better than lead-acid batteries?

A: Lithium-ion batteries have advantages such as longer lifespan and faster charging times, but they are also more expensive and require specific charging systems, making them suitable for certain applications like hybrid and electric vehicles.

[Anatomy Of A Car Battery](#)

Find other PDF articles:

<http://www.speargroupllc.com/business-suggest-003/pdf?dataid=dIR09-3825&title=best-buy-busines>

anatomy of a car battery: *THE ANATOMY OF THE AUTOMOBILE* DR. A. L. DYKE, 1904

anatomy of a car battery: *Anatomy of the Automobile* Donald Clarke, 1979

anatomy of a car battery: *An Anatomy Of Ghanaian Politics* Naomi Chazan, 2019-02-28 The paths of African states have diverged markedly since the termination of colonial rule. Nevertheless, Ghana, the first African state to achieve independence, epitomizes both the political gyrations and the overall stagnation common to many other countries on the continent. This work concentrates on the 1969-1982 period in Ghana, focusing on two interrelated facets of African politics: the decline of state power and authority, and adjustments to political recession. The author traces the dual patterns of diminution of the state and the adaptation of autonomous coping mechanisms in the separate spheres of political leadership, political structures and institutions, ideology, and political economy. The dynamic of state-society interactions is then treated in terms of the rhythm of dissent, conflict, and disengagement. Dr. Chazan provides a comprehensive study of Ghanaian politics from the 1970s to the present. By systematically analyzing the process of political decline and regeneration, she highlights similar processes apparent elsewhere in Africa. The stress on the subtleties and direction of political change has important implications for policymakers and policy analysts alike.

anatomy of a car battery: 2016 - DEBBIES BOOK(R) 28th Edition EBOOK Debbie Hemela, 2016-02-10 2016 Debbies Book® 28th Edition Full Database eBook 5 ways to experience Debbies Book®! • Physical book for users who want to hold it in their hands • Printable book for users who want to print certain pages • Tablet-friendly eBook for users who love their iPads and eReaders • Mobile App for iOS & Android Devices • Blog featuring how-tos, vendors and news The book is organized by categories in alphabetical order. Listings for Prop Houses and Costume Rental Houses are shortened to one or two lines to save space. Their full contact information is located within the Prop House and Costume Rental Houses categories only.

anatomy of a car battery: *X-kit Anatomy* , 2006

anatomy of a car battery: 2017 - DEBBIES BOOK(R) 29th Edition EBOOK Debbie Hemela, 2017-01-17 2017 Debbies Book® 29th Edition Full Database eBook 5 ways to experience Debbies Book®! • Physical book for users who want to hold it in their hands • Printable book for users who want to print certain pages • Tablet-friendly eBook for users who love their iPads and eReaders • Mobile App for iOS & Android Devices • Blog featuring how-tos, vendors and news The book is organized by categories in alphabetical order. Listings for Prop Houses and Costume Rental Houses are shortened to one or two lines to save space. Their full contact information is located within the Prop House and Costume Rental Houses categories only.

anatomy of a car battery: *Gross Anatomy, Neuroanatomy, and Embryology for Medical Students* Jonathan Leo, 2025-05-27 This work is an essential resource for medical students seeking a deep, long-term understanding of anatomy. Combining and updating two of the author's previous Springer titles—one on gross anatomy and another on medical neuroanatomy—this book also includes a wealth of new material designed to support comprehensive learning. Rather than emphasizing rote memorization, this guide helps students grasp the most complex anatomical concepts they will encounter in their first year of medical school, with a focus on clinical application. Each topic is presented with real-world scenarios in mind, making it a valuable reference not only for preclinical students but also for third- and fourth-year trainees looking for a refresher during clinical rotations. The book is organized into three sections: Section One covers the gross anatomy of the head and neck, abdomen, thorax, pelvis and perineum, lower limb, upper limb, and back. Section Two presents clinical neuroanatomy in a lesion-based format, emphasizing diagnosis through signs and symptoms. Section Three explores embryology and organ system development, also with a clinical focus. Comprehensive, accessible, and richly illustrated, *Gross Anatomy, Neuroanatomy, and*

Embryology for Medical Students: The Ultimate Survival Guide is a must-have companion for medical students navigating the challenging world of anatomy.

anatomy of a car battery: The Ultimate Guide to Car Care and Maintenance Pasquale De Marco, 2025-03-07 In a world where cars have become an indispensable part of our lives, maintaining and repairing them is a crucial skill that every responsible car owner should possess. Introducing the ultimate guide to automotive care, a comprehensive resource that empowers you to take control of your vehicle's health and performance. Written in a clear and engaging style, this book is your trusted companion on the journey to car ownership, providing you with the knowledge and confidence to tackle a wide range of automotive tasks, from routine maintenance to more complex repairs. Whether you're a seasoned mechanic or a novice enthusiast, this guide will equip you with the skills and understanding to keep your vehicle running smoothly and safely. Inside this comprehensive guide, you'll find: * In-depth explanations of automotive systems and components, demystifying the complexities of your car's inner workings. * Step-by-step instructions for a variety of maintenance and repair tasks, accompanied by clear illustrations and diagrams. * Valuable insights into troubleshooting common car problems, enabling you to diagnose and resolve issues quickly and effectively. * Expert advice on choosing the right parts and tools for your specific vehicle, ensuring that you make informed decisions and avoid costly mistakes. More than just a repair manual, this book is a comprehensive resource that empowers you to become a knowledgeable and capable car owner. By investing in this guide, you're investing in the longevity, performance, and safety of your vehicle, all while saving money on repair costs and gaining a sense of accomplishment. Take control of your automotive destiny with this invaluable guide. Whether you're looking to save money, enhance your DIY skills, or simply gain a greater appreciation for your car, this book is your ultimate companion. Embark on a journey of automotive enlightenment and unlock the full potential of your vehicle. If you like this book, write a review!

anatomy of a car battery: Vehicle Rescue and Extrication: Principles and Practice, Revised Second Edition David Sweet, 2021-06-25 This textbook helps technical rescue professionals remain safe and capable by delivering the most current practical skills and information available on today's increasingly technical vehicles.

anatomy of a car battery: Anatomy and Physiology Robert K. Clark, 2005 Anatomy and Physiology: Understanding the Human Body provides an informal, analogy-driven introduction to anatomy and physiology for nonscience students, especially those preparing for careers in the allied health sciences. This accessible text is designed with an uncluttered format, an encouraging tone, and excellent preview and review tools to help your students succeed. The text provides enough detail to satisfy well-prepared students, while the personal and friendly presentation will keep even the least-motivated students reading and learning.

anatomy of a car battery: Anatomy & Physiology Frederic H. Martini, Frederic Martini, 2005

anatomy of a car battery: YOGA BODY ANATOMY Dr. SHASHIREKHA C K, 2017-11-15 This is a book that draws on years of study and teaching experience to provide an insight into the muscular movements involved in yoga practice. Dr Shashirekha CK, internationally recognized teacher of yoga anatomy and Ayurveda, has created the ultimate reference for yoga practitioners, instructors and enthusiasts alike. □ Discover a simple and easy understanding of the anatomical perspective of kinetic movement in yoga asanas. □ Learn to achieve excellent strength in musculoskeletal tissues using clear and safe instructions, preparatory poses and expert guidance on a balanced diet. □ Read about asana practice and digestive health. □ Understand yoga therapy. br /> Don't stop at yoga; get a wholesome understanding of the Yoga Body Anatomy.

anatomy of a car battery: Textbook of Anatomy and Physiology Edward J. Reith, 1964

anatomy of a car battery: The Human Body: Concepts of Anatomy and Physiology Bruce Wingerd, Patty Bostwick Taylor, 2020-04-06 The new edition of Bruce Wingerd's The Human Body: Concepts of Anatomy and Physiology helps encourage learning through concept building, and is truly written with the student in mind. Learning Concepts divide each chapter into easily absorbed subunits of information, making learning more achievable. Since students in a one-semester course

may have little experience with biological and chemical concepts, giving them tools such as concept statements, concept check questions, and a concept block study sheet at the end of each chapter help them relate complex ideas to simple everyday events. The book also has a companion Student Notebook and Study Guide (available separately) that reinvents the traditional study guide by giving students a tool to help grasp information in class and then reinforce learning outside of class.

anatomy of a car battery: Clinically Oriented Anatomy Keith L. Moore, Arthur F. Dalley, 2018-07-12 Renowned for comprehensive coverage, the best-selling Clinically Oriented Anatomy guides students from initial anatomy and foundational science courses through clinical training and practice. The eighth edition reflects significant new information and updates and maintains the highest standards for scientific and clinical accuracy. Comprehensive updates reflect changes in the clinical application of anatomy as well as new imaging technologies, focusing on the anatomy that students need to know.

anatomy of a car battery: Automotive Industries , 1911 Vols. for 1919- include an Annual statistical issue (title varies).

anatomy of a car battery: BRS Gross Anatomy Kyung Won Chung, Harold M. Chung, 2011-05-27 Presents detailed information and diagrams about human anatomy, with review questions and answers, and a comprehensive examination.

anatomy of a car battery: The Automotive Odyssey Pasquale De Marco, The Automotive Odyssey is a captivating exploration of the world of automobiles, taking readers on a thrilling journey through the history, technology, and culture of cars. From the early days of horseless carriages to the cutting-edge electric and autonomous vehicles of today, this book offers a comprehensive guide to all things automotive. In this book, you will discover the fascinating stories of automotive pioneers and innovators who have shaped the industry. You will learn about the evolution of automotive design, the breakthrough technologies that have revolutionized the way we drive, and the future of automotive innovation and autonomous driving. But The Automotive Odyssey is not just about the machines; it's about the people and the passion behind them. You will meet car enthusiasts and explore the vibrant car culture that has emerged around the world. From motorsports to car customization, this book celebrates the thrill and excitement that cars bring to our lives. Practical insights and tips are also provided, making this book a valuable resource for car owners and enthusiasts. You will learn about car maintenance and repair, essential tools and equipment, and how to navigate the world of car buying and financing. Whether you're a seasoned car aficionado or a newcomer to the world of automobiles, this book has something for everyone. The Automotive Odyssey is not just a book; it's an adventure. Join us as we embark on a journey that will ignite your curiosity, expand your knowledge, and deepen your appreciation for the incredible machines that have shaped our world. Get ready to buckle up and experience the thrill of The Automotive Odyssey. Don't miss out on this captivating journey through the world of automobiles. Grab your copy of The Automotive Odyssey today and discover the fascinating stories, technologies, and culture that make cars more than just a means of transportation.

anatomy of a car battery: The Automobile , 1911

anatomy of a car battery: Auto Repair For Dummies Deanna Sclar, 2018-11-28 Auto Repair For Dummies, 2nd Edition (9781119543619) was previously published as Auto Repair For Dummies, 2nd Edition (9780764599026). While this version features a new Dummies cover and design, the content is the same as the prior release and should not be considered a new or updated product. The top-selling auto repair guide--400,000 copies sold--now extensively reorganized and updated Forty-eight percent of U.S. households perform at least some automobile maintenance on their own, with women now accounting for one third of this \$34 billion automotive do-it-yourself market. For new or would-be do-it-yourself mechanics, this illustrated how-to guide has long been a must and now it's even better. A complete reorganization now puts relevant repair and maintenance information directly after each automotive system overview, making it much easier to find hands-on fix-it instructions. Author Deanna Sclar has updated systems and repair information throughout, eliminating discussions of carburetors and adding coverage of hybrid and alternative fuel vehicles.

She's also revised schedules for tune-ups and oil changes, included driving tips that can save on maintenance and repair costs, and added new advice on troubleshooting problems and determining when to call in a professional mechanic. For anyone who wants to save money on car repairs and maintenance, this book is the place to start. Deanna Sclar (Long Beach, CA), an acclaimed auto repair expert and consumer advocate, has contributed to the Los Angeles Times and has been interviewed on the Today show, NBC Nightly News, and other television programs.

Related to anatomy of a car battery

Human Anatomy Explorer | Detailed 3D anatomical illustrations There are 12 major anatomy systems: Skeletal, Muscular, Cardiovascular, Digestive, Endocrine, Nervous, Respiratory, Immune/Lymphatic, Urinary, Female Reproductive, Male Reproductive,

Human body | Organs, Systems, Structure, Diagram, & Facts human body, the physical substance of the human organism, composed of living cells and extracellular materials and organized into tissues, organs, and systems. Human

TeachMeAnatomy - Learn Anatomy Online - Question Bank Explore our extensive library of guides, diagrams, and interactive tools, and see why millions rely on us to support their journey in anatomy. Join a global community of learners and

Human anatomy - Wikipedia Human anatomy can be taught regionally or systemically; [1] that is, respectively, studying anatomy by bodily regions such as the head and chest, or studying by specific systems, such

Human body systems: Overview, anatomy, functions | Kenhub This article discusses the anatomy of the human body systems. Learn everything about all human systems of organs and their functions now at Kenhub!

Open 3D Model | AnatomyTOOL Open Source and Free 3D Model of Human Anatomy. Created by Anatomists at renowned Universities. Non-commercial, University based. To learn, use and build on

Anatomy - MedlinePlus Anatomy is the science that studies the structure of the body. On this page, you'll find links to descriptions and pictures of the human body's parts and organ systems from head

Human Anatomy Explorer | Detailed 3D anatomical illustrations There are 12 major anatomy systems: Skeletal, Muscular, Cardiovascular, Digestive, Endocrine, Nervous, Respiratory, Immune/Lymphatic, Urinary, Female Reproductive, Male Reproductive,

Human body | Organs, Systems, Structure, Diagram, & Facts human body, the physical substance of the human organism, composed of living cells and extracellular materials and organized into tissues, organs, and systems. Human

TeachMeAnatomy - Learn Anatomy Online - Question Bank Explore our extensive library of guides, diagrams, and interactive tools, and see why millions rely on us to support their journey in anatomy. Join a global community of learners and

Human anatomy - Wikipedia Human anatomy can be taught regionally or systemically; [1] that is, respectively, studying anatomy by bodily regions such as the head and chest, or studying by specific systems, such

Human body systems: Overview, anatomy, functions | Kenhub This article discusses the anatomy of the human body systems. Learn everything about all human systems of organs and their functions now at Kenhub!

Open 3D Model | AnatomyTOOL Open Source and Free 3D Model of Human Anatomy. Created by Anatomists at renowned Universities. Non-commercial, University based. To learn, use and build on

Anatomy - MedlinePlus Anatomy is the science that studies the structure of the body. On this page, you'll find links to descriptions and pictures of the human body's parts and organ systems from head

Human Anatomy Explorer | Detailed 3D anatomical illustrations There are 12 major anatomy systems: Skeletal, Muscular, Cardiovascular, Digestive, Endocrine, Nervous, Respiratory, Immune/Lymphatic, Urinary, Female Reproductive, Male Reproductive,

Human body | Organs, Systems, Structure, Diagram, & Facts human body, the physical substance of the human organism, composed of living cells and extracellular materials and organized into tissues, organs, and systems. Human

TeachMeAnatomy - Learn Anatomy Online - Question Bank Explore our extensive library of guides, diagrams, and interactive tools, and see why millions rely on us to support their journey in anatomy. Join a global community of learners and

Human anatomy - Wikipedia Human anatomy can be taught regionally or systemically; [1] that is, respectively, studying anatomy by bodily regions such as the head and chest, or studying by specific systems, such

Human body systems: Overview, anatomy, functions | Kenhub This article discusses the anatomy of the human body systems. Learn everything about all human systems of organs and their functions now at Kenhub!

Open 3D Model | AnatomyTOOL Open Source and Free 3D Model of Human Anatomy. Created by Anatomists at renowned Universities. Non-commercial, University based. To learn, use and build on

Anatomy - MedlinePlus Anatomy is the science that studies the structure of the body. On this page, you'll find links to descriptions and pictures of the human body's parts and organ systems from head

Human Anatomy Explorer | Detailed 3D anatomical illustrations There are 12 major anatomy systems: Skeletal, Muscular, Cardiovascular, Digestive, Endocrine, Nervous, Respiratory, Immune/Lymphatic, Urinary, Female Reproductive, Male Reproductive,

Human body | Organs, Systems, Structure, Diagram, & Facts human body, the physical substance of the human organism, composed of living cells and extracellular materials and organized into tissues, organs, and systems. Human

TeachMeAnatomy - Learn Anatomy Online - Question Bank Explore our extensive library of guides, diagrams, and interactive tools, and see why millions rely on us to support their journey in anatomy. Join a global community of learners and

Human anatomy - Wikipedia Human anatomy can be taught regionally or systemically; [1] that is, respectively, studying anatomy by bodily regions such as the head and chest, or studying by specific systems, such

Human body systems: Overview, anatomy, functions | Kenhub This article discusses the anatomy of the human body systems. Learn everything about all human systems of organs and their functions now at Kenhub!

Open 3D Model | AnatomyTOOL Open Source and Free 3D Model of Human Anatomy. Created by Anatomists at renowned Universities. Non-commercial, University based. To learn, use and build on

Anatomy - MedlinePlus Anatomy is the science that studies the structure of the body. On this page, you'll find links to descriptions and pictures of the human body's parts and organ systems from head

Human Anatomy Explorer | Detailed 3D anatomical illustrations There are 12 major anatomy systems: Skeletal, Muscular, Cardiovascular, Digestive, Endocrine, Nervous, Respiratory, Immune/Lymphatic, Urinary, Female Reproductive, Male Reproductive,

Human body | Organs, Systems, Structure, Diagram, & Facts human body, the physical substance of the human organism, composed of living cells and extracellular materials and organized into tissues, organs, and systems. Human

TeachMeAnatomy - Learn Anatomy Online - Question Bank Explore our extensive library of guides, diagrams, and interactive tools, and see why millions rely on us to support their journey in anatomy. Join a global community of learners and

Human anatomy - Wikipedia Human anatomy can be taught regionally or systemically; [1] that is, respectively, studying anatomy by bodily regions such as the head and chest, or studying by specific systems, such

Human body systems: Overview, anatomy, functions | Kenhub This article discusses the anatomy of the human body systems. Learn everything about all human systems of organs and their

functions now at Kenhub!

Open 3D Model | AnatomyTOOL Open Source and Free 3D Model of Human Anatomy. Created by Anatomists at renowned Universities. Non-commercial, University based. To learn, use and build on **Anatomy - MedlinePlus** Anatomy is the science that studies the structure of the body. On this page, you'll find links to descriptions and pictures of the human body's parts and organ systems from head

Back to Home: <http://www.speargroupllc.com>