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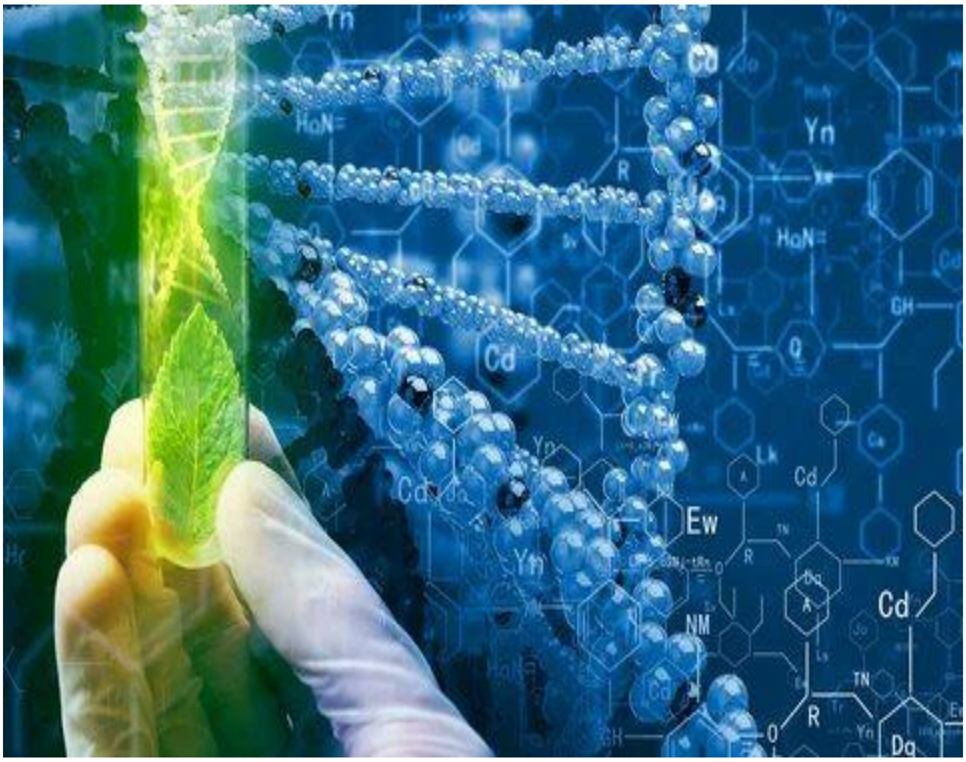
ИНСТИТУТ МЕЖДУНАРОДНЫХ ОТНОШЕНИЙ

Кафедра теории и практики перевода



Учебное пособие

Казань-2024

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BIOENGINEERING

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Казань-2024

УДК 811.111

ББК 81.432.1

Рекомендовано к публикации на заседании кафедры теории и практики перевода

Протокол №5 от 25 декабря 2023 года

Рецензенты:

Заведующий кафедрой иностранных языков ФГБОУ ВО «Казанский государственный энергетический университет»,

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Липатова Ю.Ю., Винникова М.Н., Букина Т.В. Bioengineering:/ Липатова Ю.Ю., Винникова М.Н., Букина Т.В.– Казань: Казан. ун-т, 2024. –

109 с.

Учебное пособие для обучающихся направления подготовки 45.03.02 «Лингвистика» профиля «Перевод и переводоведение». Основная цель пособия — сформировать у обучающихся базовые навыки понимания и перевода оригинальных текстов по специальности “Биоинженерия” на английском языке с опорой на знание грамматических структур, характерных для англоязычной научной литературы.

Пособие содержит лексические задания и тексты, упражнения для закрепления тем, тексты для чтения с послетекстовыми заданиями, способствующие развитию навыков устной речи и письменной речи, тексты для перевода с листа и самостоятельных занятий переводом.

Предисловие

Основная цель пособия — сформировать у обучающихся навыки понимания и перевода оригинальных англоязычных текстов по теме «Биоинженерия» с опорой на знание грамматических структур, характерных для научной литературы на английском языке.

Пособие адресовано, прежде всего, студентам лингвистических вузов.

Пособие может заинтересовать широкий круг специалистов-лингвистов, желающих свободно владеть навыками работы с англоязычной научной литературой.

Каждая часть содержит несколько тематически организованных разделов, в состав которых включены группы упражнений и тексты для тренировочного и контрольного перевода. Весь англоязычный материал носит аутентичный характер,

Упражнения снабжены заданием-инструкцией, включающим:

- рекомендации по переводу на русский язык с примерами;
- задание на перевод.

Тексты для тренировочного перевода предназначены для самостоятельной работы с последующим обсуждением и комментариями в аудитории. Контрольный перевод выполняется в качестве итоговой работы по теме и показывает степень усвоения пройденного материала.

Содержание

Глава I. Трудности перевода текста по биоинженерии 6
Термины и терминология 6
Правила перевода текста по биоинженерии с английского языка на русский 16

Глава II. Тексты для изучающего чтения 23
Текст 1.Tissues 23
Текст 2.3D printed organs 27
Текст 3. Genetically modified foods ethics 33
Текст 4. Field of work 35
Текст 5. The scope of genetic engineering 40

Глава III. Тексты для перевода с листа 43
Текст 1. What is biotechnology? 43
Текст 2.A useful vitamin 44
Текст 3.Embryo-safe cell research 45
Текст 4.GM food 46
Текст 5. Human cloning 47
Текст 6.The human genome project 48
Текст 7. A reading list about the neuroscience of reading 50

Глава IV. Тексты для письменного перевода 54
Текст 1. A protective probiotic blunts the effects of alcohol in mice 54
Текст 2. Designing mire useful bacteria. 57
Текст 3. Engineered plants produce sex perfume to trick pests and replace pesticides 62
Текст 4. «Electronic nose» built with sustainably sourced microbial nanowires that could revolutionize health monitoring 67
Текст 5. Scientists genetically engineer plants to yield more vegetable oil 71
Текст 6. 3D-printed organs could save lives by addressing the transplant shortage 76

Глава V. Статьи для самостоятельного чтения и перевода 79
Статья 1. Biotech vs. bioengineering: what’s the difference? 79
Статья 2. The future of food: insects, GM rice and edible packaging on the menu 84
Статья 3. Our future hope? 89
Статья 4. Anti-cancer CAR-T therapy reengineers T cells to kill tumors – and researchers are expanding the limited types of cancer it can target 91
Статья 5. Novel yeast-assembly technique yields living materials 95
Статья 6. Five amazing ways redesigning biological cells could help us fight cancer 99
Итоговый тест 103
Список используемой литературы 108

ГЛАВА I. ТРУДНОСТИ ПЕРЕВОДА ТЕКСТА ПО БИОИНЖЕНЕРИИ

ТЕРМИНЫ И ТЕРМИНОЛОГИЯ

Научно-техническая литература характеризуется использованием терминологических единиц.

Сотни тысяч слов и словосочетаний (словогрупп) относятся к терминологическим системам науки, техники, торговли, права, спорта, искусства и т. д. Эти лингвистические единицы не используются и даже не понимаются людьми вне конкретной специальности. Каждая область науки или деятельности имеет свой специализированный словарь. Существует специальный медицинский словарь, а также специальные термины для химии, физики, энергетики, экономики, строительства, авиации и многих других.

Термин в традиционном понимании — это слово или словосочетание, которое специально используется в определенной отрасли науки, техники, торговли, права, спорта или искусства. Например, лексические единицы *heat sink ability –способность к поглощению тепла and bag collector – рукавный фильтр* принадлежат отрасли энергетики. Термины *reinforced concrete – железобетон and workability – обрабатываемость; технологичность (материала); удобообрабатываемость; удобоукладываемость принадлежат к* сфере строительства зданий. Термины всегда объединяются в группы, которые образуют систему названий понятий исследования, взятых вместе. Следует также отметить, что термины не содержат в себе каких-либо эмоциональных или субъективные коннотации.

В современном языкознании существует ряд дискуссионных проблем, связанных с терминологией. Во-первых, это загадочный вопрос о том, теряет ли термин свой терминологический статус, когда входит в обиход.

В настоящее время это происходит очень часто, поскольку различные средства коммуникации (телевидение, радио, популярные журналы, научная фантастика, Интернет и т. д.) вооружают людей знаниями из разных научных областей, технологии, общественной жизни, торговли, права, спорта и искусства. Расширение техники и общего образования также ведут к вхождению терминов в общелитературный словарь. Вполне естественно, что в общее употребление переходят многочисленные терминологические единицы, при этом они не теряют связи со своими конкретными доменами.

Первую точку зрения высказывают лингвисты, которые считают, что только те слова, которые сохранили свою исключительность и не используемые, известные или признанные за пределами их конкретной сферы, могут рассматриваться как термины. Согласно этому мнению, слова, связанные с экономической сферой, например *account – счет, bargain - торговая (биржевая) сделка, budget – (государственный) бюджет, tax – финансовая смета, налог; сбор; пошлина* не может быть считаться термином, так как слово является распространенным.

Согласно противоположной точке зрения, предполагается, что любая терминологическая система содержит все языковые единицы, передающие понятия, свойственные данному языку. конкретной отрасли знаний, независимо от их исключительности.

Современные исследования различных терминологических систем показали и доказали, что не существует непроницаемой стены между терминологией и общей языковой системой. Напротив, терминология, кажется, соответствует тем же правилам и законам, что и единицы языка общего назначения.

Отсюда и обмен между терминологическими системами и «общим» словарным запасом – вполне нормальное явление, и было бы неправильно рассматривать термин как нечто «особое» и изолированное. Термины обычно связаны с определенной отраслью науки. Однако, в связи с быстрым распространением научно-технических идей, особенно в точных науках, можно наблюдать процесс «дефеминизации», то есть некоторые научно-технические термины начинают функционировать вне узкой области, к которой они принадлежат, и в конечном итоге начинают приобретать новые значения. Подавляющее большинство же терминологических единиц не подвергаются процессу дефеминизации и циркулируют только в научной сфере. Таким образом, могут развиться новые терминологические значения и выйти из употребления одной конкретной сферы. Наука и техника являются наиболее плодовитыми в создание новых языковых единиц.

Сущность вещей и явлений порождает новые понятия, которые требуют новых слов и словосочетаний для их обозначения. Как правило, термин имеет более прямую ссылку на объект или явление, чем описательное объяснение, нетермин. Это приводит к быстрому созданию новых терминов в любой развивающейся области обучения. Необходимо отметить, что общая лексика, используемая в научной литература передает свое прямое референциальное значение, то есть слова и словесные группы, используемые в научной литературе, всегда имеют тенденцию использоваться в их первоначальном виде. Слово, употребленное в научной прозе, вряд ли будет многозначно, в отличие от художественного стиля.

Обмен терминами между различными областями является типичным явлением. Самые интересные и актуальные научные проблемы возникают на стыке дисциплин двух или несколько наук. Их особые языки становятся ближе, обогащают друг друга, обмениваются терминами и создают новые термины. Сотрудничество специалистов смежных наук доказало свою эффективность во многих сферах.

Поскольку языковые дисциплины обладают своими уникальными особенностями, обмен терминами можно рассматривать как естественный результат этого сотрудничество. Математика в этом отношении имеет приоритет, поскольку математические термины вышли из своей области и свободно функционируют в других науках. Например, в вычислительной лингвистике есть термины в математике *(set, graph, integral),* лингвистике *(word, meaning, name),* и термины, типичные только для этой научной дисциплины: *Zipf's law – закон Ципфа* не могут быть рассмотрены с экономической точки зрения, поскольку они более или менее распространены.

Две другие спорные проблемы в области терминологии заключаются в следующем: многозначность и синонимия терминологических единиц. По мнению некоторых лингвистов «идеальный» термин должен быть однозначным (т.е. должен иметь только одно значение). Многозначные термины могут вызвать недопонимание, и это является серьезной проблемой в профессиональном общении, а также при переводе специального дискурса. Некоторые терминологические системы изобилуют многозначными терминами. Адекватность их перевода полностью зависит от контекста. В терминологии строительства термин *building* может обозначать конструкцию, сделанную из прочного материал, такого как камень или дерево, имеющий крышу и стены («здание» — «строение») и, одновременно, процесс строительства домов, заводов, офисных зданий («строительство»).

Другая спорная проблема терминологии касается синонимов. По мнению некоторых лингвистов, термины не должны иметь синонимов, так как ученые и специалисты назвали бы одни и те же предметы и явления в своей области разными терминами, что затруднило бы общение. Тем не менее, многие термины из разных сфер имеют синонимы. Например, двигатель – мотор, штукатурка – лепнина.

Перевод технических терминов абсолютно зависит от знания переводчиком тематики исходного текста. Переводчикам приходится прикладывать большие усилия для ознакомления с системой терминов в соответствующей сфере и хорошо владеть терминологическими словарями и другими справочными изданиями, а также Интернет-ресурсами.

Необходимо помнить, что термин обычно переводится с помощью соответствующего термина изучаемого языка. Такие способы перевода, как аналоги, с использованием синонимов и описательного перевод применяются тогда, когда нет эквивалентных терминов для перевода.

Термины являются относительно контекстно-свободными языковыми единицами, хотя контекст часто помогает определить конкретную область, к которой принадлежит термин. Как правило, английские научные и технические термины имеют свои постоянные эквиваленты:

heater –нагревательный прибор;

alkaline medium – щелочная среда;

silica acid – кремниевая кислота;

spherical shell – сферическая оболочка.

В русском языке имеется множество терминологических эквивалентов, образованных из английских терминов путем транскрипции или заимствованного перевода:

container – контейнер;

file – файл;

design – дизайн.

Термины могут быть и международными:

atom – атом;

proton – протон;

focus – фокус;

plus – плюс;

diode - диод.

В некоторых случаях существуют параллельные формы в русском языке: образованная транскрипцией (заимствованием) и родное слово, например:

Эквивалентность and *равенство;*

баланс and *равновесие;*

резистор and *сопротивление;*

бустер and *ускоритель;*

индустрия and *промышленность;*

инсталляция and *установка.*

Правильный выбор в этом случае совершенно необходим.

Переводчики делают свой выбор, учитывая, является ли исходный текст сугубо техническим или нет, потому, что заимствованный термин обычно более знаком специалистам, чем непрофессионалам. Переводчикам также следует принять во внимание рассмотрение возможных различий между двумя формами. Например, русское слово *индустрия* ограничена в использовании и несколько старомодна.

Большое внимание уделяется систематике новых слов. Во многих областях существуют специальные правила образования терминов для обозначения понятия и объекты определенного класса. Например, названия различных видов электронных ламп образуются по аналогии с термином electrode с указанием количества электродов, используемых в трубке. *(diode, triode, tetrode, pentode, hexode, heptode, etc.);* The correct choice is absolutely necessary in this case.

A number of special electronic devices have the element **–tron** in their structure *(additron, carcinotron, cryotron, exitron, ignitron, klystron, permatron, phantastron, plasmatron, platinotron, skiatron, thryatron, etc.);*chemical terms ending with **-ite, -ate** denote salts *(sulfate, sulfite, nitrite)*, etc.

С точки зрения своей структуры термин может 1) состоять из одного слова или 2) представлять собой словосочетание одного ключевого слова и одного или нескольких дополнений, уточняющих или изменяющих значение термина. Эти термины широко распространены и могут вызвать трудности при переводе. Такие комбинации могут состоять из двух и более элементов.

а. Словосочетания, состоящие из двух слов.

Первый элемент может переводиться на русский язык

1) прилагательным:

distribution shaft – распределительный вал;

fuel cock – топливный кран);

2) существительным в родительном падеже:

isobutylene oxide – оксид изобутилена;

failure detection – обнаружение неисправностей;

accumulator cell – элемент аккумулятора;

land retirement –эрозия почвы, выдувание почвы;

3) существительным с предлогом:

split burner – горелка с рассекателем,

carbon cloth – ткань из углеродного волокна;

4) сложным существительным:

development engineer – инженер-разработчик;

electrical engineer - инженер-электрик;

5) причастным оборотом:

unbounded coating - многослойная изоляция (трубопровода), состоящая из несвязанных между собой слоѐв;

designed experiment – эксперимент, проводимый по заранее составленной программе);

6) описательными средствами:

squawk altimeter -высотомер, показания которого выведены в ответчик;
square engine -двигатель, в котором диаметр цилиндра равен ходу поршня).

б. Словосочетание, состоящее из нескольких компонентов.

При переводе такого рода сочетаний необходимо придерживаться следующей последовательности действий:

1) перевести зависимое существительное (последнее слово словосочетания);

2) проанализировать смысловые отношения между членами слова-
сочетания и разделить их на смысловые группы (следует проанализировать слева направо);

3) переведите словосочетание, начинающееся с зависимого слова
а затем переведите каждую группу смыслов справа налево. Например:

car speed calculation problem.

1. Переводим последнее слово *problem – проблема*:

2. Делим все словосочетание на смысловые группы:

1) car speed;

2) calculation problem.

3.Перевод: *проблема вычисления скорости автомобиля.*

Атрибутивные сочетания могут начинаться с прилагательного. В данном случае необходимо определить, какое слово оно определяет:

dynamic braking circuit– цепь реостатного тормоза,

general reactor equation – общее уравнение ядерного реактора.

Терминологические системы многих областей знания, таких как математика, физика, химия, биология, геология, медицина, технология содержат так называемые эпонимические единицы. Это термины, структура которых включает имена собственные выдающихся ученых, изобретателей, врачей, и т. д. Например:

watt – ватт,

Weierstrass theorem– теорема Вейерштрасса,

Marfan syndrome – синдром Марфана.

Если в словосочетании стоит имя собственное, оно переводится прилагательным: существительным в родительном падеже или существительным с предлогом:

Kirchhoff's first law – первый закон Кирхгофа;

London Air Traffic Control Centre –Лондонский центр управления воздушным движением.

Новый иностранный термин требует точной расшифровки логическим путем, лингвистического анализа этого слова и его связи с контекстом и образования точного моносемантического эквивалента.

С точки зрения сложности понимания и перевода термины можно разделить на три группы:

1) термины, обозначающие реалии других стран. Возможны несколько способов перевода:

а) русским термином, форма которого связанна с формой английского слова (международные термины);

б) русским термином, форма которого не связана с формой английского термина;

в) значение многословного английского термина имеет полный эквивалентный русский термин;

г) общее значение многословного термина совпадает со значением аналогичного русского термина, но компоненты их различны.

2) Термины, обозначающие реалии других стран, но имеющие в целом принятые русские терминологические эквиваленты.

3) Термины, обозначающие реалии других стран и не имеющие общепринятые русские терминологические эквиваленты.

Перевод таких терминов может осуществляться следующими способами:

а) описание английского термина;

б) дословный перевод;

в) частичная или полная транслитерация;

г) транслитерация и дословный перевод;

д) транскрипция;

е) транскрипция и транслитерация.

Необходимо отметить, что основная ошибка в переводе подобных словосочетаний заключается в том, что переводчики иногда пытаются найти буквальный эквивалент английскому термину в русском языке. Такой подход не совсем правильный, так как важно передать специфику зарубежных реалий. Кроме того, эти термины могут выражать понятия, характерные только для зарубежных стран и, следовательно, они могут не соответствовать русским реалиям. Переводчики тоже могут ошибаться в результате неправильного отнесения термина к одной из вышеупомянутых групп. Еще одна ошибка переводчика – дословный перевод, когда английский термин или его компоненты аналогичны русскому термину, но имеют другое значение. При переводе необходимо учитывать значение термина в конкретной ситуации и конкретном контексте.

Таким образом, правильное понимание и перевод терминов зависит не только от хорошего знания языка, но и от знания иностранных и российских реалий.

ПЕРЕВОД ТЕКСТА ПО БИОИНЖЕНЕРИИ С АНГЛИЙСКОГО ЯЗЫКА НА РУССКИЙ

1. Общий подход к переводу

Такой перевод требуется выполнять при написании литературных обзоров, составлении рефератов, библиографических справок. Для более точной передачи смысла объекта перевода всегда необходимо использовать «птичий язык» в существующей области науки или техники – специальную узкопрофессиональную терминологию.

Не следует забывать, что дословный перевод статьи (так называемый «сырой подстрочник») приводит, как правило, к трудности понимания смысла работы, а порой и к его искажению. Такой перевод считается некомпетентным. Чтобы сделать хороший перевод, нужно не только знать язык, но и быть специалистом в данной отрасли или делать его совместно со специалистом.

Приступая к переводу, необходимо прочитать всю статью от начала и до конца, чтобы уяснить ее основное содержание. По мере чтения следует отметить наиболее трудные места. Затем можно приступить к последовательному переводу абзацев, внимательно анализируя каждое предложение.

После того как будет разобрана и переведена таким образом вся статья, приступают к литературной отделке перевода, проверяя ясность и точность выраженных мыслей. Если в нем встречаются предложения не совсем ясные, тяжеловесные или допускающие двойное толкование, что особенно недопустимо в научной статье, то производится их корректировка в соответствии с правилами русского языка. Необходимо проверить, хорошо ли читается перевод, нет ли тяжелых нерусских оборотов, назойливого повторения слов типа который, чтобы и т.п.

Заключительным этапом работы над переводом является сверка с оригиналом. Устанавливается отсутствие пропусков и отхода от оригинала, которые могли возникнуть в процессе литературной правки.

2. Стилистико-грамматические особенности английского текста

Остановимся на некоторых стилистико-грамматических особенностях английского текста, чуждых стилю русской научно-технической литературы:

а) В английском тексте преобладают личные формы глагола, тогда как русскому научному стилю более свойственны безличные или неопределенно-личные обороты, например:

You might ask why bioengineers have generally chosen to supply us with strains, rather than yeast for our household needs. - Можно спросить, почему для домашних надобностей обычно используются штаммы, а не дрожжи

We know the eukaryotes to have more complicated structure then the prokaryotes. - Известно, что эукариоты имеют более сложное строение, чем прокариоты.

б) В английских текстах описательного характера часто употребляется будущее время для выражения обычного действия. Такие предложения, руководствуясь контекстом, нужно переводить настоящим временем, иногда с модальным оттенком:

The zinc in the dry cell accumulates a great many excess electrons which will move to the carbon electrode. - Цинк в сухом элементе аккумулирует большое число избыточных электронов, которые движутся к угольному электроду.

Fig. 10 gives a drawing of an eukaryote cell; the nucleous will be seen in the centre. - На рис. 10 приводится схема эукариотической клетки; ядро ее видно в центре.

в) В английских научно-технических текстах особенно часто встречаются пассивные обороты, которые при переводе на русский язык следует заменять средствами выражения, более свойственными русскому языку, то есть, как в страдательном, так и действительном залоге.

Так, предложение “*This question was discussed at the conference”* можно перевести несколькими способами:

Этот вопрос был обсужден на конференции.

Этот вопрос обсуждался на конференции.

Этот вопрос обсуждали на конференции.

Конференция обсудила этот вопрос.

г) Авторы английской научно-технической литературы широко используют различные сокращения, которые не употребляются в русском языке, например:

d. c. (direct current) – постоянный ток;

a. c. (alternating current) – переменный ток;

s. a. (sectionarea) – площадь поперечного сечения;

b. p. (boilingpoint) – температура кипения;

Gly (glycine) – глицин (аминоуксусная кислота);

Glc (glucose) – глюкоза.

д) Некоторые слова или выражения в английском тексте содержат чуждый русскому языку образ. При переводе они должны заменяться аналогами, более обычными для русского текста, например:

Biotechnologists have learned to manufacture dozens of agriculture's plants with new properties to substitute one.

Вместо dozens (дюжины) более обычно для русского языка слово «десятки», перевод будет иметь следующий вид:

Биотехнологи научились производить десятки сельскохозяйственных культур с новыми свойствами, заменяющих природные.

3. Импликации

Особое внимание при переводе следует обратить на **импликации** – неявные словесные выражения. Известно, что русскому языку чужды некоторые импликации, характерные для английского языка, и их следует устранять. Чтобы облегчить обнаружение импликаций в тексте оригинала, выделим их основные признаки:

1. В предложении опускается одно из существительных:

The ***annealed hardness*** *of the material does not provide as good a correlation with the measured erosion wear.*

Выражение ***annealed hardness*** (отожженная твердость) на русском языке не имеет смысла. Следуя контексту статьи, где говорится об отжиге поверхностного слоя детали, импликация устраняется следующим образом:

Твердость отожженной ***поверхности*** *материала не дает такой же хорошей корреляции с измеренным значением эрозионного износа.*

2. Существительное может быть опущено в сравнительном обороте:

The James and Smith correlations show essentially the same predictive reliability, and are somewhat poorer ***than Murdock.***

Для устранения импликации добавляют слово «корреляция»:

Корреляции Джеймса и Смита дают практически одинаковую точность, но несколько менее точны, чем ***корреляция Мардука***.

3. Может опускаться слово-заменитель, но с сохранением его определения:

Fig. 5 shows the results of these tests, the upper curve being ***the large protrusion.***

Здесь **the large protrusion = the one for the large protrusion**, что и отражается в переводе:

Результаты этих опытов показаны на рис. 5, причем верхняя кривая относится к случаю большого выступания бруса.

Приведем еще один пример, ограничиваясь раскрытием импликации:

The erosion resistance of the 304 and 316 stainless steel is clearly poorer under these conditions than the remaining alloys (…than that of the remaining alloys).

4. Понятие, состоящее из нескольких слов, заменяется одним словом-заменителем. Англоязычные авторы не только чаще русских прибегают к местоимениям и словам-заменителям *(one, that, these, the former, the latter, (the) same, the whole, the foregoing, counterpart*), но и тяготеют к словам заменителям, которые называются **имплицитными** (ИСЗ) и которые нередко употребляются самостоятельно, т.е. без предшествующих им заменяемых слов.

Имплицитное слово-заменитель (ИСЗ) обладает широким значением, что позволяет ему заменять и семантически родственные слова и слова, связанные лишь метонимически, причем связь не всегда легко обнаружить.

Так, ИСЗ "consideration", имеющее словарные значения «рассмотрение», «соображение», «учет», может заменить любое слово, обозначающее некий объект рассмотрения (метонимическое отношение «процесс – объект»).

а) *Consequently, it is likely that none of the above* ***considerations*** *would have led to ball-retainer forces sufficiently large to cause failure.*

Следовательно, вполне вероятно, что ни один из вышерассмотренных ***факторов*** *не приводил к появлению усилий между шариками и сепаратором, способных вызвать разрушение.*

б)*Special* ***considerations*** *insurethereliableoperationofthesethyristordrivesystems. Надежная работа тиристорных систем электропривода обеспечивается специальными* ***мерами.***

ИСЗ "feature", имеющее основные словарные значения «особенность», «характерная черта», «признак» и «свойство», может заменить любое слово, называющее элемент некоего целого (метонимическое отношение «принадлежность – элемент»):

а) *Salient* ***features*** *of the agreement.*

Основные ***постановления*** *соглашения.*

б) Fig. 2 is a schematic diagram illustrating the salient ***features*** *of the analytical and experimental program.*

На рис.2 представлена схема,иллюстрирующая основные ***этапы*** *програм мы экспериментально-теоретических работ.*

в) *The equipment developed for the study of the mechanical pulping process consists of three major components: the grinder machinery, the grinder control instrumentation, and data collection* ***features.***

Оборудование, разработанное для исследования процесса получения древесной массы, состоит из трех основных частей: дефибрера, приборов и регуляторов системы управления и ***устройств*** *для сбора данных.*

Механизм перевода ИСЗ напоминает детскую игру «Changing WARM to COLD in four moves»: (*warm – ward – word – cord – cold).* Чтобы при переводе на русский конкретизировать значение ИСЗ, как это было сделано в вышеприведенных примерах, нужно понять общую идею, заложенную в ИСЗ. Для этого обычно достаточно проанализировать значение ИСЗ, приводимые в двуязычных словарях. Так, в случае ИСЗ consideration конкретизация не представляет большого труда: рассмотрение – рассмотрение факторов – рассмотренные факторы – факторы. Однако из словарных значений ИСЗ feature трудно сделать вывод об общей идее, и определить ее можно только после анализа самых разных контекстов.

Практика показывает, что переводчики с английского, стараясь избежать дословного перевода, так или иначе раскрывают значения ИСЗ. С другой стороны, даже опытные переводчики на английский (не являющиеся носителями английского языка) не пользуются ИСЗ либо по незнанию этого стилистического приема, либо из опасения, что редактор (также не принадлежащий к носителям английского языка) сочтет ИСЗ ошибкой.

При переводе избыточные ИСЗ опускаются без ущерба для понимания текста.

Например:

а) *A schematic drawing of the boiler* ***configuration*** *is shown in Fig. 1*. *Схематический чертеж котла показан на рис. 1*.

б) Low temperature tests were performed with the specimen completely submerged in liquid nitrogen (76 K) or liquid helium (4 K) ***environment.***

Низкотемпературные испытания проводили с образцом, полностью погруженным в жидкий азот (76 К) или жидкий гелий (4 К).

ГЛАВА II. ТЕКСТЫ ДЛЯ ИЗУЧАЮЩЕГО ЧТЕНИЯ.

ТЕКСТ 1

TISSUES

The cells which comprise the body of many-celled animals are organized into groups called tissues. The man, like many other animals, is known to be an extremely complex organism. Nevertheless his whole body consists of only five fundamentally different tissues: epithelial, vascular, connective, muscular and nervous. These five different tissues represent groups of specialized cells, that is, they are modified in structure for the performance of particular function. In some cases, as for example, in bone, a material is secreted by cells. This material is intercellular substance; it constitutes the major part of the tissue.

Epithelial tissues have one surface bordering a space, and the other adjoining an underlying membrane. This kind of tissue is found to have a very small amount of intercellular substance. Its cell membrane is usually indistinct, which often makes it difficult to determine the shape of the cell.

Vascular tissues are circulatory fluid tissues which are known to include blood and lymph. Both consist of the plasma and cells of different types.

Connective tissues are widely distributed throughout the body, they are used to bind and support parts. There are many types of connective tissues.

Muscle tissues are characterized by their ability to contract when stimulated. They form no intercellular substance and are held together by fibrous connective tissues.

Nervous tissue is composed of nerve cells and structures which support them. A nerve cell consists of a central portion, the cell body, from which numerous processes of two kinds extend: those which carry impulses into the cell body, and those which carry impulses away.

Vocabulary:

tissue, n. – ткань,

secrete, v. - выделять, секретировать,

comprise, v. - включать, составлять, surface, n. - поверхность,

nevertheless, adv. – однако, тем не менее

amount n. —количество,

distinct, a. - ясный, определенный,

epithelial, a. — эпителиальный,

fluid, n. - жидкость,

vascular, a. — сосудистый,

blood, n. - кровь,

muscular, a. – мышечный,

distribute, v. - распределять,

nervous, a. - нервный,

ability, n. - способность,

performance, n. - выполнение, работа,

fibrous, a. - волокнистый,

perform, v. - выполнять (функцию),

impulse, n. - возбуждение, толчок.

particular, a. - особый, определенный,

bone, п. – кость

1. Переведите словосочетания:

1) to apply methods, to secrete materials, to repair smth., to injure the skin, to constrict the protoplasm, to increase the amount, to comprise the body;

2) injured surface, increased amount, distributed material, covered surface, applied methods, secreted material;

3) nervous cells, fibrous tissues, distinct interval, definite method, certain amount, vascular tissue, single opportunity, small projection, pliable membrane.

2. Дайте ответы на вопросы по тексту «Tissues»:

1. What do we call tissues?
2. What are the five types of tissues?
3. What is matrix?
4. In what kind of tissues there is a large amount of intercellular substance?
5. In what kind of tissue it is difficult to determine the shape of the cell?
6. What tissue is widely distributed throughout the body? Where can we find it?
7. What are the characteristic features of the muscular tissue?
8. What is the structure of the nervous tissue? What does a nerve cell consist of?

3. Переведите текст.

Ткани

Органы состоят из различных тканей. Ткань образована клетками, одинаковыми по строению и выполняющими в организме определенные функции. Между клетками тканей находится межклеточное вещество. Ткани нашего организма разнообразны. Их можно найти в любом органе. В эпителиальных тканях клетки находятся плотно друг к другу. Межклеточное вещество плохо развито и его трудно обнаружить. Часто эпителиальная ткань образуется многими слоями клеток. Такая ткань хорошо защищает расположенные под нею органы. Эпителиальные клетки погибают в больших количествах. Поэтому они обладают способностью к быстрому размножению. Мертвые клетки заменяются новыми.

4. Переведите с английского на русский следующие слова и словосочетания:

molecule, matter, property, composition, to provide; to emit, hypothetical, disaster, to consider, to prevent, evidence; solution, sample, solvent, specimen, bind, coat, dissolve, forensic chemistry, slightly, vaporize, chemical, heavy, hard, porous, transparent, pure, toxic, foreign; ecology, community, efforts, numerous, soil, wastes; acknowledge, award, found, resign, thorough, conversion, integral, multiplication, mortality, numerical; to define, measurement, to deal with, to determine, man-made; usage, machine, procedure, to improve, to refer to, consequence, advanced technology, to fulfill, requirement, to satisfy requirements, raw material, conductor, human genome, potential medical benefits, research methodologies, proof-of-concept, somatic gene therapy, recipient's body, germ-line genetic therapy egg cells, zygote, embryo screening, enhancement medicine, potential scope of genetic medicine, single gene disorders, amino acid.

Клетка – элементарная живая система, состоящая из двух основных частей – цитоплазмы и ядра. Она является основой строения, развития жизнедеятельности всех животных и растительных организмов. Клеточное строение обнаруживается на различных уровнях организации живой природы. Итак, клетки, составляющие тело бактерий и простейших, являются самостоятельными организмами; в отличие от этого, клетки, входящие в состав тканей многоклеточных организмов, представляют собой элементы, полностью подчиненные целостному организму. Основной план строения животных и растительных клеток сходен, однако последние отличаются некоторыми особыми чертами. У животных, например, нет микроскопически видимых оболочек, а все растительные клетки окружены хорошо выраженными целлюлозными оболочками, которые могут иметь сложное строение и включать различные органические и неорганические вещества. Клетка, как живая система, поддерживает и восстанавливает свою целостность, адаптируется к условиям среды и выполняет различные функции за счет энергии вещества, пополняемой из окружающей среды. Любая клетка, являясь сравнительно высокоорганизованной формой живой материи, имеет сложный химический состав. Именно внутренняя структура клетки обеспечивает взаимодействие одних ферментов и разобщенность других, благодаря чему биохимические реакции протекают согласованно и в определенной последовательности. Описание особенностей, присущих большинству тканевых клеток и клеток простейших, составляет задачу общей цитологии.

ТЕКСТ 2

3D PRINTED ORGANS

Scientists say they have greatly advanced the possibility of being able to reproduce the body's organs via the use of 3D printing. Replacement organs could be created using a new technique for bio-printing organic tissue. This allows scientists to create networks of thin tubes and vessels, like those used in our body for the flow of blood and air. These are called vascular networks. Bio-engineering professor Jordan Miller explained why the breakthrough was so important. He said: "One of the biggest roadblocks to generating functional tissue replacements has been our inability to print the complex [vascular networks] that can supply nutrients to densely populated tissues."Professor Kelly Stevens of the University of Washington wrote about the difficulties scientists had in recreating a vascular network. She said: "Tissue engineering has struggled with this for a generation." She believes the new breakthrough will allow medical practices to change in the future. She asked: "If we can print tissues that look and now even breathe more like the healthy tissues in our bodies, will they also then functionally behave more like those tissues?" Professor Stevens said "This is an important question, because how well a bio-printed tissue functions will affect how successful it will be as a therapy." Scientists hope this method will help millions of people waiting for an organ transplant.

1. **Выберите правильный вариант ответа на вопрос**:

1) Who said bio-printing could be used to reproduce organs?

a) engineers

b) doctors

c) scientists

d) printers

2) What would bio-printing create networks of?

a) tubes and vessels

b) users

c) veins and canals

d) tubs and vassals

3) What are the networks called that scientists can now bio-print?

a) cyber networks

b) muscular networks

c) neural networks

d) vascular networks

4) Who is Jordan Miller?

a) a printing engineer

b) a bio-engineering professor

c) an expert on robotics

d) a patient

5) What did a professor say could be supplied to densely populated tissues?

a) data

b) oxygen

c) nutrients

d) blood

6) Where does professor Kelly Stevens work?

a) Tokyo University

b) the University of Washington

c) Cambridge University

d) Cairo University

7) For how long did Kelly Stevens say tissue engineering had struggled?

a) too long

b) decades

c) years and years

d) a generation

8) What did Ms Stevens say the new breakthrough would change?

a) doctors

b) medical practices

c) humanity

d) longevity

9) What will affect the success of the new therapy?

a) how well the tissue is printed

b) the health of patients

c) the quality of the printer

d) genes

10) Who do scientists hope this breakthrough will help?

a) athletes

b) older people

c) all of us

d) people waiting for an organ transplant

2. **Подберите к словам в левой колонке соответствующее определение из правой колонки предложенной ниже таблицы:**

1.advanced	a.	A substance that provides nourishment essential for growth and the maintenance of life.
2.reproduce	b.	A part of an animal or human that is self-contained and has a specific vital function, such as the heart or liver.
3.organ	c.	A tube or canal holding or transporting blood or other fluids.
4.tissue	d.	Made or caused to make progress.
5.vessel	e.	Move along or out steadily and continuously in a current or stream.
6.flow	f.	Creates something very similar to something else.
7.nutrient	g.	Any of the types of material of which animals or plants are made.
8. struggled	h.	Act or conduct oneself in a specified way, especially toward others.
9. generation	i.	Work or operate in a proper or particular way.
10.breakthrough	j.	A surgical operation in which an organ or tissue is taken out and replaced.
11.behave	k.	All of the people born and living at about the same time, regarded collectively.

12.function	l.	Treatment intended to relieve or heal a disorder.
13.therapy	m.	A sudden, dramatic, and important discovery or development.
14.transplant	n.	Striving to achieve or attain something in the face of difficulty or resistance.

3. **Заполните пропуски в предложениях, выбрав нужное слово:**

Scientists say they have greatly (1) ______ the possibility of being able to reproduce the body's organs (2) ______ the use of 3D printing. Replacement organs could be created (3) ______ a new technique for bio-printing organic tissue. This allows scientists to create networks of thin tubes and vessels, like those used in our body for the (4) ______ of blood and air. These are called vascular networks. Bio-engineering professor Jordan Miller explained why the breakthrough was so important. He said: "One of the biggest roadblocks (5) ______ generating functional tissue replacements has been our inability to print the complex [vascular networks] that can supply nutrients to (6) ______ populated tissues."

Professor Kelly Stevens of the University of Washington wrote about the difficulties scientists had (7) ______ recreating a vascular network. She said: "Tissue engineering has (8) ______ with this for a generation." She believes the new breakthrough will allow medical practices to change in the future. She asked: "If we can print tissues that look and now even (9) ______ more like the healthy tissues in our bodies, will they also then (10) ______ behave more like those tissues?" Professor Stevens said "This is an important question, because how well a bio-printed tissue functions will (11) ______ how successful it will be as a therapy." Scientists hope this method will help millions of people waiting for an organ (12) ______.

1. (a) advancing (b) advance (c) advances (d) advanced
2. (a) vie (b) viva (c) vile (d) via
3. (a) usage (b) useful (c) using (d) uses
4. (a) flue (b) flu (c) flow (d) flaw

5. (a) by (b) as (c) to (d) on
6. (a) densely (b) denser (c) density (d) dens
7. (a) on (b) in (c) so (d) by
8. (a) struggled (b) straggled (c) stricken (d) stroked
9. (a) breathy (b) breathe (c) breath (d) breathless
10. (a) function (b) functional (c) functionally (d) functions
11. (a) reflect (b) effect (c) affect (d) offal
12. (a) replant (b) complement (c) implant (d) transplant

4. **Выберите нужное слово из каждой предложенной пары, прочитайте и переведите текст:**

Scientists say they have *greatness / greatly* advanced the possibility of being able to reproduce the body's organs *viva / via* the use of 3D printing. Replacement organs could be created *using / usage* a new technique for bio-printing organic *tissue / issue*. This allows scientists to create networks of thin tubes and vessels, like *them / those* used in our body for the flow of blood and air. These are *called / naming* vascular networks. Bio-engineering professor Jordan Miller explained *why / which* the breakthrough was so important. He said: "One of the biggest roadblocks to *generation / generating* functional tissue replacements has been our *unable / inability* to print the complex [vascular networks] that can supply *nutritional / nutrients* to densely populated tissues."Professor Kelly Stevens of the University of Washington wrote about the *difficult / difficulties* scientists had in recreating a vascular network. She said: "Tissue engineering has *struggled / struggle* with this for a generation." She *believes / beliefs* the new breakthrough will allow medical *practices / practical* to change in the future. She asked: "If we can print tissues *what / that* look and now even breathe more like the healthy tissues in our bodies, will they also then *function / functionally* behave more like those tissues?" Professor Stevens said "This is an *important / importance* question, because how well a bio-printed tissue functions will *effect /*

affect how successful it will be as a *therapy / therapist*." Scientists hope this method will help millions of people waiting for an *organ / organism* transplant.

5. **Составьте предложения из слов, расположив их в нужном порядке:**

1. the say advanced they greatly Scientists have possibility .
2. 3D via the body's printing . organs Reproduce
3. be Organs could created a using new technique .
4. to functional generating biggest roadblocks tissue . The
5. inability to vascular complex the print networks . Our
6. a recreating network . vascular Difficulties had in scientists
7. a generation . engineering Tissue this with struggled for
8. allow breakthroughs change . medical to will practices New
9. will be a successful How it as therapy .
10. waiting Millions of an people organ transplant for.

ТЕКСТ 3

GENETICALLY MODIFIED FOODS ETHICS

Selective breeding has been used since agriculture began, with the development of cultivated crops from wild species and of domestic herds from wild animals. However, it is now possible to carry out gene transfers that could not occur in nature, even gene transfers from the animal kingdom to the plant kingdom. Some people have characterized this as 'playing God', with the implication that it is ethically unacceptable to interfere with nature. However, human beings are themselves part of nature and many religious people would see the responsible exercise of scientific skills as being the employment of God-given abilities.

One of the major concerns about GM crops is their possible environmental effects. Insect-resistant strains may reduce the use of insecticides, but will genes spread from herbicide-resistant strains to produce 'super weeds'? All interventions in nature run the risk of unanticipated upsets to its balance and, from the time that humans with stone axes began felling trees, agriculture has had significant environmental consequences. Because consequences are difficult to predict accurately, it is important that carefully controlled and monitored trials are used to gain the detailed knowledge on which ethically responsible decisions can be based. It is predicted that the world population, currently approximately six billion, will rise to approximately eight billion by the year 2020. Present agricultural resources, if their produce was fairly distributed, could sustain approximately 6.4 billion people. Biotechnology offers considerable possibilities to help eliminate the anticipated shortfall. However, there is also considerable concern that small-scale farmers should not be exploited by large international companies. To these considerations must be added the universal ethical obligation to respect the duty of safety. With regard to food safety, GM products do not seem to raise issues or demand the monitoring of techniques, different to those employed to assess the effects of ordinary foods.

1. **Дайте определения следующим словосочетаниям:**

genetically modified foods, selective breeding, cultivated crops, gene transfers, environmental effects, insecticides, superweeds, herbicide resistant strains, insect-resistant strains, agricultural resources, small-scale farmers, food safety.

2. Составьте предложения из данных ниже слов, расположив их в нужном порядке.

1) there are/ that/ in 2020 three particular contemporary features/ account for the public concern/on the threshold

2) to be ethically acceptable/ heart transplants/ as gene transfers/ but most people consider them/ are as radically unnatural

3) in genetics-based biotechnology/ the pace of demand/ is very rapid

4) there must be ethical restraints / what is technically feasible/ on the use of

5) the environmental consequences/ there is also uncertainty/of the genetic manipulation of plants/ about

6) who develop/ advanced technology/ that are only well understood/ by the experts/ and use them/ involves processes/

7) cannot be given/ to complex questions/ comes from/ some of suspicions/ a difficulty in understanding/ that certain answers/

3. Подберите русские эквиваленты для следующих слов и словосочетаний:

Selective breeding, cultivated crops, domestic herds, gene transfers, implication, scientific skills, Insect-resistant strains, 'super weeds', interventions in nature, ethical obligation, unanticipated upsets.

ТЕКСТ 4

FIELD OF WORK

Engineering and technology are separate but intimately related professions. As concerned to Chemical Technology/Engineering the definition is "Chemical engineering is the branch of engineering that deals with the application of physical science (e.g. chemistry and physics), with mathematics, to the process of converting raw materials or chemicals into more useful or valuable forms.

The field of chemical technology applies a wide range of specialists, they can generally be called Chemical Technologists or Chemical Engineers. Chemical engineers design processes to ensure the most economical operation. This means that the entire production chain must be planned and controlled for costs. A chemical engineer can both simplify and complicate "showcase" reactions for an economic advantage. Using a higher pressure or temperature makes several reactions easier; ammonia, for example, is simply produced from its component elements in a high-pressure reactor. On the other hand, reactions with a low yield can be recycled continuously, which would be complex, arduous work if done by hand in the laboratory. It is not unusual to build 6-step, or even 12-step evaporators to reuse the vaporization energy for an economic advantage. In contrast, laboratory chemists evaporate samples in a single step.

The individual processes used by chemical engineers (e.g. distillation or filtration) are called unit operations and consist of chemical reactions, mass-, heat- and momentum- transfer operations. Unit operations are grouped together in various configurations for the purpose of chemical synthesis and/or chemical separation. Some processes are a combination of intertwined transport and separation unit operations, (e.g. reactive distillation).

Three primary physical laws underlying chemical engineering design are conservation of mass, conservation of momentum and conservation of energy. The movement of mass and energy around a chemical process are evaluated using mass balances and energy balances, laws that apply to discrete parts of equipment, unit operations, or an entire plant. In doing so, chemical engineers must also use principles of thermodynamics, reaction kinetics and transport phenomena.

The task of performing these balances is now aided by process simulators, which are complex software models that can solve mass and energy balances and usually have built-in modules to simulate a variety of common unit operations.

The modern discipline of chemical engineering encompasses much more than just process engineering. Chemical engineers are now engaged in the development and production of a diverse range of products, as well as in commodity and specialty chemicals. These products include high performance materials needed for aerospace, automotive, biomedical, electronic, environmental, space and military applications. Examples include ultra-strong fibers, fabrics, dye-sensitized solar cells, adhesives and composites for vehicles, bio-compatible materials for implants and prosthetics, gels for medical applications, pharmaceuticals, and films with special dielectric, optical or spectroscopic properties for opto-electronic devices.

Many chemical engineers work on biological projects such as understanding biopolymers (proteins) and mapping the human genome. The line between chemists and chemical engineers is growing ever thinner as more and more chemical engineers begin to start their own innovation using their knowledge of chemistry, physics and mathematics to create, implement and mass produce their ideas.

1. **Подберите эквиваленты на английском языке для следующих слов и словосочетаний:**

1. реакция демонстрации
2. реактор высокого давления
3. повторно использовать реакцию
4. испарения
5. химический распад
6. отдельные части оборудования
7. сложные программные модели
8. разнообразный перечень продуктов

2. **Вставьте нужный предлог:**

1. Today secondary industry employs a wide range … specialists.
2. Nitrogen is extracted from methane … produce ammonia. This process takes place … a high pressure reactor.
3. All processes of chemical production must be controlled … environmental safety.
4. The processes in chemical industry can be automated of done … hand.
5. Application of new machinery helps to perform operations … a single step.
6. Distillation and filtration are used … chemical engineers … produce petrol and kerosene from crude oil.
7. Minerals are chemical combinations … native elements.
8. Chemical engineering is based on the principles … thermodynamics.

9. Many chemical laboratories today work … elimination all sorts of viruses from the technological production.
10. The materials such …. ultra strong fiber, solar cells, adhesives and gels are high-performance ones.

3. Образуйте слова от данных основ и дайте перевод.

Example: conserve (консервировать) – conservation (консервация)

1. General - , economy - , produce - , simple - , react - , continue - , evaporate - ,
2. vapour- , operate - , equip - , compose - , apply - , biology - , innovate - .

4. Переведите данные предложения, вставив предложенные ниже слова и выражения.

Encompasses, mass produce, done by hand, human genome, adhesives, space and military applications, commodities

1). … consists of 3 billion pairs of nucleotide elements.

2). In the beginning of the 20-th century …. of industrial goods started. Before it was only relevant for food and clothes.

3). The work of chemical engineer … the development of chemical material sands their use in production.

4). A wide range of oil … is used in chemical industry, machinery and light industry.

5). High-performance materials have wide automotive, ….

6). When you mix … with water they form plastic mass that subsequently is made into artificial stone.

7). When chemical experiments are done in the laboratory …. you must wear special protective equipment.

5. Ответьте на вопросы:

1. What specialists are employed in the field of chemical technology?

2. What factors should chemical engineers consider when designing production process?

3. What are unit operations and what do they consists of?

4. What principles do chemical engineers use in their work?

5. What are process simulators?

6. For what products are high-performance materials needed?

7. Can you give examples of high-performance materials?

8. How are chemical engineers and chemists related?

6. **Заполните пропуски, выбрав нужное слово.**

1. Chemical engineers process raw materials into ________ forms.

a) useful b) expensive c) large-scale

2. Chemical engineer who deals with design of chemical processes is called_______ engineer.

a) processing b) process c) designing

3. Soap and cleaning fluids are ______ product.

a) fertilizing b) adhesive c) detergent

4. Chromatography is a process of _______ of a complex substance.

a) separation b) mixing c) designing

5. Stationary phase of chromatography is ______.

a) gas or liquid b) liquid or solid c) solid or gas

6. In petroleum industry chromatography is used for separating ________.

a) hydro carbons b) monomers c) gases

7. One of the advantages of the chronometry is that it can deal with _______amounts of substances.

a) very small b) very large c) very large or small

8. A chemical engineer ________ "showcase reactions".

a) simplifies b) complicates c) simplifies and complicates

9. The work of chemical engineer is based on the laws of _______ of mass, energy and momentum.

a) conversation b) conservation c) combination

10. Ultra-strong fibers, fabrics, dye-sensitized solar cells are _______materials.

a) low-performance b) middle-performance c) high performance

11. Low-yield reactions are _______.

a) one-step reactions b) complex reaction c) unit operations

ТЕКСТ 5

THE SCOPE OF GENETIC ENGINEERING

Genetic engineering is the area of biotechnology concerned with the directed alteration of genetic material.

Biotechnology has already had countless applications in industry, agriculture, and medicine. It is a hotbed of research. The finishing of the human genome project – a “rough draft” of the entire human genome was published in the year 2000 – was a scientific milestone by anyone’s standards. Researches is now shifting to decoding the functions and inter- actions of all these different genes and to developing applications based on this information. The potential medical benefits are too many to list; researchers are working on every common disease, with varying degrees of success. Progress takes place not only in the development of drugs and diagnostics but also in the creation of better tools and research methodologies, which in turn accelerates progress.

When considering what developments are likely over the long term, such improvements in the research process itself must be factored in. The human genome project was completed ahead of schedule (it usually takes ten years to get from proof-of-concept to successful commercialization).

Genetic therapies are of two sorts: somatic and germ-line. In somatic gene therapy, a virus is typically used as a vector to insert genetic material into the cells of the recipient's body. The effects of such interventions do not carry over into the next generation. Germ-line genetic therapy is performed on sperm or egg cells, or on the early zygote, and can be inheritable. Embryo screening, in which embryos are tested for genetic defects or other traits and then selectively implanted, can also count as a kind of germ-line intervention. Human gene therapy, except for some forms of embryo screening, is still experimental. Nonetheless, it holds promise for the prevention and treatment of many diseases, as well as for uses in enhancement medicine.

The potential scope of genetic medicine is vast: virtually all disease and all human traits – intelligence, extroversion, conscientiousness, physical appearance, etc. – involve genetic predispositions. Single-gene disorders, such as cystic fibrosis, sickle cell anemia, and Huntington's disease are likely to be among the first targets for genetic intervention. Polygenic traits and disorders, in which more than one gene is implicated, may follow later, although even polygenic conditions can sometimes be influenced in a beneficial direction by targeting a single gene.

1. Переведите на русский язык следующие словосочетания:

genetic engineering, genetic material, human genome, potential medical benefits, research methodologies, proof-of-concept, somatic gene therapy, recipient's body, germ-line genetic therapy, egg cells, zygote, embryo screening, enhancement medicine, potential scope of genetic medicine, single gene disorders.

2. Составьте предложения из слов, расположив их в нужном порядке:

1) is /biotechnology /research /of /a hotbed

2) different genes /and /research /of /decodes /the functions /interactions

3) into /the effects /the next generation /do not carry over

4) are /genetic defects /embryos /tested for

5) human /still experimental/ therapy /is /gene 6) involve /and /predispositions /all disease /all human traits /genetic

3. Вставьте в предложения предложенные слова , употребляя их в правильной форме.

Concern germ-line embryo screening intervention common disease interactions inheritable somatic embryos

1) Genetic engineering ____ with the directed alteration of genetic material.
2) Germ-line genetic therapy can be______.
3) Human gene therapy, except for some forms of ______, is still experimental.
4) Research wants to decode the functions and ______ of all these different genes.
5) Genetic therapies are of two sorts: ______ and ________.
6) Researchers are working on every _______ with varying degrees of success.
7) Embryo screening tests ______ for genetic defects or other traits.
8) Single-gene disorders are the first targets for genetic ________.

4. Ответьте на вопросы по тексту.

1) What is genetic engineering?
2) Where does biotechnology have its applications?
3) What is human genome project?
4) Is there any sense of genetic engineering for medicine?
5) How much time does it usually take to get from proof-of-concept to successful commercialization? What about human genome project?
6) Genetic therapies are of two sorts, aren't they? Can you name them?
7) What is somatic gene therapy?
8) What is the main idea, principle of germ-line genetic therapy?
9) What is the potential scope of genetic medicine?

ГЛАВА 3. ТЕКСТЫ ДЛЯ ПЕРЕВОДА С ЛИСТА

ТЕКСТ 1

What is biotechnology?

The term "Biotechnology" (sometimes shortened to "biotech") consists of two parts. Bio is a Greek word for "life" and technology gives an indication of human intervention. Biotechnology can be based on the pure biological sciences (genetics, microbiology, animal cell culture, molecular biology, biochemistry, embryology, cell biology). Also its interests can be outside the sphere of biology (chemical engineering, bioprocess engineering, information technology, biorobotics). Biotechnology deals with brewing, manufacture of human insulin, interferon, and human growth hormone, medical diagnostics, cell cloning and reproductive cloning, the genetic modification of crops, bioconversion of organic waste and the use of genetically altered bacteria in the cleanup of oil spills, stem cell research and much more.

As a matter of fact, biotechnology is very ancient. Six thousand years ago, micro-organisms were used to brew beers and to produce wine, bread and cheese. Yeast makes dough rise and converts sugars into alcohol. Lactic acid bacteria in milk create cheese and yoghurt. This application of biotechnology is the directed use of organisms for the manufacture of organic products (examples include beer and milk products). In this way, classical biotechnology refers to the traditional techniques used to breed animals and plants, as well as to the application of bacteria, yeasts and molds to make bread or cheese.

Modern biotechnology came into being during the nineteen seventies. It has often been divided into several categories; every field of this science is sometimes connected with the definite color.

Green biotechnology is biotechnology applied to agricultural processes. An example would be the selection and domestication of plants via micro propagation. Another example is the designing of transgenic plants to grow under specific environments in the presence (or absence) of chemicals. One hope is that green biotechnology might produce more environmentally friendly solutions than traditional industrial agriculture, although this is still a topic of considerable debate.

Red biotechnology is applied to medical processes. Some examples are the designing of organisms to produce antibiotics, and the engineering of genetic cures through genetic manipulation. White biotechnology, also known as industrial biotechnology, is biotechnology applied to industrial processes. An example is using naturally present bacteria by the mining industry in bioleaching; so it is the designing of an organism to produce a useful chemical or destroy hazardous/polluting chemicals.

White biotechnology tends to consume less in resources than traditional processes used to produce industrial goods.

Blue biotechnology is a term that has been used to describe the marine and aquatic applications of biotechnology, but its use is relatively rare.

Bioinformatics is an interdisciplinary field which addresses biological problems using computational techniques, and makes the rapid organization and analysis of biological data possible. Bioinformatics plays a key role in various areas, such as functional genomics, structural genomics, and proteomics, and forms a key component in the biotechnology and pharmaceutical sector.

In conclusion biotechnology can berefered to any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.

ТЕКСТ 2

A useful vitamin

You'd have to eat a couple dozen oranges to get the same effect as one Vitamin C tablet that contains 500 mg of Vitamin C. Perhaps everyone knows that vitamin C and immune system of humans are interconnected principles. Ascorbic acid is a nutrient that has been shown to have a strong jolt on human health. Researchers originally intended that considerable doses of Vitamin C can reduce the severity and the rate of the common cold due to its using in oxidation-reduction in the human body.

Vitamin C is on the top of immune boosters list and there are many reasons for that. Perhaps, the greatest number of nutrient investigations was devoted to vitamin C and immune system. Ascorbic acid addendums are inexpensive to make, and it is very good that vitamin C is available naturally in many vegetables and fruits. There is another possibility to get Ascorbic acid - you can buy at any chemist's shop vitamin-C-fortified version. Now let's take a brief review of vitamin C and immune system benefit of it.

Ascorbic acid increases the infection-fighting production antibodies and white blood cells and increases interferon levels, the antibody that covers surface of cells, which are favorable for the viruses` entry.

Vitamin C diminished the cardiovascular disease risk with the help of raising HDL levels cholesterol while decreasing blood pressure and importunate with the proceeding during which fat is transformed to plaque in the human arteries. It is also interesting about vitamin C and immune system that people who have diets with higher vitamin C concentration have lower rates of prostate, colon and even breast cancer.

ТЕКСТ 3

Embryo-Safe Stem Cell Research

Researchers at Advanced Cell Technology, Inc. have found a new technique to gather stem cells. They took a single cell from an eight-cell human embryo, claiming that the process does no harm. The removal of a single cell isn't new, and has been employed infertility clinics to test for diseases. Doctors and fertility specialists do this before the embryo is implanted in the womb.

Human embryonic stem cell research is controversial because, with the present state of technology, starting a stem cell line requires the destruction of a human embryo and/or therapeutic cloning. Such reproductive cloning can fundamentally devalue human life. Those in the pro-life movement argue that a human embryo is a human life and is therefore entitled to protection. Contrarily, supporters of embryonic stem cell research argue that such research should be pursued because the result ant treatments could have significant medical potential. It is also noted that excess embryos created for in vitro fertilization could be donate d with consent and used for the research.

Although critics quickly pointed out that all sixteen embryos used in the experiment were destroyed. ACT, Inc. later admitted that scientists removed more than a single cell, and hence their destruction. In addition, scientists developed stem cell lines from only two of the ninety-one cells removed. An official of the United States Conference of Catholic Bishops disapproved of the experiment, saying "it left no embryos alive, and solves no ethical problem."

ТЕКСТ 4

GM Food

One of the best-known and controversial applications of genetic engineering is the creation of genetically modified food. There are three generations of genetically modified crops. First generation crops have been commercialized and most provide protection from insects and/or resistance to herbicides. There are also fungal and virus resistant crops developed or in development. They have been developed to make the insect and weed management of crops easier and can indirectly increase crop yield.

The second generation of genetically modified crops being developed aim to directly improve yield by improving salt, cold or drought tolerance and to increase the nutritional value of the crops. The third generation consists of pharmaceutical crops, crops that contain edible vaccines and other drugs. Some agriculturally important animals have been genetically modified with growth hormones to increase their size while others have been engineered to express drugs and other proteins in their milk.

The genetic engineering of agricultural crops can increase the growth rates and resistance to different diseases caused by pathogens and parasites. These modified crops would also reduce the usage of chemicals, such as fertilizers and pesticides, and therefore decrease the frequency of the damages produced by this chemical pollution.

Ethical and safety concerns have been raised around the use of genetically modified food. A major safety concern relates to the human health implications of eating genetically modified food, in particular whether toxic or allergic reactions could occur. Gene flow into related non-transgenic crops, off target effects on beneficial organisms and the impact on biodiversity are important environmental issues. Ethical concerns involve religious issues, corporate control of the food supply, intellectual property rights and the level of labeling needed on genetically modified products.

ТЕКСТ 5

Human cloning

Human cloning is the creation of a genetically identical copy of an existing or previously existing human. There are two commonly discussed types of human cloning: therapeutic cloning and reproductive cloning. Therapeutic cloning involves cloning cells from an adult for use in medicine and is an active area of research. Reproductive cloning would involve making cloned human beings. Such reproductive cloning has not been performed and is illegal in many countries. A third type of cloning called replacement cloning. It is a theoretical possibility, and would be a combination of the rapeutic and reproductive cloning. Replacement cloning would entail the replacement of an extensively damaged, failed, or failing body through cloning followed by whole or partial brain transplant.

Some people and groups oppose therapeutic cloning, but most scientific, governmental and religious organizations oppose re productive cloning. Many scientific organizations have made public statements suggesting that human reproductive cloning be banned until safety issues are resolved. Serious ethical concerns have been raised by the idea that it might be possible in the future to harvest organs from clones. Some people have considered the idea of growing organs separately from a hum an organism - in doing this, a new organ supply could be established without the moral implications of harvesting them from humans.

The first human hybrid human clone was created in November 1998, by American Cell Technologies. It was created from a man's leg cell, and a cow's egg whose DNA was removed. It was destroyed after 12 days.

On January, 2008, Wood and Andrew French, Stemagen's chief scientific officer in California, announced that they successfully created the first 5 mature human embryos using DNA from adult skin cells, aiming to provide a source of viable embryonic stem cells. It is not clear if the embryos produced would have been capable of further development, but Dr. Wood stated that if that were possible, using the technology for reproductive cloning would be both unethical and illegal. Thus, the 5 cloned embryos were destroyed.

ТЕКСТ 6

The Human Genome Project.

Eyes of brown? or blue?… Curly hair? or straight?…Dimples?…Freckles? …

It's in our genes. Heredity. Our mothers and fathers passed on all our traits when we were born. There are also many things in our genes that we would rather avoid, such as heart disease, diabetes, cancer, arthritis, muscular dystrophy, and other illnesses.

Many diseases come from alterations in our genes. To decipher our genetic code, a scientific journey has begun called The Human Genome Project. The genetic code is the complete instructions of all the genes that tell our body how to develop.

Over the years, some genes have been discovered for certain diseases. People who have a family history of these diseases can be tested for the specific gene. They will then know if they have this disease, even if no symptoms are present. But there are many more diseases with genetic components that have not yet been uncovered. Scientists are still unclear what or which genes affect those diseases. Francis Collins

MD, PHD, is the Project Director at the National Center for Human Genome Research. He said that “by uncovering all 30,000 to 40,000 genes in the human genome, we should at the same time uncover the heredity basis of most diseases and that would put us in a position to diagnose them better, treat them better and practice better preventative medicine.”

What are Genes? They are found in the part of the cell called the nucleus. Human cells contain 23 pairs of chromosomes, 46 in all. One member of each pair comes from the mother and one from the father. Genes occur in pairs, like the chromosomes. A chromosome is a very long chemical molecule called DNA. Genes are segments of DNA molecules. DNA is shaped like a twisted ladder. Rungs of the ladder are chemicals called “base pairs”. Chemical “A” is always paired up with “T” and “G” is always with “C”. The complete human genome (all our DNA) contains three billion “base pairs”. The Human Genome Project will find the sequence of all of them. This knowledge will revolutionize our understanding of the way genes influence disease, because the genes’ “base pair” sequence is the code that determines what it does.

What do genes do? They give cells the instructions they need to make complex molecules called proteins. Each gene code is for a different protein. A cell first converts DNA to a similar molecule called RNA. RNA carries the gene’s instructions to another part of the cell that acts like a protein factory. Most proteins that come out of the factory are enzymes. Other proteins form cell structures. Occasionally, the gene that codes for a protein has an error in its based pair sequence. The cell then makes a protein that is not able to do what it should. This is called a mutated gene. Mutated genes play a major role in human diseases. Since genes are incredibly small, it is difficult for scientists to isolate them. Making it easier for scientists to find disease causing genes is the main goal of the Human Genome Project.

ТЕКСТ 7

A Reading List About the Neuroscience of Reading

Four stories exploring the surprising neuroscience behind the mutability of language and the reading brain.

by Melanie Hamon February 23, 2023

I learned to read when my older sisters returned from elementary school and practiced with our family. I remember sitting on the left side of my mom, fingers running over pictures of ladybugs and small golden dogs, while my sister sat on her right side and read the story aloud. She could read more words than I could, but I was getting there. By the time I was 9, I hid books under my bed and pulled them out in the middle of the night to read one more chapter. By the time I was 18, packing my things for college, I puzzled over what to do with my floor-to-ceiling, overflowing bookshelf. Everything I read became a part of my identity, and everything I could keep (or steal) became a member of the sprawling crowd of voices that eventually converged into my own.

When you look up the key features of a civilization, most historians agree that a group of people must implement a system of writing in order to be "civilized." Reading makes us human.

But what if I told you that humans were never meant to read in the first place? Our brains come hard-wired with the ability to hear and speak language (from a place called Wernicke's area in the temporal lobe) and the ability to understand and remember symbols (the parietal lobe). There is no specific area in the brain that is meant to read; that's why children have to be taught to read, and why some people have an easier time learning than others. Every time a reader starts a new story, they are taking advantage of a system that is both brand-new and generations in the making. As humans evolved, our brains learned to combine the use of multiple regions and a process called neuronal recycling to "repurpose" the skills we already have. It's a miracle.

Reading a new book, learning a new language, and even speaking our own language to communicate with friends and loved ones are the results of a multifaceted, living system. Learning that reading and writing are far from natural changed the way I read my favorite books. As a writer, I can treat myself with more patience knowing the lengths to which my brain has gone so I have the chance to write anything at all. As a reader, I value every word more knowing that it has traveled through countless geographical locations and definitions so it can hold that exact spot in one specific sentence.

The reading list below is a selection of works that explain in more depth how we got to where we are today — an age when literacy is not just considered an essential skill but an outlet for escapism, obsession, and self-expression. Spoiler alert: This process hasn't finished yet. For as long as we read and write, our brains and our language influence one another and adapt to the literary climate. It is our gift to not only learn how this process takes place but to take advantage of the positive changes it could make for ourselves and our society.

Your Brain on Books: You Are What You Read (Maryanne Wolf, *Tufts Magazine*, Summer 2007*)*

Wolf is the author of many books about reading, including *Proust and the Squid* and *Reader, Come Home*. Although she works as a neuroscientist at the University of California San Francisco, she has a gift for explaining complicated processes like neuronal recycling to audiences unfamiliar with high-brow academic jargon. This essay speaks to book lovers, analyzing the process that allows readers to "step into another person's clothes." Wolf explains how this experience, at first appearing straightforward, is actually the product of several different parts of your brain (semantic and grammatical systems) working together to attach symbols to words. When we mature as readers, the cognitive process expands and we begin to feel what we read, truly "living" through words. As it turns out, Wolf reveals, the long process that has led to symbol comprehension is only just the beginning.

Human beings invented reading, and it took them thousands of years of cognitive breakthroughs to go from simple markings called tokens to text encoded in writing systems like Sumerian, Chinese, or the Greek alphabet. Reading has expanded the ways we are able to think and altered the cultural development of our species; still, it is a wholly learned skill, one that effects deep and lasting neurological changes in the individual.

Words on the Brain (Bartholomew Pawlik, *Lateral*, April 2016*)*

"Living" in literature changes us emotionally, but the effects of reading fiction at a close level are apparent cognitively, too. Here, Pawlik pulls together a variety of sources that discuss and interrogate what happens to us when we read fiction. Does literature actually pose a benefit to society beyond the individual route of escapism? Summaries of various cognitive studies reveal that reading does activate parts of the brain that are involved in interpreting social cues. More than that, Pawlik interrogates these effects on a societal level. Fiction readers are more tolerant, more empathetic, and even more likely to accept new technologies like robots.

A study, conducted by Martina Mara and Markus Appel, looked at whether science fiction can change our feelings towards robots. They had people read either a science fiction story or a non-fiction pamphlet, before interacting with a human-like robot. The participants who read the sci-fi story reported reduced feelings of eeriness, which didn't occur when people read the same information in the form of a leaflet. This led the authors to suggest that science fiction "may provide meaning for otherwise unsettling future technologies."

An In-Depth Exploration of the Neuroscience of Language Learning (Saga Briggs, *Berlitz*, January 2022)

But what happens to your brain if you're not one to sit and binge-read novels? Even though understanding, interpreting, and speaking language are natural parts of our brains, something magical still happens when we learn to speak a new language. Saga Briggs writes about how people who recently learned a language show increased activity in the parts of their brains responsible for auditory processing, memory, and grammatical comprehension. Here, Briggs lays out a step-by-step process: what happens to your brain as you learn a new language, how we measure language learning, and what this means for new language-learners. It takes a lot of the scare away from learning a new language, and for us monolingual speakers out there, it helps us appreciate just how wonderful it is that we know one language already — and what the benefits could be of two.

There's an important lesson to be gleaned from the neuroscience of language learning, then, one we can keep in mind as we tackle our next target language: our brains are adaptable, and we can trust them to take on the challenge.

Inside the Bilingual Writer (Erik Gleibermann, *World Literature Today*, May 2018)

In this beautiful examination of the multiple faces of writing, Erik Gleibermann interviews eight bilingual writers about their writing processes and the writing relationship between their mother tongue and their adopted one.

Gleibermann explores the universe of the bilingual writer in this essay, bringing to light the way that bilingual writers use variations in tongue to resurface childhood memories or imply a tone of sexual whimsy. This piece also examines the reality of the bilingual writer in the Trump-administration era and upper-level American academia, during which times many bilingual writers were encouraged to silence their backgrounds and write only in English. In the end, though, bilingual writers support and inspire one another. Even if they speak (and write) completely different languages, they form an "extended family" that welcomes everyone's stories.

Traveling back and forth can be a journey of both reconciliation and conflict.

In living this duality, these writers voice the daily experience of many bilingual immigrants around the world who are cooking breakfast, attending staff meetings, posing questions in class, and buying the week's groceries.

ГЛАВА 4. ТЕКСТЫ ДЛЯ ПИСЬМЕННОГО ПЕРЕВОДА

ТЕКСТ 1

A PROTECTIVE PROBIOTIC BLUNTS THE ILL EFFECTS OF ALCOHOL IN MICE

Excessive alcohol consumption leads to painful hangovers and accompanying headaches, fatigue, and nausea. Drinking alcohol has also been linked to a raft of health problems in the human body, including heart disease, cirrhosis, and immune deficiency. One way to avoid those consequences would be to drink less, but researchers in China have introduced another way to mitigate hangovers and other adverse outcomes -- a genetically-engineered probiotic.

In a paper published this week in Microbiology Spectrum, the researchers described their approach and reported that in experiments on mice, the treatment reduced alcohol absorption, prolonged alcohol tolerance, and shortened the animals' recovery time after exposure to alcohol. The probiotic hasn't yet been tested on humans, but the authors predicted that if it confers the same benefits, it could present a new way to reduce alcohol-induced health problems, and liver problems in general.

Meng Dong, Ph. D, at the Chinese Academy of Science's Institute of Zoology, who worked on the study, noted that clinical applications may extend beyond alcohol-related conditions. "We believe that genetically engineered probiotics will provide new ideas for the treatment of liver diseases," she said.

The human body primarily uses forms of an enzyme called alcohol dehydrogenase, or ADH, to metabolize alcohol. But some variants are more effective than others: Some studies have found that a form called ADH1B, found primarily in East Asian and Polynesian populations, is 100 times more active than other variants. Previous studies on mice have shown that viral vectors genetically engineered to express ADH1B can accelerate the breakdown of alcohol, but that approach hasn't been shown to be safe in humans.

Motivated by those findings, Dong and her colleagues looked for a safer delivery method, focusing on the probiotic Lactococcus lactis, a bacterium often used in fermentation. They used molecular cloning to introduce the gene for human ADH1B into a bacterial plasmid, which was then introduced into a strain of L. lactis. Lab tests confirmed that the probiotic secreted the enzyme. The researchers encapsulated the probiotic to ensure it would survive against stomach acid, then tested it on 3 groups of 5 mice, each exposed to different levels of alcohol.

Untreated mice showed signs of drunkenness 20 minutes after exposure to alcohol. When the mice were placed on their backs, for example, they were unable to get back on their feet. But in the group that received a probiotic that expressed human ADH1B, half the mice were still able to turn themselves over an hour after alcohol exposure. A quarter never lost their ability to turn themselves over.

Further tests showed that 2 hours after exposure, blood alcohol levels in the control group continued to rise, while those in the probiotic-treated mice had begun to fall. In addition, the researchers found that treated mice showed lower levels of lipids and triglycerides in their livers, suggesting that the probiotic could alleviate alcohol-related damage to that organ.

The next step, Dong said, is to investigate whether the potential therapeutic effect of the modified probiotic extends to humans. "We are excited about the improvement of recombinant probiotics in acute alcohol-induced liver and intestinal damage," Dong said.

Vocabulary

1. to mitigate hangovers – смягчить похмелье
2. ADH1B - Бета-полипептид алкоголь дегидрогеназы IB
3. exposure to alcohol - воздействие алкоголя
4. levels of lipids and triglycerides –уровень липидов и триглицеридов
5. accelerate the breakdown of alcohol –ускоряют расщепление алкоголя
6. ability to turn themselves over –способность перевоплощаться

7. the probiotic secreted the enzyme –пробиотик выделял фермент
8. alleviate alcohol-related damage –облегчить ущерб, связанный с алкоголем
9. potential therapeutic effect - потенциальный терапевтический эффект
10. bacterial plasmid - бактериальная плазмида
11. to confer the same benefits – предоставить те же преимущества
12. cirrhosis – цирроз
13. clinical applications - клинические применения

1. Выберите правильный вариант перевода

1. to mitigate hangovers

A. избежать похмелья

B. страдать от похмелья

C. смягчить похмелье

2. levels of lipids and triglycerides

A. уровень липидов и триглицеридов

B. уровень липидов и глицеридов

C. уровень липидов и риглицеридов

3. The researchers encapsulated the probiotic

A. ученые нашли пробиотик в капсуле

B. ученые заключили пробиотик в капсулу

C. ученые убрали пробиотик и капсулы

2. Переведите на английский язык

1. alleviate alcohol-related damage
2. molecular cloning
3. The researchers encapsulated the probiotic.

ТЕКСТ 2

DESIGNING MORE USEFUL BACTERIA

In a step forward for genetic engineering and synthetic biology, researchers have modified a strain of *Escherichia coli* bacteria to be immune to natural viral infections while also minimizing the potential for the bacteria or their modified genes to escape into the wild.

The work promises to reduce the threats of viral contamination when harnessing bacteria to produce medicines such as insulin as well as other useful substances, such as biofuels. Currently, viruses that infect vats of bacteria can halt production, compromise drug safety, and cost millions of dollars.

Results are published March 15 in *Nature*.

"We believe we have developed the first technology to design an organism that can't be infected by any known virus," said the study's first author, Akos Nyerges, research fellow in genetics in the lab of George Church in the Blavatnik Institute at Harvard Medical School and the Wyss Institute for Biologically Inspired Engineering.

"We can't say it's fully virus-resistant, but so far, based on extensive laboratory experiments and computational analysis, we haven't found a virus that can break it," Nyerges said.

The work also provides the first built-in safety measure that prevents modified genetic material from being incorporated into natural cells, he said.

The authors said their work suggests a general method for making any organism immune to viruses and preventing gene flow into and out of genetically modified organisms (GMOs). Such biocontainment strategies are of increasing interest as groups explore the safe deployment of GMOs for growing crops, reducing disease spread, generating biofuels, and removing pollutants from open environments.

Building on what came before

The findings build on earlier efforts by genetic engineers to achieve a helpful, safe, virus-resistant bacterium.

In 2022, a group from the University of Cambridge thought they'd made an *E. coli* strain immune to viruses. But then Nyerges teamed up with research fellow Sian Owen and graduate student Eleanor Rand in the lab of co-author Michael Baym, assistant professor of biomedical informatics in the Blavatnik Institute at HMS. When they sampled local sites rife with *E. coli,* including chicken sheds, rat nests, sewage, and the Muddy River down the street from the HMS campus, they discovered viruses that could still infect the modified bacteria.

Discovering that the bacteria weren't fully virus-resistant "was a bummer," Nyerges said.

The initial method had involved genetically reprogramming *E. coli* to make all their life-sustaining proteins from 61 sets of genetic building blocks, or codons, instead of the naturally occurring 64. The idea was that viruses wouldn't be able to hijack the cells because they couldn't replicate without the missing codons.

The HMS team, however, figured out that deleting codons wasn't enough. Some viruses were bringing in their own equipment to get around the missing pieces.

So, Nyerges and colleagues developed a way to change what those codons tell an organism to make -- something scientists hadn't done to this extent in living cells.

Lost in translation

The key lay in transfer RNAs, or tRNAs.

Each tRNA's role is to recognize a specific codon and add the corresponding amino acid to a protein that's being built. For instance, the codon TCG tells its matching tRNA to attach the amino acid serine.

In this case, the Cambridge team had deleted TCG along with sister codon TCA, which also calls for serine. The team had also removed the corresponding tRNAs.

The HMS team now added new, trickster tRNAs in their place. When these tRNAs see TCG or TCA, they add leucine instead of serine.

"Leucine is about as different from serine as you can get, physically and chemically," said Nyerges.

When an invading virus injects its own genetic code full of TCG and TCA and tries to tell the *E. coli* to make viral proteins, these tRNAs mess up the virus's instructions.

Inserting the wrong amino acids results in misfolded, nonfunctional viral proteins. That means the virus can't replicate and go on to infect more cells.

Viruses, however, also come equipped with their own tRNAs. These can still accurately turn TCG and TCA into serine. But Nyerges and colleagues provided evidence that the trickster tRNAs they introduced are so good at their jobs that they overpower their viral counterparts.

"It was very challenging and a big achievement to demonstrate that it's possible to swap an organism's genetic code," said Nyerges, "and that it only works if we do it this way."

The work may have cleared the last hurdle in rendering a bacterium immune to all viruses, although there's still a chance something will appear that can break the protection, the authors said.

The team takes confidence in knowing that overcoming the swapped codons would require a virus to develop dozens of specific mutations at the same time.

"That's very, very unlikely for natural evolution," Nyerges said.

Safety measures

The work incorporates two separate safeguards.

The first protects against horizontal gene transfer, a constantly occurring phenomenon in which snippets of genetic code and their accompanying traits, such as antibiotic resistance, get transferred from one organism to another.

Nyerges and colleagues short-circuited this outcome by making substitutions throughout genes in the modified *E. coli* cells so that all codons that call for leucine got replaced with TCG or TCA -- the codons that in an unmodified organism would call for serine. The bacteria still correctly made leucine in those places because of their trickster tRNAs.

If another organism were to incorporate any of the modified snippets into its own genome, though, the organism's natural tRNAs would interpret TCG and TCA as serine and end up with junk proteins that don't convey any evolutionary advantage.

"The genetic information will be gibberish," said Nyerges.

Similarly, the team showed that if one of the *E. coli*'s trickster tRNAs gets transferred to another organism, its misreading of serine codons as leucine codons damages or kills the cell, preventing further spread.

"Any modified tRNAs that escape won't get far because they are toxic to natural organisms," said Nyerges.

The work represents the first technology that prevents horizontal gene transfer from genetically modified organisms into natural organisms, he said.

For the second fail-safe, the team designed the bacteria themselves to be unable to live outside a controlled environment.

The team used an existing technology developed by the Church lab to make the *E. coli* reliant on a lab-made amino acid that doesn't exist in the wild. Workers cultivating these *E. coli* to produce insulin, for instance, would feed them the unnatural amino acid. But if any bacteria escaped, they would lose access to that amino acid and die.

Therefore, no humans or other creatures are at risk of getting infected by "super bacteria," Nyerges emphasized.

Nyerges looks forward to exploring codon reprogramming as a tool for coaxing bacteria to produce medically useful synthetic materials that would otherwise require expensive chemistry. Other doors have yet to be opened.

"Who knows what else?" he mused. "We've just started exploring."

(“Nature”, 15 March 2023)

Vocabulary

1. viral contamination - вирусное заражение
2. to prevent gene flow - предотвратить поток генов
3. biocontainment strategies - стратегии биоконсервации
4. to swap an organism's genetic code –изменить генетический код организма
5. the swapped codons - поменянные местами кодоны
6. to make substitutions – производить замену
7. horizontal gene transfer - горизонтальный перенос генов
8. infected by superbacteria - зараженные супербактериями
9. coaxing bacteria - уговаривать бактерии
10. life-sustaining proteins - белки, поддерживающие жизнедеятельность
11. biomedical informatics - биомедицинская информатика
12. incorporated in to natural cells - встраивается в естественные клетки

13. to infect vats of bacteria –заразить чаны с бактериями

14. build on earlier efforts - опираться на предыдущие усилия

15. trickster – обманщик

16.

1. **Подберите эквивалент**

1. bacteria

A. virus

B. disease

C. cell

2. to prevent gene flow

A. to stop formation of gene array

B. to delay gene formation

C. to increase gene flow

3. incorporated into natural cells

A. reproduced natural cells

B. intruded into natural cells

C. developing into natural cells

ТЕКСТ 3

ENGINEERED PLANTS PRODUCE SEX PERFUME TO TRICK PESTS AND REPLACE PESTICIDES

By using precision gene engineering techniques, researchers at the Earlham Institute in Norwich have been able to turn tobacco plants into solar-powered factories for moth sex pheromones.

Critically, they've shown how the production of these molecules can be efficiently managed so as not to hamper normal plant growth.

Pheromones are complex chemicals produced and released by an organism as a means of communication. They allow members of the same species to send signals, which includes letting others know they're looking for love.

Farmers can hang pheromone dispersers among their crops to mimic the signals of female insects, trapping or distracting the males from finding a mate. Some of these molecules can be produced by chemical processes but chemical synthesis is often expensive and creates toxic byproducts.

Dr Nicola Patron, who led this new research and heads the Synthetic Biology Group at the Earlham Institute, uses cutting-edge science to get plants to produce these valuable natural products.

Synthetic biology applies engineering principles to the building blocks of life, DNA. By creating genetic modules with the instructions to build new molecules, Dr Patron and her group can turn a plant such as tobacco into a factory that only needs sunlight and water.

"Synthetic biology can allow us to engineer plants to make a lot more of something they already produced, or we can provide the genetic instructions that allow them to build new biological molecules, such as medicines or these pheromones," said Dr Patron.

In this latest work, the team worked with scientists at the Plant Molecular and Cell Biology Institute in Valencia to engineer a species of tobacco, *Nicotiana benthamiana*, to produce moth sex pheromones. The same plant has previously been engineered to produce ebola antibodies and even coronavirus-like particles for use in Covid vaccines.

The Group built new sequences of DNA in the lab to mimic the moth genes and introduced a few molecular switches to precisely regulate their expression, which effectively turns the manufacturing process on and off.

An important component of the new research was the ability to fine tune the production of the pheromones, as coercing plants to continuously build these molecules has its drawbacks.

"As we increase the efficiency, too much energy is diverted away from normal growth and development," explained Dr Patron.

"The plants are producing a lot of pheromone but they're not able to grow very large, which essentially reduces the capacity of our production line. Our new research provides a way to regulate gene expression with much more subtlety."

In the lab, the team set about testing and refining the control of genes responsible for producing the mix of specific molecules that mimic the sex pheromones of moth species, including navel orange worm and cotton bollworm moths.

They showed that copper sulphate could be used to finely tune the activity of the genes, allowing them to control both the timing and level of gene expression. This is particularly important as copper sulphate is a cheap and readily-available compound already approved for use in agriculture.

They were even able to carefully control the production of different pheromone components, allowing them to tweak the cocktail to better suit specific moth species.

"We've shown we can control the levels of expression of each gene relative to the others," said Dr Patron. "This allows us to control the ratio of products that are made.

"Getting that recipe right is particularly important for moth pheromones as they're often a blend of two or three molecules in specific ratios. Our collaborators in Spain are now extracting the plant-made pheromones and testing them in dispensers to see how well they compare to female moths."

The team hope their work will pave the way to routinely using plants to produce a wide range of valuable natural products.

"A major advantage of using plants is that it can be far more expensive to build complex molecules using chemical processes," said Dr Patron. "Plants produce an array of useful molecules already so we're able to use the latest techniques to adapt and refine the existing machinery.

"In the future, we may see greenhouses full of plant factories -- providing a greener, cheaper and more sustainable way to manufacture complex molecules."

The research is part of the SUSPHIRE project, which received support from ERACoBiotech funded by the Horizon 2020 research and innovation program and the UKRI Biotechnology and Biological Sciences Research Council (BBSRC).

Vocabulary

1. precision gene engineering techniques –точные методы генной инженерии
2. moth sex pheromones - половые феромоны моли
3. to hamper normal plant growth - препятствовать нормальному росту растений
4. pheromone dispersers - распылители феромонов
5. to mimic the signals –для имитации сигналов
6. chemical synthesis - химический синтез
7. to produce ebola antibodies - для выработки антител против лихорадки Эбола
8. navel orange worm – пупочный орангутанговый червь
9. cotton bollworm moths –хлопковая моль

10. to refine the control of genes – усовершенствовать контроль над генами
11. energy is diverted away –энергия отводится от
12. tune the activity of the genes – регулировать активность генов
13. copper sulphate – сульфат меди
14. an array of useful molecules – набор полезных молекул
15. way to manufacture complex molecules – способ производства сложных молекул

1. Выберите правильный вариант ответа

1. moth sex pheromones

A) сексуальный запах моли

B) половые феромоны моли

C) сексуальная моль с феромонами

2. to mimic the signals

A) подмигивать и сигналить

B) для использования сигналов

C) для имитации сигналов

3. to refine the control of genes

A) вернуть контроль над генами

B) потерять контроль над генами

C) усовершенствовать контроль над генами

ТЕКСТ 4

"ELECTRONIC NOSE" BUILT WITH SUSTAINABLY SOURCED MICROBIAL NANOWIRES THAT COULD REVOLUTIONIZE HEALTH MONITORING

Scientists at the University of Massachusetts Amherst recently announced the invention of a nanowire, 10,000 times thinner than a human hair, which can be cheaply grown by common bacteria and can be tuned to "smell" a vast array of chemical tracers -- including those given off by people afflicted with different medical conditions, such as asthma and kidney disease. Thousands of these specially tuned wires, each sniffing out a different chemical, can be layered onto tiny, wearable sensors, allowing health-care providers an unprecedented tool for monitoring potential health complications. Since these wires are grown by bacteria, they are organic, biodegradable and far greener than any inorganic nanowire.

To make these breakthroughs, which were detailed in the journal *Biosensors and Bioelectric*, senior authors Derek Lovley, Distinguished Professor of Microbiology at UMass Amherst, and Jun Yao, professor of electrical and computer engineering in the College of Engineering at UMass Amherst, needed to look no farther than their own noses. "Human noses have hundreds of receptors, each sensitive to one specific molecule," says Yao. "They are vastly more sensitive and efficient than any mechanical or chemical device that could be engineered. We wondered how we could leverage the biological design itself rather than rely on a synthetic material."

In other words, the team wondered if they could work with nature to sniff out disease -- and it turns out they have done just that.

The answer begins with a bacterium known as *Geobacter sulfurreducens*, which Lovley and Yao previously used to create a biofilm capable of producing long-term, continuous electricity from your sweat. *G. sulfurreducens*' has the surprising natural ability to grow tiny, electrically conductive nanowires.

But *G. sulfurreducens* is a finicky bacterium that needs specific conditions in which to grow, making it difficult to use at scale. "What we've done," says Lovley, "is to take the 'nanowire gene' -- called pilin -- out of *G. sulfurreducens* and splice it into the DNA of *Escherichia coli*, one of the most widespread bacteria in the world."

Once the pilin gene was removed from *G. sulfurreducens*, Lovley, Yao and team modified it so that it would include a specific peptide, known as DLESFL, which is extremely sensitive to ammonia -- a chemical often present in the breath of those with kidney disease. When they then spliced the modified pilin gene into *E. coli*'s DNA, the genetically tweaked bacterium sprouted tiny nanowires bristling with the ammonia-sensing peptide. The team then harvested these ammonia-sensitive nanowires and built them into a sensor.

"Genetically modifying the nanowires made them 100 times more responsive to ammonia than they were originally," says Yassir Lekbach, the paper's co-lead author and a postdoctoral researcher in microbiology at UMass Amherst. "The microbe-produced nanowires function much better as sensors than previously described sensors fabricated with traditional silicon or metal nanowires."

And there's no need to limit these new sensors to only to ammonia and kidney disease. Toshiyuki Ueki, the paper's other co-lead author and research professor in microbiology at UMass Amherst, says that "it's possible to design unique peptides, each of which specifically binds a molecule of interest. So, as more tracer molecules, emitted by the body and which are specific to particular a disease are identified, we can make sensors that incorporate hundreds of different chemical-sniffing nanowires to monitor all sorts of health conditions."

A new paradigm for electrical engineering

Traditional nanowires, made from silicon or carbon fiber, can be highly toxic -- carbon nanotubes are themselves carcinogens -- and end up as non-biodegradable e-waste. Their raw materials can require enormous amounts of energy and chemical inputs to harvest and process, as well as leaving a deep environmental impact. But because Lovley and Yao's nanowires are grown from common bacteria, they are far more sustainable.

"One of the most exciting things about this line of research," says Yao, "is that we're taking electrical engineering in a fundamentally new direction. Instead of wires made from scarce raw resources that won't biodegrade, the beauty of these protein nanowires is that you can use life's genetic design to build a stable, versatile, low impact and cost-effective platform."

This research was supported by the National Science Foundation and nurtured by the Institute for Applied Life Sciences (IALS) at UMass Amherst, which combines deep and interdisciplinary expertise from 29 departments to translate fundamental research into innovations that benefit human health and well-being.

Vocabulary

1. invention of a nanowire –удержание нанопроволоки
2. chemical tracers - химические трассирующие вещества
3. to sniff out chemical - понюхать химическое вещество
4. capable of producing long-term, continuous electricity - способный вырабатывать длительное, непрерывное электричество
5. a finicky bacterium - привередливая бактерия
6. to splice into –соединять в

7. tweaked bacterium sprouted tiny nanowires - усовершенствованная бактерия прорастает крошечными нанопроводами

8. bristle with - щетиниться

9. more tracer molecules - на большее количество молекул трассера

10. emitted by - испускаемый

11. chemical-sniffing nanowires –химические нюхательные нанопроволоки

12. to limit new sensors –ограничивать новые датчики

1. Подберите эквивалент

1. to splice into

A) to cut

B) to build into

C) to merge

2. a finicky bacterium

A) evil virus

B) tricky bacterium

C) clever bacterium

3. to limit new sensors

A) to stop new sensors

B) to curb new sensors

C) to deviate new sensors

ТЕКСТ 5

SCIENTISTS GENETICALLY ENGINEER PLANTS TO YIELD MORE VEGETABLE OIL

Scientists from Nanyang Technological University, Singapore (NTU Singapore) have successfully genetically modified a plant protein that is responsible for oil accumulation in plant seeds and edible nuts.

Demonstrating their patent-pending method, the model plant *Arabidopsis* accumulated 15 to 18 per cent more oil in its seeds when it was grown with the modified protein under laboratory conditions.

Finding ways to make crops yield more oil in their seeds is a holy grail for the farming industry. However, most oil-producing crops such as oil palm, soybean, sunflower, and rapeseed, peanut already have a high percentage of oil in their fruit or seed, and it is hard to increase their oil content through traditional crop crossbreeding methods.

Vegetable oils are commonly used in food processing, biofuels, soaps and perfumes, and the global market for them is estimated to be worth US$241.4 billion in 2021 and is expected to increase to US$ 324.1 billion by 2027[1]. Increasing the yield of oil from plants could also help the world in its quest for sustainability, helping to reduce the amount of arable land needed for oil-yielding crops.

The secret to helping plants store more oil in their seeds is one of their proteins called WRINKLED1 (WRI1). Scientists have known for over two decades that WRI1 plays an important role in controlling plant seed oil production.

Now for the first time, a high-resolution structure of WRI1 has been imaged and reported by the NTU team, jointly led by Associate Professor Gao Yonggui and Assistant Professor Ma Wei from the School of Biological Sciences.

Published in the scientific journal *Science Advances*, the team detailed the molecular structure of WRI1 and how it binds to plant DNA -- which signals to the plant how much oil to accumulate in its seeds.

Based on the understanding that the atomic structure of the WRI1-DNA complex revealed, the team modified WRI1 to enhance its affinity for DNA in a bid to improve oil yield. In this approach, some portions in WRI1 were selected for modifications to improve its binding to DNA and several forms of WRI1 were produced.

These candidate WRI1s were then further tested to assess their ability to activate oil production in plant cells. As expected by the team, they showed that their modified versions of WRI1 increased DNA binding ten-fold compared to the original WRI1 -- ultimately leading to more oil content in its seeds.

Assoc Prof Gao, a structural biologist said: "Being able to see exactly what WRI1 looks like and how it binds to DNA that is responsible for oil production in the plant was the key to understanding the entire process. WRI1 is an essential regulator that informs the plant how much oil to store in its seeds. Once we were able to visualise the 'lock', we then engineered the 'key' that can unlock the potential of WRI1."

How modifying WRI1 works

Analysing at the atomic level, the crystal structure of the WRI1 protein and the double helix DNA strands to which it binds, the team noticed this DNA binding domain was extensively conserved. This means that there were little to no variations, suggesting it could be a common binding mechanism for many plant species.

Using this crystal structure of WRI1 as the 'target', the team then looked to modify WRI1, to enhance the binding affinity of the protein for its target DNA. The instructions for coding this modified WRI1 protein are then introduced into the target plant cells, after which the plant will use this new 'set of instructions' whenever it produces WRI1.

In lab experiments to observe how the modified WRI1 affects oil accumulation, both the modified protein and the unmodified form were injected into *Nicotiana benthamiana* leaves, and an analysis of triacylglycerol (a major form of dietary lipid in fats and oils) levels was carried out. The modified WRI1 protein generated more significant spikes in triacylglycerol production compared to the control plant introduced with the WRI1 unmodified form.

Subsequent experiments showed that the oil content in the seeds of the modified *Arabidopsis thaliana* contained more oil than the unmodified form. The offspring of this genetically modified plant will also bear the same modified WRI1 protein and produce more oil in their seeds.

Asst Prof Ma, a plant molecular biologist who has been studying WRI1 since his postdoctoral training, said modifying WRI1 to improve its binding to DNA was a logical move for the team.

"We know that WRI1 is a protein that binds to a plant's DNA sequence and sets off a specific chain of instructions that regulates the accumulation of oils in the seeds. The stronger the binding -- the more oil the plant will concentrate in its seeds. Therefore, we chose to improve this portion of WRI1 that binds to its target DNA, which is highly conserved across many seed-bearing plants. Being highly conserved means many species of plants will have the exact same mechanism that can be modified, so we should be able to translate our oil-yielding modification easily to many different types of crops in future." Asst Prof Ma explained.

"Plant seed oil is vital for the human diet and is used in many important industrial applications. Global demand for plant oil is increasing very quickly and our research contributes to efforts to improve seed oil production in a sustainable manner, and potentially reducing the environmental impact of agriculture." Asst Prof Ma added.

Moving forward, the team has filed a patent for their method of gene modification through NTUitive, the University's innovation and enterprise office, and is looking for industry partners to commercialise their invention.

This research is aligned with the NTU2025 strategic plan and the University's Sustainability Manifesto, where it aims to research and develop new technologies towards a greener future.

Giving an independent expert comment, Michael Fam Chair Professor William Chen, Director of Food Science & Technology Programme at NTU, said there are a few ways to tackle world hunger, including by increasing the amount of food produced or increasing the calories and nutritional value of the food produced.

"In a world that has limited arable land for agriculture, advanced technologies to grow more food with higher nutrition value is required if we hope to tackle world hunger. When we can increase the fat content in edible seeds and nuts, a person can eat a lesser amount but still feel full, due to the increase in calories consumed," said Prof Chen, a food security expert who was not involved in this study.

"So instead of growing more crops to feed more people, we should also look at methods where the crops grown have more calories and nutrition, so that the same amount of food can feed more people."

The NTU study is supported by Ministry of Education (MOE) of Singapore Tier 1 and Tier 2 grants, which usually awards research projects on a competitive basis up to $200,000 and $1 million respectively.

Vocabulary

1. patent-pending method –запатентованный метод
2. oil-producing crops– маслопроизводящие культуры
3. under laboratory conditions - в лабораторных условиях
4. to increase the yield –для повышения урожайности
5. a high-resolution structure –структура высокого разрешения
6. to accumulate - накапливать
7. extensively conserved –широко сохранившийся
8. research is aligned with –поиск согласуется с
9. to tackle world hunger - для решения проблемы голода в мире
10. many seed-bearing plants - многие растения, дающие семена

1. Выберите правильный вариант ответа

1. to accumulate

A) to collect

B) to pile up

C) to produce

1. research is aligned with

A) research is discussed

B) research is based on

C) research is conformed with

ТЕКСТ 6

3D-PRINTED ORGANS COULD SAVE LIVES BY ADDRESSING THE TRANSPLANT SHORTAGE

Due to the global organ shortage and limited organ donors, thousands of patients are left wanting organs and tissues in cases of severe injuries, illness or genetic conditions. Many of these patients die before transplants are available.

Tissue engineering is an emerging field that works on producing artificial tissue and organ substitutes as permanent solutions to replace or repair damage.

As biomedical engineering researchers, we are developing 3D temporary organ structures — called scaffolds — that may help regenerate damaged tissues and potentially lead to creating artificial organs. These tissues can also be used in various tissue engineering applications, including nerve repair in structures constructed from biomaterials.

Printing tissue

Approximately 22.6 million patients require neurosurgical interventions annually around the world to treat damage to the peripheral nervous system. This damage is primarily caused by traumatic events such as motor vehicle accidents, violence, workplace injuries or difficult births. It is anticipated that the cost of global nerve repair and regeneration will reach more than $400 million by 2025.

Current surgical techniques allow surgeons to realign nerve ends and encourage nerve growth. However, the incidence of recovery in the injured nervous system is not guaranteed, and the return of function is almost never complete.

Animal studies on rats have shown that if an injury destroys more than two centimetres of nerves, the gap cannot be bridged properly and may result in the loss of muscle function or feeling. In this condition, it is important to use a scaffold to bridge two sides of the damaged nerve, specifically in case of large nerve injuries.

3D bioprinting prints 3D structures layer by layer, similar to 3D printers. Using this technique, our research team created a porous structure made of the patient’s neural cells and a biomaterial to bridge an injured nerve. We used alginate — derived from algae — because the human body does not reject it.

While this technique has not yet been tested in people, once refined, it has the potential to help patients waiting for tissues and organs.

Material challenges

Alginate is a challenging material to work with because it collapses easily during 3D printing. Our research focuses on the development of new techniques to improve its printability.

For nerve repair, alginate has favourable properties for living cells growth and functions, but its poor 3D printability considerably limits its fabrication. It means that alginate flows easily during the printing process, and results in a collapsed structure. We developed a fabrication method where cells are contained within a porous alginate structure that is created with a 3D printer.

Previous research used moulding techniques to create a bulk alginate without a porous structure to improve nerve regeneration; the cells do not like such a solid environment. However, 3D-printing a porous alginate structure is challenging and often impossible.

Our research addresses this issue by printing a porous structure made of alginate layer-by-layer rather than a moulded bulk algiante; such structure has interconnected pores and provides a cell-friendly environment. Cells can easily communicate with each other and start the regeneration while the 3D-printed alginate provides a temporary support for them.

Researchers are going towards the implementation of 3D-printed structures for patients who suffer from nerve injuries as well as other injuries.

After the fabricated alginate structure is implanted in a patient, the big question is if it has enough mechanical stability to tolerate the forces applied by tissues in the body. We developed a novel numerical model to predict the mechanical behaviour of alginate structures.

Our studies will help to understand cell response, which is the main factor to take into account when evaluating the success of the alginate structures.

«THE CONVERSATION», April 6, 2021

1. **Give definition of the following notions:**

Tissue engineering

Severe injuries

Transplant

Organ donor

Organ substitutes

Neurosurgical interventions

Porous structure

Cell-friendly environment

2. **Переведите на английский язык следующие предложения:**

1)Тканевая инженерия- это развивающаяся область, которая занимается производством искусственных тканей.

2)Мы разрабатываем *временные 3D структуры органов*, называемые *каркасами*, которые могут помочь *регенерировать* поврежденные ткани.

3)Современные хирургические методы позволяют хирургам перестраивать *нервные окончания* и *стимулировать рост нервов*.

4)Есть потенциал помочь пациентам, ожидающим *пересадки тканей и органов*.

5)Мы разработали новую *цифровую модель* для прогнозирования механического поведения *альгинатных структур.*

ГЛАВА 5.
ТЕКСТЫ ДЛЯ САМОСТОЯТЕЛЬНОГО ЧТЕНИЯ И ПЕРЕВОДА

СТАТЬЯ 1

BIOTECH VS. BIOENGINEERING: WHAT'S THE DIFFERENCE?

While you might think that biotechnology and bioengineering are pretty much the same thing, they do have some important differences to know about.

This is especially important if you want to start a career in either field because it will help you to choose the best one.

What are examples of biotechnology and bioengineering?

You can find examples of both of these around you. Just look at a glass of wine – technology used to produce wine was developed by biotechnologists. Similarly, if you need an ultrasound, this is an example of bioengineering.

With that in mind, let's explore both biotechnology and bioengineering in greater detail. We'll start by looking at some important differences between them.

The Main Differences Between Biotech And Bioengineering

Biotechnology is focused on life science. Its aim is to create and develop products that can be useful in various industries, such as the food and medical industries.

It makes use of biological systems to create useful products. Biotechnology concentrates on living organisms and how they can be applied to medicine, technology, agriculture, and business.

Bioengineering, on the other hand, makes use of engineering principles to solve problems that arise in medicine as well as biology. It makes use of engineering methods and scientific concepts to find solutions.

Although they are a bit different, the two are definitely connected!

- Biotechnology makes use of technology when studying and using biological systems.
- On the other hand, bioengineering relates to designing and transforming the technology in biotechnology.

To see how this would work in real life, we can say that biotechnology creates the cells that will develop pharmaceutical drugs. Bioengineering, on the other hand, develops a process that will ensure those drugs can be produced faster.

Now that we've analyzed the main definitions of both biotechnology and bioengineering, we can explore both of them in greater detail. Let's start with biotechnology!

The Four Main Types Of Biotechnology

Biotechnology has four main types. These are:

- **Medical biotechnology**, which is focused on using living cells to create new technologies to improve human health. It also makes use of studying DNA to identify genetic disorders and find ways to treat them. Various developments in medical biotechnology include the development of antibiotics and vaccines.
- **Agricultural biotechnology**, which involves developing genetically-modified plants to increase crop yield. An example would be GM crops that are pest-resistant or can grow during droughts. This type of biotechnology also involves finding other ways to make crops healthier, such as by boosting their nutritional value. This can help to deal with the world's hunger problem.
- **Industrial biotechnology**, which makes use of technology for industrial purposes to improve manufacturing processes. It basically makes use of microorganisms and enzymes to create products to make the processes smoother.
- **Environmental biotechnology**, which uses technology to improve the environment. This can take the form of finding innovative ways for waste treatment or the prevention of air, land, and water contaminants.

THERE ARE MANY OTHER TYPES OF BIOTECHNOLOGY!

The four previous types of biotech aren't the only ones – with biotechnology growing and influencing many different fields and sectors, there are always new ones hitting the scene.

Examples of other types of biotechnology include biotechnology in food production and biotechnology that focuses on marine resources. You can find out more about all the types of biotechnology by reading the article "Types of Biotechnology Explained: 4 Biotech Colors."

WHAT ARE THE APPLICATIONS OF BIOTECHNOLOGY?

Biotechnology has applications in a variety of sectors, such as food processing and preservation, agriculture, bio energy, health and medicine, and waste management. The important thing to remember is that biotechnology mainly focuses on the natural sciences.

Taking A Closer Look At Bioengineering

Interestingly, bioengineering and its popularity can be traced back to electrical engineers of the 1950s. It came about as a way to find solutions to various needs, such as the need for replacement organs, as Britannica reports.

Some examples of bioengineering include the engineering of bacteria to produce pharmaceutical drugs and the development of artificial knees and other joints.

Even ultrasounds and other types of medical imaging techniques are examples of bioengineering, which just goes to show how it's had such a huge impact on our lives. There are exciting developments in bioengineering currently underway, such as robotics, genetic engineering, and neural engineering.

Bioengineers are usually employed by a variety of different institutions, such as pharmaceutical companies, medical research institutions, and regulatory agencies

WHAT ARE THE APPLICATIONS OF BIOENGINEERING?

Bioengineering engineering is a field that mainly concerns itself with principles of engineering, such as mechanical, electrical, or chemical engineering, basic sciences such as physics, as well as biotechnology in the form of genetic engineering and tissue engineering.

THE DIFFERENT TYPES OF BIOENGINEERING

Bioengineering uses what biological theory there is to solve problems in the world. It either makes use of biological systems that are already present or it changes them to enhance or improve their effects. There are many different types, or branches, of bioengineering. Let's take a look at them.

- **Medical engineering**. This has the focus of applying engineering principles to medical problems, such as finding ways to replace or heal damaged organs with the use of engineering techniques.
- **Agricultural engineering**. This puts engineering principles to work by using them to solve problems related to biological production and the environment.
- **Bionics**. This concerns the study of living systems so that all the knowledge gained from them can be used to design physical systems. An example of this is the use of prosthetic limbs that can be controlled with artificial intelligence.
- **Biochemical engineering**. This applies engineering principles to microscopic biological systems that create new products, such as producing protein from raw materials. Another example of biochemical engineering is the development of agricultural chemicals to treat and develop food for human consumption.
- **Human-factors engineering.** In human-factors engineering, principles of engineering, psychology, and physiology are applied to the human-machine relationship. In other words, those principles are applied to machines that are designed for our use. An example of human-factors engineering is the creation of the telephone and space suit.
- **Environmental health engineering**. This is when engineering principles are applied to the control of the environment, with the aim of increasing human beings'

health, safety, and comfort. An example includes life-support systems for space exploration.

- **Genetic engineering**. This is all about changing organisms, and it's focused on manipulating DNA or other nucleic acid molecules. This has already led to various products that can help people, such as the development of human insulin to control diabetes.

- **Biomimicry**. This is a fascinating type of bioengineering, which is also known as biomimetics. It applies natural systems to solve complicated engineering problems. An example is how scientists have mimicked the design of termite mounds to create more energy-efficient buildings. This has been adopted in Zimbabwe, with what's known as The Eastgate Building. This commercial block of offices is combined with a shopping mall, but it makes use of internal climate control by its design being similar to that of a termite mound. This makes use of natural processes to ensure that inside the building it's warm during winter and cool during summer, as Environmental Science explains.

Innovation To Pave The Way Forward

While it's clear to see that biotechnology and bioengineering have different purposes, they also intersect and influence each other. In some cases, they can be really similar in what they achieve. Both of them are trying to find more natural solutions to various problems we face in our health and environment.

For example, a marine biotechnologist will be sourcing microorganisms from the ocean to find ways to treat various health conditions, while a bioengineer could be finding inspiration from how termites build mounds in order to innovate the way we construct buildings.

Related Questions

WHAT'S THE DIFFERENCE BETWEEN BIOENGINEERING AND BIOMEDICAL ENGINEERING?

Bioengineering studies applying engineering practices to biology, whereas biomedical engineering is a specialized version of bioengineering. It puts bioengineering theories into practice to help to improve human health.

WHAT IS BIOTECHNOLOGY ENGINEERING?

This makes use of biology as well as chemical engineering principles. Genetic engineering, and cell and tissue culture technologies form part of it.

Conclusion

Biotechnology and bioengineering are linked, but they do have some interesting and important differences.

In this article, we've looked at what they both mean in greater detail as well as explored how they function in the real world and how they connect to find innovative solutions to real-world problems. When technology and biology meet, great things can happen.

(by Brinson Brothers, August 1, 2020

https://biotechhealth.com/biotechnology-and-bioengineering/)

СТАТЬЯ 2

THE FUTURE OF FOOD: INSECTS, GM RICE AND EDIBLE PACKAGING ON THE MENU

As the global population rises and food prices do too, many scientists are looking for alternatives to traditional foodstuffs.

Eating insects

Two billion people around the world, primarily in south-east Asia and Africa, eat insects – locusts, grasshoppers, spiders, wasps, ants – on a regular basis. Now, with food scarcity a growing threat, efforts are being made to normalize the concept of entomophagy, or the consumption of insects, for the other 5 billion. Last year, the UN's Food and Agriculture Organisation (FAO) published a list of more than 1,900 edible species of insects; the EU, meanwhile, offered its member states $3m to research the use of insects in cooking.

Why? Because insects compared to livestock and fish, are a much more sustainable food source. They are available in abundance: for every human on Earth, there are 40 tones of insects. They have a higher food conversion rate than even our fastest-growing livestock (meaning they need to consume less to produce the same amount of meat) and they emit fewer greenhouse gases. As a fast-food option, which is how people treat them in countries such as Thailand, insects are greatly preferable to the water-guzzling, rainforest-destroying, methane-spewing beef burger. They are nutritious too: rich in protein, low in fat and cholesterol, high in calcium and iron.

That leaves the issue of palatability. Insects are generally viewed with disgust in the west, but attitudes are beginning to change. Thanks to adventurous restaurants – Copenhagen's Noma has served up ants and fermented grasshoppers – and pioneering organisations such as Ento in London, we are coming to terms with the notion that insects might actually be nice to eat.

Edible packaging

Our current food system is monumentally wasteful. Last January, a report found that almost half of the world's food is thrown away each year. In the UK alone, according to the government's waste adviser, Wrap, we generate 6.6m tones of food, drink and packaging waste per annum, at a cost of £5bn.

The fight against waste has thrown up some intriguing solutions.

For Harvard bioengineer David Edwards, the answer to the packaging problem is simple: just eat it. Last year, Edwards launched WikiCells, a company that makes edible packaging for fruit juices, coffee, ice cream and other products. Mimicking the design of a piece of fruit, the packaging consists of a soft skin "entirely comprised of natural food particles held together by nutritive ions" encased in a protective outer layer that is edible or at least biodegradable. Not only are the membranes more environmentally friendly than plastic, they are designed to taste good too.

Other packaging innovations promise to lengthen the shelf life of perishables, which would mean a reduction in food and drink waste. Pepceuticals, a company based in Leicester, is developing an antimicrobial film that it claims "should significantly prevent the deterioration of … fresh meat and save waste".

Food replacement and eco-food innovation

One of the hottest trends attracting investors' in Silicon Valley has a lot to do with our future eating habits. A growing number of young entrepreneurs, driven by ecological as well as profit motives, are seeking to replace resource-hungry foods such as meat with synthetic and plant-based alternatives – and the likes of Twitter founders Evan Williams and Biz Stone are giving them financial support.

Their motives are well-founded. With the global population expected to reach 9 billion by 2050, and as western eating habits spread to countries such as China and India, more efficient and environmentally friendly ways are needed to produce protein-rich foods. Imitation meat is not a new concept, but Bay Area innovators, such as Beyond Meat, are making a chicken substitute good enough, they claim, to compete with the real thing. Meanwhile, Hampton Creek Foods, founded by 32-year-old entrepreneur Josh Tetrick, is working on a plant-based replacement for egg yolks to go in muffins, mayonnaise and other sauces.

Augmented-reality kitchens

As the popularity of programmes such as Master Chef and Great British Menu indicates, we have become a nation of food enthusiasts. For every budding culinary genius among us, however, there will always be a kitchen klutz who bungles the recipe and burns everything to cinders. What we need, in the view of Japanese computer scientist Yu Suzuki at Kyoto Sangyo University, is a helping hand from technology. Going several steps further than the online how-to video, Suzuki and colleagues have kitted out a kitchen with ceiling-mounted cameras and projectors that overlay cooking instructions on the ingredients. Detecting the outline of a fish, for example, Suzuki's system will help you fillet it by highlighting where an incision needs to be made.

Meanwhile, Jinna Lei, a computer scientist at the University of Washington, is developing a system that uses depth-sensing cameras to keep track of what the cook is doing. When a mistake is made, the system will prompt the cook to make amends.

While this may sound like good news, some critics believe these innovations will also minimise the basic joys of cooking. Technology writer Evgeny Morozov says: "Such standardisation can make our kitchens as exciting as McDonald's franchises."

Enhanced rice

Thirty years ago, scientists announced the creation of the world's first genetically modified plant. The new technology, it was hoped, would increase crop yields worldwide and ease global malnutrition. Since then, the fortunes of GM food have been decidedly mixed. Its uptake has been limited to just a few countries and many of its promises – including, more recently, the hope that GM crops would help reduce climate change emissions – have yet to be realised.

But in spite of continuing resistance to GM food among environmentalists and those wary of the corporations that control it, breakthroughs are expected.

Next year, it is hoped that golden rice – normal rice modified to produce beta-carotene, which the body converts into vitamin A – will be planted by farmers in the Philippines. If successful, golden rice will help counter blindness and other diseases in children in the developing world.

Meanwhile, another series of enhanced rice varieties is being developed using only conventional plant-breeding techniques. Zhikang Li, the Chinese plant breeder behind green super rice, which produces more grain while proving more resistant to droughts, floods and disease, hopes that his innovation will feed an extra 100 million people.

(https://www.theguardian.com/technology/2013/jun/16/future-of-food-insects-gm-rice-on-the-menu
Killian Fox)

Vocabulary

1. adventurous restaurants- предприимчивые рестораны
2. antimicrobial film – антибактериальная пленка
3. augmented-reality– дополненная реальность
4. be encased in - быть покрытым, заключенным в
5. biodegradable- биоразлагаемый
6. bungle- напортачить, запороть
7. burn to cinders - сгореть дотла, сгореть как спичка
8. ceiling-mounted cameras - камеры, установленные на потолке
9. chicken substitute - заменитель куриного мяса
10. conventional plant-breeding techniques- традиционные методы селекции растений
11. deterioration- порча (продукта)
12. entomophagy- этномофагия (употребление человеком в пищу насекомых)
13. food conversion rate- коэффициент конверсии
14. food scarcity- нехватка продовольствия
15. how-to video- видео-руководство
16. incision- надрез
17. klutz -неумеха, «чайник»
18. live stock- домашний скот
19. locust- саранча
20. make amends- исправить неточности
21. palat ability- вкусовые качества
22. perishables- скоропортящиеся продукты
23. pioneering organisations - новаторские организации (организации-первопроходцы)
24. shelf life - срок хранения
25. spew methan - выделять метан

СТАТЬЯ 3

OUR FUTURE HOPE?

Stem cells are cells found in most, if not all, multicellular organisms. They are characterized by the ability to renew themselves through mitotic cell division and differentiating into a range of specialized cell types. Research in the stem cell field grew out of findings by Canadian scientists Ernest McCulloch and James Till in the 1960s.

The two types of mammalian stem cells are: embryonic stem cells that are found in blastocysts, and adult stem cells that are found in adult tissues. In a developing embryo, stem cells can differentiate into all of the specialized embryonic tissues. In adult organisms, stem cells and progenitor cells act as a repair system for the body, replenishing specialized cells, but also maintain the normal turnover of regenerative organs, such as blood, skin or intestinal tissues.

To ensure self-renewal, stem cells undergo two types of cell division. Symmetric division gives rise to two identical daughter cells both endowed with stem cell properties. Asymmetric division, on the other hand, produces only one stem cell and a progenitor cell with limited self-renewal potential. Progenitors can go through several rounds of cell division before terminally differentiating into a mature cell. It is possible that the molecular distinction between symmetric and asymmetric divisions lies in differential segregation of cell membrane proteins (such as receptors) between the daughter cells.

Stem cells can now be grown and transformed into specialized cells with characteristics consistent with cells of various tissues such as muscles or nerves through cell culture. However, their use in medical therapies has been proposed.

The classical definition of a stem cell requires that it possess two properties:

Self-renewal - the ability to go through numerous cycles of cell division while maintaining the undifferentiated state.

Potency - the capacity to differentiate into specialized cell types.

Properties of stem cells can be illustrated in vitro, using methods such as clonogenic assays, where single cells are characterized by their ability to differentiate and self-renew. As well, stem cells can be isolated based on a distinctive set of cell surface markers. However, in vitro culture conditions can alter the behavior of cells, making it unclear whether the cells will behave in a similar manner in vivo. Considerable debate exists whether some proposed adult cell populations are truly stem cells.

Medical researchers believe that stem cell therapy has the potential to dramatically change the treatment of human disease. A number of adult stem cell therapies already exist, particularly bone marrow transplants that are used to treat leukemia. In the future, medical researchers anticipate being able to use technologies derived from stem cell research to treat a wider variety of diseases including cancer, Parkinson's disease, Alzheimer’s disease, spinal cord injuries, Amyotrophic lateral sclerosis and muscle damage, amongst a number of other impairments and conditions. However, there still exists a great deal of social and scientific uncertainty surrounding stem cell research, which could possibly be overcome through public debate and future research, and further education of the public.

(https://studopedia.info/7-14959.html)

Vocabulary

1. renew themselves – самообновляться, самовосстанавливаться
2. mitotic cell division – митотическое деление клеток
3. mammalian stem cells – стволовые клетки млекопитающих
4. blastocysts – бластоцисты
5. adult stem cells – взрослые стволовые клетки, зрелые стволовые клетки, стволовые клетки взрослого организма
6. progenitor cells – клетки-предшественники, прогениторные клетки
7. replenish – восполнять, пополнять

8. intestinal tissues – ткани кишечника
9. stem cell properties – свойства стволовых клеток
10. differential segregation - дифференциальная сегрегация
11. cell culture – культивирование клеток
12. set of cell surface markers –набор маркеров клеточной поверхности
13. bone marrow transplants – трансплантация костного мозга, пересадка костного мозга
14. amyotrophic lateral sclerosis– боковой амиотрофический склероз

СТАТЬЯ 4

ANTI-CANCER CAR-T THERAPY REENGINEERS T CELLS TO KILL TUMORS-AND RESEARCHERS ARE EXPANDING THE LIMITED TYPES OF CANCER IT CAN TARGET

Teaching the body's immune cells to recognize and fight cancer is one of the holy grails in medicine. Over the past two decades, researchers have developed new immunotherapy drugs that stimulate a patient's immune cells to significantly shrink or even eliminate tumors. These treatments often focus on increasing the cancer-killing ability of cytotoxic T cells. However, these treatments appear to only work for the small group of patients who already have T cells within their tumors. One 2019 study estimated that under 13% of cancer patients responded to immunotherapy.

To bring the benefits of immunotherapy to more patients, scientists have turned to synthetic biology, a new field of study that seeks to redesign nature with new and more useful functions. Researchers have been developing a novel type of therapy that directly gives patients a new set of T cells engineered to attack tumors: chimeric antigen receptor T cells, or CAR-T cells for short.

As an oncology physician and researcher, I believe that CAR-T cell therapy has the potential to transform cancer treatment. It's already being used to treat lymphoma and multiple myeloma, and has shown remarkable response rates where other treatments have failed.

However, similar success against certain types of tumors such as lung or pancreatic cancer has been slower to develop because of the unique obstacles they put up against T cells. In our newly published research, my colleagues and I have found that adding a synthetic circuit to CAR-T cells could potentially help them bypass the barriers that tumors put up and enhance their ability to eliminate more types of cancer.

How does CAR-T cell therapy work?

CAR-T cell therapy starts with doctors isolating a patient's T cells from a sample of their blood. These T cells are then taken back to the lab, where they are genetically engineered to produce a chimeric antigen receptor, or CAR.

CARs are synthetic receptors specifically designed to redirect T cells from their usual targets have them recognize and hone in on tumor cells. On the outside of a CAR is a binder that allows the T cell to stick to tumor cells. Binding to a tumor cell activates the engineered T cell to kill and produce inflammatory cytokines proteins that support T cell growth and function and boost their cancer-killing abilities.

These CAR-T cells are then stimulated to divide into large numbers over seven to 10 days, and then given back to the patient via infusion. The infusion process usually takes place at a hospital where clinicians can monitor for signs of an overactive immune response against tumors, which can be deadly for the patient.

Driving T cells into solid tumors

While CAR-T cell therapy has seen success in blood cancers, it has faced hurdles when fighting what are called solid tumor cancers like pancreatic cancer and melanoma. Unlike cancers that begin in the blood, these types of cancers grow into a solid mass that produces a microenvironment of molecules, cells and structures that prevent T cells from entering into the tumor and triggering an immune response. Here, even CAR-T cells engineered to specifically target a patient's unique tumor are unable to access it, suppressing their ability to kill tumor cells.

For the synthetic biology community, the failures of the first generation of CAR-T cell therapy was a call to action to develop a new family of synthetic receptors to tackle the unique challenges solid tumors posed. In 2016, my colleagues in the Lim Lab at the University of California, San Francisco developed a new synthetic receptor that could complement the first CAR design. This receptor, called synthetic Notch receptor, or synNotch, is based on the natural form of Notch in the body, which plays an important role in organ development across many species.

Similar to CARs, the outside of synNotch has a binder that allows T cells to stick to tumor cells. Unlike CARs, the inside of synNotch has a protein that is released when a T cell binds to the tumor. This protein, or transcription factor, allows researchers to better control the T cell by inducing it to produce a specific protein.

For example, one of the most useful applications of synNotch thus far has been to use it to ensure that engineered T cells are only activated when bound to a tumor cell and not healthy cells. Because a CAR may bind to both tumor and healthy cells and induce T cells to kill both, my colleagues engineered T cells that are only activated when both synNotch and CAR are bound to the tumor cell. Because T cells now require both CAR and synNotch receptors to recognize tumors, this increases the precision of T cell killing.

We wondered if we could use synNotch to improve CAR-T cell activity against solid tumors by inducing them to produce more of the inflammatory cytokines, such as IL-2, that enable them to kill tumor cells. Researchers have made many attempts to provide extra IL-2 to help CAR-T cells clear tumors. But because these cytokines are highly toxic, there is a limit to how much IL-2 a patient can safely tolerate, limiting their use as a drug.

So we designed CAR-T cells to produce IL-2 using synNotch. Now, when a CAR-T cell encounters a tumor, it produces IL-2 within the tumor instead of outside it, avoiding causing harm to surrounding healthy cells. Because synNotch is able to bypass the barriers tumors put up, it is able to help T cells amp up and maintain the amount of IL-2 they can make, allowing the T cells to keep functioning even in a hostile microenvironment.

We tested our CAR-T cells modified with synNotch on mice with pancreatic cancer and melanoma. We found that CAR-T cells with synNotch-induced IL-2 were able to produce enough extra IL-2 to overcome the tumors' defensive barriers and fully activate, completely eliminating the tumors. While all of the mice receiving synNotch modified CAR-T cells survived, none of the CAR-T-only mice did.

Furthermore, our synNotch modified CAR-T cells were able to trigger IL-2 production without causing toxicity to healthy cells in the rest of the body. This suggests that our method of engineering T cells to produce this toxic cytokine only where it is needed can help improve the effectiveness of CAR-T cells against cancer while reducing side effects.

Next steps

Fundamental questions remain on how this work in mice will translate to people. Our group is currently conducting more studies on using CAR-T cells with synNotch to produce IL-2, with the goal of entering early stage clinical trials to examine its safety and efficacy in patients with pancreatic cancer.

Our findings are one example of how advances in synthetic biology make it possible to engineer solutions to the most fundamental challenges in medicine.

(https://theconversation.com/anti-cancer-car-t-therapy-reengineers-t-cells-to-kill-tumors-and-researchers-are-expanding-the-limited-types-of-cancer-it-can-target-196471)

Vocabulary

1. CAR-T - антигенные рецепторные Т-клетки
2. tumor cell – раковая клетка
3. shrink – сокращаться, уменьшатся
4. cytotoxic T cells - цитотоксические Т-клетки
5. synthetic biology- синтетическая биология
6. oncology physician – онколог
7. multiplemyeloma - множественная миелома

8. pancreatic cancer – рак поджелудочной железы
9. synthetic circuit – синтетические цепи
10. to honein – нацеливаться, сосредоточиться
11. inflammatory cytokines proteins – противовоспалительные цитокины – белки
12. overactive immune response – сверхактивный/ гиперактивный иммунный ответ
13. to bypass – проходить через
14. solid tumor cancers – солидные/твердые/плотные раковые опухоли
15. synthetic receptor – синтетический рецептор
16. notch – рецептор, локализированный в клеточной цитоплазме
17. synNotch - синтетический рецептор Notch
18. transcription factor- транскрипционный фактор
19. to induce – стимулировать, подталкивать
20. IL-2 - интерлейкин-2, ИЛ-2
21. to clear tumor – избавиться от/вылечить/удалить опухоль
22. to ampup – усилить
23. hostile microenvironment – враждебная микросреда
24. side effects – побочные эффекты
25. to conduct–проводить, осуществлять, совершать
26. early stage clinical trials- клинические исследования/испытания ранней стадии

СТАТЬЯ 5

NOVEL YEAST-ASSEMBLY TECHNIQUE YIELDS LIVING MATERIALS

Researchers say structures made of the cells could potentially be used to clean up uranium from oceans, heal wounds, and more.

Imagine a bandage that could weave a wound back together near-instantaneously. Or a filter for cleaning toxic spills that could sense and adapt to its environment. These are just some of the applications that may be possible for materials built from living cells.

Engineered living materials (ELMs) can theoretically take on the properties of tissue, meaning they can grow and self-propagate. Previously, scientists have succeeded in engineering cells to come together into moldable materials, but it's been challenging to precisely control and shape how they assemble without chemical modifications that may harm the cells.

While scientists been able to shape ELMs made of bacterial cells by sculpting biofilm-building proteins, directing eukaryotic cells to where they're supposed to go has been more challenging. In a study published in *Science Advances* on November 4, scientists directed genetically engineered baker's yeast (*Saccharomyces cerevisiae*) to assemble into ELMs. With the help of microscopic "tweezers," they were able to precisely control the shape and size of the resulting ELM without chemical modifications.

"It's really difficult to introduce biological functions into materials," says Sara Molinari, a synthetic biologist at Rice University who was not involved in the study. Nevertheless, it was a goal worth pursuing because "yeast are better for certain applications," Molinari explains.

To try and glue eukaryotic cells together, the authors made use of what are known as protein-protein interactions (PPIs) among four synthetic proteins previously derived from bacteria. These interactions, as their name suggests, cause proteins to clamp onto each other extremely tightly. The proteins come in pairs that form strong PPI bonds with one another, like a lock and key: SpyTag and SpyCatcher, and Im7 and CL7. The researchers also took advantage of yeast's natural tendency to form colonies via weak interactions.

The team cloned genes encoding SpyTag, SpyCatcher, Im7, and CL7 into yeast, which then began to express these proteins on their extracellular membranes. Then, the researchers used optical tweezers—a noninvasive technique that uses lasers to manipulate living cells—to bring individual yeast cells containing complementary PPI-forming proteins together and to break other cells apart. These tweezers allowed researchers to measure the strength of interactions among the cells while both controlling and assessing the nature of the assembly of living cells at the microscopic level.

After an ultra-strong PPI is formed between two yeast cells, the cells continue dividing, forming more ultra-strong bonds with their daughter cells.

This technique could be used to produce self-propagating ELMs that have useful functions, such extracting uranium from seawater, which could be used as a renewable source of nuclear power, according to the paper. The researchers engineered production of a uranium-sequestering protein in the yeast and found that the material continued to grow and produce more of the protein. "There is a huge uranium reserve in the oceans," writes Fei Sun, a chemist and biological engineer at the Hong Kong Science and Technology University, in an email to *The Scientist*. "Self-growing ELMs, with their abilities to produce efficient uranium-binding ligands, may provide cost-effective solutions to the challenges facing chemical separation and energy industries." Sun led the study along with colleagues Richard Lakerveld, a chemical engineer, and Jinqing Huang, a biophysican chemist.

The researchers also successfully cloned a sticky, water-resistant molecule derived from the marine blue mussel (*Mytilus edulis*) into a separate batch of yeast that also contained SpyTag and SpyCatcher. These cells effectively glued themselves to a variety of things, including skin and glass. "The resulting ELMs turned out to be extremely effective bioglues" that could be used for wound healing, says Sun.

"Engineered living materials . . . [have] the promise to revolutionize the field of materials," and new applications such as the ones described in this study are "encouraging," Molinari says. However, she points out that the ELMs assembled using this method are still less than 20 microns in diameter, and there's likely further research that needs to be done before yeast can be formed into large, macro-scale ELMs.

“Overall, the ability to functionalize individual cells with genetic engineering and precisely assemble them into structured materials with microfluidics and optical tweezers provides a rich platform for new classes of advanced materials,” Sun says.

(https://www.the-scientist.com/news-opinion/novel-yeast-assembly-technique-yields-living-materials-70790)

Vocabulary

1. chemical modifications-отклонения в химическом составе
2. microscopictweezers-микроскопический пинцет
3. gluecells-соединять клетки
4. previously derived from bacteria-ранее полученный из бактерий
5. Extracellular membranes- внеклеточные мембраны.
6. ultra-strong bonds- сверхпрочные связи
7. self-propagating - самораспространяющийся
8. sequestering protein-секвестрация (изолирование, отторжение) белка
9. ultrahigh-affinity-близкое родство
10. uranium-binding ligands- ураносвязывающие лиганды
11. water-resistant molecule-водостойкая молекула
12. batch of yeast –колония дрожжей microfluidics
13. microfluidics-микрофлюидика
14. weak interactions- слабые взаимодействия.
15. spills-разливы
16. take on the properties-приобретать свойства
17. biofilm-building-создание биопленки
18. noninvasive technique-неинвазивный метод
19. advanced material-усовершенствованный материал

СТАТЬЯ 6

FIVE AMAZING WAYS REDESIGNING BIOLOGICAL CELLS COULD HELP US FIGHT CANCER

Cancer is the leading cause of death in the world. It occurs when mutations in our cells lead to unchecked growth. But what if we could engineer biological cells to fight back?

Synthetic biology is a rapidly developing discipline that allows us to encode new computational capabilities into DNA. In the same way that electronic circuits are made from components such as resistors and diodes with well defined functions, synthetic biologists make use of an ever growing library of genetic parts with functions such as switches and sensors. Using this toolkit, cells can be reprogrammed to detect and destroy tumours.

Here are five remarkable ways that synthetic biology could help us treat cancer in the future.

1. A tattoo for all cancers

Solid tumours within the body are often not detected until they are significantly developed. Increased calcium in blood is a signature of many cancers. Focusing on this, a group at Eidgenössische Technische Hochschule (ETH) Zurich have engineered cells to detect elevated levels of calcium in blood. Implanted under your skin, these engineered cells will respond to increased calcium levels by secreting melanin that cause the skin to darken. The hope is that these cells will temporarily tattoo the body, indicating that there is a potential problem needing further investigation.

2. Don't miss the target

Once cancer has been detected, killing cancerous cells while sparing healthy ones is the next challenge. Researchers have built biological systems which mimic the behaviour of electronic logic circuits. DNA sequences can be designed that only produce a desired output when all of the necessary inputs are present.

In this case, one such "genetic logic circuit" has been developed to sense several microRNAs produced by cancerous growth, and thereby distinguish between healthy and tumour cells. Only when all of the microRNAs are present will the circuit produce the output, a single protein that causes the cancer cell to self-destruct. By detecting several signals, the chances of misclassification are reduced.

This treatment can be delivered by standard gene therapy techniques such as engineered viruses, which will spread through the body and "infect" cells with the genetic logic circuit.

3. Rebooting the immune system

Cancer cells have the dangerous ability to evade our immune systems. Given this, one approach to treat cancer is immunotherapy, which aims to stimulate the immune system to attack cancer cells. A group at Massachusetts Institute of Technology (MIT) recently engineered a gene circuit that identifies ovarian cancer cells. In this case, once cancer cells are identified, the circuit essentially paints a biological bulls eye on them, directing the immune system to destroy the cancer. The advantages of this approach over existing immunotherapies are that a greater number of markers can be tested and more specific therapies achieved.

4. Reprogrammed microbes

Some types of bacteria, such as Salmonella, can live happily inside the tumour environment. These microbes can be engineered to detect and destroy tumours. One study, led by teams in San Diego and MIT, turned a probiotic strain of bacteria into a biosensor that could detect cancers in the liver and subsequently be detected in the urine with a simple colour change test. This type of system could in principle provide a non-invasive early warning screen for tumour developments. In another study by the same groups, weakened Salmonella strains were engineered to release an anti-tumour toxin into the tumour environment. The uniqueness of this system over previous approaches was that the gene circuit within the bacteria produced cycles of drug delivery, thus allowing larger therapeutic doses over a longer time period.

5. Broccoli has never tasted so good

We all know that eating greens is good for us, but engineered bacteria can make them even healthier. A group from National University Singapore (NUS) engineered common probiotic bacteria to stick to colorectal cancer cells and convert a chemical in cruciferous vegetables, such as broccoli, into a strong anti-tumour agent. They demonstrated successful conversion of food intake into the drug and a significant reduction in tumour size using their treatment. Such an approach could be used as a preventative measure to stop tumours forming and also after surgery to clean up any remaining tumour cells.

Future challenges and goals

So far, the majority of these approaches have been tested using simplified tumour models in mice. So, care must be taken when extrapolating to human treatments. But as a first step they have undoubtedly shown great promise. Big challenges, particularly in the case of engineered microbes, are containment - ensuring engineered microbes don't survive in the natural environment - and dealing with evolutionary pressures, which render the microbes ineffective. It is now clear that these challenges are not insurmountable and clinical trials of engineered bacterial therapies are already proceeding.

Synthetic biology will enable ever more sophisticated ways to treat cancer. These, combined with the knowledge generated from understanding how tumours evolve, provide hope that a significant reduction in cancer deaths can be achieved in the not too distant future.

(https://www.pakistaneconomist.com/tag_dna/)

Vocabulary

1. redesigning - перепроектирование
2. computational - вычислительный
3. electronic circuits – электронныецепи
4. solid tumours – солидные опухоли

5. genetic logic circuit - генетическая логическая цепь
6. gene therapy – генная терапия
7. ovarian cancer cells – раковые клетки яичников
8. non-invasive - неинвазивность
9. uniqueness - уникальность
10. engineered viruses – сконструированные вирусы
11. biological bulls eye - биологический бычий глаз
12. colorectal cancer- рак толстой кишки
13. salmonella - сальмонеллы
14. extrapolating - экстраполирование
15. Common probiotic bacteria - распространённые пробиотические бактерии
16. significant reduction – значительное сокращение
17. cruciferous - крестоцветные
18. synthetic biology – синтетическая биология
19. insurmountable–непреодолимый

ИТОГОВЫЙ ТЕСТ

1) ________________ is an end product of cellular respiration in organisms that obtain energy by breaking down sugars, fats and amino acids with oxygen as part of their metabolism.

a) nitrogen

b) oxygen

c) carbon dioxide

2) A __________ is a group of two or more atoms held together by attractive forces known as chemical bonds

a) quark

b) molecule

c) proton

3) __________ is the biochemical and physiological process by which an organism uses food to support its life.

a) hibernation

b) nutrition

c) photosynthesis

4) ___________are essential nutrients for the human body.

a) proteins

b) tissues

c) acids

5) In the context of nutrition, a __________ is a chemical element required as an essential nutrient by organisms to perform functions necessary for life.

a) bacteria

b) mineral

c) cell

6) ________________can be very detrimental to living organisms, as it destroys the structure of DNA.

a) UV light

b) solar power

c) radiation energy

7) Obtaining new _______________ varieties of agricultural crops with useful properties is now strongly criticized in society.

a) improved

b) genetically modified

c) pollinated

8) The role of _____________in solving global problems of mankind is to prevent the degradation of the habitat.

a) biotechnology

b) cloning

c) radiophysics

9) ______________ were invented to treat bacterial diseases.

a) pesticides

b) biologically active additives

c) antibiotics

10) The _______ is the totality of hereditary material contained in the cell of an organism.

a) genome

b) mitochondria

c) cell nucleus

11) In mammals, including humans, circular _______ is present in the mitochondrial genome.

a) DNA

b) cell

c) biomolecules

12) Amino _______ are organic compounds that contain both amino and carboxylic acid functional groups.

a) steroids

b) acids

c) fats

13) _________ is a penetrating form of high-energy electromagnetic radiation.

a) EKG

b) CT

c) X-ray

14) Fats in organism are also known as _______

a) metals

b) lipids

c) radicals

15) ___________ is a pathological condition, which is characterized by the cessation of cell activity in soft tissues under the influence of pathogens.

a) cirrhosis

b) apoptosis

c) necrosis

16) Match English and Russian equivalents for the phrases

1. stiffness
2. viscoelastic
3. fluids
4. creep
5. torsional stress
6. tensionalstress(tensile)

a. жидкости

b. напряжение при растяжении

c. ползучесть

d. вязкоупругий

f. напряжение при скручивании

g. жесткость

17) Choose the correct Russian equivalents to English words.

Matrix network.

A. Матричная сеть

B. Внеклеточная сеть

C. Нуклеиновая сеть

18) Choose the correct Russian equivalents to English words.

Anisotropic.

A. Анатомический

B. Аморфный

C. Анизотропный

19) Choose the correct Russian equivalents to English words.

Elasticity.

A. Вязкость

B. Пластичность

C. Упругость

20) Choose the correct Russian equivalents to English words.

Mechanotransduction.

A. Топография

B. Механотрансдукция

C. Мофология

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