Safety Manual

2024

March 2024

Fuchu Campus,

Tokyo University of Agriculture and Technology

Introduction: Staying Safe at the University

A wide variety of experiments and practical training are conducted each day as part of the educational curricula in the Faculty of Agriculture at the Tokyo University of Agriculture and Technology (TUAT). Since these activities can lead to various accidents such as fires, contamination by poison, electric shock, accidents involving large machinery or large animals, infection by microorganisms, and the release of hazardous substances into the environment, you should be aware that serious accidents are very possible. Accidents may also occur during physical education and extracurricular activities. This manual describes specific methods for conducting education and research activities without accidents, as well as measures to take if an accident unfortunately does occur.

To conduct activities safely, you must consider: 1) your own safety, 2) the safety of those around you, and 3) the safety of the community. Protecting your own safety during activities is obvious. The safety of those around you is also a duty, since accidents can also endanger their lives. Furthermore, because the university exists and operates within the community, it has a responsibility as a member of that community to keep the greater community safe. If the university operates separately from the community and threatens its safety, it could face social sanctions, which may lead to the suspension of university activities. This manual considers safety from these three perspectives and describes various accidents that may affect our safety.

A close examination of past accidents reveals that even minor things such as a lack of preparation to prevent accidents or cumulative minor carelessness can often cause major accidents. To ensure safety, it is therefore necessary to think about accident prevention every day and to always exercise extreme caution when conducting experiments and practical training.

The three principles of accident prevention are: 1) to wear appropriate equipment and clothing; 2) maintain and inspect all machinery and equipment, and organize the activity areas for experiments and practical training; and 3) adhere to basic procedures. This manual describes various methods for preventing accidents and ensuring safety in detail. It also describes measures to take in the unfortunate event of an accident.

It is vital to be familiar with emergency measures related to accidents. Checking this manual for the locations of fire extinguishers and fire alarms or the proper escape route after a fire breaks out is too little and too late, so please learn this information beforehand. Knowing appropriate first aid measures to conduct in an emergency may also be the difference between life and death.

The Faculty of Agriculture prepared this manual with the hope that the standard safety methods listed will help you conduct safe educational and research activities. Compiling knowhow on how to conduct experiments and practical training while preventing accidents is also part of the university's educational contents. We hope you will use this manual to pick up the necessary safety knowledge.

Before Entering the Laboratory

Below are the most key precautions common to all departments. Safety measures specific to each department, major and facility will be described later.

● Always wear protective goggles, gloves, lab coats and other gear appropriate for the experiment

Since many accidents may occur due to other people's experiments, be sure to wear protective equipment to protect your eyes and skin while in a laboratory, even if you are not conducting an experiment.

● No eating or drinking

Laboratories contain various chemicals and other substances, and they may have been spilled on laboratory tables. If you eat or drink in a laboratory, you may accidentally ingest these chemicals or substances, so do not do so.

● No distractions while conducting experiments

Chatting, listening to music, operating cellphones, and the like while conducting experiments can distract your attention and lead to accidents, so take the experiment seriously and focus on it.

● Confirm where emergency exits and secure evacuation routes are

Quick, safe evacuation is necessary when an accident occurs. Make sure the laboratory is always clean and organized to ensure swift evacuation.

● Precautions for conducting experiments on Saturdays, Sundays, holidays and at night

The university cannot respond to emergencies or reports of suspicious persons on campus during the times mentioned above. Please schedule your experiments during the daytime hours on weekdays except in unavoidable circumstances.

● Never conduct experiments if you are not feeling well

Poor health may affect your concentration adversely. This can lead to accidents, so rest up until you recover and review your experiment plan to reduce your burden.

Contents

1. Personal Accident Insurance for Students Pursuing Education and Research and Liability Insurance for Students

I. Personal Accident Insurance for Students Pursuing Education and Research

The Personal Accident Insurance for Students Pursuing Education and Research package provides protection for students who are injured due to disasters or accidents during university classes or extracurricular activities. TUAT requires all students to enroll in this insurance.

1. Enrollment

New students complete membership procedures for the prescribed years of study when they enroll in the university. Students enrolled in the university for more than the prescribed period of study, due to a lack of credits for graduation or the like, must renew membership annually.

2. When insurance benefits are paid

(1) When a student suffers bodily injury as a result of a sudden and accidental external accident during TUAT's educational and research activities.

"Educational and research activities" refers to the following:

1) During regular classes

This refers to lectures, experiments, practical training, exercises, or practical skill courses (hereinafter collectively referred to as "classes"), and also includes the following activities:

a) While engaged in thesis or dissertation research under the direction of an academic advisor. However, this excludes the period when the student is engaged in such activities exclusively at places related to the student's personal life.

b) While preparing for or cleaning up after classes as directed by an academic advisor, or while conducting research activities in the place where the class is held, or at a TUAT library, reference room or language-learning facility.

c) While taking regular courses at other universities in accordance with the provisions of Article 28 of the University Establishment Standards and Article 15 of the Graduate School Establishment Standards.

"Other universities" includes universities in foreign countries.

2) During university events

While participating in university events that are part of educational activities, such as entrance ceremonies, orientations and graduation ceremonies the university organizes.

3) While in a university facility other than 1) or 2) above

While in facilities owned, used or managed by TUAT for educational activities. However, this excludes: accidents that occur while the student is in a university dormitory, that occur at a time or location prohibited by TUAT, or that occur while conducting activities TUAT prohibits.

4) During TUAT-approved extracurricular activities outside university facilities

While engaged in cultural or athletic activities under the supervision of a TUAT-approved TUAT student organization in accordance with the prescribed procedures as stipulated in the university's rules and regulations. (However, the scope of the insurance coverage is limited.)

(2) When a student suffers bodily injury as the result of an accident while commuting to and from the university, or while traveling between university facilities, etc.

1) While commuting to and from the university

While traveling between the student's residence and university facilities by a reasonable route and method (excluding methods TUAT prohibits) for the purpose of participating in university classes, events or extracurricular activities.

2) While traveling between university facilities

While traveling by a reasonable route and method (excluding methods TUAT prohibits) between facilities owned, used or managed by TUAT for education and research, and locations where classes, university events or extracurricular activities are held.

3. Types of insurance benefits and amount

Coverage scope	Death benefit	Physical disability benefit	Medical benefit	Additional hospitalization benefits
During regular classes and university events	20 million yen	1.2 million to 30 million yen	For one or more days of treatment 3,000 to 300,000 yen	4,000 yen per day
While in university facilities for purposes other than extracurricular activities	10 million yen	600,000 to 15 million yen	For four or more days of treatment 6,000 to 300,000 yen	4,000 yen per day
During extracurricular	10 million yen	600,000 to 15 million yen	For fourteen or more days of treatment	4,000 yen per day

activities approved by TUAT, both inside and outside university facilities			30,000 to 300,000 yen	
While commuting	10 million yen	600,000 to 15 million yen	For four or more days of treatment 6,000 to 300,000 yen	4,000 yen per day
While traveling between university facilities	10 million yen	600,000 to 15 million yen	For four or more days of treatment 6,000 to 300,000 yen	4,000 yen per day

Note: "Days of treatment" refers to the actual number of days of treatment (actual number of days of hospitalization or hospital visits) during the period from the date treatment starts for an injury you suffered until the date of recovery to the extent you are able to engage in normal life activities again. It does not cover the entire period of treatment.

4. When insurance benefits are not paid

Injuries caused by intentional actions, fights, criminal activities, illnesses, earthquakes, volcanic eruptions, tsunamis, wars, riots, radiation or radioactivity, or injuries caused while driving without a license or under the influence, or while playing dangerous sports as extracurricular activities outside of university facilities.

Accidents that do not meet the conditions of sudden, accidental or outpatient treatment, such as acute alcohol intoxication due to drinking, are also not covered.

5. Insurance premiums and period (prescribed years of study)

Category	Insurance period	Insurance premiums	Remarks
Undergraduate students	Two years	1,750 yen	Transfer to the Faculty of Agriculture in the third year
	Four years	3,300 yen	Departments of the Faculty of Agriculture other than the Cooperative Department of Veterinary Medicine
	Six years	4,800 yen	Cooperative Department of Veterinary Medicine, Faculty of Agriculture (including the special clause related to infections)
Graduate students	Two years	1,750 yen	Graduate School of Agriculture master course
	Three years	2,600 yen	United Graduate School of Agricultural Science
	Four years	3,370 yen	Graduate School of Agriculture (four-year course) doctoral course (including the special clause related to infections)
Research or non-degree students	Study period For one year	1,000 yen	

6. Notifying the university about an accident and filing an insurance claim

(1) Notifying the university of an accident (using the designated postcard)

When an accident covered by insurance occurs, you must immediately notify the administrative section of your affiliation (see below) of the date, time, place, situation and extent of your injury. **Please note that insurance claims may not be paid if the notification is not submitted within thirty days of the accident.** (See Article 18 of the Insurance Terms and Conditions.)

(2) Claims for insurance benefits (make claims using the designated form)

Insurance benefit claim form (and accident certificate), medical certificate (if the billing amount is 300,000 yen or more), etc.

7. Transfers

If you withdraw from the university or take a leave of absence of one year or more during the insurance period, the difference in premiums will be refunded upon request.

8. Administrative offices for insurance matters

Affiliation	Remarks	Extension
Faculty of Agriculture Graduate School of Agriculture	Student Support Section, Fuchu Student Support Office	042-367-5579
United Graduate School of Agricultural Science	United Graduate School of Agricultural Science Office	042-367-5670
Graduate School of Bio-Applications and Systems Engineering	Educational Affairs Section, Office of Graduate School of Bio-Applications and Systems Engineering	042-388-7217

II. Liability Insurance for Students

Liability Insurance for Students is provided to compensate for injuries to others or damage to the property of others caused by student activities. TUAT requires all students to enroll in this insurance.

1. Enrollment

New students complete membership procedures for the prescribed years of study when they enroll in the university. Students enrolled in the university for more than the prescribed period of study, due to a lack of credits for graduation or the like, must renew membership annually. Insurance premiums, coverage and the like vary depending on the insurance policy you are enrolled in. For details, please check the “Enrollment Procedures” notification sent at the time of the enrollment.

2. Notification and Safety for Off-Campus Research, Tours, Practical Training, etc.

1. Advance notification for off-campus research, tours, practical training, etc.

When conducting research, tours, practical training, laboratory seminars, or attending conferences and the like as part of classes, thesis or dissertation research and other university research and educational activities outside of the university campus, such as outdoors, other research institutions, and general accommodations, for domestic locations **you must submit a Off-Campus Research Notification (Domestic) (Appendix A-1) by the deadline.** If you must send a letter of request for tours, practical training or the like, also attach a **Off-Campus Research Notification (Domestic) (Appendix A-2)**.

For overseas locations, **you must submit a Notification of Going Abroad (Appendix B) (double-sided form) by the deadline.**

If you must send a letter of appreciation to the other institution after conducting the abovementioned off-campus research, **be sure to submit Conducting Off-Campus Research (Report) (Appendix C).**

If you will be conducting surveys, experiments, practical training, etc. at another institution for a certain period of time, you must submit an application for consignment of research guidance and other necessary documents to the other institution to clarify who is responsible for research guidance. **Your academic advisor is required to submit an Application for Consignment of Research Guidance at Off-Campus Institutions (Appendix D) to the university.** The Faculty of Agriculture or the Graduate School of Agriculture will then issue a letter of entrustment. In many cases, the format of the application for consignment of research guidance or the like is designated by the other institution.

How to submit a notification

This notification is important for preventing accidents and for TUAT to take appropriate measures (such as applying for insurance) in the event that an accident occurs. You can submit it through the following methods:

・ Via the SIRIUS bulletin board

SIRIUS > Portal > Various Applications > New Application > Submit the off-campus research notification common to the Faculty of Agriculture and the Graduate School of Agriculture

・ Hardcopy

Download and print the form from the following website, fill in the necessary fields, and submit it to your academic advisor

https://sites.google.com/go.tuat.ac.jp/nou-kyomu-01/gakugai

Types of notifications

Types	Deadline	Where to submit
・Domestic: Off-Campus Research Notification (Domestic) (Appendix A-1) If a letter of request is required, attach Appendix A-2 If the student will be driving, attach Appendix A-3 Note: The form for the Hands-on Practice in Veterinary Public Health is different, so please ask your instructor for specific directions.	Please submit this by the day before the date of the off-campus research and educational activities. However, if a letter of request is required or if you wish to earn credits, by one month prior	**For off-campus research:** Educational Affairs Section, Fuchu Student Support Office akyomu1@cc.tuat.ac.jp Ext: 5059 **For Notification of Going Abroad:** Admissions Section, Fuchu Student Support Office akyomu1@cc.tuat.ac.jp Ext: 5659
・Overseas: Notification of Going Abroad (Appendix B) (double-sided form)	By two weeks prior to the departure date	
・Conducting Off-Campus Research Report (Appendix C)	Immediately after the off-campus research and educational activities are conducted	
・Application for Consignment of Research Guidance at Off-Campus Institutions (Appendix D)	By one week prior to sending the application to the other institution	

Most of the forms can be downloaded from the Nougakubu Kyoumu Web site.

Please refer to the following site for these translated forms. Please use the Japanese version for submission

▸Nougakubu Kyoumu Web site (Please log in using your TUAT-ID)

https://sites.google.com/go.tuat.ac.jp/nou-kyomu-01/%E3%83%9B%E3%83%BC%E3%83%A0

Notes:

1. Students of the United Graduate School of Agricultural Science must submit a Notification Form for Research Outside the Campus for domestic off-campus research and educational activities. You must submit the Notification of Going Abroad and Written Pledge regarding International Trips for overseas off-campus research and educational activities. Please submit these documents to the United Graduate School of Agricultural Science Office.

   You can download the necessary forms from the United Graduate School of Agricultural

Science website.

https://www.tuat.ac.jp/uni-grad/en/yoshiki/index.html

2. Students traveling abroad are required to purchase their own overseas travel insurance (in principle, overseas travel insurance coupled with Gakkensai or Futaikaigai) to ensure that they are adequately compensated in the event of an emergency.

In addition, you must submit a Written Pledge regarding International Trips as part of the procedure for enrolling in the Japan IR&C Support Service* of the Japan IR&C Corporation, with which the university has concluded a basic contract for crisis management.

*Overseas relief activity services

2. Traffic safety measures

Be aware that the environment is very different for off-campus classes. You must not forget that commuting to and from a research site is part of the class. While you may be part of the masses while you are off-campus and must act accordingly, remain aware of your status as a TUAT student. In particular, students driving university vehicles must follow the TUAT Graduate School of Agriculture and Faculty of Agriculture Vehicle Operation and Management Policy.

A wide variety of vehicles such as buses, cars, motorcycles and bicycles are driven on roads according to different traffic rules, and you must be cautious since some drivers may disregard those rules. In particular, be aware of distractions that large numbers of pedestrians and loud noise create. In urban areas, children, the elderly and other people behave in their own unique ways.

Even if it seems safe, be aware that your judgment may be wrong. There is always a possibility of getting involved in an accident. Automobiles may be running at faster speeds in seemingly quiet areas such as mountainous areas, for example, so always remain cautious.

（付表A－１）

学　外　研　究　届（国　内）

農学府長・農学部長　殿

西暦　　年　　月　　日

下記のとおり、学外（研究・教育）活動について安全管理の指導を講じた上、実施することをお届けします。

安全管理の実施 参加学生に対し指導教員が講ずるべき事項	①災害傷害および賠償責任保険の加入確認・指導 ②連絡方法・救急具の携行等、事前の安全教育の実施 ③学生が自動車運転を行う場合、本届に自動車運転許可申請書を添付し、農学府・農学部長の許可を得る 指導教員名（自署） 【内線番号：　　】

記

日程	西暦　　年　　月　　日（　　）～　　年　　月　　日（　　）※１週間以上は日程表を添付のこと。	
行先	名　称	
	所在地	TEL：
同行教員または研究先での指導者	（無・有）氏名：	所属：
目的（内容）		

※多数の場合は、同じ内容の名簿を添付のこと

※参加学生	学科・専攻	学籍番号	氏名	災害傷害 及び、賠償保険の加入（注1）
				□学研災　□学研賠または学賠
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				□学研災　□学研賠または学賠

自動車利用状況	□　学生の自動車運転あり（↓チェック）　　□　自動車は利用しない
	運転者： □本学学生（本届に自動車運転許可申請（付表A-3)を添付済み□）

単位修得を希望する者は、実施日の１ヶ月前までに、「科目履修登録届」を提出
SIRIUS農教務サイト>履修申請・単位認定

注1. 学生は、本届の提出前に必ず災害傷害保険及び賠償責任保険に加入していること。
災害傷害：学研災(学生教育研究災害傷害保険)　賠償保険：学研賠(学研災付賠償責任保険)，学賠(学生賠償責任保険・生協)

注2.【保険加入の確認、問合せ及び保険加入手続きの窓口】　学生生活係

注3.【本届の提出場所】 府中地区学生支援室　教務係（SIRIUS内）

注4.【本届の提出期日】 **実施日の前日迄**　但し、依頼状が必要な場合、単位修得を希望する場合→1ヶ月前迄

注5.　礼状の送付は、（付表C）実施報告書の提出があった場合にのみ発行する。

注6.　学生が自動車運転を行う場合、本届と共に自動車運転許可申請書を提出のこと。

学外研究届（国内）（付表A－２）

（依頼状等の送付が必要な場合は学外研究届に必ず添付すること。）

学外研究・実習等に伴う依頼状等の送付先

種類	□調査　□見学　□実習　□インターンシップ

１．依頼状

文書宛名（農学部府長名で依頼を行うため、主に所長・課長等の機関長・所属長名を記載する）

機関名：	
役職：	氏名：

送付先宛名（※手続き担当者等、文書宛名と異なる場合は記載する）

所属部署名：	
役職名：	氏名：
〒	

２．その他送付書類　（有で、すでに提出済みの場合はその旨を記載する）

□　無

□　有　（　□申請書　□誓約書　□保険加入証明書　□覚書　□他　　）

その他送付書類を一緒に提出する（指示があった）場合は窓口へ提出

（付表A－３）

自動車運転許可申請書

農学府長・農学部長　殿

西暦　　年　　月　　日

下記のとおり、学生の自動車運転について、許可願います。

指導教員名 （自署） 内線：　　】

記

日　程	西暦　　年　　月　　日（　　）～　　年　　月　　日（　　） 日間
行　先	

	学科・専攻	学籍番号	氏　名
運転者①			
	□実質運転歴2年以上　□責任５０%以上の人身事故歴２年以上なし　□体調良好		
運転者②	学科・専攻	学籍番号	
	□実質運転歴2年以上　□責任５０%以上の人身事故歴２年以上なし　□体調良好		
運転者③	学科・専攻	学籍番号	
	□実質運転歴2年以上　□責任５０%以上の人身事故歴２年以上なし　□体調良好		
運転者④	学科・専攻	学籍番号	
	□実質運転歴2年以上　□責任５０%以上の人身事故歴２年以上なし　□体調良好		
同乗者①			
同乗者②			
同乗者③			
同乗者④			

自動車の種類　　自家用車（所有者　　）・レンタカー

□使用する自動車は、運転者が被保険者となる十分な補償内容（対人無制限・対物・同乗者傷害）を備えた任意保険に加入している。

（レンタカーの場合は、上記の条件を満たす自動車保険に加入する）

自動車運転許可対象学生	**以下の対象学生が申請手続きを行い、自動車運転許可の要件※を満たす者に農学府・農学部長は自動車運転を認める。** ①　**指導教員（指導者）が同行しない場合、**大学院生（獣医5年次以上含む）の運転を認める. （学部生（獣医は4年次以下）・研究生は認めない）　なお、学部生以上の同乗者を同乗させること. ②　**指導教員（指導者）が同行するが自動車運転をしない場合、**大学院生・学部４年次生（獣医5年次以上）・研究生の運転を認める.　　（学部3年次（獣医4年次）以下は認めない） ※　・実質運転歴2年以上　・責任50%以上の人身事故歴2年以上なし　・体調良好の者

注1. 学生は、本届の提出前に必ず災害傷害保険及び賠償責任保険に加入していること。

災害傷害：学研災(学生教育研究災害傷害保険)　賠償保険：学研賠(学研災付賠償責任保険),学賠(学生賠償責任保険・生協)

2.【保険加入の確認、問合せ及び保険加入手続きの窓口】　学生生活係

3.【本書の提出場所】 府中地区学生支援室　教務係（SIRIUS内）

4.【本書の申請期日】 **実施日の前日迄　（学外研究届と共に提出）※申請の提出が遅れた場合、運転の許可を認めない。**

5.　申請の結果、不許可になった場合に限り、指導教員および申請学生（学生メールアドレス）にメールで連絡を行う。

(付表B)
Front Page

渡　航　届
Notification of Going Abroad

農学府長・農学部長　殿

Year　Month　Day
年　月　日

下記のとおり、学外（研究・教育）活動について安全管理上の措置を講じたうえ、実施することをお届けします。

指導教員名（自署） Department Chair or Supervisor (Signature)
【内線番号(TEL)：　】

学科 専攻 Affiliation	年次 Grade	学籍番号 Student ID No.	
		氏名 Name	
		国籍 Nationality	

日程 Schedule	From　Year　Month　Day ～		To　Year　Month　Day	
行　先 Destination	名　称 Institution Name			
	渡航先・国 Country		都市名 City	
研究先での指導者 Instructor	(無・有) 氏名： No・Yes　Name		所属： Affiliation	
同行者 Accompanying instructor	(無・有) 氏名： No・Yes　Name		所属： Affiliation	
旅費・修学費等の支弁 Financial Support	☐ 本学 / 国の公的機関からの支援 【支援先：　】 From　TUAT　/　Government ☐ 招へい先の支援 From Partner Institution		☐ 自費・民間奨学金、その他 Own Fund / From Private Scholarship / Other	

目的 Purpose

内容・プログラム名　：
Research theme・Program title

(関連項目に✔を記入) Please mark ☑ to your purpose.

☐卒業および修士論文 Research for Thesis　☐学会発表 Academic Presentation　☐インターンシップ Internship

☐授業科目名 【　】 ☐他 【　】
Taking class　↑course / class name　Other

単位修得の希望　：無No　・有Yes　→　「SIRIUS農教務サイト＞学外実習等履修」を参照し、必要な手続きをしてください。
Credit Transfer Request　Please refer to the Agricultural education website and follow the necessary procedures.

渡航中の緊急連絡方法（Emergency Contact During Travel）：連絡のとれるTEL、E-mailを記入して下さい。

個人所有の携帯電話 Personal Mobile Phone	TEL:	E-mail:

その他の連絡先 Emergency Contact

☐研究先Reserch Inst ☐宿泊先Accomodation ☐その他Other　(　)	名称Name：
TEL※:	E-mail:
☐研究先Reserch Inst ☐宿泊先Accomodation ☐その他Other　(　)	名称Name：
TEL※:	E-mail:

※国番号も入れてください(Please include Country Number)

☐	安全管理 Safety Management 参加学生に対し指導教員が講ずるべき事項 Make sure to check by your Supervisor	①災害傷害および賠償責任保険、海外旅行保険の加入確認・指導 Have personal accident insurance, liability insurance, and travel insurance ②連絡方法・救急具の携行等、事前の安全教育の実施 Make sure to comfirm the emergency contact and teach how to live safety overseas
☐	渡航届と併せて提出するもの Other documents needed to submit	①海外渡航誓約書　(『アイラックサポートサービス』加入手続き) Written pledge regarding international trip (I-R&C Support Service) ②海外旅行保険の補償内容のわかるもの(コピー可) Copy of travel insurance contract

注　1.学生は、渡航届提出前に、災害傷害保険、賠償責任保険および海外旅行保険に加入していること。
2.【本届の提出場所】　府中地区学生支援室　入学試験係
3.【本届の提出期日】　渡航日2週間前迄

(裏面につづく　Continue to back page)

※Please submit to Educational Affairs Office by 2 weeks before your departure※

国内の緊急連絡先 Emergency Contact in Japan	氏名Name：	続柄Relation：
住所Address：		
TEL:	携帯 Mobile：	
パスポート Passport	氏名(ｱﾙﾌｧﾍﾞｯﾄ表記): Name in alphabet	No.
海外旅行保険 Travel Insurance	加入保険会社名： Insurance Company	

※原則、「付帯海学」に加入してください。
※Please join the “Futai Kaigaku” insurance.

Attention International Students!! For Temporary Leave, please fill in below. 外国人留学生の一時帰国の場合は下記を記入してください。	
奨学金の種類 Type of scholarship	□国費 Japanese Government Scholarship Student □政府派遣 Foreign Government Sponsored Student □私費 Student at Private Expense (□学習奨励費 Honors Scholarship)
備考 Note	

スケジュール表 (別紙可) Itinerary (Please add appendix if necessary)

年月日 Date	発着地名・交通手段(便名)* Departure/Destination	訪問先 Visiting institution	滞在日数 Days	用 務 Business

*発着地名と飛行機(便名) 、バス、電車等の移動交通手段を記入して下さい。
*Please input port of departure, destination, and means of transportation including airline (flight No.), bus, and train.

□国内で空港までの往復等に自主運転で自動車を利用する予定がある
I plan to drive myself to and from domestic airports.
□海外で交通手段として、自主運転で自動車を利用する予定がある
I plan to drive myself to and from overseas airports.

【運転歴： 年】
Driving Experience(Year)

（付表C）

西暦　　年　　月　　日

農 学 部 長　殿
農 学 府 長　殿

指導教員名（自署）＿＿＿＿＿＿＿＿＿＿
【内線番号：　　】

学 外 研 究 実 施 に つ い て（ 報 告 ）

下記のとおり、大学の研究教育活動の一環として

□ 調査　□ 見学　□ 実習　□インターンシップ　□ その他

を実施いたしましたので、つきましては礼状の発行をお願いいたします。

記

参加学生　※依頼状と同じ□　（※欄が不足する場合は、名簿を用意ください。）			
	学科・専攻名	学籍番号	氏　名
1			
2			
3			
4			
5			

実施日（期間）	西暦　年　月　日（ ）　～　年　月　日（ ）	
研究先（研修場所）	名　称	
	所在地	〒
引率教員	無　・　有（引率教員名：　　）	
礼状 宛　名	機関：　役職：　氏名：	
礼状 住　所	〒　□　研究先所在地と同じ（記入不要）	
礼状 封筒宛名	※　宛名と封筒宛名が違う場合 部署：　役職：　氏名：	
備　考		

（付表D）　　年　　月　　日

学外機関における研究指導の委託申請書

農 学 部 長　殿
農 学 府 長　殿

指導教員氏名（自署）＿＿＿＿＿＿＿＿＿＿＿＿＿＿印

学科長
専攻長 氏名（自署）＿＿＿＿＿＿＿＿＿＿＿＿＿＿印

東京農工大学学則第77条及び第100条に基づいて、下記のとおり研究指導の一部を委託したいので、よろしくお取り計らい願います。

記

<table>
<tr><td rowspan="2">学生氏名等</td><td rowspan="2">学科
専攻</td><td rowspan="2">年次</td><td>学籍番号</td><td></td></tr>
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<tr><td rowspan="4">研究先</td><td>名称</td><td colspan="3"></td></tr>
<tr><td>委託学科・専攻等</td><td colspan="3"></td></tr>
<tr><td>委託指導者職・氏名</td><td colspan="3"></td></tr>
<tr><td>所在地</td><td colspan="3">〒

TEL:</td></tr>
<tr><td>研究題目</td><td colspan="4"></td></tr>
<tr><td>委託理由
※委託担当教員が記入すること</td><td colspan="4"></td></tr>
<tr><td>備考</td><td colspan="4"></td></tr>
</table>

○保険加入状況（教務係記入）

災害		賠償	

3. Disposing of Needles, Syringes and Other Medical Instruments and Equipment

When medical instruments and equipment such as needles and syringes are used during ordinary biological, chemical or physical experiments, or during plant and animal experiments, they must be disposed of as medical waste in the same manner as if they were used in medical procedures for humans or animals. The reason is that the waste processors cannot tell whether they were used for medical treatment, and the risk of infection cannot be dispelled. It is therefore necessary to dispose of all used medical instruments and equipment as medical waste, separate from general waste.

The disposal of medical waste is divided into infectious and noninfectious waste. Infectious waste includes needles, syringes used for blood and other body fluids, and medical instruments and equipment with infectious pathogens such as bacteria, viruses, and any protozoa attached to them. Noninfectious waste are medical instruments and equipment that have not been used for blood or other body fluids and are not contaminated with pathogenic microorganisms.

A professional contractor should handle the disposal of both types.

4. Wastewater Management

Wastewater from university laboratory sinks is regulated by the Ordinance on the Environment to Ensure the Health and Safety of Tokyo Citizens (Environmental Security Ordinance). (The Fuchu Campus is a “designated work area” in the “water source area [Tama River water area]” as stipulated by the ordinance.)

A third party periodically tests the quality of the university’s wastewater. If the tests show that the effluent exceeds the standards of the Environment Security Ordinance, the water is retested. If the effluent still exceeds the standards, the Fuchu City government takes strict measures such as suspending the use of the water supply and ordering the removal of contaminated substances. Waste liquids and other substances that have the potential to contaminate wastewater must be treated in accordance with TUAT rules. Other waste liquids that do not fall under this category must also be treated to ensure that their concentration does not violate the effluent standards.

Details on the main values of effluent standards are listed under “別表第 4　特定有害物質（条例第 2 条関係）（Appendix 4: Specified Hazardous Substances [related to Article 2 of the Ordinance])” of the “都民の健康と安全を確保する環境に関する条例別表一覧（List of Appendixes of the Ordinance on the Environment to Ensure the Health and Safety of Tokyo Citizens)” on the Tokyo Bureau of Environment website (https://www.kankyo.metro.tokyo.lg.jp/basic/guide/security_ordinance/attachment_list.html).

5. Use and Management of Test Reagents

TUAT uses a wide variety of chemicals during our research and education. The potential for chemical substances and the like to be released into the environment and cause harmful effects on human health and ecosystems through environmental pathways is considered an environmental risk. Given that chemical substances pose some environmental risk, simply regulating specific substances individually is not necessarily sufficient to protect human health and ecosystems.

To reduce the environmental risks of various chemical substances as a whole, it is necessary for the users of these substances as well as the government and the general public to fulfill their responsibilities and work together to reduce emissions.

1. Pollutant release and transfer register

In Japan, the Act on the Assessment of Releases of Specified Chemical Substances in the Environment and the Promotion of Management Improvement (known as PRTR Act) was enacted in 1999, and the Pollutant Release and Transfer Register (PRTR) was institutionalized. Under this system, TUAT is required to monitor the amount of designated chemical substances released into the environment and the amount transferred out of the university as waste or wastewater, and to submit a report to the administrative agency annually.

The chemical substances subject to reporting are the 515 substances designated as “Class I Designated Chemical Substances” (including 23 Specific Class I Designated Chemical Substances). The list of subject chemical substances is available on the page “化学物質排出把握管理促進法 (Act on the Assessment of Releases of Specified Chemical Substances in the Environment and the Promotion of Management Improvement)” on the Ministry of Economy, Trade and Industry (METI) website (https://www.meti.go.jp/policy/chemical_management/law/index.html), and the Pharmaceutical Safety and Environmental Health Bureau PRTR data result page on the Ministryof Health, Labour and Welfare website (http://www.nihs.go.jp/mhlw/prtr_hp/index.htm).

2. Management system for lab chemicals

To ensure compliance with PRTR and control of toxic and deleterious substances, TUAT introduced and began operating the Management System for Lab Chemicals (IASO) in academic year 2003. All laboratories that use test reagents and the like must be aware that participation in this system enables the university to properly comply with PRTR, and students must use the system under the guidance of their laboratory instructors.

3. Chemical Substance Safety Data Sheets

To properly manage chemical substances, users must know the properties and handling methods of the substances they are working with. The PRTR Act requires test reagent manufacturers and the like to provide safety data sheets (SDSs) on chemical substances specified by the Cabinet Order (515 Class I Designated Chemical Substances and 134 Class II Designated Chemical Substances) and products containing these substances to their customers when shipping them.

An SDS contains useful information, such as a summary of the substance's hazards and toxicity, measures to be taken in the event of a spill, first aid measures in case of contact with the test reagent, and precautions for disposal, so be sure to carefully check the SDS before using the substance. SDSs are also available on test reagent manufacturer websites.

6. Minimizing Damage from Earthquakes and Fires

To minimize earthquake damage, take preventive measures on a regular basis. If you do not take preventive measures in areas such as hazardous chemicals storage; locations where fire is used; or where large machinery, measuring instruments, lockers and shelves are installed, for example, an earthquake can lead to secondary disasters and cause extensive damage. Always try to foresee these risks and take measures in these areas on a regular basis.

To minimize earthquake damage, conduct the following measures and always be on alert:

(1) Take precautionary measures to reduce the damage objects in the rooms and hallways may cause if they move or topple due to tremors, as follows:
   a) Attach tall objects to the wall with bolts at the top using horizontal pillars, L-shaped brackets, etc.
   b) Fix measuring instruments, PCs and other objects to the desk so they will not fall off. If this is difficult, elevating the front feet of a desk using pads will prevent objects from falling off to some extent.
   c) Install crosspieces on shelves that contain chemicals and hazardous materials to prevent them from falling. Make it a habit to lock the doors and drawers of shelves.
   d) Secure gas cylinders to the wall or cylinder stand with thick chains. Cylinder stands should also be properly secured with anchor bolts, etc.

(2) When an earthquake strikes, promptly stop using gas and take precautions against fires.

(3) Depending on the situation, calmly evacuate to a safe place as soon as possible. Elevators are dangerous during disasters, so use the stairs instead.

You can prevent the outbreak of fires if you take the proper measures. Fires need a combination of combustible materials, oxygen and a source of ignition, so preventing the simultaneous presence of all three is the key to fire prevention. When conducting experiments and practical training, you must be fully aware of the danger of fire and take countermeasures against it.

Since chemical laboratories and research rooms often handle flammable, combustible and potentially explosive substances, the utmost care is required.

It is also essential to keep the following in mind at all times: (1) Extinguish all fires; (2) confirm the location and instructions of fire hydrants and extinguishers; (3) confirm evacuation routes, escape ladders and emergency exits; and (4) keep hallways clear of items to ensure easy evacuation.

7. Handling Electrical and Gas Equipment

1. Handling electrical equipment

Distribution boards are installed on the walls of the hallways and/or laboratories and split the main power supply distributed to the laboratory into smaller units for room outlets, lighting, experimental equipment, fume hoods facilities and so on. The table below shows the main AC power sources supplied to the distribution boards in labs.

For safety, knife switches with fuses, distribution circuit breakers, no-fuse breakers, ground-fault circuit breakers, etc. are installed at the end (primary distribution) of the main line power supply. Additionally, wiring circuit breakers, no-fuse breakers and so on are installed after branching (secondary distribution) from where indoor wiring starts. When a current exceeds the rated current, it blows the fuse or trips the circuit breaker. If this happens, calculate the total current being used, remove the cause of the excess current, and either install a new fuse or reset the circuit breaker. When replacing a fuse, be aware that an incomplete contact may cause the fuse to heat up and scorch or blow it.

Table: Types of AC Power Sources

Electrical system	Rated voltage [V]	Applications and Characteristics
Single phase 2-wire (lighting)	100	Most electrical equipment and lighting
Single phase 2-wire (lighting)	200	Large heating equipment, electrical equipment requiring large amounts of power
Single phase 3-wire (lighting)	100/200	A single phase 2-wire system 100 V power supply is obtained between the center neutral wire and each of the outer wires of the three terminals, respectively, and a single phase 2-wire system 200 V power supply is obtained between both outer wires
Three phase 3-wire (power supply)	200	For equipment and experimental facilities that contain motors, electric heaters, etc. and require large amounts of power

(AC frequency is 50 Hz in eastern Japan and 60 Hz in western Japan.)

The power branched from the distribution board is supplied to electrical equipment using a cord from an outlet attached to the end of the indoor wiring. These cords are either vinyl or rubber. Vinyl cords are generally resistant to water and oil but susceptible to heat, so they are used in equipment that does not convert electricity to heat. Rubber cords are relatively

resistant to heat and are used for electric heating devices and lightbulbs. In addition, there are vinyl- or rubber-covered cabtyre cables, which are often used for the same purposes as rubber cords because of their high durability and resistance to abrasion. Cords should not be directly connected to each other, but rather connected to each other using plug sockets, multi-taps, power strips, and other connecting devices. **Select cords and connecting devices with appropriate capacities.**

Avoid multiple wirings from a single terminal or connection device. Cord wiring should be 10 m long or shorter. If extended wiring is needed, permanent wiring (installed by a qualified electrician) for installing an outlet or the like should be added from the secondary distribution side of the distribution board, and wiring should go through that outlet.

Use switches to start, stop and control electrical equipment. Switches are often supplied with such equipment. If not, install a switch as part of the wiring. Choose the appropriate switch—such as tumbler switches, rotary switches and remote-control relay switches—depending on the purpose.

Electrical equipment used in laboratories often come with grounding functions to prevent electric shock and protect the equipment. The thickness of the grounding wire and other regulations are determined for each type of equipment based on the technical standards for the equipment. It is usually sufficient to connect the grounding wire of the equipment to the grounding terminal of the outlet. To avoid the risk of electric shock, always be sure to connect the **grounding wire first, and never touch the equipment with wet hands**.

Other precautions you should take are described below. For example, never touch or approach charged or energized parts with high voltage or high current. Put on protective equipment such as rubber shoes and gloves first, then turn off the power supply if possible and remove the charge with a grounding rod, etc. In addition, avoid conducting experiments alone, considering the measures that must be taken in the event of an accident. When heat or sparks are generated, the presence of combustible or flammable materials or dust in the vicinity may cause a fire or explosion. Electrical leakage, improper wiring or electrical loads exceeding the rated voltage of the equipment or cord generate heat. Sparks are caused when opening and closing switches, short circuits or electrostatic charging. In addition to the safe use of equipment, take care to maintain a safe environment around the equipment.

2. Handling gas equipment

City gas is supplied to laboratory desks, fume hoods and other areas in laboratories, and is also used as a heat source for Bunsen burners, hot water heaters and heaters. City gas varies in flammability and heating value according to its raw materials and/or manufacturing facilities, and is classified into seven types (see table below). Since the type of gas supplied differs by region, it is necessary to confirm that the gas equipment and gas type are compatible beforehand. The gas supplied to the TUAT Fuchu and Koganei campuses is 13A.

Table: Type of City Gas

Type[*2]	Wobbe Index (WI)[*1] The number in parentheses is the value converted to Kcal	
	Maximum	Minimum
13A	57.8 (13,800)	52.7 (12,600)
12A	53.8 (12,850)	49.2 (11,750)
6A	28.2 (6,740)	24.5 (5,860)
5C	24.7 (5,890)	21.4 (5,110)
L1 (6B, 6C, 7C)	28.9 (6,900)	23.7 (5,670)
L2 (5A, 5AN, 5B)	22.6 (5,400)	19.0 (4,550)
L3 (4A, 4B, 4C)	18.6 (4,440)	16.2 (3,860)

*1: The Wobbe Index (WI) is determined by dividing the heating value (in megajoules) by the square root of the specific gravity of the gas (with air as 1).

*2: The numeral in the gas type name is roughly equal to the average WI converted to kilocalories divided by 1,000 and rounded down to the nearest whole number. A, B or C represent combustion speeds: slow, intermediate and fast, respectively. L1, L2 and L3 represent low heating value classifications aggregated by law.

Other general items are listed below:

(1) Open the gas valve of the laboratory desk when beginning an experiment and close it securely when the experiment is over.

(2) Use a hose band to secure a rubber hose to a gas valve or combustion equipment, and be careful of gas leaks. Look out for gas leaks due to a deteriorated rubber hose.

(3) Only connect one piece of combustion equipment to each gas valve. Do not use three-way joints or the like to connect multiple pieces of equipment.

(4) Failure to provide sufficient airflow in the room or ventilate the exhaust gas from equipment can lead to carbon monoxide poisoning.

(5) When an earthquake occurs, shut off all gas valves immediately.

8. Staying Safe during Genetic Recombination Experiments

1. Precautions for experiments involving genetically modified organisms

(1) Check the ministerial ordinance of the containment measures for using genetically modified organisms as experimental materials (P1, P2, P1A, P2A, P1P, P2P, etc.) and select an appropriate laboratory. Pay special attention to measures designed to assist with subject identification management and prevent the spore dispersal of microorganisms, the escape of animals, and the pollen and seed dispersal of plants. In experiments that generate aerosols, always use a biosafety cabinet and operate under negative pressure conditions.

(2) After the experiment, all genetically modified organisms, containers and micropipette tips must be rendered inactive by autoclaving or other means before disposal or reuse. Wastewater (supernatant) from microbial cultures, animal feces and urine used in inoculation experiments—as well as wastewater and soil from plant cultivation that contain pollen or seeds—must also be rendered inactive. In particular, wastewater and soil should be sterilized for a long period. Particular attention should be paid to recombinant viruses remaining in recombinant protein solutions produced using baculoviruses or in the supernatant after centrifugation.

(3) Recombination laboratories and refrigerators/freezers where recombinant organisms are temporarily stored or kept as part of experiments shall be properly labeled as required by law.

(4) When genetically modified organisms are transported between laboratories or experimental buildings as part of experiments, the organisms should be placed in a container with a structure that prevents leakage and diffusion. When transporting such organisms to other institutions or campuses, use a secure container with a highly visible label on the outside indicating that the contents should be handled with care to prevent leakage/escape. Faculty members are responsible for complying with various laws and regulations when transferring and receiving materials to and from other institutions in Japan and overseas.

2. Training on the handling of genetically modified organisms

Training sessions are held on campus on a regular basis, and all faculty and students involved with experiments must attend.

9. Staying Safe during Experiments That Involve Handling Pathogenic Microorganisms

Safety must be ensured when handling pathogenic microorganisms (bacteria, fungi, viruses, protozoa, parasites, etc.) that may cause harm to humans and/or animals.

TUAT's Regulations for the Safety Management of Pathogenic Microorganisms (hereinafter "Safety Management Regulations") and Regulations for Prevention of Domestic Animal Infectious Disease Outbreaks require notification or an application for permission for using or storing "pathogens of monitored infectious diseases" and Level 2 or higher pathogenic microorganisms. Please visit the TUAT Center for Environmental Safety website for details on the procedures.

Appendix 1 of the Safety Management Regulations defines the criteria for classifying the biosafety level of microorganisms, and Supplement 1 describes the classification level of microorganisms in accordance with the National Institute of Infectious Diseases Safety Management Regulations for Pathogens, etc. regarding their pathogenicity to humans. Supplement 2 lists the classification level of microorganisms that infect only experimental animals.

Under the revised Act on the Prevention of Infectious Diseases and Medical Care for Patients with Infectious Diseases (2007), you must now apply for permission or submit a notification to the Minister of Health, Labour and Welfare when you intend to acquire Class II pathogens, etc. (e.g., SARS coronavirus, anthrax, Francisella tularensis, Yersinia pestis, Clostridium botulinum, botulinum toxin) or Class III pathogens, etc. (e.g., multidrug-resistant tuberculosis, rabies virus, Brucella spp., others) among the specified pathogens listed in Appendix 2 of the Safety Management Regulations or perform other prescribed actions related to them.

You must conduct experiments using Level 2 or 3 pathogenic microorganisms in a certified, designated laboratory under the guidance of an experienced person (e.g., faculty member) responsible for the experiment. Appendix 3 of the Safety Management Regulations stipulates standards for the safety equipment and operation of laboratories handling microorganisms. Special safety equipment is required in microorganism control areas where Level 3 microorganisms (which can cause serious diseases) are handled.

No notification or application for permission is required for handling Level 1 microorganisms, etc., but you should to minimize their contact with the human body and dispersal into the environment.

In addition to overseeing the handling of pathogenic microorganisms, the Specified Organisms Safety Management Subcommittee formulates regulations for handling genetically modified organisms and invasive alien species, and reviews submitted cases. If you have any questions,

please consult with the chief safety officer or other committee members through faculty members.

10. Staying Safe during Biology and Chemistry Experiments

1. Basic principles

A lack of care when conducting biology or chemistry experiments all too often leads to accidents such as explosions, fire, burns, poisoning and infections. To prevent such accidents, it is vital to prepare for the experiment properly—including acquiring the necessary practical knowledge—always be aware of disaster prevention measures, and be physically and mentally prepared to respond appropriately if an accident should occur. A good experiment is a safe and efficient experiment.

This section describes the basic principles necessary to safely conduct biological and chemical experiments.

(1) Preparations before conducting the experiment

An experiment plan should not be just a "to-do list." When designing an experiment, you must fully understand the experiment's purpose, take time to study methods of experimentation, carefully consider the precautions to take at each stage, and thoroughly plan the procedures. You must also consider the hazards of the reagents and equipment used at each stage, and confirm that safety measures for said hazards are in place.

To ensure that you carry out the above actions properly, you must have sufficient knowledge of the biological, chemical and physical properties of the materials used in the experiment. You also need a thorough understanding the reactions that may occur, and of the equipment and operation procedures required. Whenever you take subjects that involve experiments, consider the above points rather than blindly following instructions.

Other points to consider include whether you are conducting the experiment in an appropriate location, and whether emergency measures and post-experiment waste disposal/collection methods are in place.

(2) Safety guidelines for conducting experiments

a) You must have the appropriate equipment when conducting experiments. Your eyes are the most vulnerable to injury if an accident occurs. Therefore, **always wear safety glasses** when conducting chemical experiments. Contact lenses are strictly prohibited, by the way, since they may inhibit first aid measures should chemicals enter your eyes or damage your eyes if the lenses are affected or react to the chemicals.

Although a white lab coat is the standard attire for biology and chemistry experiments, if there is any risk of it being caught in a rotating object such as a motor, wear workwear or

the like. If you have long hair, always tie it in the back. Never wear sandals, only shoes that cover your feet.

b) Keep the laboratory bench clean at all times, and during the experiment only place items that you need on it. Put away any equipment you will not use again immediately and take care not to damage it. Be especially careful with glassware.

c) Always follow instructions carefully and conduct experiments calmly and carefully.

Rushing experiments, skipping steps, and listening to the radio/music during an experiment increases the risk of an accident. Always stay focused on the experiment. Pushing yourself too hard with no regard for time can also lead to an accident, so manage your health and do not strain yourself to conduct experiments. In addition, always pay attention to other experiments being done around you to prevent accidents.

Lastly, it is essential to safely clean up and dispose of experimental waste in a designated manner after you finish an experiment.

2. Taking precautions to prevent accidents during basic operations

(1) Precautions when using glassware

In terms of safety, it is crucial to understand the shape and qualities of laboratory equipment before selecting the proper instruments. You can lower the risk of accidents by thoroughly understanding the nature and operation of the experiment and selecting the most appropriate equipment. In particular, laboratory glassware has specific uses depending on its shape. For example, glassware with flat surfaces—such as Erlenmeyer flasks and Florence flasks—are more vulnerable to internal depressurization and pressurization than round-bottom flasks and other spherical glassware.

Glass is the most commonly used material in ordinary laboratory equipment because it has several properties that other materials seldom possess. These properties include relative resistance to various chemicals, the ease of creating instruments with complex shapes, and transparency to allow observation of the contents. Since glassware is not durable and can easily break, however, it must be handled with great care. Before using glassware in a chemistry experiment, always review your experiment's procedures and consider the mechanical strength required for the part to be made in glass. If there is any concern, use thicker glass, pressure-resistant glass, or other durable materials, or take other appropriate protective measures. In addition, keep in mind that cracked or distorted glass may suddenly shatter during heating, cooling or other operations. When using glassware in experiments, always remember that it is a delicate material that can easily break even when dropped from a low height.

a) Heating

Check glassware for cracks and scratches before heating it, and never heat thick-walled glassware unless it is specifically designed to be heat-resistant. In general, the rate of heat

transfer differs depending on the thickness of the glass, so glassware with both thick- and thin-walled portions does not heat uniformly. This results in a large coefficient of linear thermal expansion, which means there is a higher chance of cracking. It is safer to use glassware that has a uniform thickness. This is true for glasswork as well; you should try to make the thickness as uniform as possible. When heating glassware with organic solvents or the like, use an oil or water bath combined with a hot plate or immersion heater, or a mantle heater. Do not heat it with a gas-powered open flame.

b) Ground glass joints

When using glassware with ground glass joints, make sure that the joint part is not dry, since it will cause scratches. Apply a small amount of grease or the like. After you finish using the apparatus, wipe off the grease with an organic solvent such as hexane or toluene, and then wash the apparatus promptly. After using alkali in the glassware, wash it promptly, since the joints are particularly prone to sticking. Lastly, do not try to forcefully open a stuck joint, since this can cause the glass to break and/or cause an injury. In such cases, follow the instructions of the faculty member in charge.

c) Glasswork

Making simple glass apparatuses yourself is economical, and it is also important in advancing scientific research. However, small defects in even the simplest apparatuses can lead to unexpected failures during an experiment.

Until you gain enough experience in making glasswork, use glass having uniform quality and a low melting point. Glass with a varying coefficient of linear thermal expansion has a higher risk of sustaining damage by cooling during joining, sealing or other processes, so try to use glass made from the same batch. When working with glass that has a low melting point, use an ordinary burner or a burner with air supplied by a bellows. Use an oxygen burner for glass with a high melting point. When cutting glass tubes and rods, use a saw file with fine teeth. Once you have prepared these items, keep the following points in mind when working with glass:

Make sure no one is around before cutting and filing long glass rods or tubes. Since the cutting process involves pulling the rod or tube from both sides, the force when the rod snaps can injure people nearby. The cut surfaces are sharp; remember to heat them with a burner to round the edges.

It is hard to judge the temperature of glass based solely on appearance. Heated glass can easily cause burns, so be very careful. If you are bringing others near the heated glass, such as to discuss processing methods, be sure to inform them that the glass may be hot. There have been many cases where a person has been burned by touching heated glass because they did not know it was hot. If you are stepping away from heated glass, make sure to inform the people around you. Old or cracked glass may break if suddenly heated to a high temperature. It is advisable to always wear safety glasses just in case the glass shatters. When using high-temperature flames, always use safety glasses made for

glasswork, since the ultraviolet rays can damage your eyes.

When you are attaching rubber stoppers to glass tubes, rods, thermometers, the side arm of a flask or the like, protect your hand with fabric and hold the part of the glass nearest to where you wish to attach the stopper. Turn the stopper gently and slowly push it in further. Holding a part far from the stopper increases the risk of the glass breaking, which can lead to a serious injury. If water will not affect the experiment, you can wet the glass to make it easier to insert the rubber stopper. If water will affect the experiment, however, do not wet the glass, or completely dry the glass before using it in your experiment.

If a glass apparatus breaks, collect the shards as soon as possible and dispose of them in the special garbage can for glass.

(2) General rules for handling chemicals

Before purchasing chemicals for your experiment, carefully calculate the amount needed to save money and reduce the amount of work required to dispose of unused chemicals after you finish your experiment. When you receive the chemicals, confirm that the products and amounts are correct. Using the wrong chemicals can lead to unnecessary accidents. Do not mix chemicals carelessly; especially when experimenting with chemicals you are using for the first time, be sure to research their properties first.

Sort chemicals by hazard class, attach a label indicating the hazard, and store them in a safe place that has measures against misplacement or theft. Pay particular attention to flammable, explosive, corrosive and toxic substances. Special care is required for substances designated as hazardous by the Fire Service Act or the Poisonous and Deleterious Substances Control Act. Special management and handling methods are required in accordance with laws and regulations.

Never let chemicals come in direct contact with your skin, and never smell them directly or put them in your mouth. When pipetting chemicals, use a dropper or safety pipette. Use a hand fan when sniffing volatile substances. Laboratory reagents should never be used for purposes other than chemical experiments. For example, even if the chemical is approved as a food additive, do not use it as such, since there may be differences between the approved substance and the laboratory reagent, including contamination by toxic substances.

If chemicals do come in contact with your skin or clothing, wash them off immediately with plenty of water. Since some chemicals are particularly dangerous, make sure you carefully study their associated precautions and familiarize yourself with the measures to take if an accident occurs, especially for chemicals you are unfamiliar with or are using for the first time.

Substances requiring careful handling are sorted by various classification systems based on similarities in their hazardous properties. For example, substances are classified as ignitable, inflammable, combustible, explosive, oxidizers, water-reactive, strong acid, corrosive, toxic, radioactive and more. Some substances fall under multiple classifications, and it is vital that you become familiar with their properties when handling laboratory

reagents.

(3) Acids and alkalis

Strong acids such as hydrochloric acid, sulfuric acid, nitric acid, chlorosulfuric acid and oleum—and strong alkalis such as sodium hydroxide and potassium hydroxide—are commonly used laboratory reagents. They are designated as deleterious substances and must be strictly managed to prevent their unauthorized removal. They can irritate the skin and membranes with direct contact, so immediately wash the area with large amounts of water if that occurs. If concentrated sulfuric acid soaks into lab coats, socks or other clothing and reaches your skin, remove the clothing immediately and wash the area with water. Concentrated sulfuric acid also generates strong heat when it comes into contact with water, so pouring water over the soaked clothing without disrobing will cause severe burns. The same conditions and procedures apply to concentrated nitric acid, chlorosulfuric acid, and oleum. Glacial acetic acid and acetic anhydride do not cause much pain when they come into contact with the skin, but they do penetrate the skin and cause blisters. Wash the area with water and then with a mild solution of water mixed with baking soda. Concentrated alkaline solutions can cause serious issues such as loss of vision and blindness if they get into your eyes, so handle them with care and always wear safety glasses.

(4) Organic solvents

Although there are some exceptions—such as chloroform and dichloromethane (methylene chloride)—organic solvents are considered inflammable/combustible substances that are regulated according to the Fire Service Act. The act states a notion of designated quantity (the quantity designated by Cabinet Order that takes into consideration how dangerous the hazardous materials are). If you are handling more hazardous materials than the designated quantity, legal restrictions also apply to the technical standards for storage and management. If you are handling more than one-fifth of the designated quantity, you are additionally subject to fire prevention ordinances established by local municipalities.

(5) Poisonous/deleterious substances

The Act on Securing Quality, Efficacy and Safety of Products Including Pharmaceuticals and Medical Devices and Poisonous and Deleterious Substances Control Act are intended to prevent chemical substances hazards. General chemical substances other than pharmaceuticals are regulated by the latter law. The Poisonous and Deleterious Substances Control Act imposes various regulations on chemical substances that are highly toxic and require careful handling, chiefly to prevent poisoning, and does not consider the intended use of the substance.

Some deleterious substances, such as phenol, can cause serious chemical burns when touched, so handle them with care and seek medical attention immediately if you come in physical/skin contact with them.

(6) Heavy metals

Handle heavy metals and their salts with extreme care to avoid inhalation, skin contact,

environmental contamination and other accidents. In particular, you must strictly control dust, easily dispersible substances such as metallic mercury, and substances that vaporize quickly. Used heavy metals cannot be disposed of without permission. Store them in liquid waste bottles dedicated to the relevant heavy metal and request collection in accordance with the rules for liquid waste collection. Many heavy metals are designated as poisonous or deleterious substances, so they must be stored separately in a lockable storage unit and their use must be recorded in accordance with the law.

(7) Heating

In general, gas and electricity are used as heat sources in laboratories. For safety reasons, electricity is the preferred source, but there are times when gas must be used. General precautions for heating operations include the following:

a) Select appropriate equipment and use it correctly

b) Do not heat things rapidly

c) Do not raise the temperature too high

d) Do not leave the laboratory bench during the heating process

e) Do not set any flammable materials nearby

(8) Cooling

Although it is harder to get frostbite compared to burns and terminal cellular tissue is not permanently damaged even when cooled to 0°C, prolonged exposure to low temperatures results in the cessation of blood flow and localized tissue destruction. For example, ultra-low-temperature dry ice can cause blisters if it comes in direct contact with your skin.

(9) Cooling water

Fires are often caused by a problem with the water flow in a chiller. Make sure that the water is flowing correctly, especially around five minutes after starting the process, since the flow often weakens immediately due to the faucet packing expanding. Additionally, when using equipment that uses water cooling, be careful of leaks. Water can flood the entire floor and cause short circuits.

(10) Filtration

a) Select the appropriate method and equipment based on the amount of crystals, ease of filtration of the material, and solubility of the crystals

(b) When filtering flammable solutions, make sure there is no fire around you. Vapors of organic solvents are generally heavier than air and accumulate on the laboratory bench or floor.

(c) Use a fume hood when filtering solutions of toxic solvents

(11) Distillation

a) General cautions

First, determine the boiling point, decomposition temperature, melting point and the like of the substances in the sample solution. If the distillate's boiling point is around 150°C or lower, distill at atmospheric pressure; if the boiling point is higher, or if the compound

is susceptible to polymerization and decomposition, distill at reduced pressure. Please note that you should always inspect the equipment for cracks as well as looseness in plugs and joints before distillation.

Electricity is the preferred heat source. Never heat over an open flame, which is dangerous. Design your experiment so that the heating equipment can be removed without moving the distillation equipment. When you expect large amounts of crystals to precipitate during distillation, use special equipment and take extra care.

Do not let solutions become so concentrated that the liquid disappears if they contain long-stored ethers (which produce peroxides), peroxides, nitro compounds or other explosive substances. This presents the risk of explosion.

Fires are often caused by a problem with the water flow in a chiller, so be sure to monitor this properly. In addition, never fill up the distillation flask to more than 50 percent of its volume capacity.

b) Atmospheric distillation

To prevent accidents due to flash boiling, always add several boiling chips. After halting distillation and lowering the temperature, add more boiling chips before distilling again. If you forgot to add boiling chips—or if the boiling chips are not functioning during distillation—stop heating. Be sure to cool the sample solution before adding new boiling chips. Adding new boiling chips while distilling above the boiling point can cause flash boiling, blowing out the liquid and/or vapor, which may result in burns or a fire.

c) Vacuum distillation

Always use round-bottom flasks, never flat-bottom ones, and always connect a cold trap in addition to a pressure gauge between the distillation unit and the vacuum pump or aspirator. Use thick rubber tubes for the connection. You should also use a new bamboo strip or capillary tube, and make sure that the capillary tube is not clogged. If you use capillary tubes or bamboo strips that do not produce air bubbles, flash boiling may occur during distillation. This may cause an accident as described above for atmospheric distillation. Be sure that the pressure has decreased sufficiently before heating.

d) Steam distillation

Since steam distillation requires a large amount of steam, a gas burner is often used. Make sure that there are no flammable materials nearby. When steam distilling materials containing solid substances, make sure the pipes connecting the steam generator to the distillation flask do not clog. Distillation flasks should never be heated empty, and you should use a large, efficient chiller. Steam generators must be handled with care. Use a long safety tube and make sure it is inserted all the way in the steam generator. When halting distillation, be careful while handling the cock to avoid sealing the steam generator.

(12) Extraction

a) The volume of the separatory funnel must be at least 1.5 times the sum of the sample

solution and the extracted solvent.

b) The funnel stand must be large enough to stably support a separatory funnel containing the sample solution and the solvent.

c) Always cool liquids to room temperature before extraction. Hot liquids can create large amounts of vapor, which may cause a fire. You must keep this in mind especially when working with low-boiling-point solvents such as ether.

d) If you shake the funnel vigorously from the beginning, the pressure inside it will increase due to excess enthalpy, which may cause the contents to burst out of the plug. Instead, first turn the funnel upside down, open the cock to release the pressure, and repeat the process of gently shaking the funnel and releasing the pressure. When the pressure stops rising, shake the funnel vigorously, release the pressure one last time, and let it stand.

(13) Drying

a) Drying liquids

In general, you should place solid desiccant (1/20 to 1/30 of the liquid volume) directly into the liquid, occasionally shake it, and leave it to dry for several hours or more, preferably overnight. Be sure to select a desiccant that will not react with the sample. For example, base desiccants will react with acidic materials, which may cause an accident.

b) Drying solids

When drying solids containing large amounts of water or organic solvents, first let them dry naturally, then use a desiccator or heat-dry to dry them completely. When heating solids containing organic solvents, make sure they do not ignite. Oven-type electric dryers may be used for drying large quantities of solids. However, never heat-dry substances that decompose easily, such as peroxides and nitrides, or use electric dryers to dry samples containing flammable organic solvents.

(14) High-pressure experiments

a) General cautions

Work only within the appropriate pressure range, heat resistance range, and other performance ranges of the equipment (for high-pressure equipment, only go up to two-thirds of the tested pressure limit). Also avoid over-tightening high-pressure valves. Conduct experiments in the presence of a supervisor whenever possible. Ask the equipment's manufacturer to perform periodic pressure resistance tests on high-pressure reaction vessels and the like to ensure safety. Before using high-pressure equipment, always check for gas leakage at pressures above the normal operating pressure, and be sure to ventilate the room so that gas does not accumulate if a leak should occur. If possible, high-pressure equipment should be installed in a dedicated room, not in a general laboratory, and sufficient care should be taken to minimize damage if an accident occurs.

b) Handling high-pressure gas containers (cylinders)

Substances that are gases at room temperature and atmospheric pressure are supplied in high-pressure gas containers at up to 150 atm, and must be handled with care. There are two types of gas cylinders: left-handed thread and right-handed thread. The former indicates that it is filled with combustible gases (although helium, which is incombustible, is also supplied in left-handed thread cylinders), while the latter is filled with incombustible or combustion support gases. Refer to appropriate books for more information about a particular gas. General cautions are listed below.

- Familiarize yourself with how to handle pressure regulators
- Make sure to tighten the protective cap tightly around the container valve and use a cylinder trolley when transporting gas cylinders. If a trolley is not available, transport the cylinder by tilting it slightly from an upright position and rolling it using the bottom edge of the cylinder. Do not handle cylinders with greasy gloves, and be sure to remove pressure regulators before transporting cylinders.
- Before attaching a pressure regulator, check to see whether it is for left-handed or right-handed thread cylinders. Make sure that the valve seat of the filling port is not damaged. If there are scratches, it is best to replace the entire cylinder. If the scratches are minor, however, you can use a special rubber seal to prevent gas leakage. Do not overtighten the seal.
- Before releasing the gas, confirm that the pressure regulator valve and the outlet knob are closed. Fully open the main valve, use soapy water to confirm there are no gas leaks from the main valve stem or from the connection between the filling valve and the pressure regulator, and then slowly turn the pressure regulator valve in the specified direction to adjust the pressure to the prescribed level. Do not look into the pressure gauge during this process because an accident may occur. If gas is released rapidly, the resulting friction on the inner surface of the valve generates static electricity, which may lead to an accident if the cylinder contains combustible gas.
- To stop the release of gas, first close the main valve and then the regulator valve. Using soapy water, check again to confirm there are no gas leaks from the main valve stem or from the connection between the filling valve and the pressure regulator. Be careful not to tighten the main valve too tightly.
- Gas cylinders can easily fall over, so take measures to prevent them from toppling

(15) Low-temperature liquified gases

a) General cautions

Liquid nitrogen, liquid oxygen and other low-temperature liquefied gases can cause frostbite if they come into direct contact with the eyes or skin. Make sure to use goggles or a faceguard to protect your eyes.

Use leather gloves designed for low-temperature work if you will be handling metals cooled by liquid nitrogen. Do not use cotton work gloves, because if you spill liquid nitrogen on your hands it will seep into the glove and stay there.

Rapidly vaporizing low-temperature liquefied gas in a small-mouth container may cause an explosion. Cooling apparatuses with liquid nitrogen, etc., oxygen, argon or other elements, the element may accidentally enter the equipment and liquefy; when it returns to room temperature, it may explode. Vaporizing a large amount of liquid nitrogen in a small space can also cause anoxia (a lack of oxygen), so be sure to have adequate ventilation.

b) Never place flammable materials near liquid oxygen. There was an accident at another university in which a researcher carrying liquid oxygen tripped and fell, spilling the liquid oxygen on the asphalt pavement. A metal ballpoint pen slipped out from his pocket and sparked when it hit the asphalt, causing the asphalt to catch fire and blinding him in both eyes.

c) Liquid nitrogen is a colorless, incombustible liquid. Its melting point is -209.86℃ and its boiling point is -195.82℃. Liquid nitrogen is nontoxic and has almost no effect on the human body under normal conditions. However, it has an extremely low temperature and can cause asphyxiation in high concentrations. With that in mind, please handle, transport and store it carefully to avoid accidents.

d) First-aid measures to take in case of contact with liquid nitrogen

- Contact with the skin

  Prolonged exposure may cause frostbite. You will lose sensation in the frostbitten area, which will become yellow and waxy. Once the area warms up, the area will blister, become painful, and suppuration will likely occur. Do not rub the frostbitten area. First remove clothing from the area. (If the clothing is frozen and stuck to the skin, do not forcefully try to remove it. Cut the clothing to remove the parts that are not stuck.) Gradually warm the affected area with cold water. If the temperature of the affected area returns to normal but still feels hot, continue applying cold water to cool the area. Use gauze or the like to protect the affected area immediately after warming/cooling, and seek medical attention.

- If it enters your eyes

  Seek medical attention immediately

- If inhaled

  If someone inhales liquid nitrogen, move them to a location with fresh air or a well-ventilated room, loosen their clothing, and keep them warm with a blanket. If the person's breathing is weak, have him/her inhale pure oxygen or oxygen containing less than 1.5 percent (V/V) carbon dioxide. Oxygen gas is dry, so humidify afterward. If the person is not breathing, perform mouth-to-mouth resuscitation to the best of your abilities and call a doctor.

e) Cautions when transporting liquid nitrogen in dewar flasks

When transporting liquid nitrogen in dewar flasks or similar containers, always use a vehicle in which the driver's seat is separate from the cargo bed, and take sufficient

measures to prevent the flasks from toppling. In other words, you cannot transport these flasks via ordinary vehicles. When transporting such flasks in an elevator, do not ride with them, since you may suffer from a lack of oxygen in an enclosed space. The Faculty of Agriculture requires that a card be hung around the necks of dewar flasks stating that riding in an elevator transporting liquid nitrogen is prohibited, and that a notice must be posted on the elevator indicating that liquid nitrogen is being transported. There are designated forms for this, so use them when transporting liquid nitrogen.

f) Storing in dewar flasks

When small dewar flasks for liquid nitrogen are not in use, cover them to prevent moisture from clogging the outlet and to prevent oxygen in the air from liquifying and concentrating. In addition, check small dewar flasks periodically to ensure that moisture in the atmosphere has not accumulated and frozen, blocking the openings.

g) Handling dewar flasks

When transferring liquid nitrogen from one dewar flask to another, cool the new dewar bottle gradually to prevent thermal shock, and transfer the liquid nitrogen gradually to avoid splashing. The dewar bottle to be filled should be open to the atmosphere so that the released nitrogen gas does not accumulate. Putting room-temperature material into a low-temperature material such as liquid nitrogen can cause nitrogen to vaporize rapidly, splash droplets, and lead to accidents.

Keep in mind that new glass dewar flasks are fragile, especially if liquid nitrogen spills onto to the neck joint. When handling new flasks, always use a protective screen.

(16) Experiments that generate toxic gases

Always conduct experiments that generate toxic gases inside a fume hood. Before using a fume hood, remove all unnecessary equipment inside and clean the tabletop, since the toxic gases the reaction generates may corrode instruments inside the fume hood. When assembling a chemical reactor, use the far end of the fume hood whenever possible, and lower the front glass and put your hands in the fume hood from the bottom to work. Be aware that the intake capacity of your fume hood may be significantly reduced if the laboratory's ventilation fan or other fume hoods in the room are operational. After chemical reactions have occurred, remember to remove equipment and rinse the stands and laboratory hot water baths with water.

(17) Handling microorganisms

Microorganisms are everywhere. When conducting experiments with microorganisms, always use sterile and aseptic techniques to prevent contamination by other microorganisms. In addition to human pathogens, you must prevent the contamination of the surrounding environment animal and plant pathogens and other microorganisms.

a) Sterile techniques

Sterile techniques are essential when experimenting with microorganisms, so master

them before experimentation. The techniques are broadly classified into the following five categories:

- Heat sterilization: This includes flame sterilization, autoclaves, and dry-heat sterilization. These techniques are performed at high temperatures, so be careful not to burn yourself. See (19) a) and g) of this section for more information about the use of autoclaves and dry-heat sterilizers.
- Gas sterilization: This method uses sterilizing gases such as ethylene oxide and formaldehyde. These gases are toxic and must be used with caution.
- Filter sterilization: This method removes microorganisms from a liquid by passing it through a filter with a pore size of 0.22 to 0.45 μm. Be aware that this method cannot remove mycoplasmas and viruses.
- Ultraviolet sterilization: 265-nm ultraviolet light kills microorganisms most effectively by damaging their DNA. The drawback is that only the surfaces exposed to the UV light are sterilized. Do not view UV light directly since it may cause blindness, and can also cause sunburn-like injuries to the skin.
- Radiation sterilization: In general, this method uses gamma rays. It is commonly used for sterilization of sterilized plastic instruments and other products.

b) Preventing contamination of the surrounding environment by microorganisms

You must wear lab coats in laboratories, but do not leave the laboratory while wearing one, especially to eat or go to the breakroom. Keep disinfectant close at hand during experiments, and disinfect immediately if the surroundings become contaminated. After the experiment is finished, properly clean and dispose of the culture medium, instruments, laboratory benches, waste, animal carcasses, and the like to prevent contamination.

When experimenting with pathogenic microorganisms, take extra precautions against zoonotic pathogens.

(18) Handling animals

When conducting experiments or practical training using animals, you must observe the Tokyo University of Agriculture and Technology Animal Experiment Policy and the Faculty of Agriculture Guidelines for Animal Experiments. The two main dangers that arise when handling animals are the animals' natural defensive behavior and pathogen infection. Since horses, cattle and pigs have long been raised in the Faculty of Agriculture, tetanus spores are endemic in the soil. To prevent infection through outer wounds, it is best that you receive the tetanus toxoid (vaccination). Only general matters are discussed below. For more information on handling various types of animals, please refer to "Staying Safe during Experiments and Practical Training in the Cooperative Department of Veterinary Medicine and Related Majors" in this manual.

a) Safely handling laboratory animals

- Carefully consider the species, strain, genetic quality (inbred, mutant, closed colony,

etc.), microbiological quality (sterile, gnotobiotic, SPF [specific pathogen free], conventional, etc.), sex, number of animals and other factors appropriate for the purpose of the experiment.

- Special attention should be paid to pathogen contamination of new laboratory animals. Laboratory animals are normally purchased from specialized laboratory animal vendors, and it is safe to assume that they have already gone through quarantine inspection. However, you must constantly monitor laboratory animals and conduct quarantine measures, since pathogen contamination can disrupt the results of the current experiment as well as spread infectious diseases to surrounding healthy animals, and even cause zoonotic diseases.
- Be thoroughly familiar with the proper handling methods for individual animals. Unexpected injuries may occur due to bites or scratches when handling them. To avoid such injuries, get the animal used to interacting with humans on a regular basis. When administering injections to or performing surgeries on animals, it is safer to administer anesthesia through a method appropriate for the individual animal. However, no matter how careful you are, injuries can occur. In such cases, immediately wash the injured area with running water, then apply disinfectant, antibiotics, etc. Seek medical attention if necessary.

b) Safety handling large animals

- Large animals such as cows and horses can step on or fall onto people and seriously injure them even during their normal daily activities. Even normally docile animals will exhibit defensive behaviors such as biting, scratching, ramming and kicking if they are startled or excited. It is especially dangerous when you are working with syringes or knives, or when handling large animals in confined spaces. To lower your risks of injury as much as possible, learn the habits of the animal you are handling to predict its behavior, and receive instruction on restraining methods appropriate for that species. It is also important to use anesthesia and other pharmacological methods to restrain animals, since physical restraints have limitations.
- Keep doors and windows closed when handling small animals to prevent escape. For large animals, be sure to secure an escape route for people in case the animals start to act wildly. It goes without saying that first-aid treatment and immediate medical attention are necessary for major injuries sustained from animals. Even minor injuries should be cleaned and disinfected promptly, and you should seek medical attention immediately if there are any abnormalities.

c) Dangers of animal pathogens

Animals can harbor a variety of pathogens, including those for zoonotic diseases. If you observe any signs of disease—such as abnormal mucous membrane secretions, skin or coat abnormalities, or diarrhea—do not use the animal in experiments. Since animals may be infected and shed pathogens without showing symptoms, always wear gloves, a

mask, hat, lab coat and other protective gear when handling animals, and be sure to wash your hands and disinfect when you are finished. Animal feces, urine, blood, and syringes used for these materials can also become a source of infection, so handle them with care. When disposing of these materials, always use designated methods, such as disposing of them as medical waste or incinerating them in an animal incinerator. It is also crucial to keep animal housing clean, and to regularly quarantine and inspect animals to prevent outbreaks of infectious diseases.

(19) Safety measures when using laboratory equipment

a) Autoclaves

- The tested pressure limit, normal operating pressure and maximum operating temperature are indicated on the equipment; only conduct experiments within these limits
- Only fill the autoclave container up to one-third of its capacity
- Carefully inspect the rubber seal when closing the lid. For flanged lids, avoid over-tightening or uneven tightening, and tighten the bolts diagonally across from each other uniformly several times in sequence in pairs.
- Confirm that the safety valve is functioning normally and inspect it occasionally
- Only remove the sample after the pressure returns to atmospheric pressure and the sample has cooled sufficiently. Be sure to wear gloves.
- Refer to the equipment's instruction manual for more information

b) Gas compressors

- Only turn the pressure up to two-thirds of the tested pressure limit. Confirm that there is no gas leakage at pressures above the normal working pressure. Drain gas and water from the tank after use.

c) Chromatographs

- These devices are for separating and refining mixed substances, and include gas chromatographs (GCs) and liquid chromatographs (LCs). Keep the following in mind to ensure that you operate chromatographs safely:
- Handle the high-pressure cylinder for GCs with extreme care
- The column and detector of GCs are often heated to a high temperature
- Attach a radioactive material label to GCs equipped with electron capture detectors (ECDs)
- Install an over-temperature protection device in the column temperature control mechanism
- For LCs, make sure the evaporation solvent does not accumulate in the room, and eliminate sources of ignition
- For ion chromatographs, collect and neutralize the eluent
- Refer to the equipment's instruction manual for more information

d) Laminar flow cabinets

- Turn off the germicidal lamp before use
- When using a gas burner, adjust the flame to an appropriate level
- Avoid handling flammable materials
- Do not handle hazardous substances, pathogens, etc. in air-blown-type equipment (use circulating-type equipment or biosafety cabinets)
- Adjust the air volume accordingly. HEPA filters should be replaced according to the amount of use.

e) Vacuum pumps

- Do not use these to pump acidic gases. When connecting to an acidic gas generator, be sure to connect a filtering tube containing sodium hydroxide granules.
- Use cooling traps when pumping water vapor or organic vapors
- Do not pump toxic gases
- Do not connect containers that may break due to pressure changes
- Be sure to let the air back in as soon as the pump is stopped. The vacuum may cause pump oil to backflow.

f) Aspirators (vacuum ejectors)

- Attach a trap to prevent accidents the backflow of water may cause due to changes in water pressure or other factors
- Prolonged use of tank-type aspirators will cause the water temperature to rise and the vacuum to drop, which may cause backflow. Drain the water occasionally while in use.

g) Dry heat sterilizers

- Place on a fire-resistant laboratory bench and keep away from flammable materials
- Do not put sealed containers in them, since there is a risk of explosion
- Avoid using flammable and combustible materials
- Use cotton work gloves or the like when loading and unloading sterilized glassware to avoid burning yourself
- If the temperature rises abnormally without a clear reason, do not panic; turn off the main switch and leave it alone. Do not open the airflow cover to lower the temperature, since this may cause a fire.
- Make sure there are safety measures in place for the wiring, switches, etc. For maximum safety, install an earth-leakage circuit breaker.

h) Shaking incubators

- Put in/remove contents after the shaking switch is turned off
- Secure the contents to the incubator table tightly
- Operate the switch at a sufficient distance from the machine

i) Jar fermenters

- Make sure an experienced operator is present when using the machine. It is extremely dangerous to operate alone if you are not familiar with its use.

- Sterilization is performed using high-pressure steam, so be careful of burning yourself due to contact with the steam and piping
- Pay close attention to the vapor pressure of boilers and fermenters
- Operate valves precisely and one at a time
- Make sure the culture medium does not leak
- The culture medium may scatter from the exhaust valve when the growth medium foams
- After use, sterilize with high-pressure steam first before washing
- Read the instruction manual thoroughly

j) Refrigerators

- If you store organic solvents with a low boiling point (such as ether) in an ordinary refrigerator, vapor will accumulate in the refrigerator. This may lead to an explosion if the thermostat sparks. You must therefore store such organic solvents in explosion-proof refrigerators.

k) Freezers and ultra-low-temperature chambers

- When loading and unloading samples, wear cotton work gloves or the like to avoid the risk of low heat burns. Do not wear short-sleeved clothing in the laboratory, since there is a risk of burning your arms. Always wear a lab coat or the like.

l) Centrifuges

Centrifuges are used to rapidly separate liquids and solids that are difficult to isolate as well as liquids of different densities. Since the rotational speed of centrifuges can range from 1,000 rpm to tens of thousands of rpm, operational abnormalities while spinning large masses can lead to serious accidents. If a part gets loose, it can shoot out like a bullet and damage property and injure people. Always take the following precautions when using centrifuges:

- Test the machine and safety devices before use
- If an abnormality is detected during operation, stop the machine immediately and take the necessary measures
- Do not leave the machine while it is running
- Do not touch the machine while it is spinning
- Do not stop the machine with your hands
- Make sure it is balanced
- Do not let the rotor spin faster than the allowable rpm
- Always remove the operating rotor before spinning the swing rotor
- The centrifuge must be grounded when in use
- Do not operate a centrifuge if it is unbalanced
- Check the rotor for corrosion, scratches, etc.
- Always keep an operation log
- Read the instruction manual thoroughly before use

・ If you hear an abnormal sound from the machine while it is running, contact the on-campus support staff and the manufacturer for instructions

(Rotor maintenance and inspections)

・ Inadequate rotor maintenance can lead to a breakdown during centrifugation. This is especially true for ultracentrifuges.

・ The strength of a rotor gradually decreases during use due to material fatigue and friction. Rotors therefore have a designated life span. In general, you should calculate this by the total number of revolutions or the time spent rotating. If either of these numbers reach the levels indicated in instruction manuals (for primary/first life span), reduce the rotor's maximum rpm by 10 percent. If the figures reach the designated levels stated in the manuals (secondary life span), further use is prohibited. Note: Some rotors, such as titanium alloy rotors, only have primary life spans.

・ Aluminum rotors will corrode if maintenance is inadequate. Pay particular attention to corrosion around the tube insertion hole, which can cause rotor breakage.

・ Rotors must be inspected after every 100 hours of use. In particular, check the tube holes in the rotor and the tapered holes at the bottom of the rotor thoroughly, since corrosion can cause a significant loss of strength. Corrosion shows up as surface discoloration, indentations, cracks and the like. Do not use corroded rotors.

・ Refer to the equipment's instruction manual for more information

m) UV irradiation devices

・ Ultraviolet (UV) irradiation devices are mainly used to detect ethidium bromide-stained DNA. Direct exposure to UV light can cause tearing, vision impairment, and even blindness. Exposure to skin may cause dryness or blisters. Always wear protective glasses and take care to avoid direct exposure to the skin.

n) Freeze dryers

・ The depressurization process for freeze dryers does not pose much danger if you handle the machine according to the instruction manual. If you open the valve all the way when releasing the vacuum, however, air will rush into the drying chamber and scatter the dried material. Make sure the power is off when performing inspections.

o) Dryers

・ These are high-temperature devices, so make sure you are familiar with their operating procedures. Also be sure to protect yourself by wearing long-sleeved clothing (lab coat) and cotton work gloves when loading and unloading the device.

・ Do not use alcohol and other flammable solvents to clean dryers

・ Do not place flammable objects around the installation site (within thirty centimeters)

p) Electric heaters

・ These are high-temperature devices, so make sure you are familiar with their operating procedures

- Do not place flammable objects around the installation site (within thirty centimeters)
- Wear long-sleeved clothing (e.g., a lab coat) and cotton work gloves when operating one

q) Electric furnaces

- Make sure there are adequate safety measures for electrical equipment, such as electrical wires, switchboards and switches. Observe general handling precautions for electrical equipment as well.
- This equipment can often reach extremely high temperatures, so be especially careful. Only load/unload equipment and samples once the temperature inside the furnace has dropped below 200°C, and make sure to wear long-sleeved clothing (e.g., a lab coat) and cotton work gloves.
- Certain refractory materials may become conductive at high temperatures. When handling such materials, do not touch the material in the furnace with a metal rod or the like to avoid electric shock.

r) Thermostatic baths

- Observe the general precautions for handling electrical equipment. Since this device uses water, take care not to spill water on non-waterproofed parts (such as the controller) since that can lead to electric shocks, electrical leakage accidents and breakdown of the device.

s) Amino acid analyzers

- Since these analyzers use ninhydrin samples containing organic solvents (methyl cellosolve) and acidic buffer solutions, avoid skin contact and keep them away from flames. Wear plastic or rubber gloves when handling these samples.
- These analyzers use high-pressure nitrogen gas cylinders. Observe the handling method for high-pressure gas containers.
- Observe the general precautions for handling electrical equipment

t) Oil baths

- Soybean oil, silicone oil and the like are used for oil baths. The flashpoint of soybean oil is around 300°C and the ignition point is around 450°C. Take care not to overheat the oil; the maximum temperature should be around 200°C.

u) Sand baths

- These devices are used to heat substances with relatively high boiling points for distillation or reactive purposes. If you are heating with a burner or other device that does not have a temperature control device, you may overheat the sample. This can cause part of the sample to rapidly decompose and become dangerous. In addition, sample material that has entered the joints of the glassware may decompose and prevent the joint from coming off. Therefore, do not leave the sample heated when heating with a burner. When using a sand bath for distillation, a sample with a high boiling point may not distill even though it is boiling. In such cases, do not carelessly

raise the temperature in the sand bath. Cover the heated portion of the distillation equipment and above with aluminum foil or the like, and distillation will begin.

v) Hot plate magnetic stirrers

- These devices heat and stir the solution in a beaker, stainless steel tray, etc. placed on their hot plate. If you are filling a tray with soybean oil or the like and intend to use a hot plate magnetic stirrer as an oil bath, always check to ensure that the temperature is not above your desired level, since a temperature above that could lead to overheating, fuming and ignition. The weight capacity of the plate is around three kilos. If you spill water or another cold liquid on a heated plate, the plate may break. The plate should also be covered with aluminum foil to prevent contamination by chemicals and oil.

w) Ultra-high-pressure reactors

Ultra-high-pressure reactors pressurize (and can also simultaneously heat) samples placed in a chamber that reaches pressures greater than 12,000 atm. Since these reactors are designed to be very sturdy, it is unlikely that an explosion or other accident will occur even if the reactor is left pressurized. However, incorrectly operating one of these reactors can cause parts in the pressure reaction chamber to be ejected, so be careful when pressurizing a sample or when returning to atmospheric pressure by opening a valve and waiting for the chamber to depressurize. A part ejected from the chamber pressurized to several thousand atm can penetrate concrete, so ordinary protective gear will not keep you safe. Therefore, keep the following points in mind when conducting your experiments:

- First receive guidance from an experienced person on the basic required operating methods, such as the direction of the base in the sample chamber and how to tighten the valve
- Never retighten the sample chamber screws after pressurization. If oil or air begins to leak from the sample chamber while the pressure is rising, return the sample chamber to atmospheric pressure before retightening the screws.
- When returning the chamber to atmospheric pressure, loosen the valve slowly, since suddenly loosening it may damage the pressure gauge. When opening the sample chamber, wear the designated protective equipment and use a wrench with a handle enough long to keep you well away from the equipment. You face and hands should never be directly above the equipment during this time.

x) Microtomes

- Receive guidance from an experienced person
- The blades of these cutting tools are very sharp, so be especially careful not to cut your fingers when installing and removing them. Many students carelessly injure themselves as they gain experience working with the blades. Always keep in mind that you are using a sharp blade.

- Use microtome oil to make the blades slide smoother. Before cutting hard tissue, conduct moderate softening treatment

(20) Safety in special laboratories

a) Safety in low-temperature laboratories

Chemistry experiments are often conducted in low-temperature laboratories. Keep the following points in mind when using such laboratories:

- The following types of chemistry experiments are often conducted in low-temperature laboratories: When using glass columns for separation and refining, take measures to prevent them from toppling to prevent breakage. When performing extractions using volatile solvents or the like, do not assume that the amount of vapor generated is small because of the low temperature. Since low-temperature laboratories are closed systems, be wary of flammable vapors accumulating. When storing samples in a low-temperature laboratory, take measures to prevent them from tipping over.
- By their very nature, low-temperature laboratories are designed to be completely closed, so accidents may occur in which a person is trapped inside during an experiment. If you become trapped, activate the alarm system to notify someone and wait for rescue.
- Before entering the laboratory, locate the alarm system switch so that you can activate it promptly in the event of an emergency
- You could freeze to death if you lose consciousness inside a freezer room, so be sure to notify a friend/classmate before entering one. If you are alone in the lab, avoid entering the room whenever possible. And as a general rule, do not store dry ice in the freezer room, since there is a risk of carbon dioxide gas accumulating there, which can lead to suffocation. If you are storing dry ice in a freezer room, warn the people around you and display a warning at the entrance.
- If your bare skin comes into contact with the metallic equipment in a freezer room, your body temperature will melt the ice, which will quickly freeze again. This may cause objects to stick to your skin or lead to unexpected accidents. Before entering a freezer room, put on cotton work gloves and a lab coat or other clothing to protect your skin.

b) Safety in a darkroom

When you work in a darkroom, the only source of illumination is the dim safety lights. Before beginning work, always organize the area. Decide where all the equipment you will be using will be placed, and remove any unnecessary items. If the developer or photographic fixer gets on your skin or in your eyes, immediately wash the affected area with running water, and then get the appropriate treatment.

11. Staying Safe during Physics Experiments, Engineering Experiments and Practical Training

1. Staying safe during physics experiments

Although few devices used during physics experiments are dangerous, carelessness can cause damage to relatively expensive equipment and injury to the user.

(1) Maintaining the experiment area

The basic attitude toward experiments is not much different from that toward biological or chemistry experiments. Laboratory equipment, including wiring, should be arranged so that it is easy to handle. Position chairs and the like so that the operator can maintain a comfortable posture while manipulating the equipment. Equipment placed in the center of the laboratory table may be safely situated but difficult to handle, and if it is placed too close to the edge it may fall off the table.

(2) Precautions for handling equipment

a) Measuring instruments with high sensitivity and accuracy are often equipped with stoppers and fine-adjustment screws for safety when not in use. Handle these with care and operate them only after carefully reading the instruction manual. If the operation does not go as expected, do not try to force it, since this may damage the equipment. Dust can hinder the operation of computers and measuring instruments, so always keep them covered when not in use. Always turn off the equipment before covering it, since the cover may heat up if the power is on.

b) For experiments that use a power supply, connect the wires between the equipment (make sure the wiring is organized) before connecting the power supply. Always turn off the power supply first when changing the wiring during an experiment or when disconnecting the wiring after the experiment is over. Large-capacity capacitors may retain an electrical charge even after the power is turned off. This may cause an unexpected electric shock, so always ground the wiring and check the charge with a tester.

c) It goes without saying that you should always take precautions against explosions and electric shock when using high-pressure or high-voltage equipment. A gas cylinder connected to an incompatible pressure gauge can cause them to burst. Specific precautions in experiments involving high voltages vary widely. A safety manual should be prepared for each experiment or research project that considers actual conditions.

d) In experiments that require lasers, keep in mind that looking directly at lasers without protective goggles is dangerous and must be avoided at all costs.

2. Safety in engineering experiments and practical training

General precautions to take while performing mechanical experiments

- Anticipate risks: Consider possible hazards and take adequate precautions. Conspicuously mark hazardous areas with warning signs. Take measures to prevent people from touching/entering hazardous areas. Use all your senses to detect abnormalities as soon as possible.
- Organization and cleaning: Organize the area so people do not trip on objects placed on the ground. Take care not to spill oil. If spilled, immediately clean it so people do not slip and fall. Do not place objects in aisles.
- Concentration: Be fully aware that experiments involve unknown elements. Pay attention to even the slightest anomaly during experiments. To concentrate fully, the use of radios, televisions, earphones and the like is strictly prohibited. Do not engage in needless conversations or carelessly leave equipment during experiments. Do not conduct experiments alone. Pay attention to other experiments being conducted around you and confirm their safety.
- Clothing: Wear work clothes suitable for experiments that can be soiled with oil or other substances. Take care not to get your body and clothing caught between gears or other rotating objects. When handling machinery, do not wear gloves except when welding. Wearing sandals is strictly prohibited. Helmets should be worn when there is a risk of heavy objects falling.

12. Staying Safe during Experiments at Night and on Saturdays, Sundays and Holidays

In principle, you should conduct experiments and practical training at the university during the daytime on weekdays. This includes student experiments as well as research for theses, dissertations, etc. One reason is that the concentration needed to conduct experiments at night is often lacking due to fatigue or drowsiness. This can result in the loss of valuable samples and time due to failed experiments and presents a high possibility of accidents and injuries.
It is also difficult to take appropriate measures if an accident occurs when you are conducting an experiment alone at night and/or on a holiday. If you lack experience, conduct experiments under the guidance of someone familiar with the procedure, such as an academic advisor. Plan your schedule so that you can receive instruction during the daytime on weekdays between lectures and other activities. There have also been reports that suspicious persons and thefts occur on campus at night and on holidays. From a crime prevention standpoint, it is not safe to be in unpopulated places, especially at night.
If you must conduct an experiment at night or at any time on a Saturday, Sunday or holiday for an unavoidable reason, always ask for instructions from your academic advisor. Please refer to the following instructions to ensure that your experiment is carried out safely:

1) **Wear safe and appropriate clothing.** Wear a lab coat made of flame-retardant materials and avoid exposing your skin whenever possible. Wear gloves and protective equipment as necessary.
2) **Secure sufficient experiment space and organize and clean the area.** Keep laboratory tables, instruments and equipment clean. Secure sufficient space for your experiment to avoid causing an accident.
3) **In addition to having a thorough understanding of the principles of the experiment and the operations necessary, you should know the procedures for aftertreatments.** When your experiment may produce unknown reactions or when you conduct unfamiliar tests, be cautious, including conducting preliminary experiments with small amounts of samples first.
4) **Assume that accidents may occur and be prepared to handle them.** Check whether the laboratory has gas valves, switches, fire extinguishers and emergency safety showers, and secure emergency evacuation routes. Take all possible precautions, such as checking the posted emergency contact chart in laboratories, etc. and confirming that first-aid kits and emergency medical treatment are available.
5) **Never conduct experiments alone.** This is extremely dangerous if an accident should occur. This is especially true at night and on Saturdays, Sundays and holidays, when few people are around to help.

The above items are not necessarily limited to securing safety during night and holidays. However, since it is difficult to obtain the assistance and advice of others during these hours, if you must conduct experiments do so with particular care. In addition, when operating experimental equipment continuously over a holiday or overnight, thoroughly consider in advance whether there is any risk of fire, explosion or other hazards.

13. Staying Safe during Outdoor Experiments and Surveys

1. Precautions for surveys

Field surveys always come with some risks. To conduct them safely, always have a clear understanding of your survey's content and purpose, and take appropriate safety measures and make other preparations. Make a plan that considers your entire itinerary from departure to return, conduct the survey with sufficient time to spare, and reflect on the results after the survey. Field training and surveys should be conducted under the guidance of an instructor, and you should not just decide to conduct a survey yourself. You must first submit an Off-Campus Research Notification (academic advisor's signature required) to the university through your academic advisor.

If you have no field survey experience, learn the procedures from an experienced person. Never conduct surveys alone; do so with two or more people. It is safer and easier to prevent getting lost or involved in a traffic accident, and the group can quickly respond if an accident occurs. Confirm in advance the range of communication devices such as cellphones.

Wear appropriate clothing for the survey, such as long sleeves and comfortable shoes. Water-resistant clothing may be necessary, and you should wear a hat or helmet.

Safety points may differ during field surveys depending on the location, survey items, survey methods and so on. A summary of these points is listed below in accordance with the content of the class.

Students are required to enroll in Personal Accident Insurance for Students Pursuing Education and Research (Gakkensai) and personal liability insurance (Gakkensai supplemental liability insurance or university co-op student liability insurance) at the time of enrollment. You cannot participate in outdoor experiments and surveys unless you are enrolled in these insurance plans, so please confirm your enrollment status beforehand.

2. Precautions for activities in forest and mountain areas

(1) Clothing: Wear work gloves, long sleeves, long pants, and shoes that cover your ankles. Wear a helmet during work and travel.

(2) While traveling: Do not separate from the group without permission. Sudden changes in weather may result in people getting lost. Be careful of fog. Encounters with animals can also be dangerous. Many simple wooden bridges on forest trails can break easily. Walk softly on such bridges so they do not break, which will create problems for others who use the bridge. Wet trees and stones are very slippery. On switchback trails, keep in mind the people that may be traveling the road below, so be careful not to cause rocks to fall or landslides.

Never smoke while walking to prevent wildfires.

Tree stumps are hard to see on gentle slopes and root surfaces are slippery, so do not run in the forest. Shrubs, bamboo and the like that are cut with a sickle, machete, or other blades are pointy. Be careful when you walk, since one could pierce your shoe.

Always use a case when carrying bladed tools to your destination or put them in a knapsack, etc., and keep both hands free whenever possible.

(3) Staying safe during fieldwork

Always wear a helmet when working. Do not touch heavy machinery such as bulldozers and backhoes and chainsaw unless a supervisor instructs you to do so. You may only use properly maintained chainsaws after receiving instructions. (You should get special training on chainsaw use.) To prevent accidents with blades, learn and follow the correct methods of use. For instance, it is dangerous to handle tools such as machetes or machinery with wet or muddy hands. It is very dangerous to carry a knife openly during short trips during fieldwork. Put them in sheath and then in a sack before traveling.

On steep slopes, stay away from rocks and cliffs not related to the experiment/survey. Check your footing carefully to avoid stumbling and falling. Check the position of others and be careful to prevent rockfalls. If you cause a rock to fall, shout “falling rock” or “fall” to warn others. Be careful of your footing when working near mountain streams, where stones are often slippery.

Do not shake or kick dead trees carelessly; there is a risk of injury from falling dead branches. Do not work in forests when winds are strong because of the danger of falling branches.

(4) Never drink untreated water from streams or springs, which can be infested with parasites, especially in areas where wildlife is abundant.

3. Precautions for activities in water areas

When conducting surveys or other fieldwork in rivers, lakes, oceans and their shores, the following points should be observed to avoid water-related accidents:

(1) Pay attention to weather conditions and tides, and avoid water hazards caused by rising tides, high waves and tsunamis. Toxic animals and plants are also abundant in bodies of water, so do not touch them with your bare hands.

(2) Always wear a life vest during activities on small boats. If you fall into the water, calmly remain face up and wait to be rescued. If you notice someone fall into the water, shout to notify the captain.

(3) If you find a person drowning and flailing, throw a lifebuoy or other floating object into the water for them. If you try to rescue the person, they may cling to you and put both of you in danger.

(4) Water entering the lungs and trachea can lead to asphyxiation and mental panic. If a person inhales a large amount of water, seek medical attention even if the initial symptoms are

minor.

(5) If someone who has been in the water is not breathing, perform CPR. If the person's body temperature has dropped, keep him/her warm while performing CPR.

(6) Licenses and other qualifications are required for diving activities, and divers must be present during the survey. Obtain the appropriate knowledge and training and take care to avoid decompression sickness and other risks.

(7) When entering rivers and lakes, avoid areas that are more than knee-deep, even if you are wearing hip boots or waders. If you fall and water gets inside, the weight of the water may prevent you from standing up, which is very dangerous.

14. The Dangers of Forest Creatures and Countermeasures for Them

1. Hornets and related insects

The most common and dangerous creatures in the forests of Japan are probably bees and hornets. Since your chances of encountering them are high, you should gain sufficient knowledge of these insects.

Types of bees and related insects that sting

Four groups of bees and related insects (hornets, paper wasps, honeybees and bumblebees) are known to sting, and about twenty species in these groups can cause problems if they sting humans.

Considering their aggressiveness, hornets are particularly dangerous, so you should study the common habits of hornets and ways to handle them. Most stings are caused by Japanese yellow hornets and common Asian yellowjackets, the latter of which are wasps. Common Asian yellowjackets make their nests in the soil, and the total number of cells in a colony often exceeds ten thousand. They may be known by different names depending on the region. These wasps become agitated and aggressive when people walk close to their nests and cause vibrations.

Japanese yellow hornets are the most commonly seen hornets in the country. Although they may make their nests in the soil, they often make huge nests on trees or eaves. Even if the nests are fairly high up, the hornets can become aggressive if a person trips on a vine and that vibration reaches the nest.

Why do bees, hornets and related insects sting?

Although hornets are known to be aggressive, scouts ranging away from the nest only attack if people try to swat or catch them. Their venomous stingers are defensive weapons and are not used for hunting. Their main purpose is to defend the nest, and the colony's aggressiveness is determined by its size and the number of workers. As such, if nesting begins in April or May, they start becoming dangerous in July or beyond, when the size of the hive suddenly increases, and that lasts until around October.

In most cases, hornet scouts are monitoring the area within a range of five to ten meters around the nest. If a person or animal approaches the nest, the scouts buzz loudly and fly around the target, emitting a clicking, threatening sound. This warning sound may be difficult to hear. If the person or animal is unaware of the warning sound and approaches the nest or causes the nest to vibrate, the scouts emit a chemical signal to tell the hornets waiting at the nest to

scramble. The hornets waiting at the entrance of the nest fly out with the scouts to sting the target. They use their venomous stingers to protect the nest, i.e., their offspring. In the case of an underground nest, many hornets will fly out from the nest at once if they feel vibrations from aboveground (when something walks on top of it) or when something passes by the entrance.

Prevention

It is best to avoid bees, hornets, wasps and hives whenever possible.

(1) Do not go near hives

When you discover a hive, be wary and keep your distance as you quietly walk away. Bees, hornets and so on are also sensitive to sudden movements, such as waving your hands or twisting your body from side to side.

(2) Do not go near bees or other such insects that are feeding

These insects are found around oak sap, fruit, mushrooms, and the like. Giant hornets may attack to protect their food.

(3) Clothing

Wear clothing that covers your arms, legs, head, etc. Wear long sleeves, long pants and a hat (or helmet). Avoid wearing black; wear white or light-colored clothing instead. Wearing clothing made of wool or fur poses a higher risk of being attacked, so consider other materials when choosing winter wear.

(4) Odor

Certain odors may aggravate these insects. They are known to be sensitive to hairspray, hair tonic, perfume and other cosmetics, and the smell of sweat. Hornets also drink juice, so be careful if you are drinking from a can.

(5) When these insects enter cars or buildings

These insects trapped inside a car or structure may panic, but they rarely attack people, so do not try to slap them down or chase them. Instead, open a window and wait for them to fly out. Since these insects have difficulty seeing downward, if they fly up to the ceiling, they may not be able to find the light window. Inside buildings, spraying insecticides from a distance of one to two meters can also be effective. These insecticides do not immediately take effect, but these insects will die after 5 to 10 minutes.

(6) Dead bees and hornets

Even if a bee's body is completely crushed or part of the body is removed, for about a day the abdomen may reflexively move its needle to sting if touched.

Insect venom

The venom of bees and other related insects is a mixture of many chemical components rather than a single substance. Hornet venom contains main components that cause pain—amines, such as serotonin and histamine, and bee venom kinins, as well as high molecular proteins

such as proteolytic enzymes and various peptides. These cause various physiological changes in the sting victim.

Insect venom allergy

Most deaths from insect stings are caused by allergic shock (anaphylaxis) rather than the insect venom itself. Each sting only injects about 0.05 ml of venom, but it causes significant swelling and is painful. The symptoms normally disappear in a few days. However, when there is an allergic reaction, there are systematic symptoms such as abdominal pain, dizziness and rashes. There are also cases of unconsciousness, difficulty breathing, low blood pressure, and even death. Most deaths occur within an hour of being stung, so it is imperative to provide appropriate treatment as soon as possible after systemic symptoms are observed. If you have experienced severe symptoms from stings from bees or other such insects or are concerned about bee allergies, receive a blood test for bee allergy and follow the doctor's instructions.

2. Animals

(1) The main dangerous large animals present in the university's Field Museum (former Study Forest) are Asian black bears and wild boars.

(2) In most cases, both of these beasts sense humans before we notice them and flee. It is extremely rare for a group of people to encounter these animals. In even rarer cases, the animal may sense danger and attack if you suddenly encounter them in a bamboo bush by approaching downwind on a windy day or on a sharp turn on the road.

(3) Humans must not enter the zone of activity of bears or wild boars. Carrying a bell or other object that makes noise is effective, since it causes the animals to run before you encounter them. Carry pepper spray in case of an encounter.

(4) The above also apply to wild dogs.

(5) While rabies is normally associated with dogs, other animals such as rats can also have rabies if bitten by an infected animal, so do not carelessly touch animals of any size since there is a risk of being bitten.

3. Snakes

(1) Japan has eight species of snakes, excluding Okinawa, but only the mamushi and tiger keelback are venomous. It is essential to be able to recognize these species. Look at multiple photographs and live specimens to learn their characteristics. Remember that the colors and patterns of these snakes vary depending on age, region and other factors. Mamushi are said to have a pattern that resembles coins with a hole in them, or have a triangular head, but it is difficult to identify them on first sighting through these characteristics.

(2) In many cases, snakes will flee without attacking. This applies to mamushi. Do not needlessly try to chase or catch them.

(3) Accidents often occur after snakes are captured.

(4) In summer, snakes are often found in damp places, but in spring and fall they can be found basking on stones or in attics. It is dangerous to believe that snakes are always found in damp places.
(5) The mamushi's range of attack is about 20 cm, so you are safe if you stay 50 to 60 cm away. Mamushi do not have a strong bite, so even if you unknowingly step on them and they bite your boots, you will not be poisoned.

Prevention

(1) Do not go near snakes or try to capture them.
(2) Wear long pants and boots that cover your ankles.

If you are bitten

(1) See a physician as soon as possible and receive a serum injection or other treatment.
(2) Remember the type of snake that bit you.
(3) When providing first aid, tie a cord around the body part between the bite and the heart to stop the flow of blood, or if water is available, wash it out while squeezing out the blood. However, if you have wounds in your mouth or cavities, do not suck out the venom with your mouth.
(4) In addition to venom, snake bites present a risk of tetanus and other bacterial infections, so even if you are bitten by a Japanese rat snake or other snake, please see a doctor.

4. Other threats

(1) Since there is no malaria in Japan, infectious diseases caused by mosquitoes are not a major concern, and only damage caused by direct bites should be considered. However, reports of scrub typhus have recently been increasing in many areas, and outbreaks of severe fever with thrombocytopenia syndrome (SFTS), which is transmitted by different tick species, have also been reported in Japan. The basic measures to take after returning from a forest are to bathe and change clothes. Trombiculidae mites wait for rodents and other hosts on fallen leaves, so it is dangerous to sit, roll around, or expose bare skin for long periods of time in thicketed areas.
(2) If you leave your shoes unattended, centipedes or other insects may enter in rare cases. Inspect your footwear before you put them on.
(3) Gnat and moth scales can cause rashes. It is important to wear long-sleeved shirts and long pants.
(4) Since Japanese mountain leeches can crawl into your clothing or shoes and suck blood, it is advisable to spray leech repellents and wear boots.

Note: The following were used as references when compiling the section on bees, hornets and so on:

Rinnai Anzen, Shunichi Makino, 1993, No. 53129－31
Kinjin, Seiya Kawano, 1993, No. 39 (8) 50－58

15. The Dangers of Plants and Mushrooms in Forests and Countermeasures for Them

1. Rashes caused by plants

(1) The plants in forests that most commonly cause rashes are Asian poison ivy (Tsutaurushi) and Wild lacquer tree (Yamaurushi). Simply touching these plants for a short period will not cause a rash, but many people will get a rash if the sap from cut leaves, vines or trunks get on the skin. Since cutting the roots can also lead to rashes, check to be sure none of these plants are in the area when conducting soil surveys. Asian poison ivy is especially toxic, so learn its characteristics and avoid touching it.

(2) The edges of the leaves of sasa (running bamboo) and Chinese silver grass have small thorns that can cause itching if they scratch the skin. The thorns of Japanese hop and the hard hairs of Amur silver grass can as well. Before entering shrubbery, put on thick long sleeves and long pants, and work gloves, and wrap a towel around your neck to avoid exposing your skin.

(3) When providing first aid for a rash, wash the affected area thoroughly with water (do not rub) and apply a steroid ointment containing antihistamine. If the rash spreads, seek medical attention from a dermatologist as soon as possible.

2. Injuries from plant thorns

Cutover areas and forest edges usually have many shrubs with thorns, such as multiflora roses, brambles, Japanese angelica trees and Japanese pepper trees. When working in such areas, take the abovementioned measures for preventing rashes, such as wearing clothing that does not expose skin. When walking, do not to flick branches at those behind you, since it is especially dangerous if the thorns on the branches hit eyes.

3. Poisonous plants and mushrooms

(1) You cannot be poisoned caused by poisonous plants and mushrooms unless you eat them. Never eat them or recommend them to others based on uncertain knowledge.

(2) Accidental ingestion of poisonous plants occurs when they are mistaken for wild vegetables during the sprouting season, or when they are confused with edible plants because of their similarity in name and shape. There are also many edible and poisonous species of mushrooms that look very similar. Do not rely solely on illustrated guides and photo collections to learn about wild plants and mushrooms. Seek guidance from an expert.

(3) Some plants commonly thought of as wild vegetables, such as bracken, can be poisonous if not properly treated, which includes removing their astringent taste. Additionally, mushrooms ordinarily considered edible may be toxic depending on the region and the time

of year in which they grow (e.g., angel wings). Toxicity can also differ depending on the individual, so take care even when consuming plants or mushrooms that are considered edible.

(4) If you develop symptoms such as abdominal pain, vomiting, dizziness or numbness after eating wild vegetables or mushrooms, seek medical attention immediately. Try to save what you have eaten so you can show it to the doctor.

16. Excerpts from the Biosecurity Manual

As of July 1, 2020, the new biosecurity standard based on the Order of Minister of Agriculture, Forestry and Fisheries stated that livestock owners had to prepare a biosecurity manual by February 2022. Under this new standard, livestock owners must clearly state that sanitation measures are implemented on farms, share them with all concerned parties (farm staff and outside staff), and ensure that they are thoroughly followed. The methods of sanitation measures TUAT's farm staff and those who enter the biosecurity areas must take are in this manual (attached). The basic points are presented below.

1. Handling of livestock off the farm is prohibited

In principle, handling livestock off the farm is prohibited. (Farm staff are not allowed to keep livestock at home.) Contact with wild animals is also prohibited in principle.

2. Measures when traveling overseas and after returning to Japan

Persons who have entered Japan from a foreign country within the past week are not allowed to enter a biosecurity area. Clothing brought in from overseas cannot be brought onto the farm for at least four months after returning to Japan, unless it has been disinfected using specific procedures. Meat and dairy products cannot not be brought in from overseas (including transportation by mail or other means).

3. Bringing inappropriate items to the farm is prohibited

Do not bring in inappropriate items (e.g., items used at other livestock-related facilities, clothing used overseas, etc.), since they may introduce pathogens. Tools, equipment and the like for repairing farm facilities should be kept on the farm.

4. Pets are prohibited

Dogs, cats and other pets cannot be kept at biosecurity areas.

5. Measures to prevent intrusions by wild animals

Patrol the perimeter of biosecurity areas, clean up spilled food, and conduct other measures. Use protective fences and bird nets as necessary.

6. Changing clothes and using disinfection to prevent epidemics

When entering a biosecurity area, always change to the special boots and work clothes provided in the dedicated changing rooms at the entrance. Be careful not to contaminate the residential area with soiled work clothes and the like. Disinfect your hands at the entrance with the disinfectant provided or wear gloves.

Disinfect your boots in the step-in disinfection tank placed at the entrance to cattle barns and the like. Disinfect your hands with the disinfectant provided at the entrance to the barn. When leaving the barn, wash your boots and disinfect your hands with disinfectant soap at the washing station in the breeding area. As a rule, vehicles are not allowed in the breeding area.

17. Staying Safe during Experiments and Practical Training in the Department of Environmental and Natural Resource Sciences

Experiment on Environmental and Natural Resource Science I (Advanced Physics)

The items listed in "10. Staying Safe during Physics Experiments, Engineering Experiments and Practical Training" in this safety manual must be observed.

(1) Synthesis of adhesives and production and evaluation of the properties of wood materials

The synthesis of adhesives and production and evaluation of the properties of wood materials is a series of experiments to synthesize adhesives that are frequently used in resource composition and to examine the properties of these adhesives.

Accidents possible during these experiments include (1) injuries from broken glassware and/or blades, (2) burns from "bumping" due to exothermic reactions, and (3) irritating odors generated by chemicals.

The proper mental preparation and methods to prevent these accidents as well as first aid measures are explained in detail at the beginning of the experiment. The main points are as follows:

- Each group must assemble its own adhesive synthesizing equipment. The first step in preventing bumping is to devise a way to ensure continuous and stable agitation.
- A lot of glassware used in experiments is fragile. When attaching or removing rubber tubing, rubber stoppers or the like to glassware, wet the glass with water. This helps to complete the procedure without applying excessive force.
- If you are careless, you may touch a glass stirring rod—which is made by thermally melting one end of a glass rod with a gas burner—or a tripod used for heating. Attend to even minor burns as soon as possible, such as cooling the burn for at least thirty minutes with running water or other methods.
- When handling chemicals, always wear protective eyewear to prepare for chemical splashes unless advised otherwise. Wash your hands after handling chemicals as well.
- One chemical used in experiments is formalin, an ingredient of thermoset adhesives. It has a strong pungent odor (formaldehyde), and can damage the respiratory tract if inhaled. Always handle this chemical in a fume hood and be sure to ventilate the room.
- Small samples need to be cut off to examine adhesive performance. To avoid being cut, do not go near the blade. Support rods and other jigs are provided to prevent such accidents. The use of these rods and jigs is essential for safe and reliable work.
- Cut off samples in the processing area. Lab coats and other long-hem clothing are strictly prohibited in the workshop.

(2) Paper production and evaluation of paper properties

Recycling of waste paper

a) Precautions for using pulp disintegrator (2 L capacity)

- During the experiment, the specimen tank should be firmly fixed to the defined position of the disintegrator's base (pedestal).
- The concentration of the specimen being disintegrated should be 1 to 2 percent and the volume of the specimen suspension liquid composition should be 1,500 to 2,000 ml.
- Feed pulp and other specimen materials into the specimen tank gradually. Pulp may become entangled in the blades, causing axial vibration. Be especially careful when disintegrating used paper or during high-concentration disintegration.
- Disintegrator speed can be as high as 3,000 rpm. Be sure your hands and clothing do not become caught in the spinning blades during disintegration.

Preparing handmade paper for experiments

a) Fix the specimen tank to the base by a rubber tube, etc. Do not approach the blades while they are spinning, and make sure your hands do not get caught. Take care to avoid injury, since the large inertia involved is dangerous.

b) Precautions for using pulp beaters (PFI mills)

Rolls and mill houses are heavy and have large inertia, so do not approach them when they are rotating, since there is a danger that clothes such as lab coats may get caught. Turn off the switch and make sure the mill house has stopped rotating before opening its lid. The lid is also quite heavy, so open it slowly and carefully to avoid crushing your fingers.

c) Precautions for using a handmade paper sheet machine

Dropping the couch roll is dangerous because it is very heavy, so hold it carefully.

Physical tests of handmade paper

When cutting strips of test paper from handmade paper, place the special metal ruler firmly on the handmade paper (placed on the rubber plate so that it does not slide) and firmly cut the strips with a box cutter. Handle the box cutter with care.

Be careful, since the Elmendorf Tearing Tester moves with relatively large inertia. When the test paper is cut in a fold resistance test, switch off the machine before reading the rotational values.

After cutting the test paper, never press down on the knob of the machine without turning it off, because the machine will suddenly rotate.

(3) Safety measures for wood machining, safety training, wood drying and environmental (noise, dust) measurements

Many of these experiments involve the use of woodworking machinery. Here is a list of basic safety requirements for using woodworking machinery:

- Wear long pants and a jacket with tight-fitting sleeves
- Wear shoes with nonslip soles

- Do not leave pieces of wood, tools or other objects on the workshop floor or in aisles
- Do not store processed materials and waste materials in random locations
- Be very careful about fire
- Familiarize yourself with the operations, safety devices, tool attachment and removal, and other functions of any machine before using it
- Use sharp and well-calibrated tools
- Always inspect any machine, safety devices, tools and the like before starting work
- Prepare the necessary materials, jigs and auxiliary tools, and familiarize yourself with the work procedures before starting your task
- Never remove safety devices on machines
- Make sure that pieces of wood, tools or other objects are not touching the mashines, and that other workers are not in a dangerous position before operating any machine
- If an abnormality occurs during machine operations, stop working immediately
- Keep hands away from tools during operation, preferably 15 cm or more. Use a duster or pry bar to remove wood chips and scraps.
- When performing inspections, repairs and cleaning, stop operations and display a sign that notifies others of the situation
- When you are finished with your task, inspect the machine, safety devices, tools and the like, and clean the machine and work area

Common Specialty Basic Subjects Fundamental Experiment on Chemistry and Experiment on Environmental and Natural Resource Science II (Advanced Chemistry)

Precautions common to Fundamental Experiment on Chemistry and Experiment on Environmental and Natural Resource Science II (Advanced Chemistry) are listed in the first half of this manual under “Matters Common to the Faculty of Agriculture and Graduate School of Agriculture.” Basic safety precautions are also included in the experiment memo distributed before the experiments. Read these in advance and obtain the general explanation, including safety precautions, on the first day of the experiment before starting work. Please follow the detailed instructions for each experiment, which the faculty will distribute on the day of each experiment.

While some of the information below overlaps with what the experiment memo lists, here are some particularly important points:

1. Wear a lab coat and protective eyewear. Please note that vision-correction eyeglasses are not a substitute for protective eyewear. Students are responsible for providing their own protective equipment (purchased at co-ops, etc.). Some experiments may require students to wear protective gloves, which the instructor will provide.
2. Glassware is fragile and should be handled with care. Inspect it for scratches and cracks before use. When you must apply some force to the glassware, such as when inserting a

glass capillary into a rubber stopper, it is particularly easy for glass to break and cause injury. Take safety precautions such as wearing work gloves, and wet the glass capillary tube before inserting it.

3. When heating organic solvents, take extreme care to prevent ignition and avoid spilling organic solvent from containers. The evaporation of the solvent and the increased concentration of vapor can also cause ignition. Read the text and decide what to do in case ignition occurs.
4. When handling test reagents, be sure to follow the descriptions in the text and the instructions of the instructor. In general, reagents used in student experiments are designed to minimize hazards—assuming that they are handled properly—but hazards cannot be completely eliminated. Details on the general handling of reagents are listed in the "Matters Common to the Faculty of Agriculture and Graduate School of Agriculture" section of this manual.

The following are precautions specific to each type of experiment:

Common Specialty Basic Subjects Fundamental Experiment on Chemistry

(1) Analytical Chemistry Experiment I

- Handle the concentrated acids and alkalis (hydrochloric acid, nitric acid, ammonia water, sodium hydroxide solution) used in the experiment with care
- When heating with a gas burner, make sure to avoid incomplete combustion, bumping, and heating empty pans
- Centrifuge tubes may break during centrifugation. Be careful when disposing of broken glass fragments.
- Since various heavy metals are used, be careful when sorting liquid waste for disposal

(2) Analytical Chemistry Experiment II

- Handle acids and alkalis with care

(3) Inorganic Chemistry Experiment III

- Handle the concentrated acid (sulfuric acid) with care
- Use a rubber bulb when measuring out the solution with a volumetric pipette
- Hydrogen peroxide causes skin irritation, so be careful not to get it on your skin. If it does, rinse the area promptly with large amounts of water.

(4) Inorganic Chemistry Experiment II

- Handle acids and alkalis with care
- If ion-exchange resin gets on your hands, etc., rinse the area promptly with large amounts of water
- When heating with a gas burner, make sure to avoid incomplete combustion, bumping, and heating empty pans
- Vanadium effluent is stored in an alkaline form, so it should not be mixed with other heavy metal effluents (most of which are stored in acidic form)

(5) Physical Chemistry Experiment I

- Phenol causes severe irritation when it comes in contact with skin. Take care not to get it on your hands. If it does, rinse the area promptly with large amounts of water.

(6) Physical Chemistry Experiment II

- Chloroform is toxic. Ventilate the room well and avoid inhaling its vapors as much as possible.

(7) Organic Chemistry Experiment II

- Exercise extreme caution to avoid ignition of solvents and their vapors. Use fume hoods effectively.

Experiment on Environmental and Natural Resource Science II (Advanced Chemistry)

Also comply with 1 to 4 listed on the previous page for Experiment on Environmental and Natural Resource Science II (Advanced Chemistry).

The following are precautions specific to each type of experiment:

(1) Organic Chemistry Experiment I

- Handle nitric acid and sulfuric acid with care
- Handle burners with care. DO NOT leave ignited burners unattended.

(2) Behavior of polymeric environmental substances

- Handle strong alkalis (sodium hydroxide solids and hexamethylenediamine undiluted solution) with care
- Chloroform is toxic. Ventilate the room well and avoid inhaling its vapors as much as possible.
- Use a rubber bulb when measuring out the solution with a volumetric pipette

(3) Behavior of inorganic environmental substances

- Handle acidic solutions (hydrochloric acid) and concentrated alkaline solutions (potassium hydroxide solution) with care
- Use a rubber bulb when measuring out the solution with a volumetric pipette

(4) Chromatography

- Methanol, which is used to analyze synthetic detergent components, should be handled with plastic gloves to avoid skin contact. Inhaling large amounts of methanol vapor is also harmful to the body, so work in an area that is properly ventilated with a ventilation fan and ducts.
- Use a rubber bulb when measuring out the solution with a volumetric pipette

(5) Environmental analysis: measurement of dissolved oxygen

- Handle strong acidic and alkaline chemicals with care
- Handle burners with care
- Use a rubber bulb when measuring out the solution with a volumetric pipette

Experiment on Environmental and Natural Resource Science III (Advanced Biology)

1. Effects of soil water stress on plant growth and leaf gas exchange speeds

(1) Wear comfortable clothing, since you will be doing outdoor work. Bring a raincoat in case it rains.

(2) Since the risk of heatstroke exists depending on the weather conditions, safeguard your health well and drink plenty of water. If you feel unwell, inform a faculty member immediately. Pay attention to the condition of other participating students as well.

(3) Be careful when you are cutting plants with scissors to avoid hurting yourself and others

(4) Be careful of burning yourself when using the oven to dry the plants

(5) Use measuring equipment carefully to avoid accidents and damage

2. Plant tissue observation and tissue culture experiments

(1) Plant tissue observation

a) Cutting observation samples

Take care to avoid injury when using a box cutter or safety razor to prepare samples manually. Always use a sharp knife or razor, soften hard tissues before cutting, and concentrate while cutting. When using a microtome, take special care when attaching and detaching the microtome blade. Other precautions include using microtome oil for smooth movements, softening hard tissue by boiling it beforehand, and using a sharp blade.

b) Fixation and embedding

When observing a specimen using an optical microscope, the tissues are sometimes fixed in place with a mixture of alcohol, formalin and acetic acid, or with glutaraldehyde. Formalin vapor can damage the mucous membranes of the eyes and nose, so handle it with care. Handle it in a fume hood or take other measures so that it does not touch your skin.

c) Dehydration, staining, replacement, mounting

Organic solvents such as alcohol and xylene are used in the process from dehydration to mounting. Avoid inhaling solvent vapor or touching the solvent. If the solvent gets on your skin, wash the area well with tap water. Fragments of glass slides and coverslips can also cause injuries, so handle them with care. When disposing of glassware, place it in a dedicated container for glass waste. Be sure to put organic solvent waste liquids such as dehydrated solution in a designated container.

d) Tissue dissociation

When observing individual cells of a tissue, you must dissolve potassium chlorate in concentrated nitric acid to create a dissociation solution and perform delignification. Prepare the dissociation solution and conduct delignification in a fume hood. Heating samples during the delignification process temporarily emits mucous membrane-irritating vapors, so keep your face and hands away from the dissociation solution. If the dissociation solution gets on your skin, immediately wash the area thoroughly with water.

e) Handling optical microscopes, etc.

Using a microscope improperly can cause eye fatigue and affect your vision. Adjust the optical axis and aperture to ensure proper observation before use, and avoid prolonged observation under strong light. When using reflected light as a light source, conduct your observations in a brightly lit place. Get instructions on how to use scanning electron microscopes and transmission electron microscopes before use.

(2) Tissue cultures

a) Autoclave

Confirm the limits for pressure test pressure, normal operating pressure, and maximum operating temperature in advance. If you are using an autoclave for the first time, read the user manual and familiarize yourself with the machine. Always make sure the safety valve works properly and inspect it periodically. Also make sure that the pressure has decreased to atmospheric pressure and that the temperature has dropped sufficiently, and wear gloves when removing sterilized instruments or specimens.

b) Laminar flow cabinet

Always turn off the UV lamp before use. Begin work after the air starts blowing and it becomes sterile. Adjust the air volume accordingly. If you are using a gas burner, adjust the flame to the appropriate strength and avoid having any flammable substances nearby.

c) Collection, preparation, chemical sterilization and cultivation of explants

When using blades such as saws, knives, razors and scalpels to collect and prepare explants, concentrate on your work to prevent injuries. Handle hazardous substances such as hydrogen peroxide for chemical sterilization with care. When using shaking incubators or centrifuges for cultivation, confirm the precautions in advance.

3. Experiments related to fungi biodegradation

(1) Minimize the amount of airflow in the laboratory and keep the lab clean at all times

(2) Wear clothing suitable for performing experiments (such as lab coats)

(3) Keep the lab bench clean and organized. Always wash glassware to keep it clean.

(4) Always sterilize and dispose of medium and used strains after an experiment

(5) Always close the main valve after using flame sources such as gas burners and/or a water supply

(6) Keep noise to a minimum and pay attention to the instructor's instructions. If an accident occurs, no matter how small, contact your instructor for instructions.

4. Staying safe during animal physiology experiments

(1) Take care not to injure yourself and others when handling dissecting tools such as scalpels and razors. Do not carelessly splash blood and other biological materials.

(2) Separate animal carcasses and used scalpels from other waste, since disposal will be outsourced to a contractor

(3) Blood and excrement may carry zoonotic diseases. If they come in contact with your skin, wash such substances off thoroughly with water and then disinfect your body.

(4) Disinfect cuts with 3 percent H_2O_2 and apply 1 to 5 percent $FeCl_3$ (a hemostatic agent). See a specialist if you have any external injuries.

5. Staying safe during Safety in environmental microbiology experiments

Microorganisms are present everywhere—including in the air, in distilled water, on laboratory equipment, and even on your skin—so you must take special care to prevent contamination by microorganisms that are not the target of the experiment. For this reason, it is essential to fully master the basic techniques of sterilization and aseptic manipulation. Dispose of samples after the experiment carefully and properly so that you and those around you are not contaminated by microorganisms. Lab coats must be worn in the laboratory. Do not leave the laboratory or enter the cafeteria while wearing a lab coat.

(1) Sterilization

a) Autoclave: This uses high-pressure steam as a sterilization method. The general setting for sterilization is a temperature of 121°C for fifteen minutes. After sterilization is complete, always check the pressure gauge to make sure the autoclave's internal pressure has returned to normal before opening the lid. Please note that the temperature may still be high immediately after opening the lid and hot steam may rise, so be careful not to burn your hands and face. Wear cloth gloves when removing containers, etc. Cooling hot glass containers immediately after sterilization may cause them to shatter. In addition, never vigorously shake a glass container filled with hot liquid, since it may break and cause glass shards and the liquid to disperse, which is extremely dangerous.

b) Dry heat sterilization: This method sterilizes by heating the sample to a high temperature in an oven. The general setting for sterilization is a temperature of 180°C for fifteen minutes. After sterilization is complete, wait until the temperature inside the oven has dropped below 80°C before opening the lid.

(2) Aseptic manipulation

- When using a pipette to measure samples that containing suspended microorganisms, always use a rubber bulb. To draw in a bacterial solution, move the pipette gently along the tube wall to avoid bubbles, and do not spray the bacterial solution on the liquid surface. This is important to minimize aerosol generation.
- Wash your hands thoroughly before and after each operation to keep them free from contamination
- Always keep a disinfectant solution (such as a 70 percent ethanol solution) close by, and disinfect immediately if there is a possibility of microbial contamination of the surrounding area

(3) Disposing used culture media and laboratory equipment

Autoclave all culture media, bacteria and the like used in experiments before disposal to

prevent environmental contamination. Also sterilize and wash laboratory equipment that may have been contaminated by microorganisms.

(4) Handling culture apparatus

Since there are a large number of microorganisms being cultivated in the container, be very careful not to drop and damage the culture apparatus. When entering and leaving a thermostatic chamber, open doors widely and close them securely, and do not perform work with the door left open.

(5) Other experimental equipment

- Centrifuges: Set the rotor securely. Confirm the maximum speed of the rotor being used and do not to exceed that speed when operating the machine. Make sure that the centrifuge tube containing the sample is balanced and that there is no water inside the rotor before starting the machine. Do not leave the centrifuge unattended until the desired rotation speed is reached. If you notice any abnormality in sound or vibration, immediately press the stop button. Always keep the inside of the rotor clean. If the inside of the rotor becomes contaminated by samples, etc., wash it immediately and dry it thoroughly before use.
- Optical microscopes: Follow the safety items noted in "plant tissue observation and tissue culture experiments."

Experiment on Environmental and Natural Resource Science IV (Geoscience)

1. Field surveys

Follow the instructor's instructions and take measures to prevent accidents when conducting surveys. Stay away from dangerous places and do not wander outside the survey area without permission. Wear comfortable clothing but limit skin exposure to protect yourself from birds, animals and insects. Wear tight, nonslip shoes, since you may be walking on steep, slippery mountain paths. Wearing a hat is advisable for sun protection. Some surveys are conducted in the rain, so bring a raincoat and umbrella.

2. Observations at Field Museum Fuchu

Be careful to avoid electric shock when unplugging or plugging in equipment. Be careful not to break glassware and injure your hands.

3. Basic measurements for forest catchments

Deleterious chemicals such as strong acids are used for some measurements. Handle them with care.

4. Anthropogenic activities and water quality

Wear plastic gloves when using methanol for antibiotic analysis to avoid contact with your skin. Inhaling large amounts of methanol vapor is also harmful to the body, so work in an area that is properly ventilated with a ventilation fan and ducts.

18. Staying Safe during Surveys (Experiments) and Practical Training in the Department of Ecoregion Science and Related Majors and Courses

1. Precautions regarding field surveys and experiments

Follow the instructor's instructions and prepare according to the purpose of your research. Before conducting a field survey, be sure to complete an Off-Campus Research Notification and submit it through your academic advisor (his/her signature required).

Stay away from dangerous places and do not wander outside the survey area without permission. When outdoors, wear comfortable clothing that is easy to move in and does not expose your skin. Wear tight, nonslip shoes, since you may be walking on steep, slippery mountain paths, and because many of the pieces of equipment used in field surveys are heavy. Also wear a hat to protect yourself from the sun and rain, or a helmet if the locations and situations make that a better choice. If you have a pre-existing medical condition or allergy, bring the corresponding medication with you and inform the instructor of your condition in advance. Always conduct surveys in rivers, forests and other desolate places in groups of two or more. When sleeping in tents or at facilities, behave responsibly and stay safe. During outdoor activities, have a means to make emergency calls, such as a cellphone, if an emergency occurs.

To prepare for unexpected accidents, this department's students are required to enroll in Personal Accident Insurance for Students Pursuing Education and Research (Gakkensai) and personal liability insurance (Gakkensai supplemental liability insurance or university co-op student liability insurance) at the time of enrollment. You cannot participate in field surveys and experiments unless you are enrolled in these insurance plans, so please confirm your enrollment status beforehand.

General precautions for field surveys (including experiments)

Responding to accidents: If an accident occurs, immediately stop the survey and contact your instructor, etc. Depending on the nature of the accident, you should also contact the police, fire department and other authorities as necessary. For minor injuries, provide first aid immediately and guide the victim to a road or the like.

Health: Bring your own water; do not drink water from streams, rivers or lakes. In addition, many outdoor accidents result from a lack of sleep or drinking too much alcohol, so take good care of yourself. If you are not feeling well, do not take part in the survey.

Traffic safety: Students must meet the requirements for driving cars and motorcycles during a survey. Consult with your instructor and follow the necessary procedures before driving a

car or motorcycle. You must also make an activity plan in advance, drive safely, and submit a report afterward.

Clothing and other items: Follow the instructor's instructions on preparing suitable clothing (long sleeves, long pants, hiking shoes/boots, etc.) and other items (survey tools, map, compass, altimeter, drinking water, first-aid supplies, personal ID, etc.) according to the survey.

Handling blades: Carry blades such as machetes, axes and saws in a case and put the case in a daypack, etc. Do not carry luggage and blades in both hands. Be very careful when using blades of any kind.

Safety while working: Be careful of slippery areas and rockfalls on steep slopes. If a rockfall occurs, shout loudly to alert others. When splitting up into groups to conduct the survey, check the current location on a map and confirm the meeting place and time.

Fire safety: Do not build a campfire. Do not smoke during the survey or while walking. If you are a smoker, bring your own portable ashtray.

Weather: Suspend the survey if there is rain or dense fog and safety is questionable. In addition, if a thunderstorm is predicted or already approaching, stop the survey immediately and get to a safe location.

2. Precautions for social science fieldwork

Social science fieldwork is conducted through interviews, participant observation and questionnaires. In urban areas, subjects include government agencies such as the national government and municipalities, educational institutions, NPOs and other organizations, as well as residents and experts. In rural areas, subjects include producers (farmers, forest owners, forestry corporations, etc.), agricultural and forestry organizations (agricultural cooperatives, land improvement districts, forestry unions, etc.), various businesses such as commerce and tourism, government agencies, and village residents. Fieldwork will also include visits to business offices, factories, markets and other facilities, production areas for agricultural, forestry and fishing industries, as well as the home offices and homes of residents. In addition, students collect and record administrative and financial documents, local documents and other literature, utensils in everyday use, customs and practices, rituals, and other information. Unlike experiments and practical training in the natural sciences, some problems may occur because the subjects of investigation are people. Pay careful attention to the following three points to ensure safety and smoother, problem-free fieldwork:

Responses to traffic accidents: Students generally use public transportation when conducting fieldwork. If you are involved in an accident during fieldwork, immediately contact the office in charge (Student Support Section) and your academic advisor.

Ensure safety: Always be aware of the risk of being involved in various crimes, even in desolate areas such as farming and mountain villages. In general, do not conduct fieldwork alone. You should always be in a group, especially at night.

Responsible behavior: It may be obvious, but being a university student does not exempt you from having social common sense and making rational decisions. Even if you are conducting a survey off-campus, it is still part of the curriculum (educational activities). You must act based on your understanding of the precautions distributed by the academic advisor and instructor before fieldwork begins. During fieldwork, you will often be divided into small groups to visit different subjects, so judgment and behavior based on common sense are required of each individual. If your fieldwork extends into the night, if meals or beverages are provided by the subject as a courtesy, or if confidentiality of the subject matter is strictly demanded, you are expected to act rationally and with common sense to avoid unnecessary friction and accidents (or crimes).

3. Field surveys from planning to completion

(1) Preparations before the survey

- Submit a field survey plan to your academic advisor describing the survey content, a reasonable survey schedule, scheduled course, emergency contact information, local contact information during the survey (if available), and contact information after returning home.
- Complete an Off-Campus Research Notification and submit it to the university through your academic advisor
- Inspect your survey equipment, and be sure to bring first-aid supplies, handheld transceivers, radios and the like
- Identify and stay away from dangerous places in the survey area

(2) During the survey

- Monitor the weather forecast when traveling to the survey site. Always notify the person responsible if you are involved in a traffic accident or if there is a change of plans.
- Check your physical condition. If you are not feeling well, do not participate in the survey. If you are not feeling well during the survey, do not hesitate to go back to the university or home.
- Work in groups of two or more people as much as possible
- Do not overexert yourself
- Avoid excessive alcohol consumption
- Be very careful to avoid traffic accidents when commuting to and from the survey site. Be especially careful on the return trip, since fatigue can cause you to be easily distracted.

(3) After the survey

- Always contact your academic advisor, etc. when you are finished with your research
- Review the entire procedure and report any hazards you experienced
- Review the survey and its procedures for areas that can be improved

4. Precautions when taking field measurements

- When performing field measurements outdoors, take care not to disturb the flow of traffic of pedestrians, automobiles, etc. Be careful when using a tape measure or making observations on roads where vehicles pass to avoid accidents and damage to instruments.
- When taking measurements in undeveloped land such as fields and rivers, watch your step to avoid unexpected injuries. Extra safety precautions should be taken in forests and mountainous areas.

When taking measurements in national parks that may conflict with the Natural Parks Act, obtain prior permission from the park office having jurisdiction and complete the prescribed procedures. When conducting research in national forests, complete the necessary procedures for entering the forest at the forest management office having jurisdiction.

5. Precautions for practical training sessions by class subject

Safety precautions for each practical training session are noted below:

Practice on Ecoregion Science I and II

This course of study offers various types of training, and the safety precautions vary depending on the type of training involved. Be sure to complete the pre-training course and receive specific explanations from your instructor.

Forest Planning Training

This section describes the intensive field training that is part of this course.

Sophomores participating in this training should be especially careful about safety precautions since this is the first long-term practical training in the Field Museum (with the exception of some of the abovementioned Practice on Ecoregion Science I and II), and because they are not used to working outdoors, especially in forest areas with steep slopes.

Students will conduct forest volume measurements and the like in the Field Museum using various instruments and machines, analyze tree trunks by collecting slices from harvested trees, carry out forest surveys to develop forest plans in accordance with priority functions and uses, and other training. In addition to the items listed under “12. Staying Safe during Outdoor Experiments and Surveys,” “13. The Dangers of Forest Creatures and Countermeasures for Them,” and “14. The Dangers of Plants and Mushrooms in Forests and Countermeasures for Them,” please be aware of the following situations:

- When walking through steeply sloping forest areas, avoid loose rocks, dead branches and other surfaces where you may lose your balance, and grab trees or shrubs as necessary so that you maintain your balance

- When cutting down a tree, be sure to move out of the range of the falling tree
- When splitting up into groups to work, take special safety precautions since you may be entering an unknown part of the forest. Obtain permission from faculty, technical staff or TAs before entering the forest.

Practice of Wildlife Conservation

This training consists of outdoor training (at Field Museum Tama) and indoor work (lectures, data analysis and presentations) at the Fuchu Campus. Please note the following points to stay safe during outdoor training. There are no special safety considerations for indoor work, so behave in the same manner as you would during a regular lecture.

(1) Outdoor training

- Get enough sleep: The training session starts early in the morning to observe wildlife. You are responsible for getting enough sleep.
- Animal restraints: The research involves measuring rodents

(1) Safety precautions

a) Ensure that the animal is properly restrained

In this situation, restraining an animal means to artificially control its natural defensive capabilities. It is a prerequisite to understand the subject animal's behavior so that you can predict its next move. When physically restraining an animal, you must effectively contain its attacks (biting, scratching, kicking, etc.) rather than simply immobilizing it with brute force. Never put your face near the animal.

b) Be careful with instruments

The training involves sharp instruments such as syringes, scalpels and scissors. In addition to avoiding injury yourself, be careful not to injure others by being careless.

(2) Sanitary considerations

a) Do not touch animals with your bare hands

The laboratory animals used during the training are hygienically controlled. As long as you interact with them in a sensible manner, such as washing your hands after touching them, there is virtually no risk of contracting a zoonotic disease. Wild animals, however, must be handled with the assumption that they carry some pathogens. Wear rubber gloves, lab coats, hats and masks when touching animals.

b) Clean and disinfect instruments after use

To avoid spreading possible infections, always clean and disinfect instruments after use.

- Ensure a means of communication: Since you may be outside the cellphone service area, carry a handheld transceiver as well
- Prepare emergency rations: Have emergency food on hand in case you get lost during the research
- Prepare first aid supplies: Have first aid supplies ready in case of injury

Practice on Silviculture

Practice on Silviculture will be conducted at the Field Museum (former Study Forest) and at the university's plant nursery. Training related to thinning, pruning, planting and other work will be conducted at the Field Museum, and training in raising seedlings will be conducted in the plant nursery. In addition to the matters listed under "12. Staying Safe during Outdoor Experiments and Surveys," "13. The Dangers of Forest Creatures and Countermeasures for Them," and "14. The Dangers of Plants and Mushrooms in Forests and Countermeasures for Them," please pay attention to the following situations:

- When cutting down a tree, pay close attention to others and make sure they are out of the range of the falling tree
- Make sure no one is around you before using a machete, sickle or other blade
- Training camps at the Field Museum are physically exhausting, so be sure to get enough sleep and avoid fatigue
- Ensure safety by following the precautions given in the training guidance and the instructions of the faculty and staff members onsite

Experiments and Practice on Forest Soil

Experiments and Practice on Forest Soil is also conducted in laboratories. This laboratory work includes training experiments that use analytical methods and the scientific properties of major inorganic elements, so please read the safety manual instructors have prepared carefully and familiarize yourself with the process. In addition, since many types of instruments are used in laboratories, you should take the following safety precautions to avoid disturbing other students:

- Detailed instructions on the handling glassware, precautions for using analytical instruments, and methods for liquid waste disposal are given before the experiment begins, so be sure to follow them
- If you notice broken glassware, do not use it and inform the faculty member. Serious injuries often occur when cleaning up broken glassware.
- Laboratory tables should be kept clean and organized, instruments should be arranged so that experiments can be conducted smoothly, and used glassware should be promptly washed and dried
- When chemicals are used, read the handling instructions for them before conducting experiments. Return unused chemicals taken out of the chemical room to the original shelf as soon as possible.
- When using concentrated hydrochloric acid or concentrated sulfuric acid, collect and dilute the substance in a fume hood. If it accidentally gets on your hands or other parts of your body, quickly wash it off with plenty of water.
- The instruments used differ according to the experiment. Read the manuals prepared for

each instrument carefully and follow the precautions listed. Before using an instrument for the first time, receive guidance from the instructor or teaching assistants.

- After using large instruments, etc., return them to their original condition. For example, be sure to close the valves of acetylene gas cylinders and other gases after an experiment.
- Do not wear earphones (or headphones, etc.) during experiments
- If you or someone around you gets injured, inform the instructor immediately and follow his/her instructions.
- If you have any questions regarding the disposal of liquid waste, ask your instructor or a teaching assistant for instructions

Practice on Mountain Conservation and Erosion Control Planning

Erosion control planning training is performed at the Field Museum (formerly the Study Forest). In addition to the matters listed under "12. Staying Safe during Outdoor Experiments and Surveys," please pay attention to the following when conducting field training and surveys:

- Rocks and stone slabs in mountain streams can be very slippery and dangerous when wet, so be sure to check your footing when walking. Be especially careful when it is raining.
- Be especially cautious around waterfalls and steep slopes, which are hazardous
- If the water level of a river or stream suddenly decreases or rises, or the water becomes muddy, especially during rainfall, immediately retreat to a safe place higher than its level
- When visiting erosion control facilities and similar facilities, carefully read and follow the directions and safety rules posted around the facility
- Be careful not to hit people around you when moving or setting up surveying equipment, poles, etc.

Practice on Forest Engineering Systems

Field training takes place at Field Museum Karasawayama. In addition to the matters listed under "12. Staying Safe during Outdoor Experiments and Surveys," please pay attention to the following:

- Handle surveying equipment with care during forest road design training. Report any damage to surveying equipment and tape measures to the instructor.
- Wear ankle-high shoes and other protective footwear. Be careful of slips and falls, since the planned forest road route may cross a stream or uneven surfaces, and the soil may become soft and slippery due to regular foot traffic in the same area. As the work progresses, many piles will be driven into the path. Since you may be walking while dragging a meter-long rope, be careful of obstacles. Be especially careful of your footing and watch out for slips and falls when carrying heavy objects such as stakes and surveying equipment.

- Do not lean on mowing sickles for support while resting, because the sickle may slip and cut your foot
- When observing cableway work, do not stay in the path the cable may fly to if the pulley comes off or the cable snaps (the narrower angle side of the cable pulled down by the pulley). Use wire ropes and nylon ropes only within their load-bearing capacity, and always use new ropes.
- Since you may be working in the habitat of ticks and Japanese mountain leeches, be sure to wear appropriate protective clothing

Practice on Forest Health and Arboriculture

This training takes place in the Field Science Center. Since some research training is conducted off-campus, students must commute to the research site using the public transportation designated.

Please refer to "12. Staying Safe during Outdoor Experiments and Surveys" for information on clothing and personal belongings during training.

When using a high-pressure sterilization kettle, please follow the instructor's guidance, be sure to check the temperature display, and use protective gloves when inserting and removing specimens.

Practice on Forest Dendrology

The purpose of this training is to understand the nature and ecology of trees in diverse forests. Please pay attention to the following:

- When walking through steeply sloping forest areas, avoid loose rocks, dead branches and other surfaces where you may lose your balance, and grab trees or shrubs as necessary so that you maintain your balance
- Keep pruning shears used for collecting tree samples in a case and take care when carrying them
- All types of training, not just overnight training, are physically exhausting, so be sure to get enough sleep and avoid fatigue

Experiment on Agricultural Environment Engineering, Practice on Agricultural Environment Engineering, Seminar on Agricultural Environment Engineering

(1) Agricultural land and soil

- You will have to handle heavy metal objects, so be careful not to drop them on your feet or hands
- Since many devices are pressurized using air or water, be careful not to operate their valves carelessly. Carefully consider the fundamentals of the operation and use them in the proper sequence.
- Be careful not to burn yourself while using electric dryers

(2) Hydraulic engineering

- Stay away from the pump and operation panel while the water pump is on
- Do not touch valves, stopcocks or other control devices during the experiment
- Do not touch other experimental equipment in the laboratory
- Wear shoes with a good grip that prevents slipping and falling on the floor (avoid sandals)
- No specific attire is specified. Your normal clothes are acceptable, but avoid wearing loose-fitting clothes that can easily get caught on equipment.

(3) Structure and materials

- Many tasks require multiple people to cooperate, so follow the instructor's instructions and work with each other while paying attention to your surroundings
- Wear lightweight clothing that can get dirty, since gravel and grease will be used. Avoid wearing clothing with decorations, scarves, mufflers, etc. that can easily get caught on equipment used during experiments. Boots or sneakers are preferable; sandals or slippers are not acceptable.
- Before using the concrete compression testing machine, always put the protective panels in place. The formwork and concrete specimens are heavy, so be careful not to drop them.
- After the experiment, clean and organize the instruments and equipment used, and make sure all equipment you used is turned off

(4) Machinery and measurements

- Wear lightweight clothing that can get dirty and will not get caught in the machine. Safety shoes are preferable when handling heavy objects. As a rule, you should not use gloves.
- Do not touch the tip of soldering iron with your hand
- Do not get superglue on your hand
- Handle glassware and precision instruments with care. If shattered glass spreads when an instrument is dropped, notify the instructor immediately and follow his/her instructions for cleaning up the glass.

(5) Operational engineering

- When operating agricultural machinery, wear work clothes or lightweight clothing with cuffs and hems that can be shortened. Boots or sneakers are preferable. Clogs, sandals, slippers and the like are not acceptable. Do not wear gloves.
- When operating machinery, please observe the following points: 1) make sure no one is around before operating the machine; 2) signal before operating the machine; 3) stay away from rotating parts that are in motion; 4) be aware of the tangential direction of rotating parts, since objects may fly in that direction.
- Do not enter paddy fields barefoot; wear paddy field boots or tabi shoes for paddy fields
- When working under the sun, take precautions against heatstroke, such as taking adequate rest, wearing a hat, and bringing water or tea along
- Do not try to handle heavy objects alone

- Consider your surroundings before using farm tools such as sickles, shovels and rakes, and handle them with care. Ensure that they are returned to their original locations after use.

Experiment and Practice on Ethology

The goal of Experiment and Practice on Ethology is to provide students with hands-on experience at performing research, mainly in fields related to comparative behavior and comparative psychology. Students conduct behavioral observations of animals as well as humans both on and off-campus. In doing so, pay attention to the following precautions to ensure that experiments and training are conducted safely:

- When conducting human behavioral observations on campus, most experiments set conditions for observations. In most cases, however, the subjects of the experiment are not informed in advance that they are subjects. Therefore, even respected university personnel may take unexpected actions during the experimental observations. In such cases, it is necessary to fully explain the experiment's purpose to gain their understanding. It is important to avoid unnecessary trouble. This is even more crucial during off-campus experiments and observations, so be extra careful. In particular, when off-campus, do not try to solve problems that you cannot handle. Instead, contact your academic advisor as soon as you find it impossible to solve the problem.
- When observing animal behavior at a zoo or other facility, carefully listen to the precautions the facility staff set in advance and conduct observations within the limits the facility permits. For field observations, please refer to "13. The Dangers of Forest Creatures and Countermeasures for Them" and "14. The Dangers of Plants and Mushrooms in Forests and Countermeasures for Them" for precautions related to animals and plants, and be sure to conduct training in a safe manner. Wear clothing appropriate for conducting outdoor activities safely, such as a hat, long-sleeved shirt and long pants. Light hiking shoes are recommended. In addition, carry raingear and warm clothes such as a sweater at all times to be ready for changing weather conditions. Research sites are usually located in mountainous areas that are relatively close to human residences and are not very high in altitude, but trouble with other people is still a possibility. When conducting observations, particularly early in the morning or at night, always work in groups whenever possible and seek the understanding of local residents, such as by notifying them in advance so they are not suspicious of your presence.

When conducting experiments and training off-campus, always be aware of your responsibility to yourself and act with consideration to your surroundings.

Practice on Surveying

- Surveying instruments: Since these are precision optical instruments, handle them with the utmost care to avoid damaging them. When handling instruments that use laser

beams, do not look directly into the beam.

- Practice on Basic Surveying and Practice on Geoinformatics: Since this training is conducted on campus, mark the presence of surveying instruments clearly to prevent bicycles and automobiles from hitting them. Take insect-repellent measures during the summer.
- Practice on Mountain Surveying: If you are taking the intensive course conducted at Field Museum Karasawayama, the survey will be conducted in mountainous terrain, so be careful of your footing.
- Make sure you read and understand the matters listed in "12. Staying Safe during Outdoor Experiments and Surveys."

Practice on Eco-social Investigation

Students conduct community research during this training. Follow the basic instructions listed in "2. Precautions for social science fieldwork" above, and act in accordance with the instructions given in the Practice on Eco-social Investigation lecture. During this training, you are expected to remain conscious of the fact that you are an outsider intruding into the daily lives of local residents and act accordingly.

- At research sites, follow the instructions of the personnel serving as intermediaries with the residents for the training (e.g., municipal officials)
- Be sure to greet local residents when you meet them while strolling or traveling in the village/town
- Never smoke or drink alcohol when offered, even if you are of legal age
- Participate in community events such as rituals and annual events whenever you have the opportunity, and actively assist in such activities

19. Staying Safe during Experiments and Practical Training in the Cooperative Department of Veterinary Medicine and Related Majors

The Cooperative Department of Veterinary Medicine often uses animals for experiments and practical training and has been raising a large number of livestock for many years. Since this department it is an endemic area for *Clostridium tetani*, it is essential to take measures against tetanus. If you have not already been vaccinated, we highly recommend that you receive a tetanus shot.

Part of this training will be conducted at Iwate University and other off-campus institutions. Follow the instructor's directions at the institution to prevent accidents and be sure to use public transportation rather than your own vehicle when commuting to the site. Since the extramural institution staff take time out of their day to assist with our training in addition to their regular duties, any behavior that might interfere with the performance of their duties, such as being late, is strictly prohibited. Below are precautions to take to ensure the safe implementation of experiments and practical training in the Cooperative Department of Veterinary Medicine:

1. Handling instruments and equipment

a) Dissection and surgical instruments

When using skinning knives, dissecting saws, chisels, hammers, scalpels, scissors, suture needles and other tools, be careful not to damage your hands as well as those of others around you. In particular, be aware of your surroundings when working in groups.

b) Syringes and needles

Take sufficient care to avoid stabbing yourself or others with needles. Do not carelessly expel biological materials such as pharmaceuticals and blood in syringes into the air. Dispose of used syringes and needles as medical waste or in another designated manner.

c) Anesthetic equipment

Volatile inhalation anesthetics are often used during experiments and practical training involving animals. Be sure to ventilate the laboratory thoroughly before placing a cotton ball that has absorbed inhalation anesthetics into a container to use as a simple anesthetic. Before using circulating anesthesia equipment, get instructions on its use and conduct inspections to confirm that there are no circuit leaks or abnormalities in the exhaust.

2. Handling chemicals

a) Formalin

Formalin is used to chemically fixate animal specimens that need to be preserved for the long term. Since formalin is pungent and dangerous, wear rubber gloves, safety goggles,

protective masks and the like when handling formalin-fixed specimens and organs, and always use ventilation equipment and formaldehyde reduction equipment during your work. If formalin gets on your skin, rinse it off immediately with water and wash the area with soap. If it gets in your eye, wash it out with plenty of water and seek medical attention immediately if you experience any unusual symptoms. If you spill formalin, use a formalin neutralizer to remove it.

b) Pharmaceuticals

There are many times during Cooperative Department of Veterinary Medicine coursework when you will have to administer pharmaceuticals to animals. Students also often handle poisonous or deleterious drugs, anesthetics and psychotropic drugs. These drugs, which can cause serious injury to the human body, require stricter controls than ordinary drugs. In particular, the high number of drug-related accidents and incidents recently has heightened public concern, and special awareness and caution are required when using these substances. Follow the instructions from your instructor and be careful not to accidentally leave these substances unattended or take them out of the facility.

3. Handling microorganisms

Microorganisms handled in the veterinary medicine field include zoonotic pathogens, which carry the risk of infection if handled carelessly. You must therefore acquire basic key techniques such as sterilization, disinfection and aseptic manipulation before handling them. Other precautions for preventing infection in laboratories are described below:

a) Syringes

Take sufficient care to avoid stabbing yourself or others with the needle or ejecting the contents accidentally. Before expelling air bubbles from a syringe, wrap the tip of the needle in alcohol cotton and gently push out the air bubbles.

b) Pipettes

Oral manipulation is dangerous. Use a rubber bulb or similar device. When using a pipette, move the pipette gently along the tube wall to avoid bubbles, and do not spray the solution on the liquid surface. Aerosol generation may cause a spread of infection.

c) Mortar, homogenizer, ultrasonic processor

Procedures such as grinding infected organs in a mortar, processing in a homogenizer, and destroying microorganisms with an ultrasonic processor generate aerosols. Conduct these procedures in the certified training room that handles microorganisms or a biosafety cabinet in the laboratory.

4. Handling animals

As mentioned previously, animals are frequently used in experiments and practical training during coursework in the Cooperative Department of Veterinary Medicine. The species handled are also diverse, ranging from small laboratory animals such as mice and rats to

large animals such as horses and cows. The key to conducting experiments and training with animals is to be familiar with the characteristics of each animal and treat them all with care. It is therefore vital to learn methods of restraining animals that are safe for both humans and animals. Anesthesia and other pharmacological methods should be administered when necessary.

When handling livestock such as pigs, cattle and horses, you must make efforts to prevent infectious diseases in accordance with the biosecurity manual each farm prepares according to the law. Persons who have entered Japan from a foreign country within the past week are not allowed to enter a biosecurity area. Clothing and shoes brought in from overseas cannot be brought into a biosecurity area for at least four months after returning to Japan. If there are unavoidable circumstances, clothing and shoes must be cleaned and disinfected through specific procedures.

Do not bring tools and other items that were used on a different farm. When entering a biosecurity area, always change to the special boots and work clothes at the entrance. Before entering a cattle barn, disinfect your boots in the step-in disinfection tank, and also disinfect your hands. For details, refer to the university's biosecurity manual. (You can also refer to "15. Excerpts from the Biosecurity Manual" of this safety manual.)

The following describes matters to note for each species:

a) Mice and rats

Rats are particularly known for carrying zoonotic diseases such as hantavirus hemorrhagic fever with renal syndrome, so specimens that have been quarantined should be purchased from a laboratory animal specialist.

The main point of restraining the animals is to prevent bites. When working with mice, hold the tail and place the mouse on the metal lid of the cage or the like. Secure the neck by grabbing the rodent by the back and holding its tail. When working with rats, use the index and middle fingers on your nondominant hand to hold down the sides of the rat's head and neck, use your thumb and ring finger to grasp under the axilla and chest, and finally use your pinky to hold down the tail.

b) Guinea pigs

Guinea pigs are very docile animals. Grasp the chest from the dorsal side and secure the neck in the same way as you would a rat.

c) Rabbits

Rabbits can injure people by kicking with their powerful hind legs, scratching or biting. Do not grab a rabbit's ears to lift when restraining. Grasp the skin of the neck with one hand and hold its loins with the other hand. Special restraining gear is available.

d) Dogs

Preventing bites is the first priority. Beagles that specialized companies breed as laboratory animals are mild-mannered and easy to treat and are recommended for

experiments. After calming the animals by talking to them, use muzzles or mouth masks as necessary to properly restrain them. From the standpoint of animal rights, painful procedures should be performed under anesthesia.

e) Cats

Cats are very difficult to handle—they bite, scratch and try to run away at every opportunity. Unlike dogs, it is difficult to obtain specimens that have been bred as laboratory animals. Use commercially available cat bags and laundry nets for restraining them. The use of anesthesia should also be considered as necessary.

f) Goats and sheep

Although they are docile and relatively easy to handle, be careful not to get poked in the eyes by their horns. To restrain the animal, hold its body between your legs and hold the head firmly with both hands.

g) Pigs

The mini pigs used in experiments only grow to around 60 kg in weight; be careful with male sire pigs since they have well-developed tusks. Restrain specimens weighing up to around 30 kg in a supine position. Consider the use of sedatives or anesthesia if it is uncooperative. Use restraining gear for larger specimens. Domestic pigs, especially breeding pigs, are much larger than mini pigs. Snout snares or side-position restraints are used in stalls, but the use of drugs may also be important. Piglets for fattening can be restrained in an inverted position. Pig farms are very sensitive about sanitation management, so follow the biosecurity manual of each farm.

h) Cattle

Dairy cattle that interact with humans on a daily basis are docile, but seed bulls and pasture-raised beef cattle may be aggressive and must be handled with extreme care. The main dangers cattle pose are from their horns and hooves. Getting pierced by horns and getting kicked are painful and dangerous. In addition to kicking backward, cattle are known to kick forward, sideways, and may even perform roundhouse kicks. Other behaviors include sudden lunges, leaning on humans, and pinning humans between walls. It is especially dangerous when a cow or bull is backing up with an agitated look in its eyes; scolding it or hitting it will only aggravate the situation.

When approaching cattle, avoid sudden movements and speak calmly. The basic method of restraining a cow or bull is to grasp the nose ring or use a cow halter. In many cases, a restraint frame is necessary. It is also important to restrain the tail when treating the rump, anus or genitals. Students have many opportunities to interact with cattle such as during blood sampling, injections, udder examinations and rectal examinations, but it is dangerous to concentrate only on the area being treated. To avoid injuries, it is crucial to safely restrain these animals beforehand and to understand their behavioral habits.

i) Horses

Horses are sensitive animals and are easily frightened. An anxious horse will use defensive

behaviors such as kicking, biting, jumping and mounting. Since horses have superior strength and athletic ability, getting in the way of these defensive reactions can lead to fatal injuries. Therefore, the basic rule for handling horses is to fully understand their nature and avoid scaring them or making them anxious. It is essential to observe a horse's body language before approaching it. If the whites of its eyes are showing and its ears are laid flat, the horse is cautious and potentially hostile. If it is breathing shallowly with the alar folds of its nose open, it is anxious and fearful. If it is holding its head and tail high and breathing loudly with its nostrils flared open, it is startled and nervouse. If a person is fearful when approaching a horse, the horse will sense the fear and become fearful itself, so the person must stay calm and composed. Approach the horse while talking in a gentle voice and stop about two meters before reaching it to reassure it and calm it down. Do not make loud noises or sudden movements. Approach the horse quietly from around its left shoulder, talking calmly to it, and stroke it from the shoulder to the neck area, or pat it lightly with your palm. Approaching a horse suddenly from behind is extremely dangerous. Horses are handled using a bridle and rein and restrained by tying them to a hitching post or held in place in the stall. An experienced keeper is required when handling horses. Take extreme care to avoid agitating a horse even after it is restrained, since exciting it can result in a serious accident.

5. Euthanizing animals and disposing of their carcasses

Secure your own safety before euthanizing an animal and ensure instantaneous loss of consciousness and immobilization through the use of anesthetics and the like from the standpoints of animal rights and safety.

Ask a specialized contractor to dispose of animal carcasses.

6. Handling analytes

Blood, urine, feces and other analytes present a risk of transmitting zoonotic diseases. If any of these substances get on your skin, wash it off thoroughly with water and then disinfect the area.

20. Staying Safe during Experiments and Practical Training at the Animal Medical Center

Since the majority of animals handled at the Animal Medical Center are domesticated dogs and cats, this safety manual will focus on the treatment of these animals. Safety measures related to treatment in the center are divided into the handling of animals, use of electronic medical equipment, and use of X-ray and X-ray CT imaging equipment.

The handling of pharmaceuticals and clinical reagents is another element that should be considered. In particular, it is essential that poisonous, deleterious and psychotropic drugs be strictly stored under the guidance of instructors. Carcinogenic anticancer drugs must also be handled with gloves and masks to prevent direct contact and inhalation. Since the development of test kits makes it possible to do testing of clinical reagents without direct contact, safety measures regarding the handling of drugs and reagents are omitted here.

1. Handling subject animals

First and foremost, you must keep in mind that receiving medical treatment is an extremely stressful experience for domesticated cats and dogs. Furthermore, there are many stimuli in the center that may be visually and olfactorily stressful. You must therefore be able to quickly avoid or respond to instinctive or defensive aggressive behavior that animals exhibit during medical treatment. Refer to the section on handling laboratory animals under “18. Staying Safe during Experiments and Practical Training in the Cooperative Department of Veterinary Medicine and Related Majors” of this safety manual for information about basic procedures for handling animals.

The center is a place where various animals that normally live in separate environments coexist in the same space. If animals accidentally come in contact with each other, they may fight. This can cause unnecessary injuries to the animals and also often results in excited animals attacking handlers. Take extreme care when moving and leashing animals to avoid such situations.

2. Using electronic medical equipment

In recent years, veterinary hospitals often use precision instruments such as electrocardiographs, ultrasound equipment and automated blood testing equipment. Although these electronic devices are equipped with safety devices to prevent or detect excessive current or electrical leakage, be sure to familiarize yourself with the prescribed procedures before use.

Laser equipment has a risk of eye and skin damage, so read the instructions carefully and

wear appropriate protective equipment.

3. Using radiology equipment

Diagnostic X-ray devices are the only pieces of radiology equipment used at the center. Therefore, you can ensure safety by preventing external exposure. However, it is also essential to consider the general public because the center is used as an outpatient clinic. Since the same technology is used for humans at hospitals and the animals do not feel anything from the X-rays used for the diagnosis, we tend to underestimate the importance of protection. Therefore, the following strict preconditions are imposed from the standpoint of damage prevention:

(1) When animals are exposed to radiation, stochastic effects must be considered, even for minute doses

(2) Organisms can repair damage from some degree of radiation exposure. However, when considering protection, do not factor in this repair mechanism, but rather work under the assumption that the effects will accumulate.

The benefits of X-rays in veterinary medicine are tremendous, and X-rays have become essential to the field. The safe handling of X-rays based on proper awareness is required. The following are basic guidelines for persons involving experiments and training using X-ray equipment:

(1) Understand the basic properties of radiation

(2) Always undergo educational training (prior to entering a controlled area and regularly every twelve months)

(3) Always undergo an ionizing radiation health examination (prior to entering a controlled area and regularly every six months)

(4) Always wear a personal dosimeter

(5) Become proficient in handling equipment

(6) Only conduct X-ray exams when absolutely necessary

(7) Always leave a record of use on the use ledger provided when using the equipment

(8) Avoid radiation exposure whenever possible

(a) Only work in areas where X-rays are used for short periods of time

(b) Consider the direction of the X-ray beam and move as far away from the source as possible

(c) Provide effective shielding (protective shields, protective clothing, protective gloves and thyroid protectors)

(d) Understand that it is a crime for veterinarians and students to radiograph the human body

(e) If you notice any abnormality in the X-ray equipment, immediately stop using it and contact the equipment manager

[A] Using stationary X-ray equipment

Location: Old Building X-Ray Room (Room 104)

Applications: Small animals, radiography

(1) As a rule, use the radiograph remotely. Avoid manual restraint whenever possible, and instead use tools or drugs to restrain the animal.

(2) If you must restrain an animal manually, be sure to wear protective clothing, protective gloves and a thyroid protector, and use a holding strap to keep as much distance between your fingers and the field of irradiation as possible. Narrow the irradiation field by using a diaphragm. Under no circumstances should your body be in the irradiation area during the primary X-ray beam.

(3) A veterinarian must always be present when using the equipment. Only a veterinarian may press the exposure switch.

[B] Using mobile X-ray fluoroscopy equipment (C-Arm)

Location: Old Building Operation Training Room (Room 112), New Building Operation Room No. 3 (Room 208)

Applications: Small animals, X-ray fluoroscopy

Note that the leakage dose is higher than that of the stationary type. Guidelines for safe handling are given below:

(1) If the animal must be cared for during X-ray irradiation, the handler should work within the mobile protective shield. You must also wear protective clothing, protective gloves, a thyroid protector and radiation protection goggles.

(2) The fluoroscope operator should wear protective clothing, protective gloves, a thyroid protector and radiation protection goggles, and should be positioned as far back behind the equipment as possible.

(3) All persons except the fluoroscope operator and assistants must leave the room. All doors should be closed and locked except for emergency exits. Post signs notifying others that the equipment is in use to prevent accidental exposure to radiation.

(4) A veterinarian must always be present when using the equipment. Only a veterinarian may press the exposure switch.

[C] Using stationary X-ray CT scanner

Location: New Building CT Room (Room 113)

Applications: Small animals, computed tomography

Precautions for handling: Most precautions are the same as those for stationary X-ray equipment, but special precautions are required because the radiation dosage is higher than that of X-ray equipment.

(1) Permission from a faculty member is required to enter the CT room, regardless of whether

imaging is being performed

(2) Entry into the CT room and manual restraining are prohibited during imaging

(3) Only faculty members are permitted to press the power and exposure switches and perform calibration and warm-up

(4) Always obtain the permission of the equipment manager before use

4. Using the MRI scanner

Location: New Building MRI Room (Room 110)

Applications: Small animals, tomography

Precautions for handling: No magnetic metals are allowed inside the MRI room because the MRI scanner is made of powerful magnets that constantly generate a magnetic field. Bringing magnetic metals (oxygen cylinders, IV stands, hairpins, scissors, knives, keys, enamel trays, etc.) into the MRI room may damage the equipment due to the item being attracted to the machine, and personal injury may occur due to the items flying.

Workers and students with magnetic metal implants (cardiac pacemakers, cerebral artery clips, cochlear implants, defibrillators, nerve stimulators, carotid clamps, iron plates, etc.) in their bodies must check in advance, since there may be life-threatening risks. In addition, be sure that everyone knows that magnetically sensitive items (watches, hearing aids, magnetic cards) should not be brought in, since they may malfunction.

5. Response to emergencies

(a) If an earthquake, fire or other emergency occurs, immediately stop your work to ensure your own safety, and cooperate in reporting the incident and initial fire extinguishing activities

(b) If you are accidentally exposed to radiation, record the voltage/current used, irradiation time, distance/location, etc., then contact your instructor and receive immediate medical attention

21. Staying Safe during Experiments and Practical Training at the Scleroprotein and Leather Research Institute

The following describes safety precautions for using special equipment and facilities at this institute.

1. Staying safe when using the cold storage/freezer room

Since you may freeze to death if you have an accident and lose consciousness in the cold storage/freezer room, always inform a fellow laboratory member of your intention to enter the room. Avoid entering the room alone whenever possible. Although the room's door has a doorknob with a two-factor safety device, be sure to reconfirm the location and operation of the alarm bell on a regular basis.

2. Staying safe when using the biohazard room and sterile cell culture room

These rooms are equipped with sterilization lights and CO_2 incubators. Sterilization lights can damage your eyes and skin, so turn them off when working in these rooms. To prevent carbon dioxide gas from filling the room, always keep it properly ventilated.

3. Staying safe when using the animal room

Before entering the animal room, change into the special clothing provided. It is advisable to enter the room in a group. Maintain constant ventilation, temperature and humidity in the room.

22. Staying Safe during Experiments and Practical Training at the Gene Research Center

Genetic recombination experiments

The Gene Research Center has a dedicated laboratory for genetic modification work. When handling genetically modified organisms, pathogenic microorganisms and the like, monitored infectious disease pathogens (pathogens of livestock contagious diseases), designated invasive alien species, and other items listed in "特定生物の保管・管理 (Storage and Management of Specified Organisms)" of the Center for Environment and Safety website (https://web.tuat.ac.jp/~kankyou/02_a/01_safetymanual.shtml), please complete the appropriate procedures before applying to use the Gene Research Center. When defining and classifying genetic recombination experiments and the guidelines for conducting experiments, please refer to "8. Staying Safe during Genetic Recombination Experiments." Please handle the storage and disposal of recombinant organisms with care in accordance with the guidelines. If you have any questions, contact a full-time faculty member.

Microbiological experiments

Aseptic manipulation is performed in a laminar flow cabinet (positive pressure) or biosafety cabinet (negative pressure). The laboratory is not equipped with city gas, but you may borrow a cylinder-type burner if necessary. Always sterilize recombinant organisms or pathogenic microorganisms by autoclaving or the like before disposing of them. When handling active pathogenic microorganisms, refer to "9. Staying Safe during Experiments That Involve Handling Pathogenic Microorganisms." If the microorganism is classified as a Bio Safety Level 2, an Animal Bio Safety Level 2 or a higher pathogenic microorganism or otherwise requires approval from the Specified Organisms Safety Management Subcommittee, follow the appropriate procedures before beginning work. If you have any questions, please contact a full-time faculty member.

Use of equipment

Take extra care when using equipment with high-pressure gas cylinders—such as CO_2 incubators, particle guns, mass spectrometers, and next-generation sequencers—as well as equipment that is subject to high voltage (such as DNA sequencers, electroporators and isoelectric focusing devices) or has sharp blades (such as vibratomes and microtomes).

Response to emergencies

If an earthquake, fire or other emergency occurs, immediately stop work. The top priority is to

ensure your own safety, report the incident according to the emergency contact procedure, and then assist in initial fire-extinguishing activities.

Other

In principle, it is prohibited to operate constant-temperature water baths, electrophoresis instruments, vacuum pumps or the like overnight. However, if it is absolutely necessary, consult with a full-time faculty and obtain approval first. For other equipment that cannot be turned off, consult with a full-time faculty member.

23. Staying Safe during Experiments and Practical Training at the Advanced Plant Factory Research Facility

The following is a description of the special equipment and other features of this facility:

1. Using facilities and equipment

Research facilities (environmental controlled room, laboratories) and research equipment (LED equipped chambers, NC analyzer, high-performance liquid chromatography (HPLC), ion chromatograph, real-time PCR, integrated fluorescence microscope, laminar flow cabinet, growth chamber, etc.) are for shared use, so you must apply/reserve them beforehand. The facility is open from 9 a.m. to 5 p.m. (use is generally prohibited on Saturdays, Sundays and holidays). Get a proper explanation about how to operate the equipment from the facility manager or her/his designee before use. Return all used equipment to its original position, and collect waste liquids to bring back to the own laboratory for disposal.

2. Entry to research facilities and the environmental controlled room

You must change into clean shoes before entering the research facility. You must also use the air shower before entering to prevent pests and plant pathogens from entering the **environmental controlled room**. Please also ensure that any plants and equipment you bring are free of pests and plant pathogens.

3. Precautions at the environmental controlled room

The CO_2 concentrations may be increased in the **environmental controlled room** to facilitate photosynthesis. Plant respiration may also increase the CO_2 concentration naturally. In particular, CO_2 tends to accumulate underground. If the CO_2 monitor installed in the room is activated, evacuate the facility immediately. Additionally, since bees may be kept in the room as pollinators, be careful not to get stung. Do not look at strong light sources such as LED illuminators or halogen lamps, and pay attention to the movement of transport equipment.

4. Hoist crane

You must complete a course of special education for crane operation and a slinging skill training course, and pass a final examination before using the hoist cranes for transporting cargo. Consult with your manager.

24. Staying Safe during Experiments and Practical Training at the Center for Infectious Disease Epidemiology and Prevention Research

1. General precautions

Conduct experiments in accordance with the TUAT's Regulations for the Safety Management of Pathogenic Microorganisms and Regulations for Prevention of Domestic Animal Infectious Disease Outbreaks. At our university, the laboratories on the fourth floor of New Building 4 (4-454, 4-455 and 4-456) and the West Building of the Gene Research Center (W15) are certified as BSL2 laboratories, so you can handle BSL1 and BSL2 microorganisms there. Pay extra care when handling microorganisms that cause zoonosis. Carefully read "9. Staying Safe during Experiments That Involve Handling Pathogenic Microorganisms," and apply for permission to enter the microorganism control area, possess microorganisms, perform genetic modifications, and other necessary certifications before conducting experiments.

The center also often handles animal samples. Conduct experiments in accordance with the matters regarding the handling of microorganisms and animals in "Staying Safe during Experiments and Practical Training in the Cooperative Department of Veterinary Medicine and Related Majors." In addition, when using the Gene Research Center, conduct experiments in accordance with the matters in "21. Staying Safe during Experiments and Practical Training at the Gene Research Center."

2. Other precautions

Specimens believed to contain pathogenic microorganisms should be handled in a biosafety cabinet. Depending on the type of specimen and the analyzing instrument, however, it may not be possible to use a biosafety cabinet. Even in such cases, only handle pathogenic microorganisms in a BSL2 laboratory, and strive to prevent the spread of microorganisms to the best of your abilities. Unnecessary specimens and used instruments should be autoclaved to completely inactivate them before disposal.

If an accident or the like occurs during after-hours use of the laboratory, respond promptly and follow the emergency contact network to make the necessary reports.

3. Shared use

Next-generation sequencers, scanning electron microscopes and other such equipment in the center is available for use by any TUAT faculty member, researcher or student. We encourage you to employ them during your education and research.