



## REPORT.

The National Academy of Sciences was established by act of Congress in March, 1863, with power to frame its own constitution, select its own members, and provide in other respects for its continuance and successful operation.

The object of the academy is to advance science, pure and applied, by original researches; to invite the attention and aid of the government to scientific inquiries of especial public importance, to be directed by the academy; and especially to investigate, examine, experiment, and report on any subject of science or art whenever called upon by any department of the government. ←

The academy contains at present about one hundred members, representing within their ranks nearly every department of knowledge, whose services, in accordance with the charter of the academy, are always at the disposal of the government.

to do so

(1)  
[1881]

→ It is also empowered by its charter to report to Congress on "all matters needful or usual in such Institutions."

Since the last report of the Academy submitted to Congress May 1<sup>st</sup>. 1880, ~~the Academy~~ it has held two Sessions, that convened at Columbia College N. Y. Nov: 16<sup>th</sup> to 19<sup>th</sup> 1880. which was devoted entirely to scientific work & the regular annual meeting held in Washington April 19 to 22 1881. <sup>It is proposed that</sup> In conformity with the decision of the Academy, the present annual report to Congress shall include, besides the Scientific & other proceedings of the two Sessions above referred to, the transactions of the present meeting; that hereafter these annual reports shall be made to <sup>embrace</sup> ~~include~~ the work of the Academy from the beginning to the close of the each Calendar Year.

The members of the National Board of Health were invited to be present and to take part in the scientific proceedings. After a short address by the president of the academy the following papers were read and discussed :

TITLES OF PAPERS READ.

**Draper, H.**—On Photographing Spectra of the Stars.

**Young, C. A.**—Spectroscopic Notes.

**Woodward, J. J.**—Original Researches Reported in the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.

**Dalton, J. C.**—Some Observations on the Structure of the Human Brain.

**Guyot, A.**—Some Remarks on a New Map of the Catskill Mountains and on the Topographical relations of that mountain group to the adjacent regions of the Appalachian System.

**Alexander, S.**—Brief Comments on the Nebular Hypothesis of La Place.

**Hall, J.**—On some new and remarkable forms of Crinoidæ from the lower

Scientific Session <sup>held</sup> ~~held~~ in New York City  
Nov. 16 to 19, 1880.

At this session held in <sup>rooms in</sup> Columbia College kindly provided for the use of the Academy by the College Authorities, the following members were in attendance.

names.

In the absence of the Pres., on acct of illness, (Vice Pres. Marsh) ~~pres~~ the meetings were presided over by ~~Twenty eight papers were received.~~

~~Twenty eight papers were read as follows.~~  
~~Titles of the papers read~~

The following papers ~~Twenty eight in number~~ were read & discussed.

List of papers.

The Vice President announced the death <sup>(\*)</sup> of the following members (since the last meeting of the Academy) <sup>(\*)</sup> Lewis J. Postals <sup>(\*)</sup> of Cambridge Mass. July 19<sup>th</sup> 1880. <sup>(\*)</sup> Jonathan Homer Lane <sup>(\*)</sup> Wash<sup>I</sup> DC May 3<sup>d</sup> 1880. <sup>(\*)</sup> Sam<sup>l</sup> S. Haldeman; Chickies Penn. Sept. 20<sup>th</sup> 1880. <sup>(\*)</sup> a few days after the close of this meeting the Academy was deprived of another of its members by the death of James Craig Watson <sup>(\*)</sup> director of the M. Obs. at Madison

who died on Nov: 23<sup>d</sup> 1880. Mr Simon Newcomb  
has been requested to prepare a Biographical Memoir  
of Mr Watson to be presented to the Academy.

[1851]  
Messrs J. E. Hilgard, Alex. Agassiz & John L. Leconte 13  
were selected to prepare biogra: memoirs of the deceased members  
respectively in the order above stated.

Mr Le Conte having <sup>subsequently</sup> declined ~~on account of other~~  
~~engagements~~ the task assigned him Mr J. P. Leslie  
was chosen to prepare the memoir of Mr. Walcott.

Mention was also made of the death of Prof.  
Ben<sup>d</sup>. Pierce at Cambridge Mass who, tho not  
recently associated with the Academy,  
a member was one of <sup>its</sup> original members of  
the Academy & <sup>long had participated within a few</sup> for many years an active  
participant in its labors.

The vacancy created by the death of  
Ben<sup>d</sup>. Hector Synedale in the Board of Trustees  
of the Synedale fund has been filled by the  
appointment of Prof. Joseph Lovering of Cam.  
In closing the session <sup>the following</sup> resolution  
was adopted: <sup>conveying the thanks</sup> ~~Resolved: that the~~ <sup>of the</sup> Academy  
of the Academy ~~be~~ <sup>be</sup> to the trustees of Columbia Col.  
for their courtesy in providing rooms for its  
sessions & <sup>to</sup> Pres<sup>t</sup>. Barnard & the officers of  
Columbia Coll. as well as to ~~the~~ other members  
of the Academy in N. Y. for their hospitable  
entertainment.

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A communication was received May 1880, from the Sect. of the Interior, <sup>Hon. Sec.</sup> Carl Shurz as Chairman of a committee appointed by act of Congress, requesting "the Pres. of the Nat: Academy of Sciences to appoint from among the members of the Academy a committee ~~of~~ to inquire into the practicality of restoring the faded writing of the original Manus of the Declaration of Independence, to report what measures, if any, can be adopted for its restoration, as well as how it may best be protected against future injury. In compliance with this request ~~I~~ <sup>they</sup> ~~appointed~~ the following members of the academy, <sup>were appointed</sup> a committee for the object ~~above~~ referred to, namely

Molcott Gibbs

J. E. Hilgard

C. F. Chandler

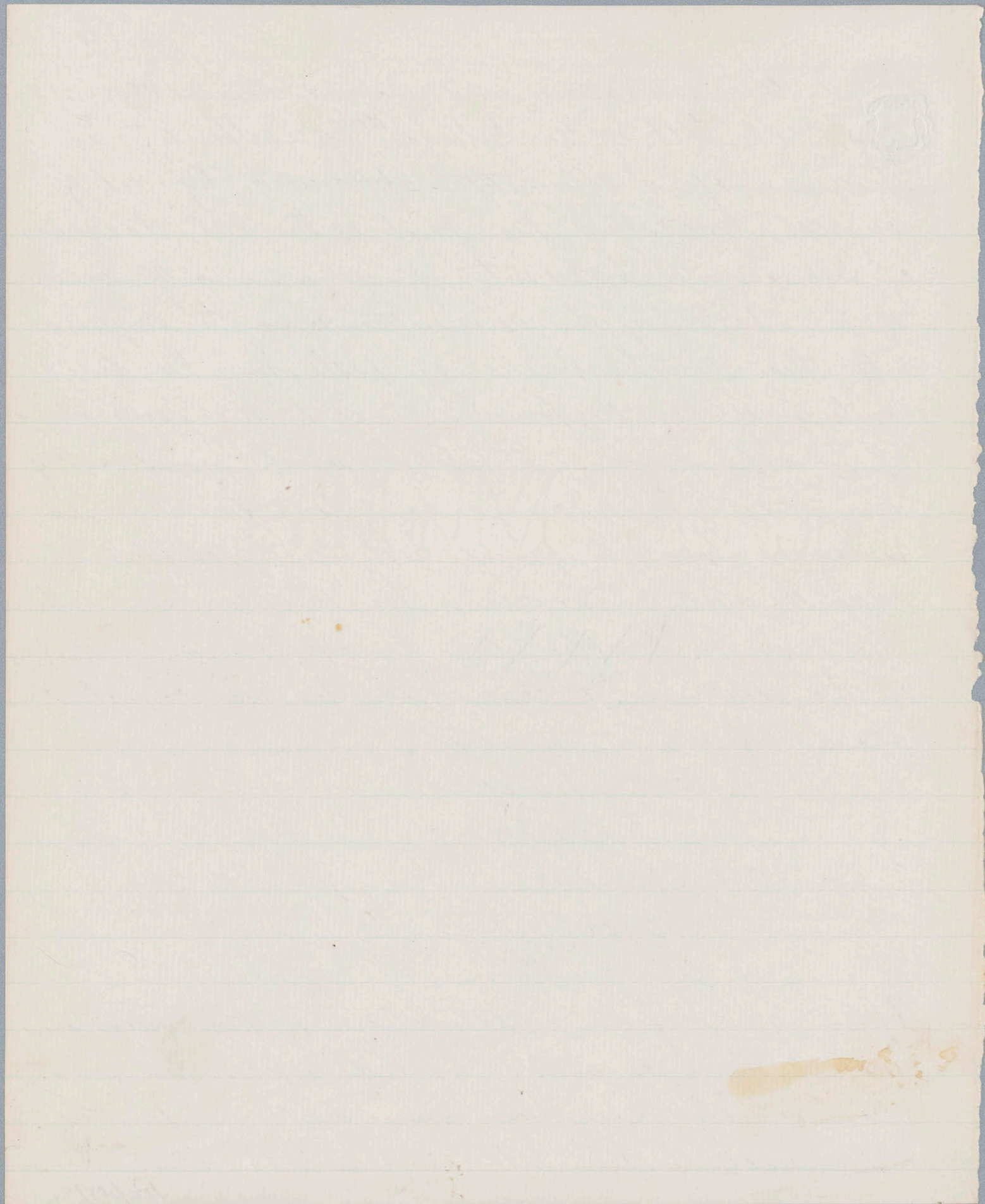
R. E. Rogers

J. L. Smith,

After a careful investigation of the questions involved, the Committee agreed upon the following report which ~~in due time~~ was transmitted to the Sect. of the Interior Jan<sup>y</sup> 18<sup>th</sup> 1881.

Report.





Stated session held in Washington City  
April 19 to 22 1881. ~~A~~

The meetings were held in All Souls Church  
Past W.B. Rogers presiding.

The following members ~~attended~~ <sup>attendance</sup> were in  
names.

After a ~~Past~~ brief address of welcome from  
The ~~Past~~ ~~President~~

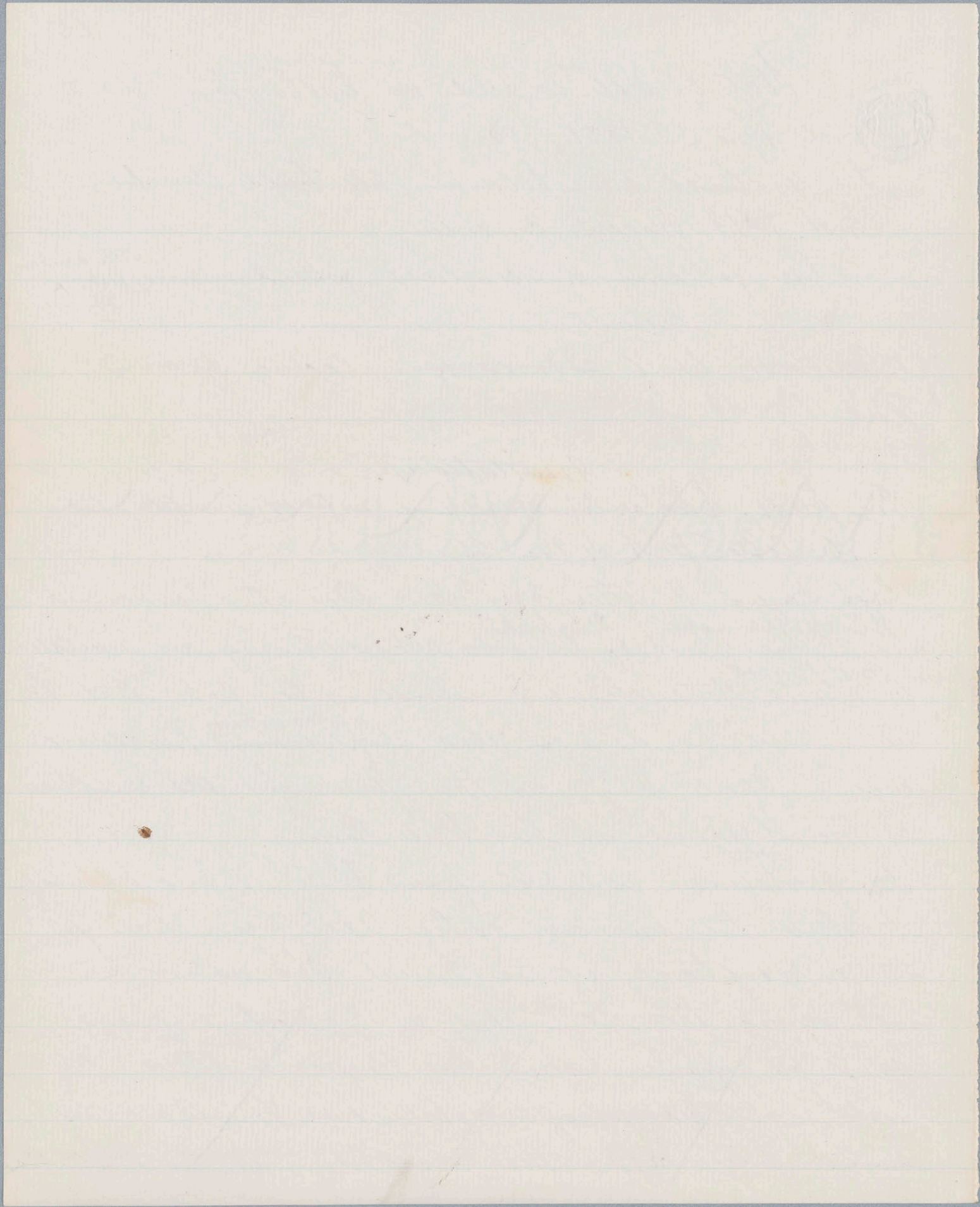
Invitations.

The ~~Past~~ ~~President~~ ~~of~~ the Academy having visited the  
A letter ~~from~~ of the U.S.

Past Rogers A letter was laid before the Academy  
from ~~the~~ <sup>his excellency</sup> ~~Past~~ ~~President~~ ~~of~~ the U.S. <sup>Garfield</sup> acknowledging an invitation  
from ~~Past~~ ~~President~~ Rogers.

to attend its meetings & expressing the hope that he  
would be able to do so also <sup>appointing</sup> ~~suggesting~~ Thursday  
evening April 21<sup>st</sup> as the time for ~~the~~ reception  
of the Academy at the White House.

~~A~~ <sup>letter</sup> ~~invitation~~ was rec<sup>d</sup> from Mr. & Mrs John <sup>Cady</sup> ~~Cady~~  
inviting the members of the Academy & their families  
to a reception at the Naval Observatory on  
Wed: evening the 20<sup>th</sup> inst at 8 o'clock also an  
invitation from ~~Past~~ ~~President~~ ~~of~~ the U.S. <sup>to the ac</sup> ~~to~~ attend a  
recep<sup>n</sup> at Moraley's Hotel on Thursday evening  
immediately after the reception at the White Ho.



Treat: Report.

Prof. Hilgard's statement in regard to the Academy property in Washington.

Resolutions regarding the same.

Prof. Newcomb's statement in regard to the Academy bequest of the late Prof. Watson.

Referred to the council.

The following is a list of the Papers read at this ~~title of Papers read~~ session

Biographical Memoir.

At the meeting of April 21<sup>st</sup> a biographical memoir of Louis J. Portalis, prepared by Mr Agassiz was read by Mr Guyot, the author being absent.

Elections.

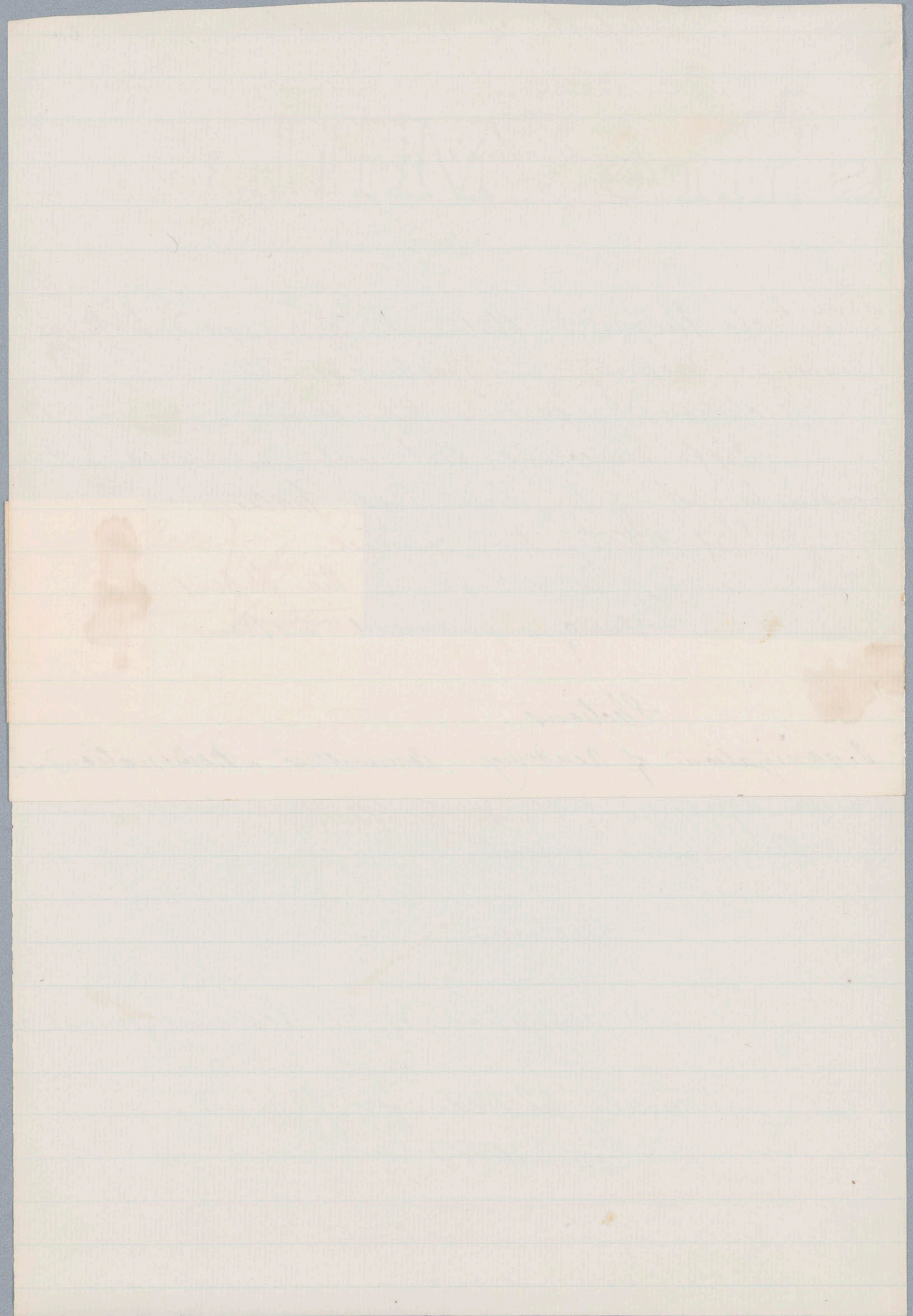
Organization of the Academy for 1881-2.

Council elected for 1881-2.

Committees.

A. Graham Bell	} by invitation of the Academy.
M. W. Dole	
J. M. Mallett	
Genl. B. Alvord	

After the papers.



The Pres: announced that there would be a meeting of the Antino: Soc: at the Columbian Med: Coll: in the even'g of the 19<sup>th</sup> to wh members were invited to attend.

Meeting first

Communications were received from the Secty of the Cosmos Club of Wash: ~~the~~ inviting the members of the Academy to make use of their ~~their~~ Club House during their stay & from Hon Corcoran to visit The Corcoran Gallery of Art, <sup>& the Washington Monument.</sup> Mr Newcomb announced that he wd be glad to exhibit <sup>at Fort Meyer</sup> to these members also his apparatus for measuring the velocity of light now in operation at Fort Meyer.

2 For response to a communication from Gen Hayes we see under date of <sup>apr: 4, 1881</sup> The Pres: appointed Newcomb Chairman & Messrs Searns, Gilbert, Newton, Hill, Ferrel, Shott & Langley a committee on Meteorology to confer & cooperate with the chief signal officer and Messrs Reed & Young were subsequently added to the above committee.

The vacancy created in the Board of Trustees of the Tyndall fund by the death of Gen. Hector Tyndale of Phila has been filled by the appointment May 1880. of Prof Joseph Sauer of Cambridge. Advisory Committee on Coming Transit of Venus.

page of declaration after meeting

Insert after April 1881 meeting

The British Minister at Washington <sup>in a communication dated April 11, 1881</sup> (communicated to our government) <sup>stated</sup> that the Lord Comptroller of her Majesty's Treasury had departed to a Committee of the Council of the Royal Society of London the preliminary duty of reporting to her Majesty's Gov<sup>t</sup> for approval what arrangements should be made for or Great Britain or concerned for taking part in the observations of the approaching Transit of Venus, and for the said Committee to determine by whom what part in the same work is to be undertaken by Foreign Gov<sup>ts</sup> who are likely to take active steps for observing the Transit. This communication was transmitted by the Secy of the U.S. to Gen Adm<sup>l</sup> Rodgers the Superintendent of the U.S. Naval Observatory who is the President of the Commission appointed by our Gov<sup>t</sup> some years since to make arrangements for the observations of the Transit of Venus of 1874 & matters relating thereto.

This Commission (which is <sup>now engaged on</sup> being) desires to take measures as early as practicable to prepare for the observations by American Astronomers of

of the Transit of 1882 - has through its President  
 the Superintendent of the U.S. Naval Observatory  
 has requested me as Pres. of the National  
 Academy of Sciences and as a member of said  
 Commission to nominate four members  
 of the Academy who shall form an advisory  
 Committee to Co-operate with the Commission  
 in determining the best methods of observing  
 the approaching Transit, as well as the  
 stations to be occupied & the Instruments to  
 be used.

The joint Commission thus formed will it  
 is expected be at once authorized by the  
 Secy of the Navy to act in the name of  
 the Government until the next meeting  
 of Congress - when the Commission may be  
 confirmed or modified by that body, in  
 connection with such legislation as may be  
 adopted to provide for systematic observations  
 by American Astronomers of the coming Transit  
 of Venus.

I have taken the liberty to name you  
 as one of the four Academicians to compose

The Commission into the request of the Super of the U.S. Naval Observatory the following members  
 of the Academy have appointed an advisory committee to act in the name of the Government until the next meeting of  
 Congress - when the Commission may be confirmed or modified by that body, in connection with such legislation as may be  
 adopted to provide for systematic observations by American Astronomers of the coming Transit of Venus.

the Commission of Co-operation. I trust that  
 you will accept the nomination, & be ready  
 to aid the Commission in the preparatory work  
 referred to -

I have the honor to be dear Sir  
 Yours very truly

William B. Rogers,  
 Pres. Nat. Ac. of Sci.

addressed severally to

- Prof. C. H. F. Peters - Litchfield Ct.?
- " S. P. Langley - Allegheny Pa.?
- " E. C. Pickering - Harvard U. Ct.?
- " C. A. Young - Pomona Cal.
- " H. A. Newton - Yale Coll. New Haven Conn.

all of whom have signified their willingness to serve,  
 Henry Draper

Memorandum for  
Com. of Co-operation of  
Boards of Dec. 1882.

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[481]  
Loan to Washburn Observatory of Books &c  
included in the bequest of the late Prof. Watson.

A communication dated \_\_\_\_\_ was rec<sup>d</sup>  
from the Execs & Admin<sup>rs</sup> of the late Prof. J. C. Watson  
asking "the Academy to authorize their loaning  
to the Washburn Observatory certain articles  
believed to have been bequeathed by Prof. Watson  
to the Academy."

With the concurrence of the Council, this  
request was granted in the following form.

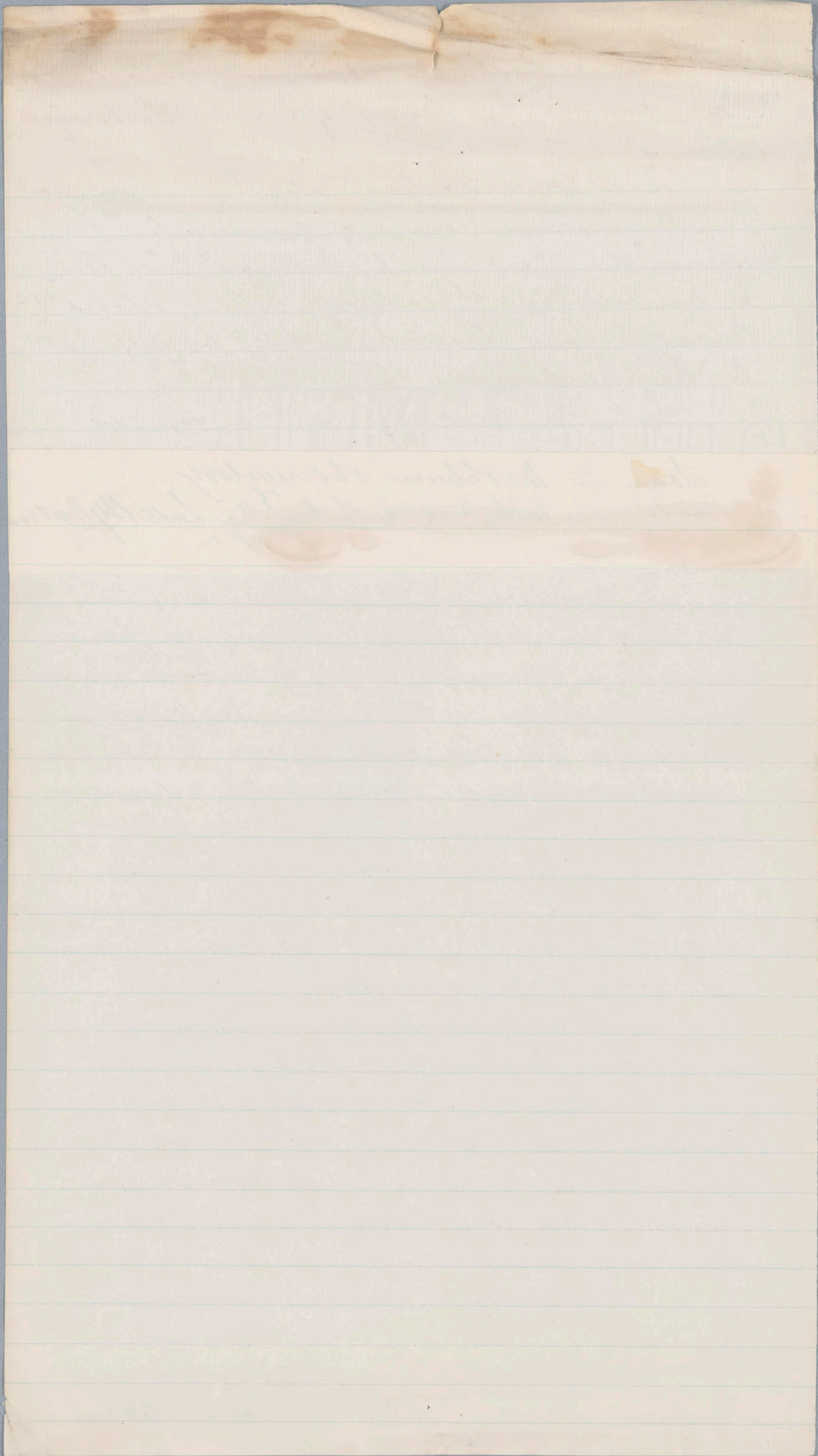
The executors and administrators of the  
estate of the late James C. Watson are hereby  
authorized and requested to loan to the <sup>Washburn</sup> ~~Watson~~ Observatory  
during the pleasure of the Academy the following  
articles from the said estate supposed to have been  
bequeathed by said Watson to the National  
Academy of Sciences.

1. The professional books of his library.
2. The star maps constructed by him at Ann Arbor.
3. The transit instrument now mounted in the  
west room of the Observatory.
4. The pieces of optical glass belonging to him  
in various stages of manufacture.

The said executors and administrators to take  
duplicate receipts for said property from the Board  
of Regents of the University of Wisconsin and  
transmit - one copy thereof to the National  
Academy of Sciences.

By order of the Council of the National  
Academy of Sciences.

William B. Rogers  
Pres<sup>t</sup> Nat: Acad of Sciences



A list of the Books & Papers included in Prof. Watson's  
 Argument has been read by the Academy by Prof. E. S. Holden  
 now in Charge of the Washburn Observatory. Among them  
 are his Star Charts ~~which~~ enumerated below.

List of the Ecliptic Charts of Prof. J. C. Watson,  
 loaned to the Washburn Observatory by the  
 National Academy of Sciences.

No of Chart	R. A.		Dec.		Equinox: Remarks			
	from	to	from	to				
1	0 0	0 12	+6	0	+9	30	1863.0	Unfinished
3	8 53	9 9	+28	15	+30	0	55.0	"
4	9 31	9 41	+17	30	+20	15	55.0	"
5	9 33	9 42	+16	0	+17	30	2.0	"
6	12 27	12 41	-1	0	-4	0	00.0	"
7	15 12	15 21	-20	30	-23	15	50.0	"
8	15 12	15 21	-18	0	-20	45	52.5	"
9	15 12	15 21	-15	15	-18	0	52.5	"
10	15 12	15 21	-12	30	-15	15	50.0	"
11	16 4	16 18	+14	15	+17	15	55.0	"
12	16 18	16 32	+14	30	+17	15	55.0	"
13	16 20	16 34	-24	0	-23	0	---	"
14	20 58	21 10	-25	15	-26	0	73.0	"
15	22 38	22 48	-2	45	+1	0	55.0	"
2	22 42	22 52	-2	45	-6	15	50.0	"
16	23 0	23 10	-2	45	+0	45	55.0	Finished
17	23 0	23 10	+0	45	+4	15	55.0	Unfinished.
18	23 10	23 20	-8	0	-11	30	55.0	Finished
19	23 48	24 0	+6	0	+9	30	63.0	Unfinished

List of Miscellaneous Papers.

- 1. 1 Bundle of Papers on Optics of a refracting telescope [incomplete].
- 1. 1 Small bundle of papers on Observations of (139) at Peking:
- 1 small bundle of papers on the discovery of Vulcan 1878 July 29. [This collection is by no means complete]
- 1 package of computations for the Ephemerides of several minor planets. [The results have all been published.]

List of Manuscripts

No. 1. Small papers in [illegible] [illegible]

No. 2. Small bundle of papers on [illegible] -  
[illegible] of [illegible] at [illegible]

No. 3. Small bundle of papers  
discovery of [illegible] 1878  
[illegible] is by [illegible]

Watson  
Newcomb

No. 4. Package of [illegible] for the  
[illegible] of several [illegible]  
[illegible]. The results have all  
been published.

First Page

National Academy of Sciences  
Washington D. C.

February 15<sup>th</sup> - 1882.

Sir:

In conformity with the requirements of the Act of incorporation, approved March 3<sup>d</sup> 1863, I have the honor to submit herewith a Report of the proceedings of the National Academy of Sciences from November 16<sup>th</sup> 1880 to the close of the year 1881.

Very respectfully,

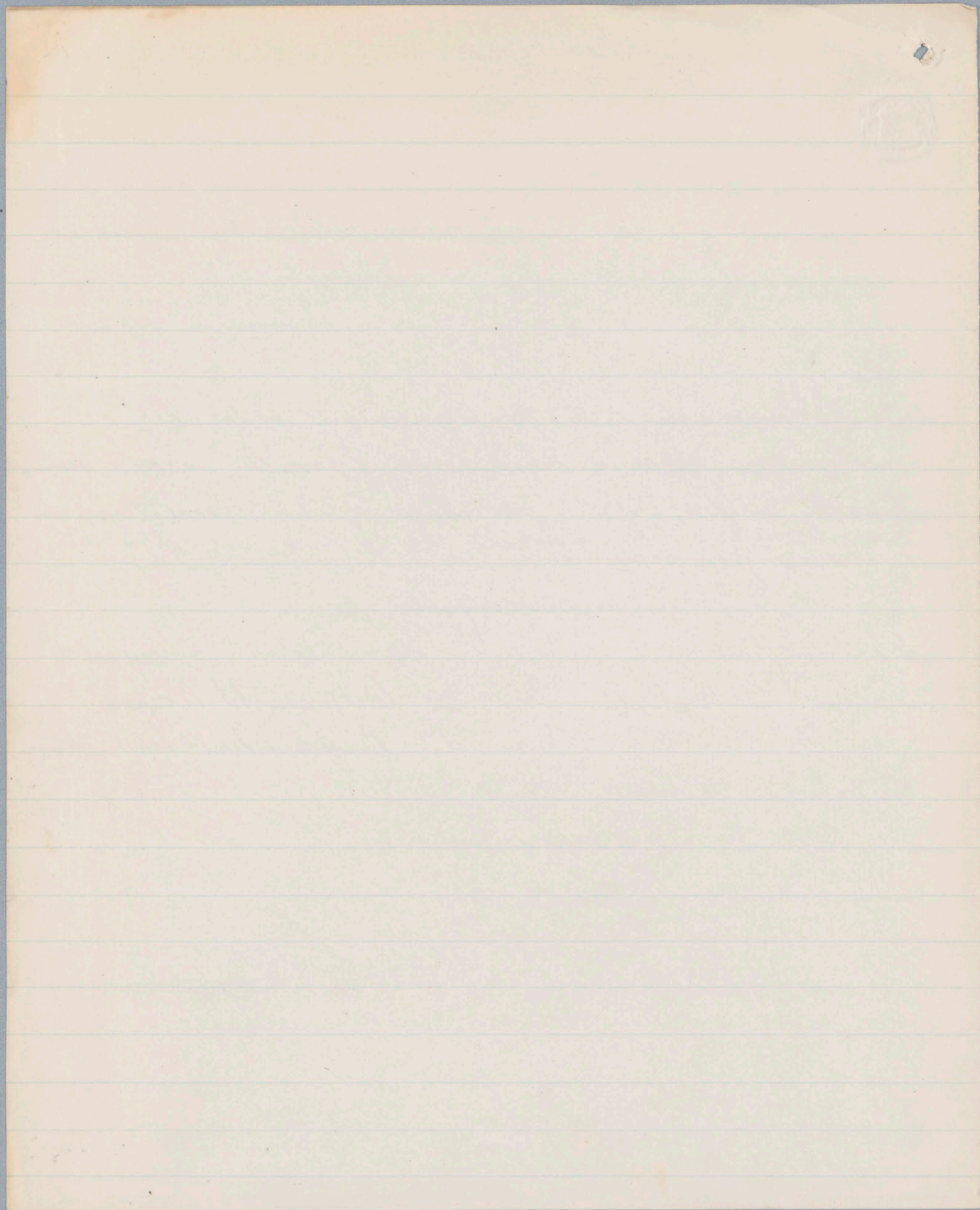
Your obedient servant

William B Rogers

President - Nat. Acad. of Science

The Hon. the Speaker

of the House of Representatives.



[2/15/1882]

(1)  
Report

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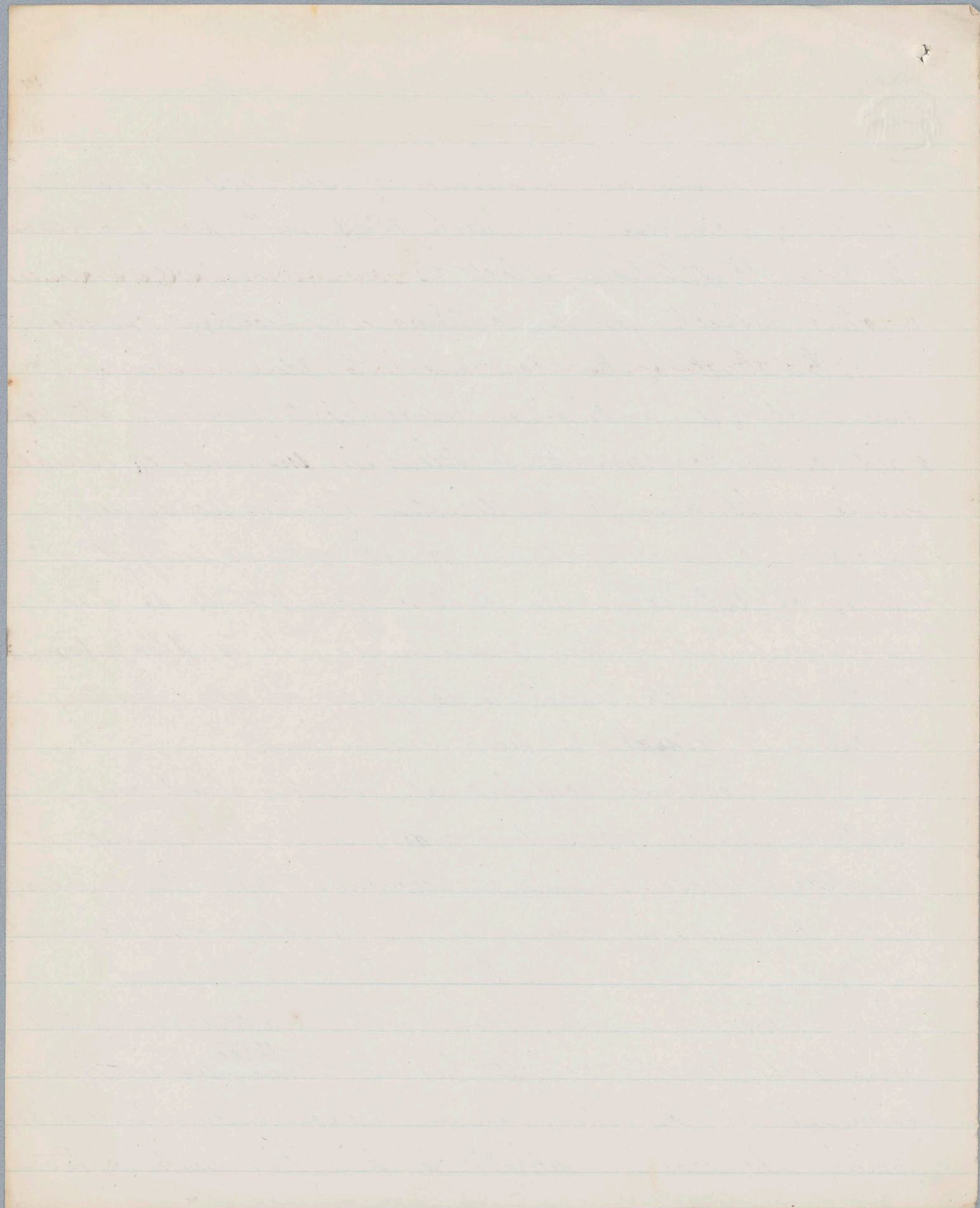
The object of the Academy is to Advance Science, pure & applied, by original researches; to invite the attention & aid of the Government to Scientific Inquiries of special public importance, to be directed by the Academy; & especially to investigate & report on any subject of Science or Art whenever called upon to do so by any Department of the Government. It is also empowered by its Charter to report to Congress on all matters needful or usual in such Institutions.

The Academy contains at present about one hundred members, representing nearly every department of knowledge, whose services, in accordance with the Charter of the Academy, are always at the disposal of the Government.

Sessions of the National Academy

Since the last report of the Academy, submitted to Congress May 1<sup>st</sup> 1880, it has held ~~two~~ <sup>three</sup> sessions, <sup>at</sup> that convened at Columbia College, New York Nov 16 to 19 1880, which was devoted entirely to Scientific work, & the





regular annual meeting held in Washington <sup>17</sup>  
 April 19 to 22. 1881, & a Stated session held in Philadelphia <sup>Nov. 15-17, 1881</sup>

In conformity with the decision of the Academy it is proposed that the present Annual Report to Congress shall include ~~besides the scientific~~ <sup>the</sup> ~~other~~ the proceedings of the <sup>three</sup> sessions above referred to, ~~the transactions of the present meeting~~; & that hereafter these annual reports shall be made to embrace the work of the Academy from the beginning to the close of each calendar year.

Scientific session held in New York City  
 Nov: 16 to 19 1880.

At this session held in Rooms in Columbia College, kindly provided for the use of the Academy by the College authorities, the following members were in attendance:

Agassiz	Draper (J.B.)	Mayer	Rutherford
Baird	Gilks	Morse	Scudder
Barker	Gould	Morton	Silliman
Barnard	Hall	Newton	Trowbridge
Chandler	Hilgard	Newberry	Trumbull
Coffin	Hunt	Peters	Young
Cope	Langley	Pickering	
Draper (H)	Marsh	Rood	

1871

1871

1871

In the Absence of ~~the~~ <sup>Rogers,</sup> President, on account of illness, the Meetings were presided over by Vice-President Marsh.

The following papers, Twenty eight in number, were read & discussed.

Titles ~~and~~ of Papers.

1. Report on the dredging cruise of the U. S. Steamer Blake, Commander Bartlett, during the Summer of 1880.

Alexander Agassiz.

2. On the intimate structure of certain mineral veins.

Benjamin Silliman.

Remarks by Mr Hunt:

3. Notes on the relations of the <sup>Oneonta</sup> ~~Preacuta~~ <sup>Montrose</sup> ~~Montrose~~ Sandstones, with the Sandstones of the Catskill M<sup>ts</sup>.

James Hall.

4. On a new general method of Analysis.

Malcott Gibbs.

Remarks by Mr Hunt:

5. On some recent experiments in determining the Electro-motive force of the British dynamo-electric Machine.

Henry Morton.



6. Measurement of new form of Electric Lamps  
operating by incandescence.

Henry Morton.

Remarks by Messrs Gibbs & Barker.

7. On the Phenacodontidae.

E. D. Cope

Remarks by Mr Newberry.

8. On the ~~Pliocene~~ Miocene Mimosauridae & Canidae of the  
Miocene Period.

E. D. Cope

- 9 10 On the origin of the Coral Reefs of the Yucatan  
& Florida Banks.

Alexander Agassiz

- 10 9 On the Basin of the Gulf of Mexico.

J. E. Hilgard

The subjects of these two papers were  
discussed by Messrs Guyot, Morse, Coffin & Newberry.

11. Observations on Ice & Icebergs in the Polar regions.

by Lieut: F. Schwatka U.S.A.

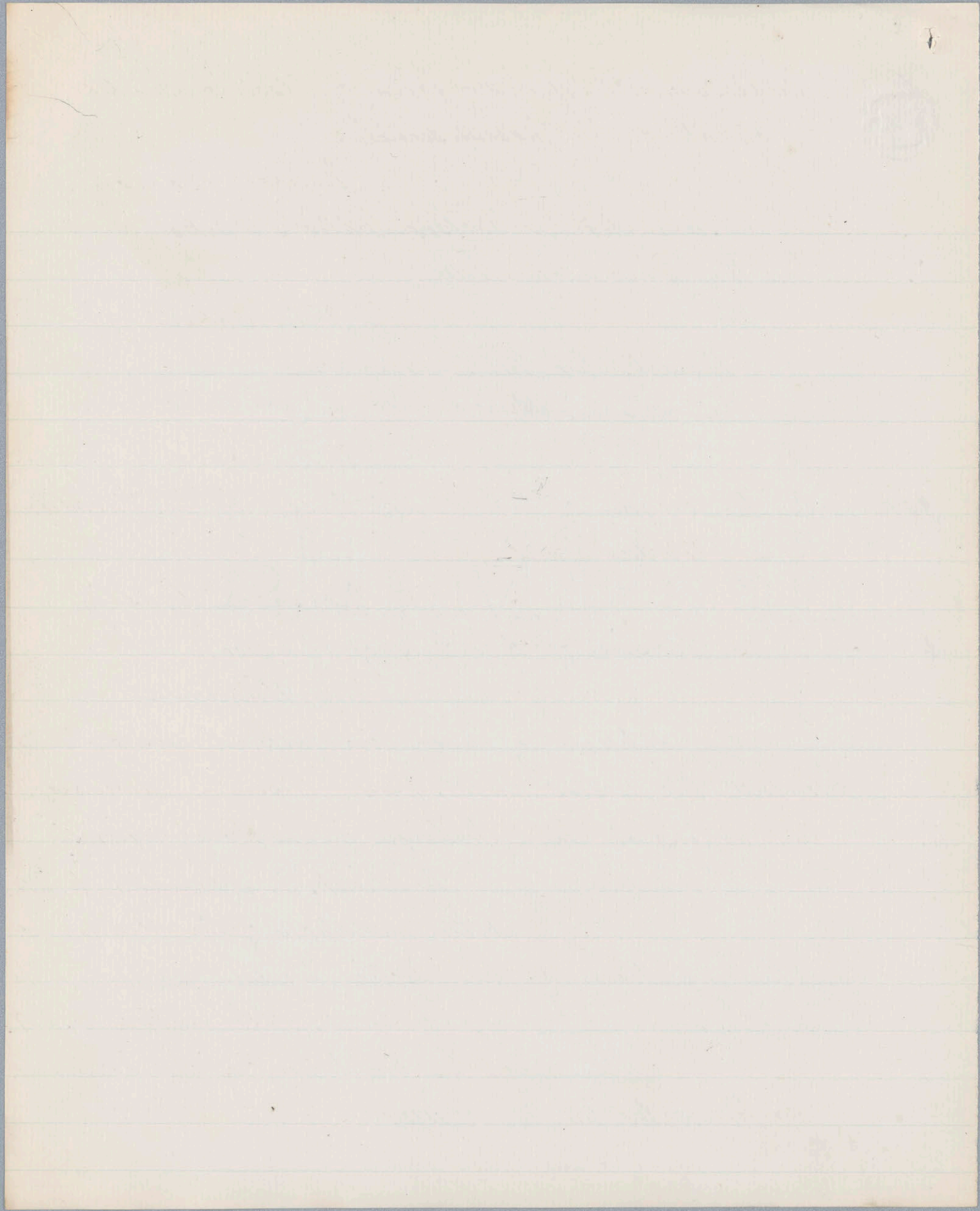
at the invitation of the Academy.

- 12 On the duration of the Arctic Winter.

by Lieut: F. Schwatka U.S.A.

at the invitation of the Academy.

Remarks by Mr Guyot.



## 13. Mineralogical Notes.

Benjamin Silliman.

Remarks by Messrs Newberry &amp; Morse.

14. The relationship of the Carboniferous  
to living & extinct myriapods

Samuel H. Scudder.

Remarks by Messrs Agassiz &amp; Morse.

## 15. On measurement of radiant energy.

S. P. Langley.

Remarks by Mr Young.

## 16. On the Bolometer Balance

S. P. Langley.

Remarks by Mr Barker.

17. Causes which determine the progressive movements  
of Storms

Elias Loomis.

Read by Home Secretary.

## 18. On the Antimony Mines of Southern Utah

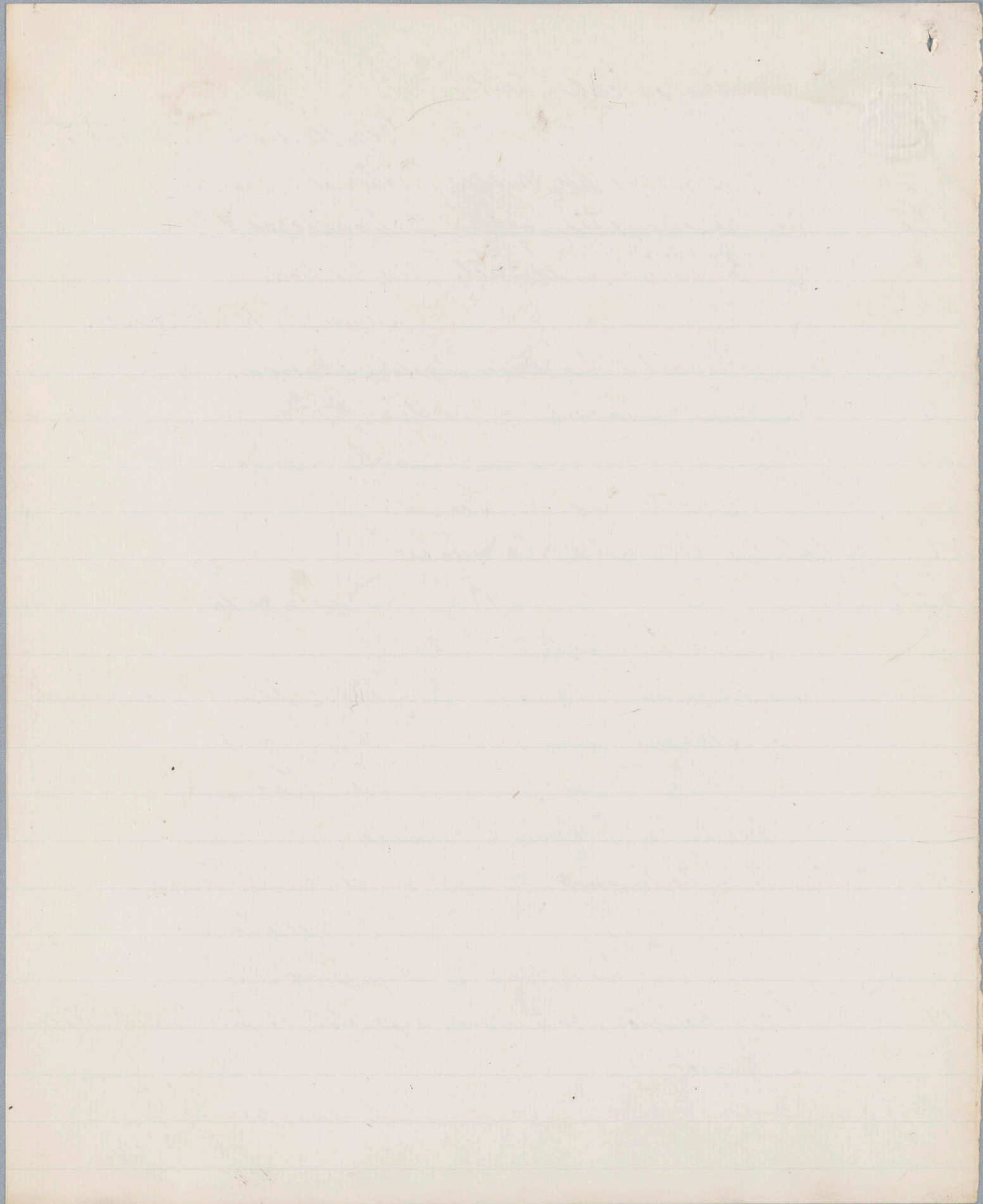
J. S. Newberry.

Remarks by Messrs Bonish &amp; Brewer.

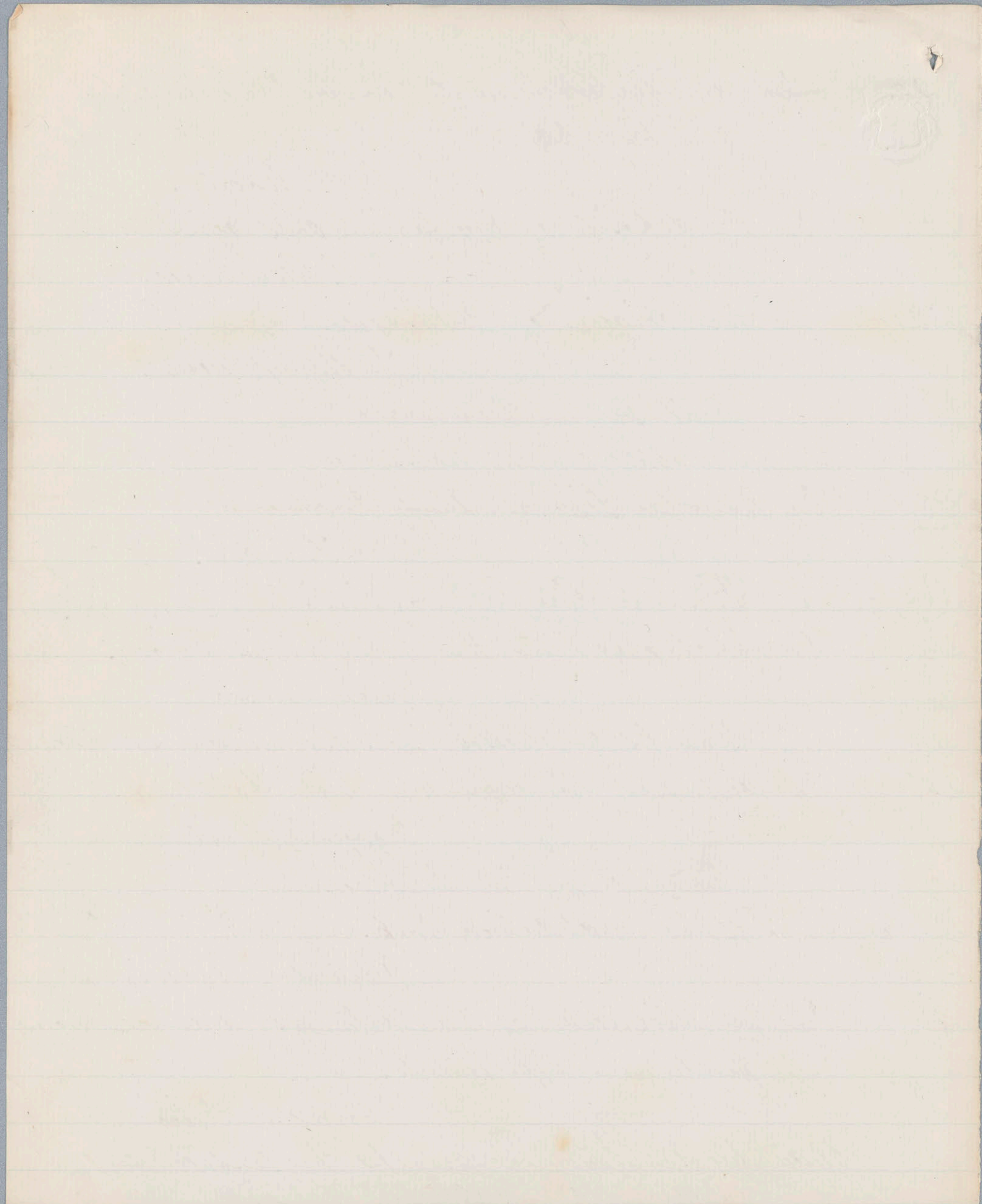
19. On the Conglomerate Ore deposits of the United States  
& Mexico.

J. S. Newberry





20. On an improvement in the Sprengel  
air pump.  
O. N. Rood.
21. On the deposits of Crystalline ores ~~of~~ in Utah.  
J. S. Newberry.
22. On the origin of Anthracite.  
J. Berry Hunt.  
Read by Mr Newberry  
Remarks by Mr Newberry.
23. On the Star List of Abul Hassan  
C. W. F. Peters.  
Remarks by Mr Coffin.
24. On photographing the nebula in Orion.  
Henry Draper.  
Remarks by Messrs Rood, Pickering & Langley.
25. On condensers for currents of high potential.  
George F. Barker.  
Remarks by Mr Langley.
26. On Sigbee's gravitating trap.  
Alexander Agassiz.
27. On the Ellipticity of the Earth as deduced from  
pendulum experiments.  
Charles S. Peirce.  
Read by Mr Langley. Remarks by Messrs Peters,  
Agassiz & Langley.



C. C. Marsh.

The Vice President - announced the death, since the last meeting of the Academy of the following members.

Jonathan Homer Lane, of Washington D.C. May 3<sup>rd</sup> 1880.

Lewis J. Portalis, of Cambridge Mass. July 19<sup>th</sup> 1880.

Sam<sup>l</sup>. S. Haldeman, Chickies Penn. Sept. 20<sup>th</sup> 1880.

Messrs J. E. Hilgard, Alexander Agassiz and John L. Le Conte were selected to prepare biographical memoirs of the deceased members respectively in the order above stated.

Mr Le Conte having subsequently declined the task assigned him, Mr J. P. Lesley was chosen to prepare the memoir of Mr Haldeman.

Mention was also made of the death of Prof<sup>r</sup> Benjamin Peirce at Cambridge Mass: who, though not recently associated with the Academy, was one of its original members & has been until within a few years an active participant in its labors.

A few days after the close of this meeting the Academy was deprived of another of its members, by the death of James Craig Watson, director of the Washburn Observatory, Madison, <sup>Wis.</sup> who died on Nov. 23<sup>rd</sup> 1880. Mr ~~James Watson~~ <sup>J. E. Hilgard</sup> ~~Watson~~ has been requested to prepare a Biographical

Memoir of Mr Watson to be presented to the Academy, and has signified his willingness to do so.

### Trustee of Tyndall Fund.

The vacancy created in the Board of Trustees of the Tyndall Fund, by the death of Gen<sup>l</sup> Hector Tyndale of Philadelphia has been filled by the <sup>President</sup> of the Academy by the appointment, May 1880, of Prof<sup>r</sup> Joseph Lovering of Cambridge.



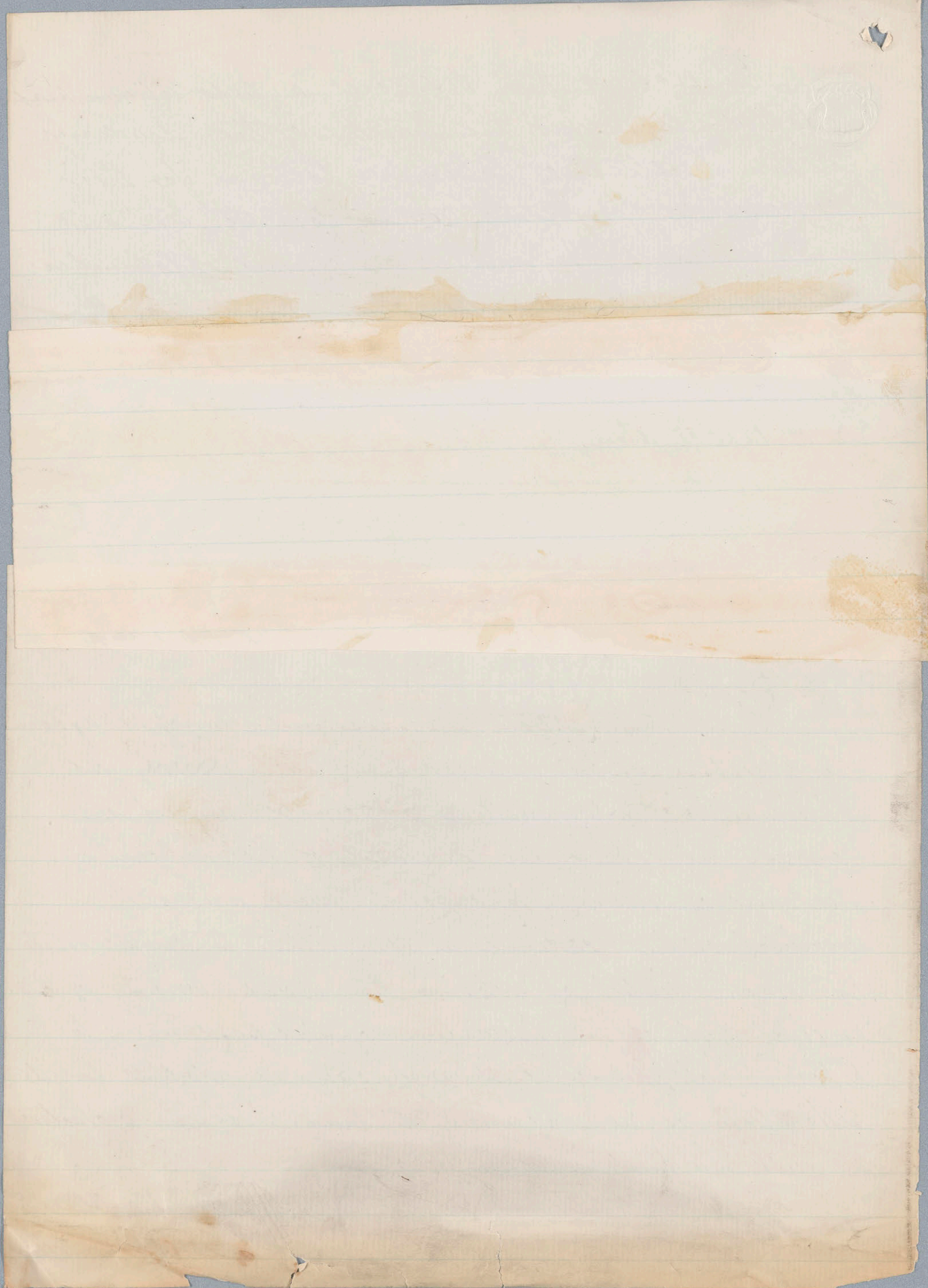
The page contains several lines of extremely faint, illegible handwriting. The text is scattered across the page, with some lines appearing as horizontal streaks and others as more distinct but still unreadable characters. The ink is very light, making it difficult to discern any specific words or sentences.

In closing the session a resolution was adopted conveying the thanks of the Academy to the Trustees of Columbia College for their courtesy in providing rooms for its sessions & to President Barnard & the officers of Columbia College as well as to the other members of the Academy in New York for their hospitable entertainment. The Academy then adjourned to meet in the City of Washington on April 19<sup>th</sup> 1881.

Restoration & Preservation of the Mss of the Declaration of Independence.

A communication was received May 1880 from the Secretary of the Interior Hon: Carl <sup>Schurz</sup> ~~Wright~~ as Chairman of a committee appointed by act of Congress requesting "the President of the National Academy of Sciences, to appoint from among the members of the Academy a committee to enquire into the practicality of restoring the faded writing of the original Mss of the Declaration of Independence & to report what measures, if any, can be adopted for its restoration as well as how it may best be protected against further injury."

In compliance with this request the following members of the Academy were appointed a committee



for the object referred to, namely.

- Wolcott Gibbs
- J. E. Hilgard
- C. F. Chandler
- R. E. Rogers
- J. L. Smith.

After a careful investigation of the questions involved, the committee agreed upon the following report which was transmitted to the ~~President~~ <sup>Member</sup> ~~of~~ <sup>Earl Schurz</sup> Sect<sup>y</sup> of the Interior Jan<sup>y</sup> 18<sup>th</sup> 1881.

Report of the Committee of the National Academy of Sciences on the restoration of the manuscript of the Declaration of Independence.

Prof. Wm. B. Rogers,

President of the National Academy of Sciences.

Sir:

The Committee of the National Academy of Sciences to which was referred the question of restoration of the faded writing of the original manuscript of the Declaration of Independence respectfully reports;

That in the judgment of the Committee it is not expedient to attempt to restore the manuscript by chemical means, partly because such methods of restoration are at best imperfect and uncertain in their results, and partly because the Committee believes that the injury to the document in question is due, not merely to the fading of the ink employed, but also and in a large <sup>measure</sup> ~~measure~~, to the fact that press copies have been taken from the original so that a part of the ink has been removed from the parchment.

The Committee is therefore of <sup>the</sup> ~~the~~ opinion that it will be best, either to cover the present receptacle of the manuscript with an opaque lid, or to remove the manuscript from its frame and place it in a portfolio, where it may be protected from the action of light, and furthermore that no press copies of any part of it should in future be permitted.

Wolcott Gibbs, Chairman.

J. E. Hilgard,

J. Laurence Smith,

R. E. Rogers,

C. F. Chandler,

Boston. Jan. 7, 1881.





Report of the Committee of the National Academy of  
Sciences on the restoration of the manuscript of the  
Declaration of Independence.

Prof. Wm. B. Rogers,  
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to attempt to restore the manuscript by chemical means partly  
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measure, to the fact that press copies have been taken from the  
original so that a part of the ink has been removed from the  
parliament.

The Committee is therefore of opinion that it will be  
best either to cover the present receptacle of the manuscript  
with an opaque lid or to remove the manuscript from its frame and  
place it in a portfolio, where it may be protected from the action  
of light and furthermore that no press copies of any part of it  
should in future be permitted.

Wolcott Gibbs, Chairman.  
J. E. Willard,  
J. Lawrence Smith,  
R. F. Rogers,  
C. W. Chandler,

Boston, Jan. 7, 1881.

Stated Session held in Philadelphia  
November 15 to 17, 1881.

The meetings of this session were held at the University of Pennsylvania in rooms kindly provided by the Authorities of the University.

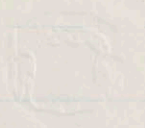
The following members ~~(30)~~ were in attendance.

Abbie	Gilks W.	Morse	Sellers
Agassiz	Gill	Morton	Silliman
Baird	Hayden	Peirce	Frumhale
Barker	Langley	Pumpelly	Walker
Chandler	Sesley	Rodgers J.	Wood
Cope	Le Conte J. L.	Rogers F.	Young
Draper W.	Marsh <del>Seidy</del>	Rogers R. E.	
Genth	Mitchell	Rogers W. B.	Rowland

The Academy was called to order by the President at 12 o'clock. ~~He~~ and the Home Secretary

The Home Secretary Mr Newcomb being absent Mr George Barker was appointed Secretary pro tem.

After the reading by the Secretary of the Report of the April meeting of the Academy & its approval the President announced the following members as the Local Committee for the session. Barker, Cope, Genth,



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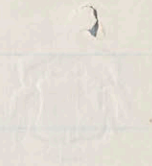
Hayden, Le Conte, Leidy, Lesley, Rogers F. Rogers R. E.,  
Sellers & Wood.

Mr Barker announced that Gen<sup>l</sup> Thomas Eckert of the Western Union Telegraph Company & President W. J. Phillips of the American District Telegraph Co had offered to the Members of the Academy the use of their respective services, both Telegraph & Messengers during the present session.

### Scientific Proceedings.

The President in opening the Scientific session made a brief reference to some points of recent Scientific interest, after which the reading of papers was begun.

The following are the titles of the papers (21 in number) presented to the Academy during the several days of its session.



(137)  
List of Papers.

1. On a gigantic Salpa from the Gulf Stream  
A. Agassiz  
Remarks by Mr Morse
2. The Ichthyi of the Challenger Expedition.  
A. Agassiz
3. Classification of the Dinosauria  
O. C. Marsh  
Remarks by Mr Cope
4. Mean Annual Rainfall for different Countries of  
the Globe.  
Elias Loomis  
Read by the Secretary
5. The Propertidae & Vileleridae & the Surface Fauna  
of the Gulf Stream.  
A. Agassiz  
Remarks by Mr Morse
6. On Complex Inorganic Acids  
W. Gibbs.  
Remarks by Messrs Genth & Barker.



7. On the *Phenacodontidae* a new group  
of *Perissodactyla* E. D. Cope.  
~~Remarks~~ Remarks by Mr Marsh.
8. Succession in time of the *Allotheria*  
O. C. Marsh.  
Remarks by Mr Cope
9. The distribution of the Corals of the *Fortugas*.  
A. Agassiz.  
Remarks by Mr Silliman.
10. A comparison between the shells of  
*Kjökkenmöddings* & present shells of the same species.  
E. S. Morse  
Remarks by Messrs Marsh & Cope.
11. On a form of Regulator for the driving clock  
of an Equatorial.  
C. A. Young.
12. On the objects & results of the recent Expedition  
to Mount Whitney.  
S. P. Langley.  
Remarks by Messrs Rowland, Gibbs,  
Agassiz & Albee.
13. Notice of a remarkable mineral vein in the Black  
Range (Negretta Mts) of Socorro Co. New Mexico.  
B. Silliman.





Statement respecting experiments on  
the Velocity of Light. ~~Not of above list.~~  
By Simon Newcomb,

It is now about three years since the Academy recommended an appropriation for a determination of the velocity of light on a larger scale than any before attempted. In accordance with this recommendation an appropriation was made in 1879 and the writer was assigned to the supervision of the experiments. They have now reached a stage when a definite report of their progress can be made.

The apparatus, though founded on well known principles, was in its construction and arrangement entirely new. Its completion was therefore a somewhat tedious process, in view of the precautions necessary at every step to avoid mistake. It was therefore not



until the summer of 1880 that it was actually mounted and got into operation.

A selection of a site offered great difficulties.

It was necessary

I To have a nearly horizontal line of sight ~~from~~ two miles in length more or less, <sup>and</sup> so high above the ground that the atmospheric disturbances should not be seriously perceived.

II. To have both ends of the line under some form of public protection, convenient of access, and free from interruption.

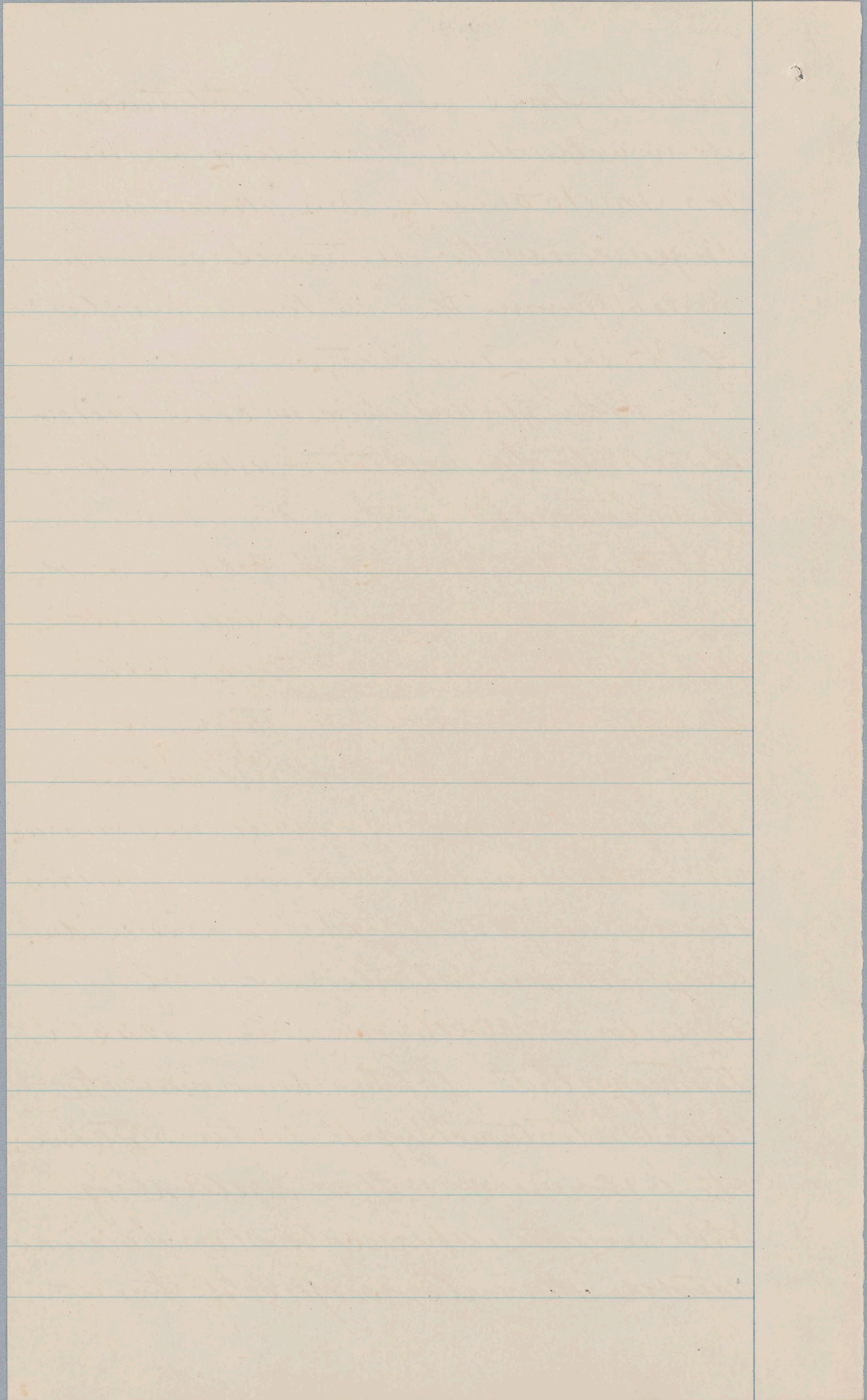
The station selected as the main one was Fort Whipple now Fort Myer west of the Potomac. The great advantage of this station was its height, in consequence of which different points in the city of Washington could be selected, the rays of light from which

111

would pass over the Potomac at an elevation ranging from 100 to 150 feet. Its disadvantage was the distance of four miles from the central parts of Washington City.

The station first chosen for the distant reflector was upon the grounds of the Naval Observatory. Between Fort Myer and the Observatory we succeeded during the summer and autumn of 1880 in making nearly 100 sets of measures the <sup>deviations</sup> divisions ranging from four to six degrees.

Besides the regular measures on the rays of light two subsidiary determinations were of equal importance. One was a triangulation to determine the exact distance of the two stations; the other the determination of the value in arc of the divisions under the microscopes of the



instruments. The first determination was made under the auspices of the Coast Survey by Assistant Sinclair with the assistance of Midshipman J. H. L. Holcomb, U.S.N. Mr Sinclair also made a determination of the value of one division of the Photolachometer by the aid of the theodolite.

In the spring of 1881 a few more determinations were made between the same stations. The fixed mirrors were then removed to a station at the base of the Washington monument in order to make a new set of measures at a greater distance. The distance to the Observatory was in round numbers 2550 metres; that to the monument 3720 metres. Great difficulties were however experienced in getting the apparatus into actual operation on the new



1/2 1/2 1/2

line of sight. The adjustment of the mirrors had to be much more precise than when they were at the Observatory not only on account of the long line of sight, but because the curvature of the mirrors corresponded more nearly to the greater distance, which rendered a more exact adjustment necessary. The pier on which the mirrors rested at the monument was built on recently made ground, so that for the first two months they were very <sup>stable</sup> ~~unsatisfactory~~. Moreover, the rays were more obscured by smoke at the greater distance. Notwithstanding these drawbacks when all the adjustments were successfully made, and the atmosphere was quite clear, the image was as well seen from the monument as it had

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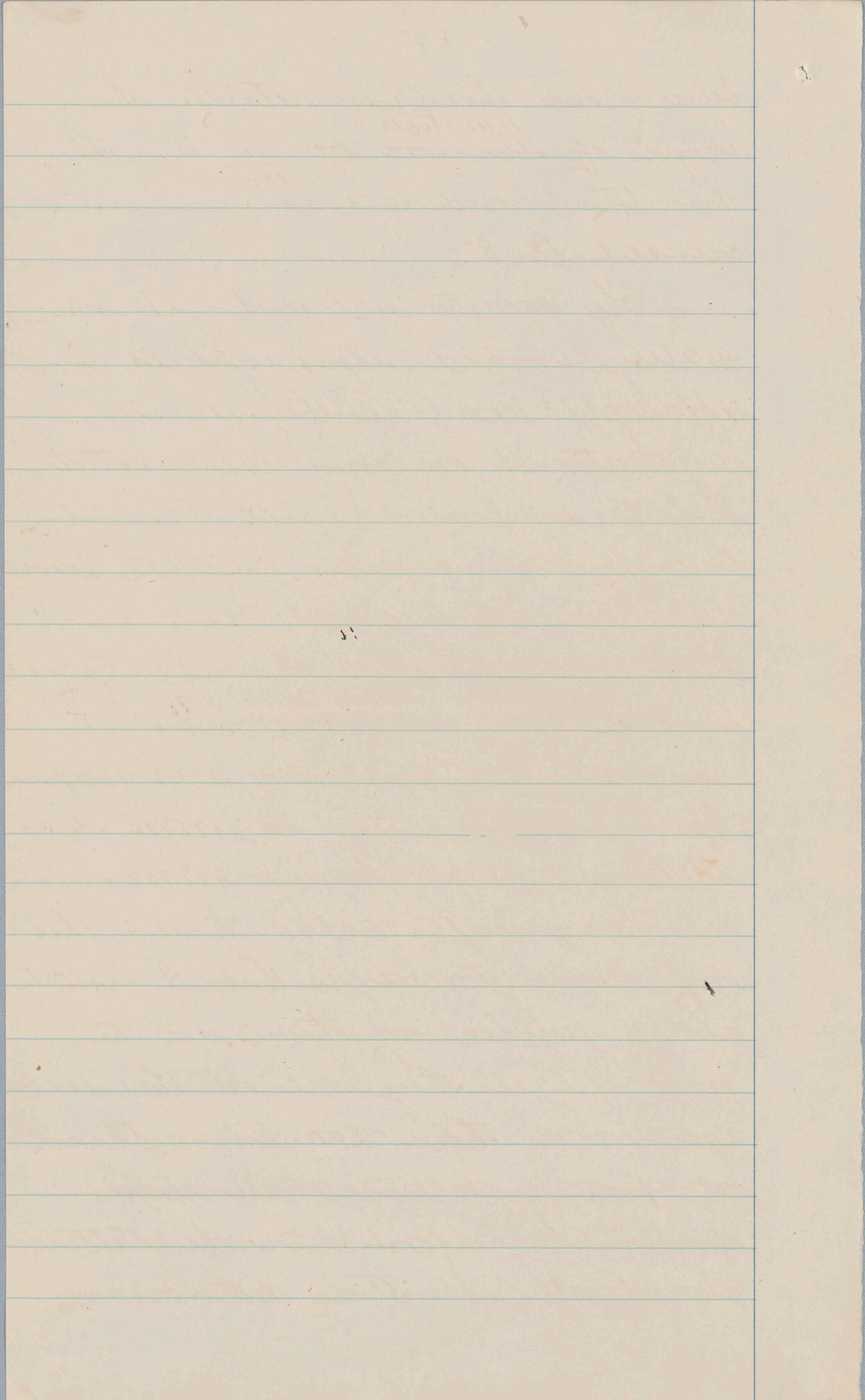
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been from the Observatory. The angle of <sup>deviation</sup> ~~distortion~~ on which the velocity depended was now increased to  $8^\circ$ .

The results are not yet completely worked up, as it is necessary to combine the separate observations on some well established uniform plan. The following preliminary results from the three series will however so far as yet known be subject to but slight alterations

Summer of 1880 to Observatory	299 680	K.M. per sec.
Spring " 1881 " " "	299 720	" " " "
Autumn " 1881 from Monument	299 750	" " " "

These results are so embarrassing from two causes that I hesitate about publishing them. In the first place they are on the average more than 200 kilometres or  $\frac{1}{1500}$  part less than those of Mr Michelson. Now the latter aimed at permitting no source



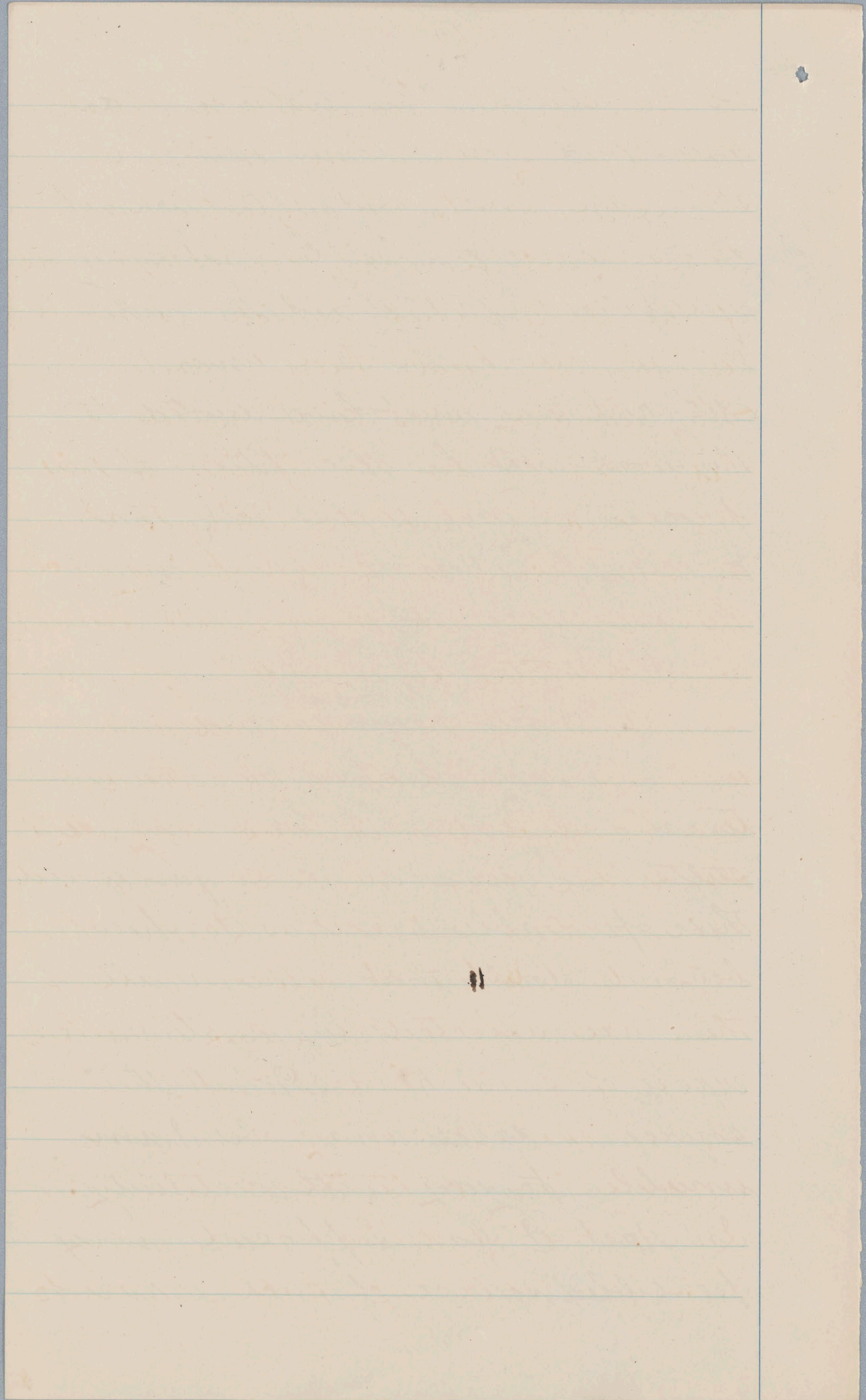
of error to creep in which could possibly amount to  $\frac{1}{10000}$  part of the whole, and from a careful examination of his work I am unable to assign any probable cause of error which should have affected it by even fifty kilometres. It is true there are two points connected with his work which I have not yet been able to examine. One is a possible inclination of the reflecting surface of his mirror <sup>to</sup> and the axis of rotation. This axis was not independently adjusted to verticality in his experiments but was adjusted to throw the reflected ray along a certain path as the mirror revolved. If there were any lack of parallelism between the reflecting surfaces and the axis of rotation it might materially affect his results. The other point is the distance ~~of~~



of his station. This distance was measured four times with a steel tape line and although it seems scarcely possible that any systematic mistake should be made in this, in view of the care which Mr. Michelson must have devoted to the work, yet his description of his process is not so explicit that a scientific jury could pronounce the measures absolutely free from the possibility of error.

The next circumstance which will be remarked is that the systematic differences between my results as given above so far exceed their probable error as to show beyond doubt that some or all of them are affected by systematic error of some kind. What the source of error may be I am unable to say with certainty. In fact I had supposed every possible source of such error to

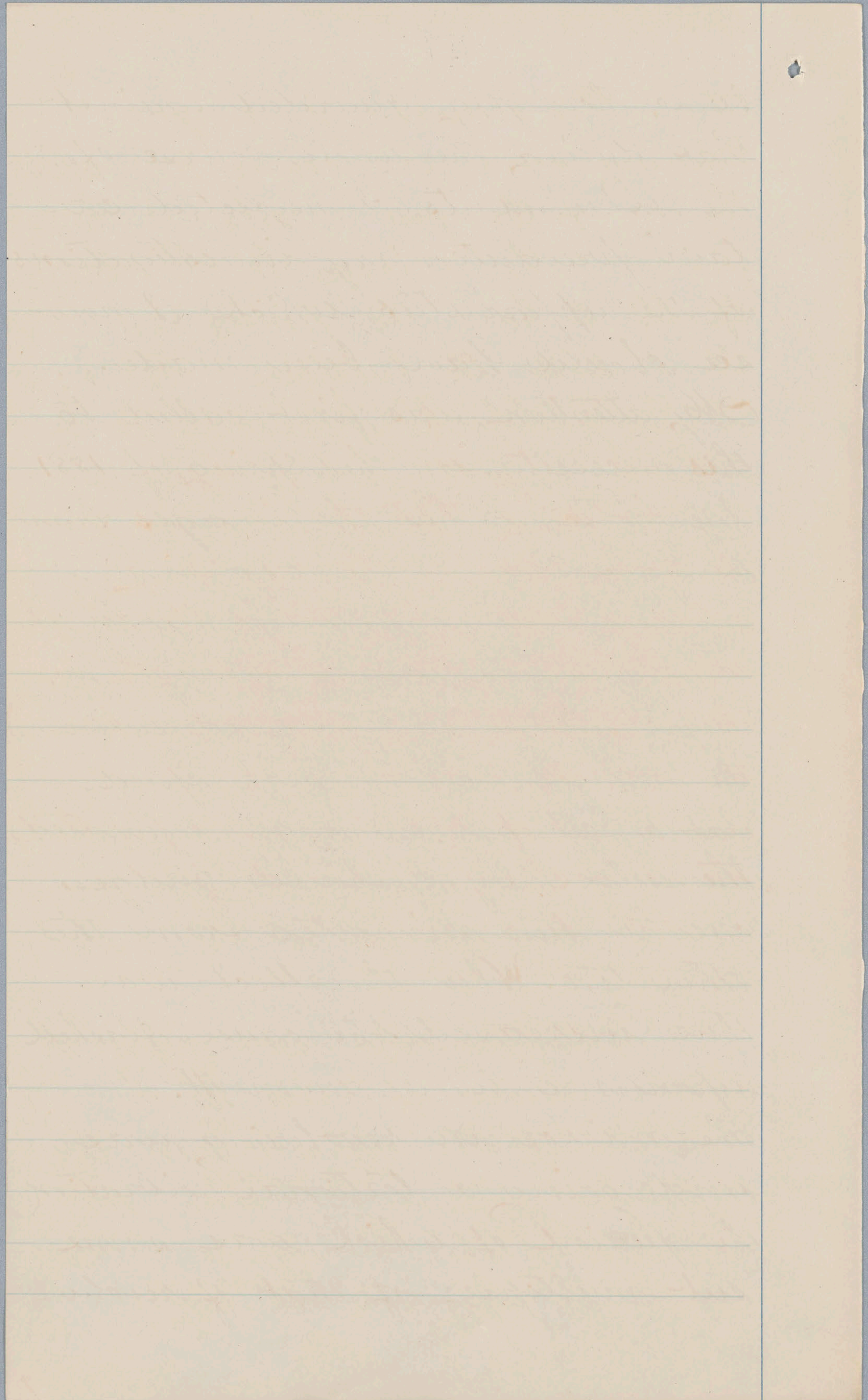




be so thoroughly guarded against that during the whole course of the experiments I neglected certain precautionary investigations of the apparatus which I now see should have been made.

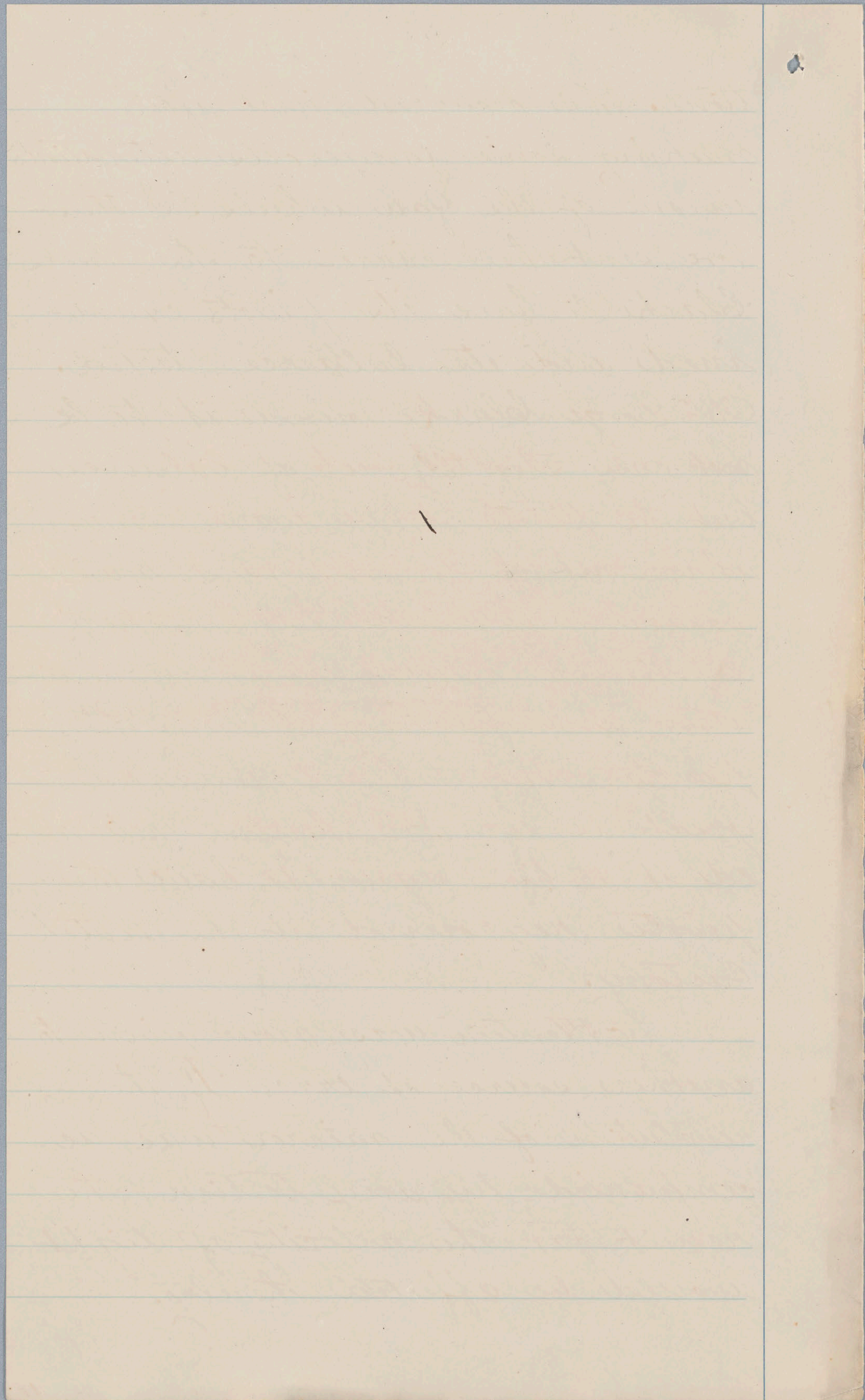
My attention was first called to this necessity in the Spring of 1881 by noticing that the images from the four faces of the revolving mirror did not always lie in the same vertical line. At length, in August, I one day observed when the mirror was at high speed that a set of two images separated themselves by, I should judge, one or two minutes from the other two. When the effect was thus increased the cause flashed upon me in a moment.

The mirror in revolving was undergoing a torsional vibration the period of which was some sub-multiple of that of revolu-



tion. This occurred just after making some dangerous alterations in one of the fan wheels. I therefore sent the mirror to the Messrs Clark to have its pivots examined and its balance tested. Mr. George Clark found it to be not only slightly out of balance but the pivots to be worn somewhat out of round. As I was anxious to complete the experiments he returned it immediately without regrinding the pivots. But the evil was as great as ever. I therefore returned it to him again to have the pivots reground at the watch factory.

Attention was now given to another source of error. If the revolution of the mirror was accompanied by any torsion, the result for the velocity of light would be affected thereby.



This had been foreseen from the beginning; and, to avoid it, fan wheels had been placed on both ends of the mirror, so that being driven equally at both ends no torsion should have place. It now occurred to me that the exceedingly small torsion necessary to produce a considerable systematic error might still be possible. I therefore made arrangements for investigating the motion of the mirror by means of a reflector in its immediate neighborhood. The absolute effect of torsion would be as great from this near mirror as from the distant one. After the pivots were re-ground the mirror was found to run better than ever and to be free from any sensible torsional vibration. To put the question of systematic torsion

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to as severe a test as possible several experiments were made by running the mirror with only a single fan wheel. The torsion measured from the near mirror was so slight that systematic error from that source scarcely seems possible. The concluding experiments have been made only within the past few days and are not yet worked up so that I am unable to present definitive results.

I can only say that I have thus far been unable to detect any possible source of systematic error which could affect the result by as much as 100 kilometres.

The season is now so far advanced that no further investigations can be made until spring. It is then essential to the final success of the exper-

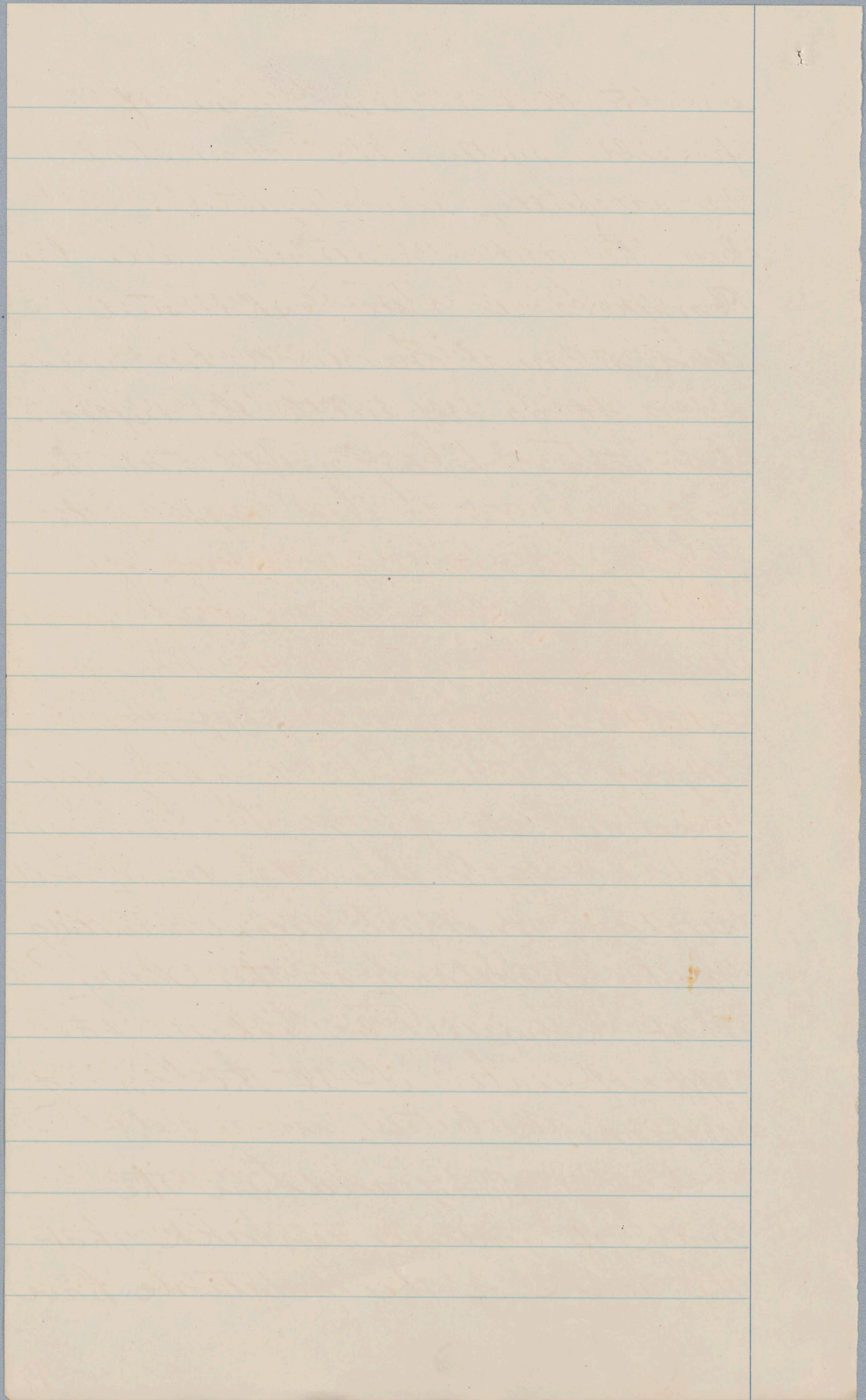




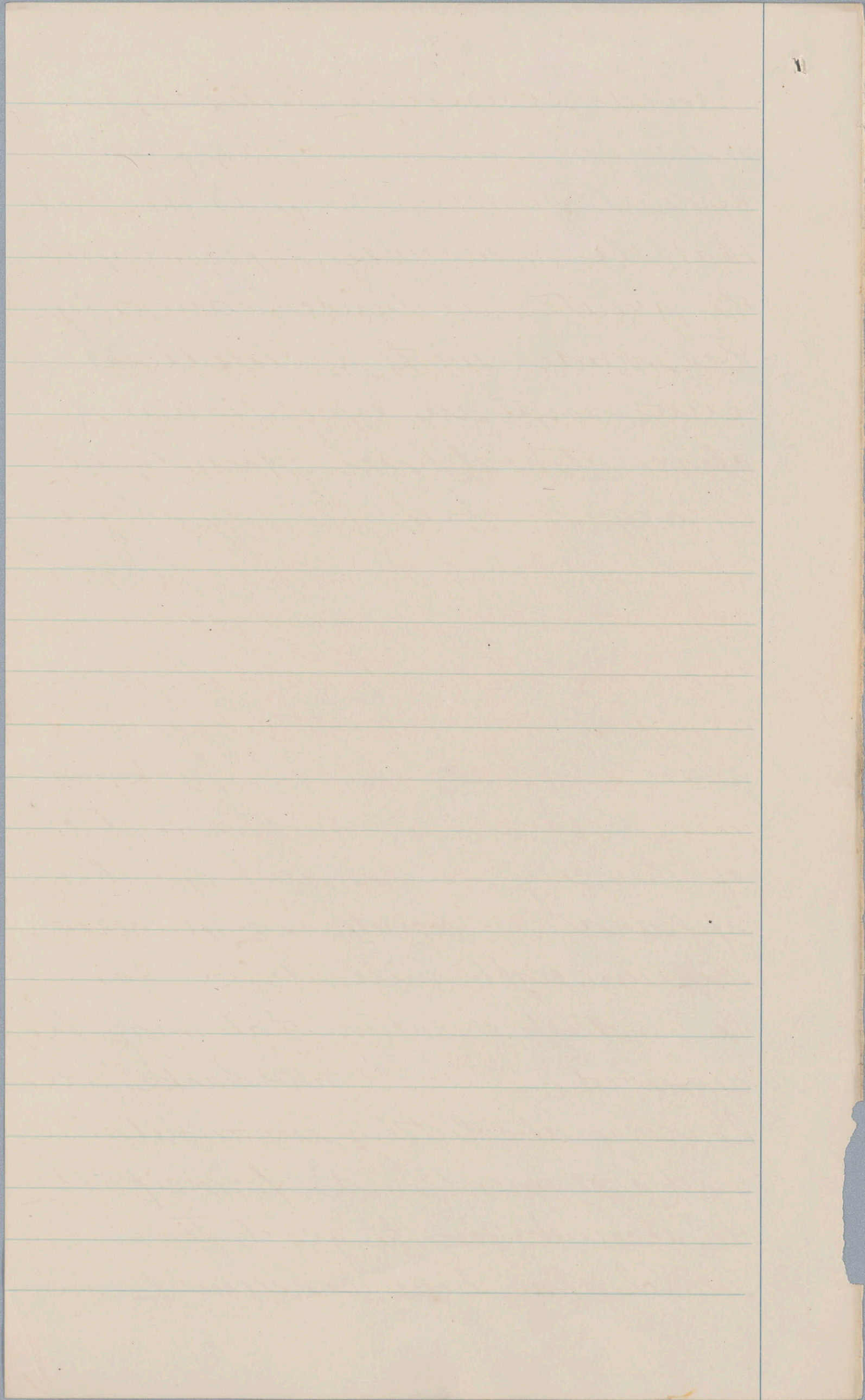
iments that every source of possible systematic error shall be carefully investigated.

But the appropriation made by Congress is now exhausted and a new one will be necessary to go on with the experiments. I may add that the original estimated cost of the whole work was \$7000 of <sup>which</sup> that only \$5000 has thus far been appropriated and expended. The remaining \$2000, if appropriated, will amply suffice for the purpose in view and I hope the Academy will sustain me in recommending to the Secretary of the Navy that Congress be asked to appropriate <sup>that sum</sup> ~~it~~ at the coming session.

I may add in the way of general remark that the whole of the operations have



proved excessively tedious; far more so than expected, from several causes. One is the fact that the measures, especially at the greater distance, can only be made with a cloudless sun and an exceptionally clear atmosphere. Accordingly a large part of the day is frequently spent in waiting for clouds to clear away or unavailing attempts to see the image through a smoky atmosphere. Another drawback is the distance from the centre of the city to the seat of the apparatus rendering necessary an eight mile drive for the smallest operation that may be required. These drawbacks are however absolutely unavoidable and are mentioned principally to account for the great time which has been consumed in



the experiments.

I feel also that some explanation is due of my failure to make an early investigation of possible sources of systematic error. The reason is that the introduction of any new mechanism such as is required for this purpose disarranges the apparatus and renders a new adjustment necessary when the regular observations are to be made. They were therefore postponed until the necessity was apparent. Unfortunately this did not occur until it was too late to carry them out with our present means.

It may also be remarked that much more time has been consumed on these than on any previous similar experiments. I should reply to this that I doubt if any

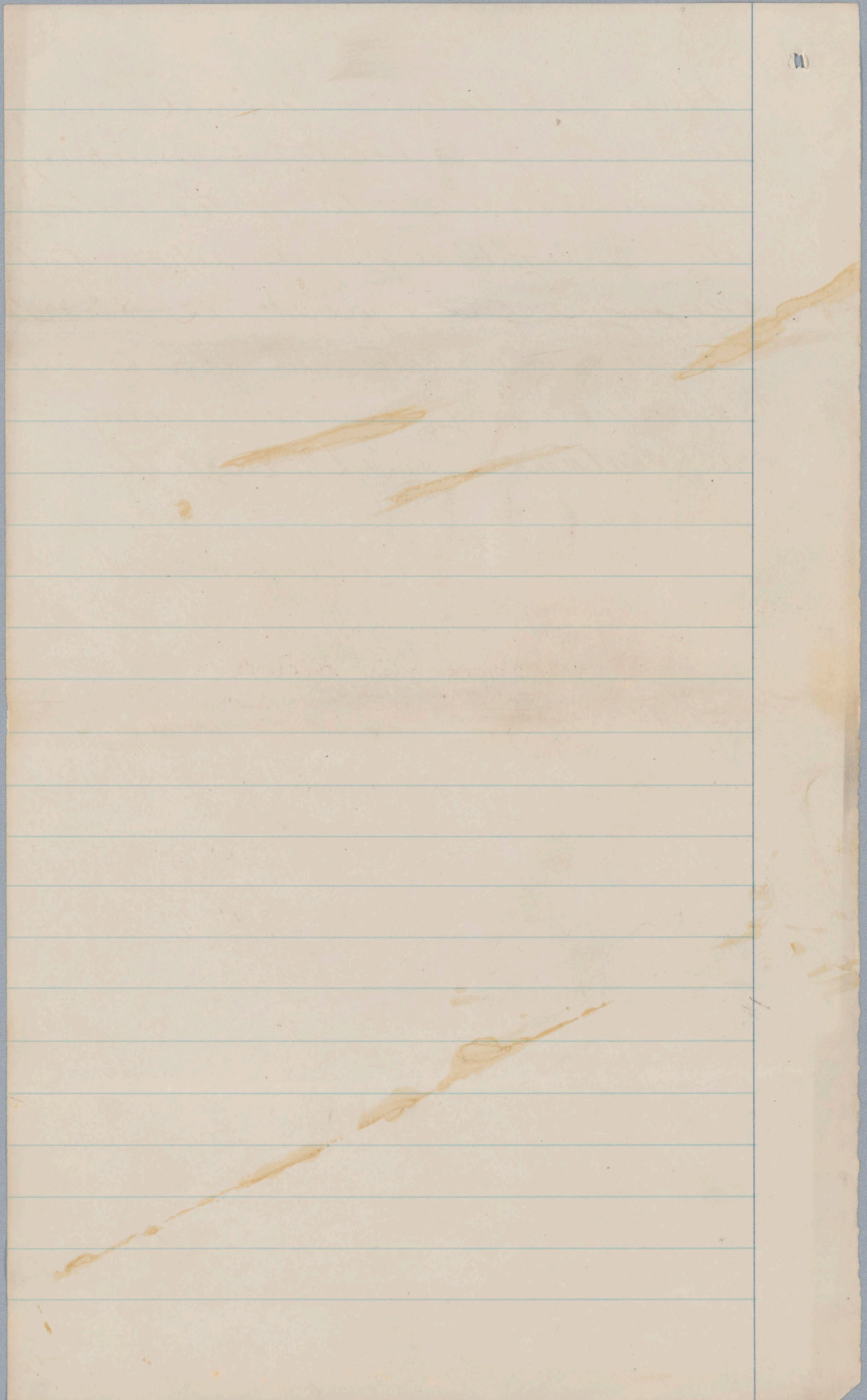


physicist ever conceived of even the possibility of making the measurements of the velocity of light, depend upon that of an arc so great as  $8^\circ$  or of seeing a return flash in a revolving mirror from a distance of  $2\frac{1}{2}$  English miles.

S. Newcomb

Washington, Nov. 15<sup>th</sup> 1881.





14.

Statement respecting Experiments on the  
velocity of Light.

S. Newcomb.  
<sup>present report</sup>

~~Read by the Secretary~~ ~~see page~~ of 1

15.

On the Logic of Numbers.

C. S. Peirce

16.

On Hydrometer Scales.

C. F. Chandler

Remarks by Messrs Peirce & Silliman.

17.

On Chinoline, its synthesis & Medical uses.

Henry Morton.

Remarks by <sup>Mr</sup> Abbe

18.

On the Theory of the Dynamo-Electric Machine.

W. Gibbs.

Remarks by Messrs Rowland Morton & Barker.

19.

Facts regarding Sorghum & some conclusions as  
to its value as a source of Sugar.

Peter Collier

Presented by <sup>Mr</sup> Silliman at the invitation  
of the Academy.

Remarks by Messrs Chandler & Abbe

20.

On Mascart's Electrometer and its use as a  
Meteorological Instrument.

G. F. Barker.

Remarks by Messrs Abbe & Rowland?

68-

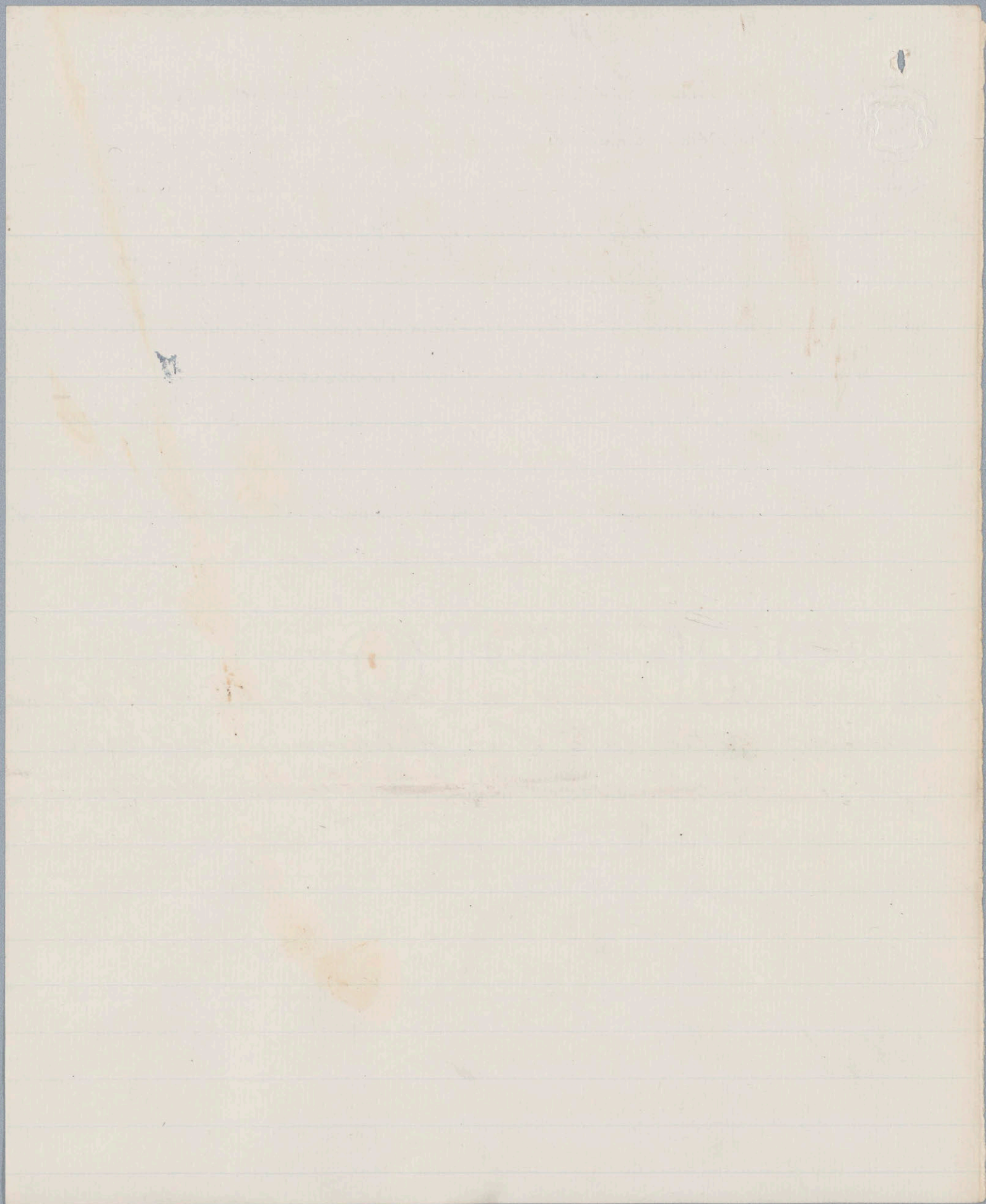
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- 21. On the Fossil & Recent Fauna of the Oregon Desert.  
E. D. Cope.
- 22. On a new form of Volvumscope.  
R. E. Rogers.
- 23. The newly determined line of the Terminal Moraine across Pennsylvania  
J. P. Lesley.

The last two named papers though entered on the list of the Secretary were not read.

Biographical Memoir.

At the meeting on November 16<sup>th</sup> a Biographical Memoir of the late S. F. Haldeman prepared by Mr J. P. Lesley was read by the Author.



## Amendment to the Constitution.

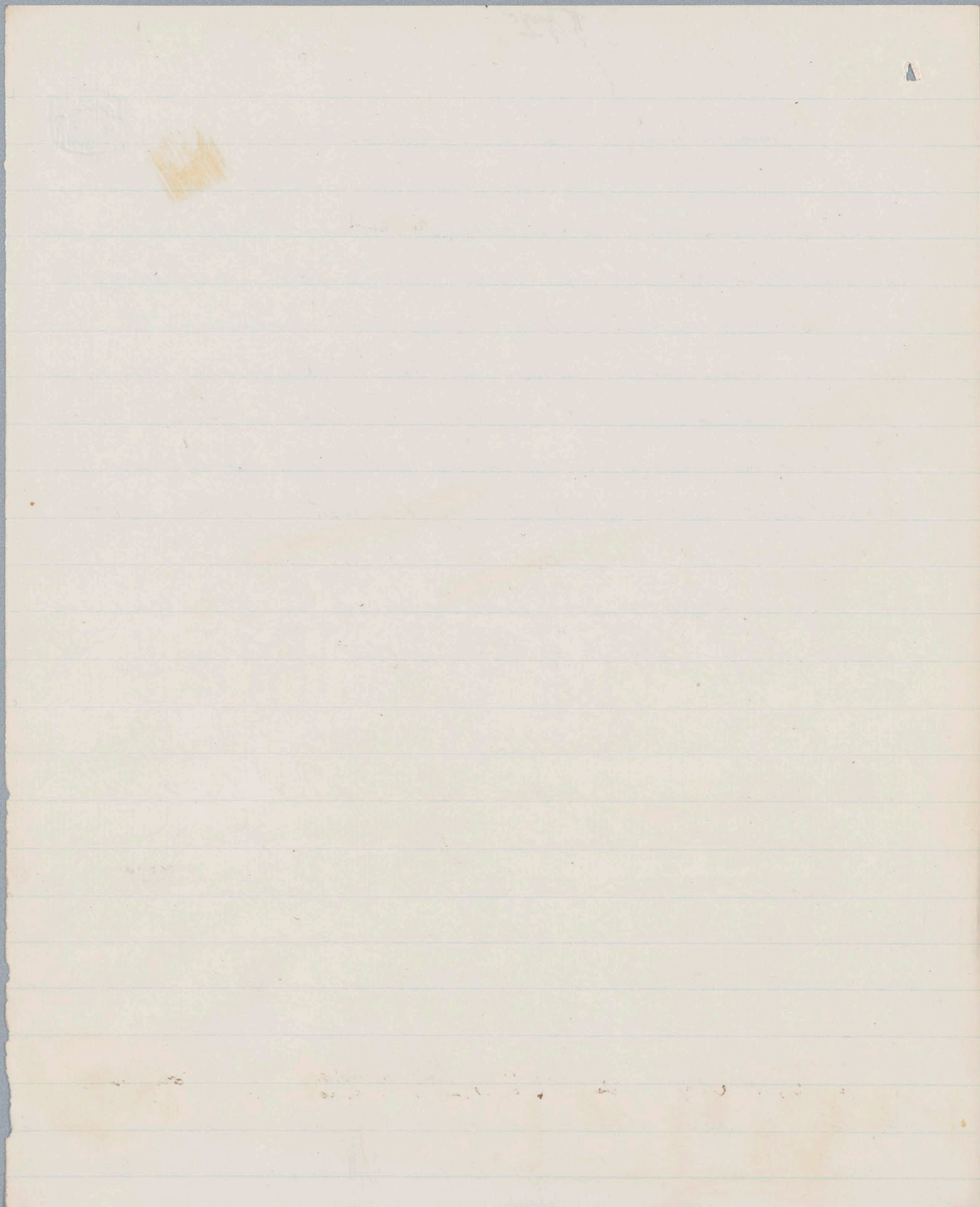
The Amendment to Section 1, Article 1, approved at the meeting of the Academy April 1881, proposing to add at the close of the original sentence the word "Members shall be citizens of the United States or shall have declared their intention to become ~~such~~<sup>so</sup>" was not adopted, but as a substitute the following amendment was adopted in Committee of the Whole, to be voted on at the next stated session.

"A Candidate for Membership in the Academy must be a Citizen of the United States."

## Resolutions.

The following resolution was offered by Mr Silliman & referred to the Council.

Resolved: "That the Subject of Sorghum Sugar, the experimental results on which, obtained during the three or four years last past by Dr Peter Collier, of the Agricultural Department, submitted in brief by invitation, to the Academy at its Philadelphia session in November 1881, is in the opinion of the Academy of sufficient importance to be referred to a Committee of Chemists, members of this



(58)  
Academy, with the request that they give  
Dr. Collier's results & methods a careful consideration  
& report at their early commencement the conclusions  
to which they come." see note.

The following resolution was offered by  
Mr. Chandler & referred to the Council

Resolved: "That a committee be appointed  
by the Academy, to consider what action if any  
is desirable, with a view to establishing a legal  
value for the degrees of the Beaumé & other  
Hydrometers of arbitrary scales; the Committee to report  
at the next meeting."

Both these resolutions were approved by the  
Council, whereupon the President appointed the  
following members of the Academy to constitute the  
Committees referred to:—

On Sorghum Sugar:

Messrs Silliman, Johnson, Chandler, & ~~Sturges~~ Smith.

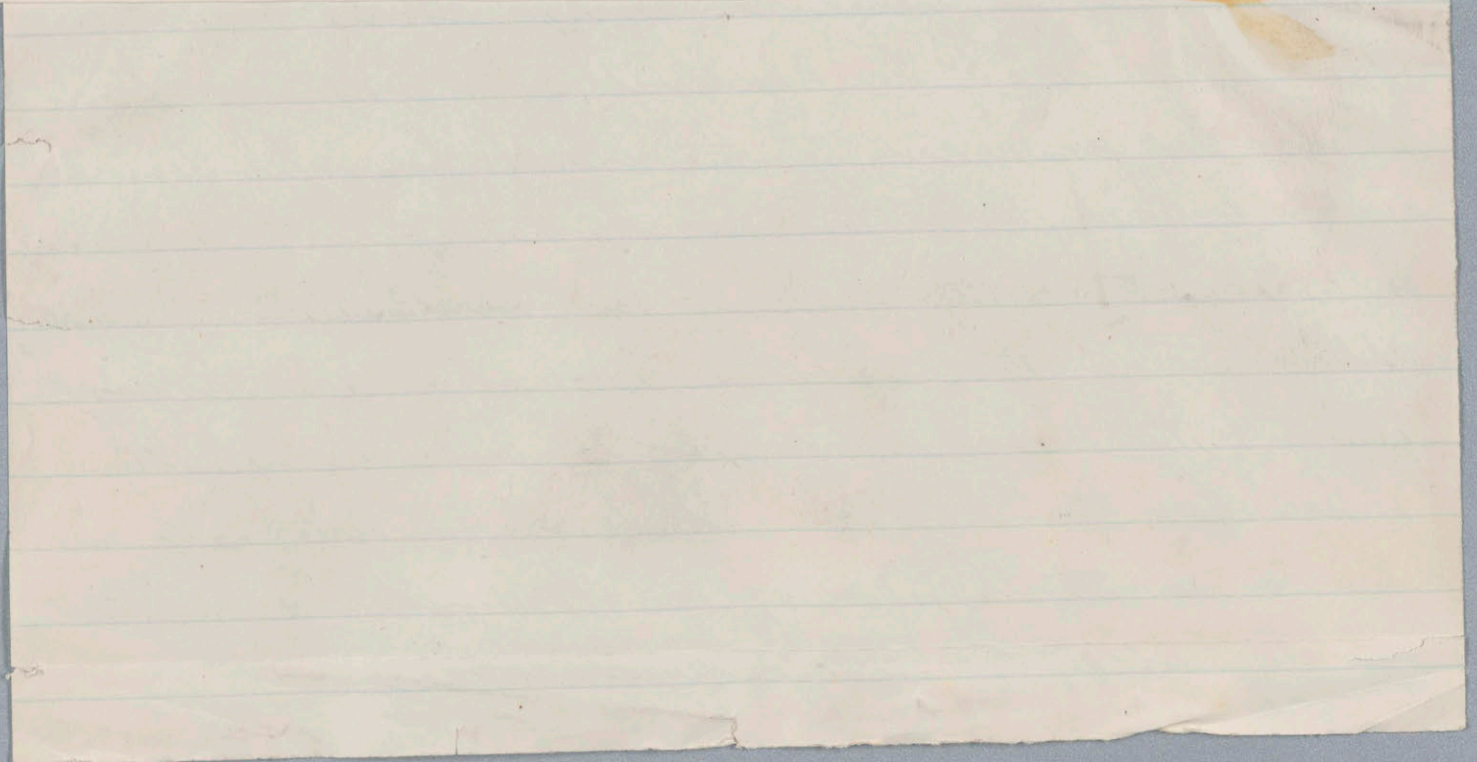
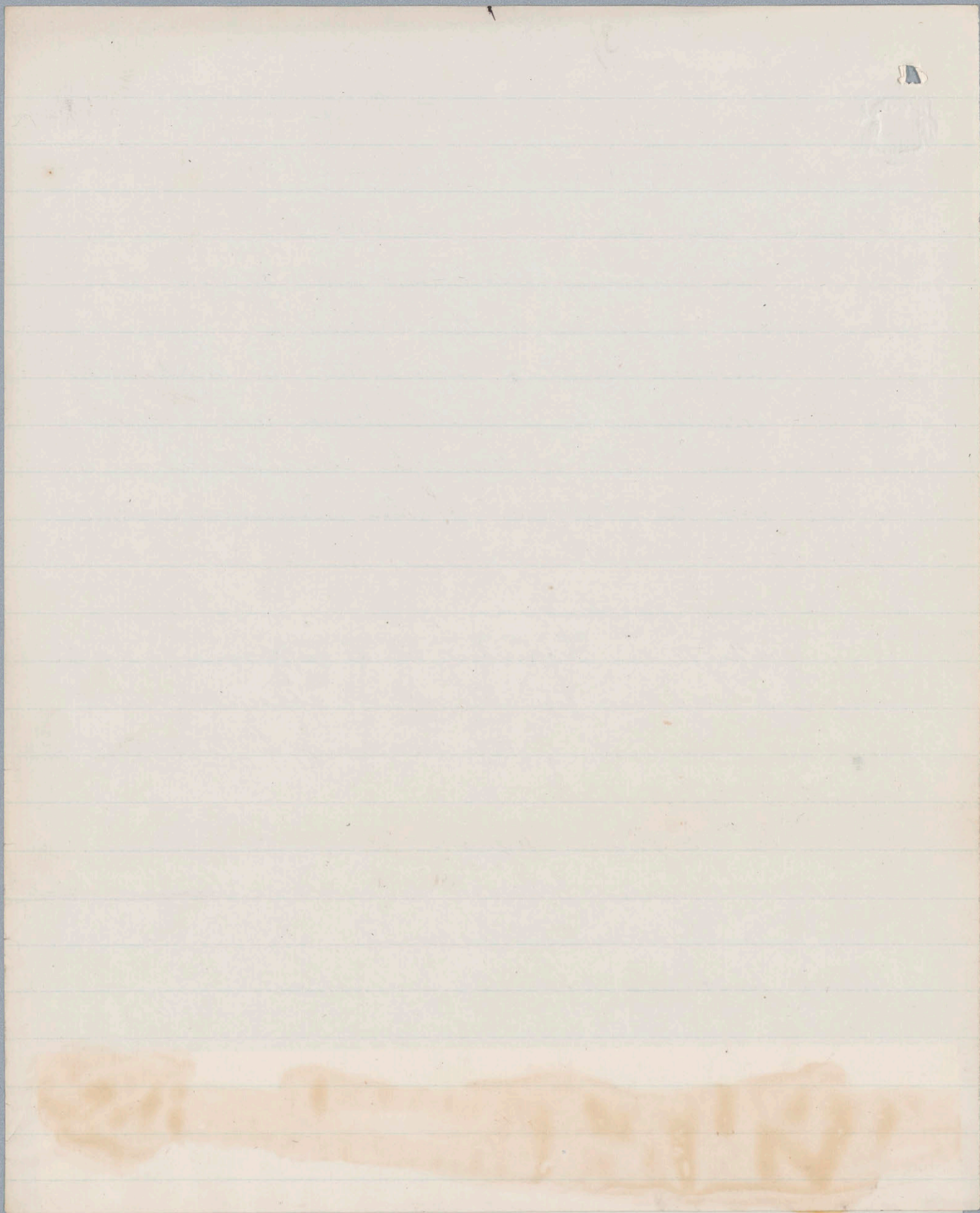
On Hydrometer Scales:—

Messrs Hilgard, Chandler & Morton.

Please turn back at the foot of the Paper Certificates—the resolution  
note relating to Sorghum Sugar, making a reference mark. (A)

Since the meeting of the Academy the Commissioner  
of Agriculture, Hon George B. Loring, having been inform-  
ed by the Pres<sup>t</sup> of the Academy of its action as above  
stated, has forwarded to the Pres<sup>t</sup>: him the documents  
on the subject, with the request that they be submitted  
to a Committee of the Academy for investigation & examination,  
adding that "if this reference involves a scientific investi-  
gation of the Sorghum question he will be greatly  
obliged for the Report." These documents have been  
placed in the hands of the Committee appointed  
for the purpose. whose investigations





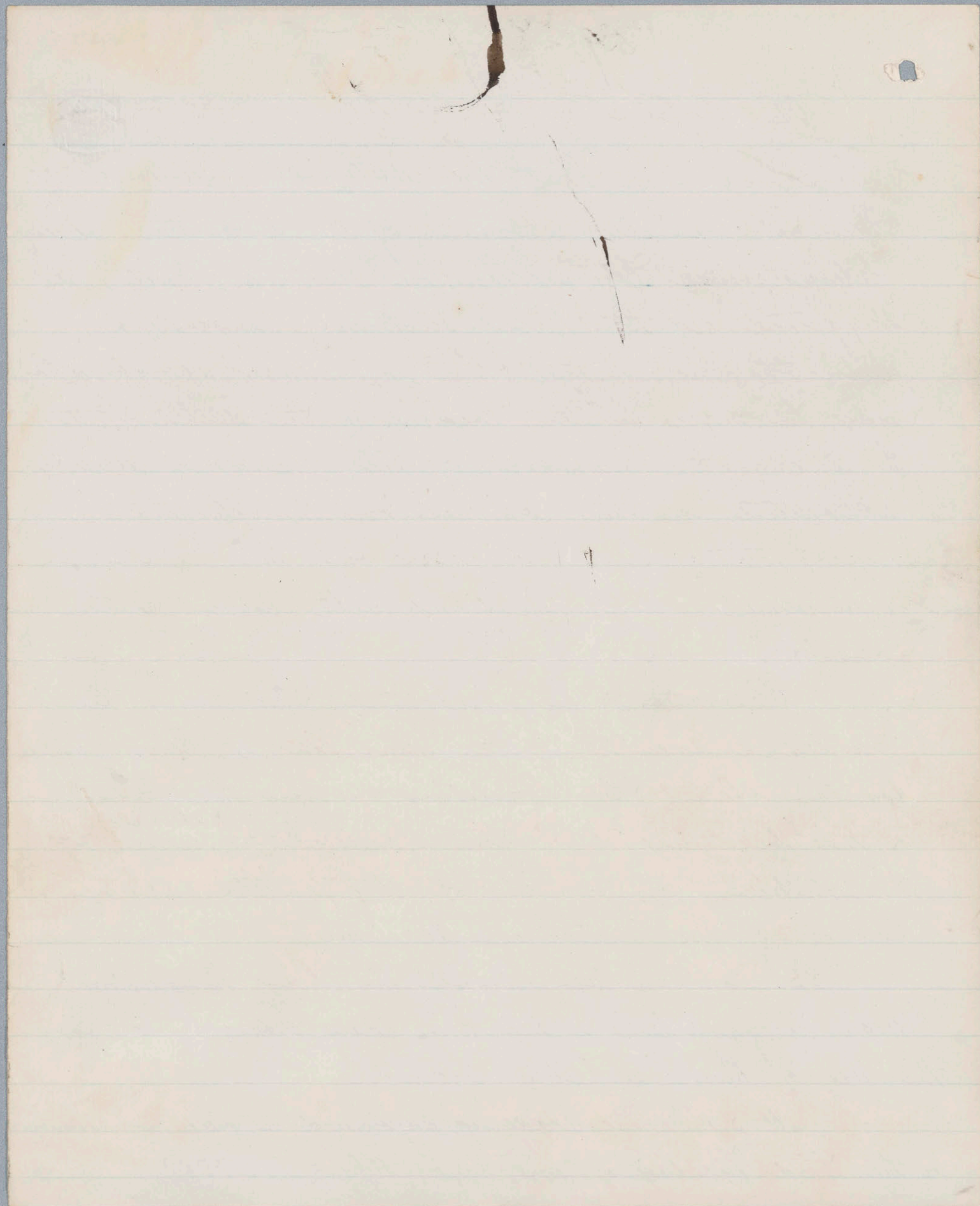
On motion of Mr Barker it was ~~resolved~~

Resolved:— "That the National Academy of Sciences cordially approves of the formation of an International Commission on Electrical Units, as suggested by the Paris Electrical Congress, & earnestly hopes that the necessary appropriation may be made by the Congress of the United States, to enable the members of this Academy already appointed on this Commission through the Department of State, to carry out the needed experimental determinations with credit to the Country."

Resolutions were adopted thanking the Trustees & faculty of the University of Pennsylvania for the use of the Building during the meeting of the Academy & to the Academy of <sup>Natural</sup> Sciences of Philadelphia for placing ~~of~~ its facilities at the service of the National Academy.

A resolution was adopted thanking the Western Union Telegraph Co & the American District Co for the use of their respective services.

At 3. P.M. The Academy adjourned to meet in Washington on the third Tuesday of April next. (April 18. 1882).



Last pages

It was intended, in accordance with the decision of the Academy at the meeting of April last, to include in the present Report, along with the proceedings & special reports heretofore usually published, all the scientific papers, either in full or in abstract, as the case might be, which have been presented & accepted at the several meetings to which the report relates. <sup>It</sup> \*As from <sup>insufficient notice</sup> ~~various~~ causes <sup>of other</sup> it has been found however that this intention could not now be carried out as \* only a few of the papers read before the Academy have been furnished to the ~~Home~~ Secretary to be ~~incorporated~~ in the report, for incor<sup>in</sup> in the report. It is nevertheless confidently expected that in future Annual reports the scientific work of the Academy will be fully set forth in the way proposed.

This new feature of the reports of the Academy is so obviously essential to a proper representation of its labours as a scientific body & therefore of its operations as contemplated in its Charter that it must, we think, be regarded as an authorized if not a required part of the Annual report expected from it by the Government.



Last pages

~~part of the Annual Report expected from it by~~ ~~the Govt~~

As regards the publication of these larger & complete reports it may be added that although the investigations of the Members of the Academy are in general accessible in the Scientific Journals or the proceedings of other ~~learned~~ societies, such a collected publication of <sup>its Scientific</sup> ~~the~~ Transactions, ~~of~~ ~~the~~ Academy as that proposed, <sup>seems to be</sup> demanded by a regard to the rank of the Academy among the Scientific organizations of the Country & the importance of its labors, as well as by its peculiar responsibility as a Scientific adviser of the Govern<sup>mt</sup>.

In conclusion I may be allowed to say that in as much as the Academy is at all times ready to respond to the official calls made upon it for Scientific service, & as its Members do not receive compensation for the time & labor expended by them in such investigations, we feel warranted, in assuming that the <sup>Govt</sup> will, <sup>willingly,</sup> ~~at the expense of~~ <sup>the attendant,</sup> ~~the~~ <sup>the</sup> publication of its Scientific papers as part of ~~the~~ <sup>its</sup> Annual Report. Will be <sup>willingly</sup> ~~returned~~ <sup>returned</sup> by the Gov<sup>t</sup>.

Report of N. A. S. for 1881-2  
rough Copy.

11/15/91

